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**THE TEMPLETON CROCKER EXPEDITION TO WESTERN
POLYNESIAN AND MELANESIAN ISLANDS, 1933**
No. 30

DIPTERA

BY

C. H. CURRAN

American Museum of Natural History, New York City

With the Collaboration of C. P. ALEXANDER (Tipulidae)

and E. T. CRESSON (Ephydriidae)

The Diptera collected by the Crocker Expedition to the South Seas comprise an interesting collection containing a fairly large percentage of undescribed species, and add to our knowledge of the distribution of species previously known to science. Some of the specimens are from other islands in the South Sea, but the vast majority are from the Solomon Group. I have also included in this report a small collection made by the Whitney South Sea Expedition of the American Museum of Natural History so that our knowledge of the fauna may be more complete.

In order to conserve space I have not included the collector's name after the data, except to indicate those specimens secured by the Whitney Expedition. All other specimens were collected by Mr. Maurice Willows, Jr., under the direction of Mr. Crocker, and the types and uniques are deposited in the Museum of the California Academy of Sciences. Duplicate material and the Whitney Expedition specimens are in the American Museum of Natural History.

No attempt has been made to identify the Culicidae, represented by several species in indifferent condition. Dr. C. P. Alexander has once more rendered great assistance by preparing a report on the Tipulidae and Mr. E. T. Cresson, Jr., has prepared the report on the

Ephydriidae. I wish to express my appreciation to them for their aid, which has increased the value of this contribution, and also to Mr. E. P. Van Duzee for the privilege of examining the collection and retaining duplicate material.

C. H. CURRAN.

TIPULIDAE

(By CHARLES P. ALEXANDER)

I am greatly indebted to Dr. C. Howard Curran for the privilege of examining a small series of crane-flies from the Solomon and Santa Cruz Islands, chiefly collected by Mr. M. Willows, Jr., while a member of the Templeton-Crocker Expedition of 1933. The types of the novelties of these species, mostly in very indifferent condition, are preserved in the Museum of the California Academy of Sciences. Dr. Curran has also included for examination a few additional species from Bougainville and the other Solomon Islands, belonging to the American Museum of Natural History.

TIPULINAE

Megistocera fuscana (Wiedemann)

Nematocera fuscana Wiedemann; Dipt. exot., 1: 29, 1921.

Widely distributed in the Indo-Malayan and Australian regions: Sumatra, Java, Borneo, Celebes, Aru Islands and New Guinea, northward to northern Luzon, southeastward to Queensland, eastward to the Solomon Islands. The genus is one of several crane-flies that occurs in northern Luzon, yet does not reach Formosa.

One female, Guadalcanar Island, September 17, 1927; Am. Mus. Nat. Hist. Accession No. 27590. The record is the most easterly so far reported for this fly.

Nephrotoma guttipleura Alexander, new species

Text figure 1

Mesonotal praescutum yellow, with three black stripes, the outer ends of the lateral pair suffused with more brownish areas that reach the outer margin; posterior border of mediotergite with paired confluent black spots; pleura heavily variegated with brownish black; wings yellow, prearcular region and cells *C* and *Sc* clear light yellow; wing-tip weakly darkened; abdominal tergites orange, ringed caudally with black, presenting a tigrine appearance.

Female: length, about 16 mm.; wing, 13.5 mm.

Frontal prolongation of head moldy, apparently yellow, with the nasus and adjoining regions blackened; basal two segments of palpi brownish yellow, terminal segments black. Antennae with scape and pedicel yellow; proximal flagellar segments yellow, beyond the third or fourth flagellar segment with the basal enlargement slightly darkened; verticils long, exceeding the segments. Head yellow, the occipital brand small and poorly-delimited.

Pronotum yellow medially, brownish black on sides. Mesonotal praescutum yellow, with three black stripes, the lateral pair somewhat more polished than the median; a pale brown suffusion opposite the anterior ends of the lateral stripes, reaching the pretergites; scutum yellow, each lobe with two confluent black areas; a group of black setae on posterior lateral portion of each scutal lobe; scutellum pale brown, the parascutella a little darker; mediotergite yellow, the posterior border with two confluent polished black areas. Pleura pale yellow, conspicuously variegated by brownish black, including most of the anepisternum; ventral sternopleurite; extreme cephalic border of pteropleurite and adjoining posterior edge of anepisternum and sternopleurite; ventral meron; and ventral edge of pleurotergite. Halteres reddish brown, the apex of knob a little brightened. Legs with the coxae orange, the base of middle coxae narrowly blackened, of posterior coxae more broadly so; trochanters yellow; femora obscure yellow; tibiae brownish yellow, the tip very narrowly blackened; (a single leg, fore, remains; tarsi broken). Wings (Text fig. 1) strongly tinged with yellow, the prearcular field and cells *C* and *Sc* clear light yellow; stigma oval, brown; wing-tip restrictedly darkened; veins pale brown, the prearcular veins, *C*, *Sc*, *R* and *Cu* yellow. About a dozen stigmal trichia in cell *R*₁. Venation: *Sc*₂ opposite origin of *Rs*, *Sc*₁ near tip; cell *M*₁ narrowly sessile; *m-cu* on *M*₄ shortly beyond fork; *M*₃ and *M*₄ forking at a common point.

Abdominal tergites orange; basal tergite with caudal border blackened; tergite two with caudal border black, together with extensive lateral darkenings on basal ring; tergites three to eight with transverse black caudal borders, presenting a tigrine appearance; on lateral margins, these black borders turn slightly cephalad and on segments three to five the cephalic-lateral angles of the segments are restrictedly darkened; ovipositor and genital shield orange.

Holotype: female, **Bougainville Island**, May 3, 1928; in Am. Mus. Nat. Hist., Accession No. 28250.

The present fly is readily told from other species and subspecies in the Solomon Islands by the heavily spotted thoracic pleura and narrowly darkened wing-tip. The clear yellow costal border is more like *Nephrotoma solomonis* Alexander than *N. opima* Alexander. The accompanying key will separate the known species and races so far discovered in the islands.

The genus Nephrotoma in the Solomon Islands.

1. Thoracic pleura heavily spotted with brownish black; extreme wing-tip slightly infumed. *guttlepleura* sp. nov.
- Thoracic pleura indistinctly variegated with reddish areas; wing-tip undarkened. 2
2. Cell *Sc* dark brown, contrasting with the pale yellow cell *C*. *opima* Alexander
- Cell *Sc* yellow, concolorous with cell *C* (*solomonis* and races). 3
3. Abdomen orange, scarcely patterned, only the ninth segment black (male). *solomonis malaitana* subsp. nov.
- Abdominal tergites yellow or orange, the posterior margins ringed with black 4
4. Praescutal stripes intensely black, the lateral pair turned outward at their anterior ends; abdomen with basal four tergites orange, the posterior margins black; segments five to nine chiefly black *solomonis guadalcanarana* subsp. nov.
- Praescutal stripes brownish black, the median stripe more or less obliterated at anterior end; abdomen with basal seven tergites yellow, the posterior margins black; segments eight and nine chiefly dark brown. *solomonis solomonis* Alexander

***Nephrotoma opima* Alexander**

Nephrotoma opima Alexander; Ann. Mag. Nat. Hist., (9) 13: 49, 1924.

The type is a female from Pamua, San Cristoval Island, collected by William M. Mann. A few additional specimens in the present series: Males and females, Star Harbor, San Cristoval Island, July 1, 1933. One male, Santa Catalina Island, Solomon Group, July 2, 1933.

The male hypopygium is much as in *Nephrotoma solomonis* Alexander and it is possible that the present fly will eventually be held to be only a geographic race of the latter, despite very distinct details of coloration. The abdomen of the male has tergites two to five orange, the posterior borders black; sternites two to five similar, but the borders only indistinctly darkened; segments six to nine, including hypopygium, black. Antennal flagellum chiefly black.

***Nephrotoma solomonis* Alexander**

Nephrotoma solomonis Alexander; Ann. Mag. Nat. Hist., (9) 13: 48-49, 1924.

The types are from Tulagi, Florida Island, Solomon Group, collected by William M. Mann. A few additional specimens which I refer to this species show characters that necessitate the erection of subspecies, which may well be found to be restricted to certain islands of the Solomon Group.

***Nephrotoma solomonis solomonis* Alexander**

Praescutal stripes brownish black, the median one more or less obliterated at anterior end; abdominal tergites one to seven with caudal margins narrowly and evenly blackened; segments eight and nine dark brown; styli of hypopygium obscure yellow.

***Nephrotoma solomonis malaitana* Alexander, new sub-species**

As in typical *solomonis*, differing as follows: Antennae more strongly bicolorous, the basal enlargement dark brown, the remainder yellow; flagellar segments more strongly incised. Ground-color of head and thorax more orange, the praescutal stripes more reddish brown, subnitidous. Abdomen orange, without distinct markings, only segment nine black. Male hypopygium with outer dististyle yellowish brown.

Holotype: male, No. 4019, Mus. Calif. Acad. Sci., Ent., Uras Cove, Malaita Island, May 28, 1933.

***Nephrotoma solomonis guadalcanarana* Alexander,
new sub-species**

As in typical *solomonis*, differing as follows: General coloration of body more orange than yellow. Praescutal stripes intensely black, the lateral pair with a velvety-black spot opposite their anterior end, outcurved to margin; scutellum

(male) with paired pale brown spots. Abdomen with basal four segments orange, the posterior borders narrowly and evenly blackened; fifth segment black, the extreme base vaguely brightened; succeeding segments (male) black.

Male: length, 10.5—11 mm.; wing, 10—10.5 mm.

Female: length, about 15 mm.; wing, about 12 mm.

Holotype: male, **Guadalcanar Island**, July 1927; Am. Mus. Nat. Hist., Accession No. 27, 590; *allotopotype*: female, No. 4020, Mus. Calif. Acad. Sci., Ent., **Kau Kau Plantation, Guadalcanar Island**, May 23, 1933, Templeton Crocker Expedition; *paratopotype*: male, with the allotype; author's collection.

LIMONIINAE

Limonia (Laosa) bipartita Alexander, new species

Text figure 2

General coloration yellow, the posterior two-thirds of the praescutum, together with the scutum, darkened; rostrum light yellow; knobs of halteres dark brown; wings whitish, with an irregular, pale brown, crossbanded pattern; supernumerary crossveins in cells R_3 and R_5 ; abdominal tergites yellow, their caudal borders black.

Female: length, about 7 mm.; wing, 7.2 mm.

Rostrum light yellow, relatively long, exceeding one-half the length of remainder of head; palpi brownish black. Antennae with scape and pedicel yellow; flagellum brownish black; terminal segment one-half longer than the penultimate; verticils shorter than the segments. Anterior vertex reduced to a narrow, light gray strip, about one-third as wide as the diameter of the scape; posterior region of head dark brown.

Pronotum light yellow. Mesonotal praescutum light yellow on anterior third, the posterior portion darkened; scutum similarly darkened, including the median area; scutellum pale yellow, the posterior border very weakly darkened; mediotergite yellow, the posterior half or less suffused. Pleura and pleurotergite pale yellow. Halteres of moderate length, yellow, the knobs dark brown. Legs with the coxae and trochanters light yellow; remainder of legs broken. Wings (Text fig. 2) whitish, with an irregular pale brown pattern that is distributed about as illustrated, the outer edges of the brown areas very slightly darker than the centers; veins pale brown, darker in the clouded portions. Venation: Sc relatively long, Sc_1 ending about opposite one-fourth the length of cell $1st\ M_2$, Sc_2 at its tip; free tip of Sc_2 and R_2 in approximate transverse alignment; supernumerary crossveins in cells R_3 and R_5 ; cell $1st\ M_2$ long, widened distally, m shorter than the basal section of M_3 ; $m-cu$ at near one-third the length of the cell; Anal veins beyond base very strongly convergent, at narrowest point cell $1st\ A$ reduced to a linear strip.

Abdomen with the tergites obscure yellow, the caudal borders of the segments black, this pattern involving segments two to seven; shield of ovipositor darkened; sternites chiefly pale yellow. Ovipositor with the valves short but slender, the cerci gently upcurved.

Holotype: female, No. 4021, Mus. Calif. Acad. Sci., Ent., **Star Harbor, San Cristoval Island**, July 1, 1933.

The only described regional species of *Laosa* with two supernumerary crossveins in the radial field of the wing are *Limonia (Laosa) falcata* Alexander (New Britain), readily told by the falcate wings, with abundant brown dots in the interspaces; and *L. (L.) riedelella* Alexander (New Guinea), a much larger fly, with m much longer than the short, transverse, basal section of vein M_3 , and with the

dark wing-pattern restricted to small seams on certain of the cross-veins and deflections. I have indicated in other papers the reasons for restricting the name *Laosa* to those species of *Limonia* having one or two supernumerary crossveins in the outer radial field of the wing.

***Limonia* (*Libnotes*) *willowsi* Alexander, new species**

Text figure 3

Close to *aurantiaca*; general coloration yellow; praescutum variegated by brownish black on posterior half; wings pale yellow; cells *C* and *Sc* more saturated; conspicuous brown crossbands, including a more extensive fascia at and beyond arculus, the yellow costal border beyond this band reduced in area; abdominal tergites yellow, segments three to seven each with a conspicuous, triangular, black area on either side, the midline narrowly pale.

Female: length, about 8.5 mm.; wing, 11 mm.

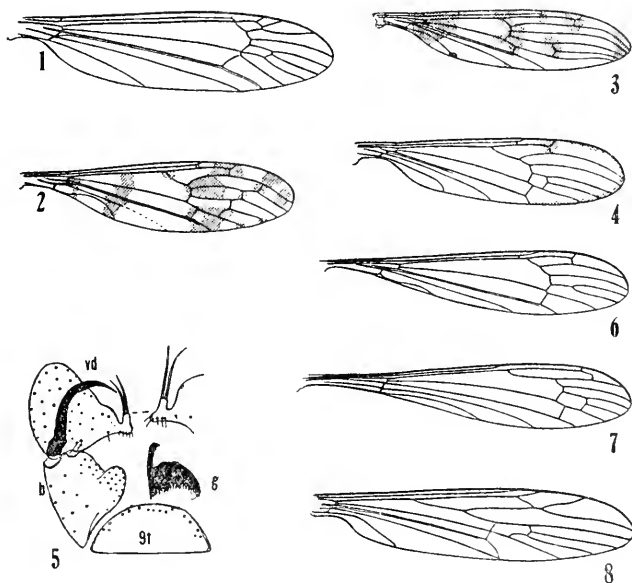
Rostrum yellow; palpi obscure yellow. Antennae with the scape yellow; pedicel and basal segments of flagellum black, the outer flagellar segments somewhat paler, yellowish brown; basal flagellar segments short-oval, the outer ones more elongate; terminal segment long and slender, about equal in length to the two preceding segments combined; longest verticils unilaterally arranged, a little longer than the segments. Posterior vertex and occiput brown; eyes broadly holoptic, obliterating the anterior vertex.

Pronotum yellow, broadly dark brown behind. Mesonotal praescutum light yellow on about the anterior half, the posterior half light brown, with a more brownish black darkening on the anterior border of the infuscated portion, more extensive on the sides; scutum yellow, the lobes chiefly blackened; scutellum light yellow; mediotergite yellow in central portion, brownish black sublaterally. Pleura and pleurotergite yellow. Halteres relatively elongate, the stem yellow, the knob dark brown. Legs with the coxae and trochanters light yellow; remainder of legs broken. Wings (Text fig. 3) pale yellow, cells *C* and *Sc* more saturated yellow; a conspicuous brown crossbanded pattern, more intense along the costa, somewhat paler behind; the dark pattern includes the extreme wing-base; a broad fascia beyond the arculus; cord; tip of *Sc*; stigma and outer end of cell *1st M*₂; wing-tip more weakly darkened; small dark spots at outer ends of Anal veins; veins yellow, darkened in the clouded areas. Venation: *Sc*₁ ending shortly before outer end of cell *1st M*₂, *Sc*₂ at its tip; *R*₁₊₂ jutting distad beyond level of free tip of *Sc*₂, the latter lying shortly beyond level of *R*₂; *m-cu* more than its length beyond the fork of *M*.

Abdomen yellowish brown, the third to seventh tergites with a conspicuous triangular black area on either side, the mid-line narrowly pale; sternites yellow. Ovipositor with valves short but slender, reddish horn-color, the bases more darkened; cerci strongly upcurved.

Holotype: female, No. 4022, Mus. Calif. Acad. Sci., Ent., Uras Cove, Malaita Island, May 28, 1933.

Limonia (*Libnotes*) *willowsi* is named in honor of the collector of this interesting series of crane-flies from the Solomon Islands. The fly is very close to *L. (L.) aurantiaca* (Doleschall) and may prove to be a geographical form of this latter species. The much heavier and more extensive brown wing-pattern and differences in the coloration of the thorax and abdomen induce me to consider the fly as being specifically distinct. *L. (L.) flavipalpis* (Edwards) and *L. (L.) illecebrosa* (Alexander) are more distantly allied.



- Fig. 1. *Nephrotoma guttipleura* Alexander, new species, venation.
 Fig. 2. *Limonia* (*Laosa*) *bipartita* Alexander, new species, wing.
 Fig. 3. *Limonia* (*Libnotes*) *willowsi* Alexander, new species, wing.
 Fig. 4. *Limonia* (*Libnotes*) *ephippiata* Alexander, new species, wing.
 Fig. 5. *Limonia* (*Dicranomyia*) *cruzi* Alexander, new species, male hypopygium.
b, basistyle; *g*, gonapophysis; *t*, tergite; *vd*, ventral dististyle.
 Fig. 6. *Limonia* (*Pseudoglochina*) *fuscolata* Alexander, new species, venation.
 Fig. 7. *Limonia* (*Thrypticomys*) *spathulata* Alexander, new species, venation.
 Fig. 8. *Trentepohlia* (*Mongoma*) *solomonensis* Alexander, new species, venation.

***Limonia* (*Libnotes*) *solomonis* (Alexander)**

Libnotes solomonis Alexander; Ann. Mag. Nat. Hist., (9) 13: 39-40, 1924.

Described from Guadalcanar Island, January 17-18, 1921, collected by J. A. Kusche. Later reported by the present writer from Rabaul, New Britain, January 1933, taken by Frank H. Taylor.

One male, Nupani Reef Island, Santa Cruz Group, May 8, 1933. One male, Matema Islands, Santa Cruz Group, July 8, 1933.

Readily told from all generally similar species of *Libnotes* by the conspicuously blackened bases of all tibiae.

***Limonia* (*Libnotes*) *ephippiata* Alexander, new species**

Text figure 4

General coloration of thorax reddish, with a transverse black saddle beyond midlength of the praescutum; flagellum dark brown; head black, sparsely pruinose; knobs of halteres dark brown; wings subhyaline, the prearcular region and cells

C and *Sc* light yellow; stigma small, dark brown; wing-apex narrowly bordered by dark; cell *1st M*₂ small; abdomen reddish, the basal two sternites with black areas near outer ends.

Female: length, about 6.5 mm.; wing, 7 mm.

Rostrum brown; palpi black. Antennae with scape black; pedicel obscure brownish yellow; flagellum dark brown; flagellar segments oval, gradually decreasing in size outwardly, the terminal segment a little shorter than the penultimate; verticils subequal in length to the segments. Head black, sparsely pruinose; eyes very large, contiguous on vertex.

Prothorax and mesonotal praescutum entirely reddish except for a very conspicuous black saddle on the latter, lying transversely across the sclerite, its anterior edge at near midlength of the praescutum, its posterior border some distance before the suture; surface of thorax polished; posterior sclerites of mesonotum more yellow. Pleura reddish. Halteres pale, with dark brown knobs. Legs with the coxae and trochanters reddish; remainder of legs broken. Wings (Text fig. 4) subhyaline, the prearcular region and cells *C* and *Sc* light yellow; stigma small, subcircular, dark brown; wing-border from just beyond the stigma to end of vein *Cu*₁ very narrowly darkened; veins dark brown, yellow in the flavous areas. Venation: *Sc*₁ ending nearly opposite *r-m*, *Sc*₂ a short distance from its tip; free tip of *Sc*₂ and *R*₂ in transverse alignment; cell *1st M*₂ small, with *m-cu* at near one-third its length; Anal veins gently divergent.

Abdomen reddish, the tergites unmarked; basal two sternites with a black mark near outer margin, the second one larger; bases of hypovalvae blackened. Ovipositor with the elongate cerci slender and nearly straight.

Holotype: female, No. 4023, Mus. Calif. Acad. Sci., Ent., Star Harbor, San Cristoval Island, July 3, 1933.

By Edwards' key to the species of *Libnotes* (Journ. Fed. Malay St. Mus., 14: 74-80; 1928), the present fly runs to couplet 61, differing from all forms beyond this point, and likewise from all other more recently characterized species, by the transverse black saddle beyond midlength of the praescutum.

Limonia (Dicranomyia) cruzi Alexander, new species

Text figure 5

Belongs to the *tristis* group; allied to *subsordida*; mesonotal praescutum obscure yellow, with a median brown stripe, lateral stripes lacking; pleura brown, sparsely pruinose, with a narrow, dark brown, longitudinal stripe; halteres yellow, the knobs dark brown; male hypopygium with the rostral spines elongate, exceeding one-third the length of the dorsal dististyle; mesal-apical lobe of the large blackened gonapophyses with microscopic denticles.

Male: length, about 4 mm.; wing, 4.4 mm.

Rostrum and palpi black. Antennae black throughout; flagellar segments oval, the verticils subequal in length to the segments. Head gray; narrowest point of vertex about one-half as wide as the diameter of scape.

Pronotum dark brown. Mesonotal praescutum obscure yellow, with a conspicuous brown median stripe that is partly interrupted at near midlength; no lateral praescutal stripes; scutum obscure yellow, the mesal half of each lobe darkened; scutellum testaceous brown; mediotergite weakly darkened, sparsely pruinose. Pleura brown, sparsely pruinose; a narrow, dark brown line from the cervical region to the base of abdomen. Halteres yellow, the knobs dark brown. Legs with the coxae yellow, the bases weakly darkened; trochanters yellow; femora yellow basally, passing into brown; tibiae and tarsi pale brown, the outer segments

of the latter dark brown. Wings tinged with grayish, the small, subcircular stigma brown; scarcely evident darkenings at arculus and origin of *Rs*; veins brown. Venation: *Sc*₁ ending opposite origin of *Rs*, *Sc*₂ at its tip; free tip of *Sc*₂ and *R*₂ in transverse alignment; *m-cu* at fork of *M*.

Abdomen dark brown. Male hypopygium (Text fig. 5) with the caudal margin of tergite, *9t*, convexly rounded, with nearly a score of strong setae arranged around margin. Basistyle, *b*, short and stout, the ventro-mesal lobe basal in position. Ventral dististyle, *vd*, large and fleshy, the rostral prolongation stout at base, suddenly constricted before the spines; these latter are two in number, from a conspicuous common tubercle; spines close together, long and slender, gently diverging; each spine exceeds one-third the length of the sickle-shaped dorsal dististyle. Gonapophyses, *g*, appearing as broad blackened plates; mesal-apical lobe long and narrow, a little dilated at apex, the margin with a series of microscopic denticles.

Holotype: male, No. 4024, Mus. Calif. Acad. Sci., Ent., **Matema Island, Santa Cruz Group**, July 7, 1933.

The nearest ally is *Limonia* (*Dicranomyia*) *subsordida* (Edwards) of Samoa, which differs in slight details of coloration of the mesonotal praescutum and halteres, and more evidently in the structure of the male hypopygium, especially the rostral spines and the elongate spinous mesal-apical lobe of the gonapophysis.

***Limonia* (*Pseudoglochina*) *fuscolata* Alexander, new species**

Text figure 6

Allied to *laticincta*; mesonotum almost uniformly light brown; pleura chiefly occupied by a broad, pale yellow, longitudinal stripe, the ventral sternopleurite dark; tibiae white, with a very broad central brownish black ring; tarsi white; wings with a brownish tinge, the stigma oval, darker brown; *Sc*₁ ending about opposite midlength of *Rs*; anterior cord oblique; *m-cu* beyond fork of *M*; cell *2nd A* very small.

Female: length, about 5.5 mm.; wing, 5.6 mm.

Rostrum and palpi black. Antennae black throughout; flagellar segments oval, clearly separated; verticils conspicuous. Front dark; vertex pale brownish yellow, darker behind.

Mesonotum almost uniformly light brown, the humeral region of praescutum a little darker. Pleura chiefly occupied by a very broad, pale yellow, longitudinal stripe, restricting the brown color to the ventral sternopleurite and dorsal pleurotergite. Halteres dark brown. Legs with the coxae pale basally, darker apically; trochanters brownish testaceous; femora brown, passing into dark brown; tibiae snowy-white, with a very extensive brownish black central ring that is about twice as wide as the pale apex beyond; basal white ring narrow; tarsi snowy-white, the outer segment slightly darker. Wings (Text fig. 6) with a strong brownish tinge; stigma oval, darker brown; veins brownish black. Veins somewhat stouter than in *laticincta*. Venation: *Sc*₁ ending some distance beyond origin of *Rs*, nearly opposite one-half the length of the vein; *Rs* and basal section of *R*₄₊₅ shorter and more oblique than in *laticincta*; *m-cu* shortly beyond the fork of *M*; cell *2nd A* very small, only about one-half as long as in *laticincta*.

Abdominal tergites dark brown, the sternites more yellowish brown.

Holotype: female, No. 4025, Mus. Calif. Acad. Sci., Ent., North-west end of **Bellona Island**, June 21, 1933.

Limonia (*Pseudoglochina*) *fuscolata* is entirely distinct from the larger *L. (P.) laticincta* (Edwards) of Samoa, which has a somewhat similar leg-pattern but an entirely different venation, as shown above.

***Limonia* (*Thrypticomyia*) *spathulata* Alexander, new species**

Text figure 7

General coloration of mesonotum uniformly pale brown, the pleura yellow; legs brown, the tarsi snowy-white, with about the proximal sixth of the basitarsi darkened; wings almost uniformly tinged with brown, the prearcular cells more hyaline; Sc_1 ending just before origin of R_s ; free tip of Sc_2 about three times its length before R_2 ; R_{1+2} lacking; basal section of R_{4+5} short; $m-cu$ at about one-third the length of cell 1st M_2 ; abdominal tergites uniformly dark brown.

Female: length, about 4.5 mm.; wing, 5.5 mm.

Rostrum and palpi black. Antennae black, relatively long, the long-oval flagellar segments with conspicuous apical pedicels; verticils very long, especially on the more basal segments. Head dark.

Mesonotum uniformly pale brown, the mediotergite a little paler. Pleura pale yellow. Halteres brown. Legs with the coxae and trochanters pale yellow; femora brown, the bases narrowly yellow; tibiae darker brown; tarsi white, with about the proximal sixth of the basitarsi darkened. Wings (Text fig. 7) almost uniformly tinged with brown, the prearcular cells more hyaline; stigma elongate, darker brown; veins brownish black. Wing-form more accentuated spatulate than in most members of the subgenus, the prearcular region and cells immediately beyond arculus strongly narrowed. Venation: Sc_1 ending just before origin of R_s , Sc_2 some distance from its tip; free tip of Sc_2 about three times its length before R_2 , the latter meeting R_1 at a right angle, with no basal spur of R_{1+2} persisting; basal section of R_{4+5} unusually short, slightly angulated at near midlength; $m-cu$ at about one-third the length of cell 1st M_2 .

Abdominal tergites uniformly dark brown, the sternites paler.

Holotype: female, No. 4026, Mus. Calif. Acad. Sci., Ent., **Matema Island, Santa Cruz Group**, July 9, 1933.

Among the now rather numerous species of *Thrypticomyia* known in the Australasian fauna, the present species comes closest to *Limonia* (*Thrypticomyia*) *doddi* (Alexander) of Queensland, which is best-separated by venational details (as the longer Sc , long basal spur of R_{1+2} , elongate basal section of R_{4+5} , which is distinctly longer than the basal section of M_{1+2} and almost equal in length to $m-cu$) and by the more extensive darkening of the basitarsi which involves approximately the basal half of the segment.

***Trentepohlia* (*Mongoma*) *brevipes* Alexander**

Trentepohlia (*Mongoma*) *brevipes* Alexander; Ann. Mag. Nat. Hist., (10) 7: 18-19, 1931.

Described from Suali, Vailala River, Papua, collected by Littlechild. Later discovered in New Britain (Toma, February 1933, collected by Frank H. Taylor).

One female, Star Harbor, San Cristoval Island, July 3, 1933.

***Trentepohlia (Mongoma) solomonensis* Alexander, new species**

Text figure 8

General coloration of body pale brown; femora and tibiae uniformly darkened; outer tarsal segments paling to obscure yellow; wings subhyaline; basal section of R_5 long; vein R_3 exceeding one-half the length of vein R_4 ; proximal end of cell M_3 lying basad of that of cell 2nd M_2 ; $m-cu$ at fork of M .

Male: length, about 6 mm.; wing, 6.3 mm.

Rostrum obscure yellow; palpi brown. Antennae with the scape a trifle brighter in color than the remaining dark brown color of the organ; flagellar segments cylindrical, with verticils that are subequal to or shorter than the segments. Head dark, pruinose; anterior vertex reduced.

Mesonotum rather pale yellowish brown, the praescutum without clearly defined stripes; setae of interspaces relatively long and erect. Pleura yellow. Halteres dusky. Legs with the coxae and trochanters yellow; femora and tibiae brown, the outer tarsal segments paling to yellow; femora at bases with a series of from 6 to 8 short black spines; two long black setae at distal end of tibia (at least on one pair of legs, detached, but presumably the posterior). Wings (Text fig. 8) subhyaline; veins darker. A series of about 14 strong trichia on outer section of vein R_5 . Venation: Basal section of vein R_3 relatively long, approximately two-thirds the length of R_5 ; R_2 sinuous, some distance before fork of R_{3+4} ; vein R_3 oblique, about three-fifths the length of R_4 ; inner end of cell M_3 lying proximad of that of 2nd M_2 ; $m-cu$ at fork of M ; apical fusion of veins Cu_1 and 1st A slight.

Abdomen dark brown, the basal sternites somewhat paler.

Holotype: male, No. 4027, Mus. Calif. Acad. Sci., Ent., **Kau Kau Plantation, Guadalcanar Island**, May 23, 1933.

By Edwards' key to the Australasian species of *Trentepohlia* (Insects of Samoa, Part 6, fasc. 2, Diptera Nematocera, pp. 94-95; 1928), the present fly runs to *Trentepohlia (Mongoma) brunnea* Edwards, a large vigorous species with strongly infumed wings. I am indebted to Doctor Edwards for a paratype specimen of this latter insect. I know of no other more nearly allied species.

PSYCHODIDAE

There is a single, very badly rubbed specimen of *Parabrunettia* from Santa Catalina Island, July 3, 1933, but its condition is too poor for determination.

SCIARIDAE

This family is represented by two or possibly three species taken on Santa Catalina Island, July 2, 1933. Two of the specimens are in such poor condition that they cannot be named. Three specimens may prove to be *S. pruinosa* Rübsaamen. In these the first flagellar segment is only half as long as the second, not twice as long, as given in Edward's key. On account of the difference in the length of the antennal segments I hesitate to identify the specimens, even though I think the statement of length is erroneous.

STRATIOMYIDAE

There are five species before me, three of them represented only by specimens collected by the Whitney South Sea Expedition.

Evaza Walker

Five specimens collected by the Whitney South Sea Expedition represent three species, all of which appear to be undescribed. They may be distinguished by means of the following key.

Table of Species

- | | |
|----------------------------------------------------------------------------------------------------------------------|----------------------------|
| 1. Sides of the mesonotum very broadly silvery white haired in front of the suture..... | 2 |
| -. Sides of the mesonotum with a linear stripe of silvery white hairs in front of the suture; genitalia reddish..... | <i>solomensis</i> , n. sp. |
| 2. All the tibiae dark brown; genitalia black; posterior tarsi wholly reddish yellow..... | <i>incidens</i> , n. sp. |
| -. Posterior four tibiae and tarsi yellowish white; genitalia reddish..... | <i>whitneyi</i> , n. sp. |

Evaza solomensis Curran, new species

Posterior four tibiae rusty reddish with the median third yellowish. Length, 8 mm.

Male: head black, the frontal triangle and face white pollinose; lower part of the occiput with brown, the cheeks with yellow pollen; occipital hair brown, that on the proboscis yellow. Proboscis and palpi brown, the labellae reddish. Antennae brownish red, the third segment reddish yellow; arista light brown. Eyes with enlarged facets on the upper two-thirds.

Thorax black, the humeri, posterior calli, a slender stripe on the upper edge of the mesopleura and the area immediately surrounding the roots of the wings ferruginous, the free border of the scutellum, except basally, and its spines yellowish. Mesonotum with somewhat more than the median third on the posterior two-thirds, the narrow lateral margins and the scutellum, with appressed silvery white hair, otherwise with very short brown hair; pleura with silvery white hair.

Coxae and femora yellow; apical third of the posterior four femora and almost the apical half of the anterior pair rusty reddish; hair pale yellow, black on the dark portions. Anterior tibiae pale brown, brown haired; middle and posterior tibiae pale brownish with about the median third reddish yellow, the middle tibiae with yellowish hair in front and brown behind, the posterior pair mostly yellowish haired but with some black hairs on the dark areas. Anterior tarsi brown and with brown hair; posterior four tarsi reddish yellow, the hair wholly pale.

Wings cinereous hyaline, the costal border broadly brown on the apical half, the apical third of the wing, except the discal cell, and the first basal cell pale brown. Squamae brown. Halteres reddish yellow, with brown knobs.

Abdomen shining black, the hair brown. Genitalia reddish.

Female: front narrowest at the anterior fifth, a little more than twice as wide in front of the ocelli, vertex rather deeply excavated on either side of the ocellar tubercle; occiput strongly produced above, the edge rather sharp; antennae wholly reddish yellow; eyes without enlarged facets. Abdomen brownish, the apices of the segments and much of the venter dull reddish.

Holotype: (♂), and *allotype*: (♀): **Vella Lavella Island, Solomon Group**, November 16, 1927 (Whitney Expedition); in American Museum of Natural History.

Apparently related to *fortis* Walker, but the legs are differently colored. Brunetti states that the posterior four femora and tibiae are pale brown on the apical half in *fortis*.

Evaza incidens Curran, new species

Posterior four legs with the apical fourth of the femora and the tibiae entirely brown. Length, 6 mm.

Female: head shining black, the front and occiput sometimes brown; face thinly cinereous pollinose, the front with a small silvery spot immediately above the bases of the antennae. Front twice as wide above as at the anterior fifth. Occiput rather strongly produced on the upper half, deeply incised on the vertex on either side of the ocellar tubercle. Hair on the occiput and face black, very short on the face. Proboscis and palpi brown. Antennae reddish yellow, the arista black.

Thorax black, the humeri, a small spot on the posterior calli, and the upper edge of the pteropleura shining brownish red. Hair silvery white, appressed, a broad arch of brown hair extending across the front margin of the mesonotum and carried back to the posterior border on either side, widened to reach the lateral margins behind the suture but very broadly separated from them in front of the suture. Free border of the scutellum except basally, and the spines, yellow.

Legs brown, the coxae, basal fourth of the front and two-thirds of the posterior four femora, and the posterior four tarsi yellow; apices of the posterior four femora black. Hair yellow on the pale parts, brown on the dark portions.

Wings cinereous hyaline, the costal border broadly brown on the apical half; apical portion of the wing light brown beyond the discal cell. Squamae brown. Halteres dark brown, the stem reddish.

Abdomen shining black, the hair brown, mostly pale on the middle of the venter.

Holotype (♀), and *paratype* (♀): **Choiseul Island, Solomon Group**, November 26, 1927 (Whitney Expedition); in American Museum of Natural History.

Apparently related to *maculifera* de Meijere and *indica* Kertesz, but differing in the color of the legs and in other respects.

Evaza whitneyi Curran, new species

Apical third of the femora black, the front tibiae and tarsi brown. Length, 7.5 mm.

Male: head black; frontal triangle white pollinose, the face cinereous, the cheeks brown; hair black. Palpi and proboscis brown, the labellae reddish brown. Antennae yellow, the arista black. Eyes with enlarged facets on the upper two-thirds.

Thorax black, with silvery and brown hair as in *incidens*, the scutellum similarly colored.

Legs pale yellow, the femora black on the apical third; anterior tibiae and tarsi brown. Hair yellow, brown on the dark areas.

Wings colored as in *incidens*. Squamae and halteres brown, the latter with reddish yellow stem.

Abdomen shining black, the hair wholly brown. Genitalia reddish.

Holotype (♂): **Malaita Island** (Whitney Expedition).

This species has the legs so strikingly different in coloration from *incidens* that I do not believe the two forms can be sexes of one species. The humeri are wholly black.

Lophoteles plumula Loew

Lophoteles plumula Loew, Berl. Ent. Zeitschr., ii, p. 111 (f), 1858.

Salduba exigua Wulp, Termes. Fuzet., xxi, p. 413 (f), 1898.

Two ♂, 1 ♀, Matema Islands, Santa Cruz Group, July 8, 1933;
♂, ♀, Nupani Reef Island, Santa Cruz Group, May 8, 1933.

Pedicella mactans (Walker)

Sargus mactans Walker, Proc. Linn. Soc. London, iv, p. 97, 1860.

Sargus mactans Wulp, Notes Leyd. Mus., vii, p. 65, 1885.

Sargus mactans de Meijere, Tijds. v. Ent., liv, p. 263, 1911.

Male: Guadalcanar Island, September 18, 1927; ♀, Choiseul Island, November 25, 1927 (Whitney Expedition); ♀, Kau Kau Plantation, Guadalcanar Island, May 20, 1933.

This species is recorded from many of the oceanic Islands, occurring from India to Australia.

ASILIDAE

In addition to the material secured by the Crocker Expedition there are a number of specimens before me collected by the Whitney South Seas Expedition during 1927.

Leptogaster crockeri Curran, new species

Related to *trifasciata* de Meijere, but the lateral black mesonotal vittae are very broad; there are large basal yellowish spots on the sides of the abdominal segments, and the apex of the wing is more extensively brown. Length, 7 mm.

Male: head black in ground color. Face linear above, widening below and just below the antennae, whitish pollinose; front narrow, with parallel sides, the ocellar tubercle shining. Proboscis brownish red. Antennae reddish, the third segment brown, narrow, not as wide as the second, tapering, the arista stout, brown, as long as the antenna. Hair on face and occiput whitish.

Thorax rusty reddish, the mesonotum darker and shining, with an entire, posteriorly tapering median black vitta, the sides very broadly blackish on more than the posterior half; pleura pale yellow pollinose. Scutellum concealed by gum. Mesosternum more or less brown or ferruginous.

Coxae and trochanters yellow, the anterior coxae darker; femora yellowish, the posterior pair swollen on the apical third, with a broad brown band on the apical fifth; middle femora with a pale brownish band near the apical fourth; the hair black. Tibiae pale brownish yellow, the posterior pair darker, the hair yellowish, but mostly black on the hind pair. Tarsi brownish yellow, the basal one or two segments paler.

Wings hyaline, the veins black, the apex with a broad brown border extending from the apex of the marginal cell to the second submarginal where it forms a large triangle. Halteres yellow, the knob brown.

Abdomen black, with violaceous tinge above; a broad band on the middle of the second segment and the bases of the third to sixth segments moderately broadly, reddish yellow, the basal yellow fasciae expanding laterally and extending over the sternites; seventh sternite broadly yellowish basally, the eighth wholly yellow. Hair black. Genitalia ferruginous below, brown above.

Holotype: male, No. 4028, Mus. Calif. Acad. Sci., Ent., **Santa Catalina Island, Solomon Group**, July 2, 1933.

***Clinopogon nicobarensis* (Schiner)**

Stichopogon nicobarensis Schiner, Novara, p. 161, 1868.

A female from Matema Island, Santa Cruz Group, July 7, is referred here with some doubt, since Schiner's description leaves much to be desired.

***Smeringolaphria ferruginosa* (Wulp)**

Laphria ferruginosa Wulp, Tijds. v. Ent., xv, p. 185, 1872.

Female; Auki Bay, Malaita Island, May 26, 1933.

The determination of this specimen must be regarded as tentative since I have no material for comparison.

Maira Schiner

Many of the species belonging to this genus bear a close superficial resemblance, and it is almost impossible to identify the species from available descriptions. It seems likely that some of the published synonymy is erroneous, and that the actual number of species will be found to be greater than the number now recognized. I have before me six species from the Solomon Islands, only one of which can be placed with any degree of certainty. Three of these are represented by females only and must be ignored until the genus has been properly revised. Two of the species are described as new, figures of the genitalia being given, this seeming to be the only satisfactory means of separating closely allied forms at the present time.

Table of Species

(All included species have the face golden).

1. Anterior four femora and tibiae with long golden yellow hair... *spectabilis* Guerin
- . Legs without golden yellow hair..... 2
2. Occiput with black hair extending onto the lower half..... 3
- . Occiput with the black hair not extending to the middle..... 4
3. Mesonotum with numerous erect black hairs posteriorly..... species No. 1
- . Mesonotum with only the dorsocentral hairs posteriorly, almost without erect hairs..... species No. 2
4. Posterior trochanters with only a few white hairs..... *whitneyi*, n. sp.
- . Posterior trochanters almost all white haired; knob of halteres yellow with black base..... 5
5. Three or four pairs of scutellar bristles; bristles of the mystax all black; collar with many black hairs..... *willowsi*, n. sp.
- . One pair of scutellars; lower bristles of the mystax yellow; collar without black hairs..... species No. 3

Maira species No. 1

Female; N.W. end of Bellona Island, June 22, 1933.

This species is close to *willowsi* but has the halteres brown and the whole posterior orbits and front of the cheeks bear black hair.

Maira species No. 2

Female: Guadalcanar Island, July, 1927 (Whitney Expedition).

Related to *spectabilis* because of the absence of long hairs on the mesonotum behind, but the legs bear white hair and the antennae are much shorter.

Maira spectabilis (Guerin)*Laphria spectabilis* Guerin, Voy. de la Coquille, III, p. 85, 1830.

Two males: Bougainville Island, May 3, 4, 1928 (Whitney Expedition).

This species has the third antennal segment elongate and the male bears long, golden yellow hair on the under surface of the anterior four legs.

Maira whitneyi Curran, new species

Plate 1, figure 7

Metallic blue; face golden; pleura whitish pollinose; legs with long white hair. Length, 13 to 17 mm.

Male: face and front dark ochraceous pollinose; facial hair golden; six or seven pairs of black bristles in the mystax; ocellar tubercle black. Occiput shining black and black haired above, densely white pollinose and white haired on more than

the lower half; cheeks with white hair. Palpi black haired. Antennae black; third segment slightly clavate, almost one-third longer than the basal two combined; hair and bristles black.

Thorax and abdomen metallic blue, usually with violaceous tinge. Humeral area and sides of the mesonotum bronzed, with brownish pollen; pleura white pollinose; mesonotum with long hairs in front and behind and between the rows of dorsocentrals; scutellum with two or three pairs of marginals. Hair black, white on the pleura, except the upper part of the mesopleura; trichostichal bristles all black.

Legs metallic steel blue or purplish, the coxae densely whitish pollinose and with white hair; hair black, long and white on the under surfaces of the anterior four femora and tibiae, the latter also with long black bristly hairs ventrally, the posterior femora mostly white haired beneath; hair of tarsi and of the posterior trochanters black.

Wings hyaline basally, grayish behind, brown to pale brown on the apical half; anterior crossvein situated at the basal third of the discal cell. Squamae and halteres brown.

Abdomen with black hair except on the sides of the first segment basally, and on the venter, where there are white hairs mixed with the black. Genitalia short and robust (Pl. 1, fig. 7).

Female: The long hairs on the mesonotum are sparser and do not extend between the dorsocentrals; there is very little white hair on the legs and the hair on the venter and sides of the abdomen is much shorter.

Holotype: ♂, *allotype*: ♀, and *paratype*: ♂, **Florida Island**, September 12, 13, 11, 1927 (Whitney Expedition). American Museum of Natural History.

***Maira willowsi* Curran, new species**

Plate 1, figure 8

Similar to the preceding species, but the legs bear more abundant yellowish white hair, the posterior trochanters are practically all white haired and the male genitalia are much narrower. Length, 13 to 15 mm.

Male: face and front golden yellow pollinose, the face with golden hair; three or four pairs of black bristles in the mystax, the bristles along the oral opening yellow; ocellar tubercle brown; occiput cinereous pollinose and white pilose, shining black above, with thin brown pollen and black hair limited to the upper fourth. Cheeks with white hair. Palpi with black bristles, basally with short white hair. Antennae black, black haired, the third segment moderately wide, almost one-third longer than the basal two combined.

Thorax dark metallic blue-green or blue, the pleura whitish pollinose, humeral area and the sides more bronzed and with yellowish brown pollen. Hair black on the mesonotum and scutellum, white on the pleura, long on the front and posterior borders of the mesonotum and between the dorsocentrals, black on the upper part of the mesopleura, the trichostichal bristles black above, white on the lower half. Scutellum with three or four pairs of marginals.

Legs metallic blue, sometimes more or less violaceous, the coxae whitish pollinose and pilose; hair white, largely or mostly black on the upper surfaces of the femora and tibiae and entirely so on the tarsi; posterior trochanters with only a few black hairs.

Wings hyaline on the basal half, pale grayish behind, smoky on the apical half. Squamae with yellow fringe. Halteres brownish yellow, the base of the knob with a Y-shaped brown marking.

Abdomen metallic green-blue or blue, the sides with yellowish white hair except apically on the second segment, the venter with pale yellow hair. Genitalia moderately narrow (Pl. 1, fig. 8).

Female: the long hairs on the mesonotum are less numerous and do not extend over the disc between the dorsocentrals; hair on legs somewhat shorter.

Holotype: ♂, No. 4029, *allotype*: ♀, No. 4030, Mus. Calif. Acad. Sci., Ent.; and *paratypes*: three males, **N.W. end of Bellona Island**, June 22, 1933.

Maira, species No. 3

A single female, Kungava Bay, Rennell Island, June 16, 1933, differs from the preceding species in having only one pair of scutellar bristles, the lower pair of bristles of the face yellow, the front more golden and smaller size. It is only 8 mm. in length.

Ommatius excurrens Wulp

Ommatius excurrens Wulp, Tijds. v. Ent., xv, p. 265, 1872; *ibid*, xvi, plate 12, fig. 15.

Male and 4 ♀, N.W. end of Bellona Island, June 22, 1933.

The male agrees fairly well with the original description, but the anterior crossvein is situated at or beyond the middle of the discal cell and not before the middle. The figure shows the crossvein at the basal third of the discal cell. The male has the scutellum black haired, the female with mostly white hair.

BOMBYLIIDAE

There are two specimens of *Geron* in poor condition.

Geron simplex Walker

Geron simplex Walker, Proc. Linn. Soc. London, iii, p. 90.

Two females, N.W. end of Bellona Island, June 21, 1933.

These are placed tentatively as *simplex*. The mesonotum has a broad cinereous, median vitta on the anterior fourth.

EMPIDAE

The three species in the collection are undescribed.

Syneches matema Curran, new species

Related to *deficiens* Walker, but with brown wings. Length, 6 to 7 mm.

Male: black, the thorax and legs mostly rusty reddish yellow. Head black, the proboscis and palpi reddish; face cinereous pollinose. Hair yellowish on the occiput, black on the palpi, antennae and vertex. Antennae reddish, the third segment black, except basally; arista brown. Eyes with greatly enlarged facets on the upper half.

Thorax rusty reddish, the mesonotum with the anterior half or more brown on about the median half, but this color merges gradually into the reddish ground and the whole is moderately brownish pollinose. Hair and bristles black; scutellum bare on the disc, with a row of marginal hairs and bristles. Pleura thinly tawny pollinose, without hair.

Legs rusty reddish yellow, the posterior femora and tibiae black; apical segment of all the tarsi and the posterior coxae brown or ferruginous. Hair and bristles yellowish, black on the posterior legs and on the upper surface of the tibiae and tarsi. Posterior femora with a row of seven anteroventral bristles, the apical five arising from more or less strongly developed tubercles, the under surface with four or five tubercles apically, from which weak bristles or setulae arise; posterior tibiae with a row of about seven weak ventral tubercles.

Wings light brown, darker anteriorly. Squamae brown, the fringe pale. Halteres reddish yellow, the basal half of the knob more or less brown.

Abdomen brownish black, the first segment yellowish; venter yellowish basally, becoming brown apically. Hair black, long and yellow on the sides of the basal three segments. Genitalia small.

Female: the ventral tubercles on the posterior femora are stronger and each gives rise to a short bristle, the anteroventral tubercles are weak, those on the tibiae absent; abdomen with the basal segment reddish or brown.

Holotype: ♂, No. 4031, *allotype*: ♀, No. 4032, Mus. Calif. Acad. Sci., Ent.; *paratypes*: 2 ♂, 1 ♀, **Matema Islands, Santa Cruz Group**, July 9, 1933.

According to Melander's definition of the subgenera of *Syneches* this species would fall in *Harpamerus* Bigot, although it does not bear remarkably strong spines on the posterior femora. It seems to belong more properly in *Epiceia* Walker, but its position here is anomalous in view of the leg armature. I think that *Harpamerus* might well be considered distinct from *Syneches* and that *Epiceia* should be placed as a synonym of Bigot's genus, since these two subgenera have the third and fourth veins conspicuously convergent toward the apices. The recognition of genera and subgenera upon sexual characters does not seem to be sound policy, since it leaves one sex entirely undeterminable unless it can be associated with the determinable sex collected at the same time.

Drapetis confusa Curran, new species

Shining, black, the anterior half of the thorax and base of the abdomen reddish, the legs yellow. The male agrees well with the description of the Australian *bicolor* Bezzi, but there is a reddish brown band extending over the posterior border of the sternopleura from the middle coxae to the base of the wings, this band being reddish in the female. This band is not present in the female of *bicolor*. Length, 1.25 to 1.5 mm.

Female: head shining black, the bristles yellowish; front narrow, wedge-shaped; face obliterated by the contiguity of the eyes except above and below, or represented by a very fine line. Proboscis and palpi yellow. Antennae reddish yellow, the third segment and arista brown, the latter pubescent; third segment one-half longer than wide, moderately pointed.

Thorax red on the anterior half, the red color rectangularly produced posteriorly on the middle of the mesonotum and extending on the sternum to the middle coxae, a broad band extending upward over the middle of the pleura to the base of the wings, leaving a broad black band extending from the upper margin of the mesopleura to the middle of the sternopleura. Hair and bristles yellowish, the bristles on the posterior half black or brown. Scutellum with one pair of bristles, its apex rather transverse, the disc flattened.

Legs reddish yellow, the apical tarsal segment reddish brown; hair and bristles yellow.

Wings cinereous hyaline, the veins luteous or pale brown, yellow basally; hair on the basal two-thirds of the costa fairly long. Halteres pale yellow.

Abdomen shining black, the first segment broad; second and third reddish yellow or reddish, each with a triangular, brown lateral spot; sides of the fourth segment with semi-squamose, black hair. Genital lamellae brownish yellow.

Male: bristles of the thorax wholly yellow; median pale band on the pleura almost obsolete, rather ferruginous; third abdominal segment less extensively yellowish; sides of the fourth segment with simple hairs; genital appendages luteous; hair brown.

Holotype: ♀, No. 4033, Santa Catalina Island, Solomon Group, July 2, 1933; *allotype*: ♂, No. 4034, Mus. Calif. Acad. Sci., Ent., N.W. end of Bellona Island, June 21, 1933; *paratypes*: ♀, Santa Catalina Island, July 2, 1933, and ♀, Matema Island, Santa Cruz Group, July 7, 1933.

The abdomen may be contracted so that the second and third segments are largely concealed beneath the first, the yellow band therefore appearing quite narrow.

Drapetis crockeri Curran, new species

Black, the legs yellowish. Differs from *exul* O.S. in having pale yellow palpi. Length 1.5 mm.

Female: head shining black, the bristles black; front rather narrow; face linear, the eyes distinctly separated; palpi pale yellow. Antennae reddish, the third segment elongate, but not twice as long as the basal two together; arista brown, pubescent, somewhat longer than antenna.

Thorax shining black; hair and bristles yellow; disc of scutellum flattened, the apex rather truncate.

Legs pale reddish yellow, the apical segment of the tarsi brown; hair and bristles yellow; posterior tibiae with only one strong, anterodorsal bristle and without apical spine.

Wings cinereous hyaline; veins pale brown, yellow basally; costa without long hairs basally. Halteres white.

Abdomen shining black, the disc of the second and third segments reddish; lamellae of the ovipositor brownish. Hair black, the sides of the fourth segment without squamose hairs.

Holotype: ♀, No. 4035, Mus. Calif. Acad. Sci., Ent., **Puka Puka Island, Cook Islands**, April 9, 1933.

DOLICHOPIDAE

Most of the specimens belonging to this family are in poor condition or are females, and cannot be properly identified. The following species are among those collected.

Rhagoneurus hirsutisetus de Meijere

Rhagoneurus hirsutisetus de Meijere, Tijd. v. Ent., lix, p. 229, 1916.

Male, Malaita Island, May 30, 1933.

Sciapus evulgatus Becker

Sciapus evulgatus Becker, Cap. Zool., i, Deel 4, p. 205 (f).

Female: Matema Islands, July 10, 1933.

There is another species of *Sciapus* taken at the same place on July 8, 10.

Chrysosoma divisum Becker

Chrysosoma divisum Becker, Cap. Zool., i, Deel 4, p. 182.

Female: Florida Island, Sept. 11, 1927 (Whitney Expedition).

There is a single specimen of another species from Guadalcanar Island, May 20, 1933.

SYRPHIDAE

Only two specimens belonging to this family were collected.

Lathyrrophthalmus punctulatus (Macquart)

Eristalis punctulata Macquart, Dipt. Exot., Suppl. 2, p. 59, 1847.

♂, ♀, Kungava Bay, Rennell Island, June 16, 1933.

PIPUNCULIDAE

This interesting family is represented by two specimens, one of them new to science.

Pipunculus synadelphus Perkins

Pipunculus synadelphus Perkins, Haw. Sug. Plant. Assoc., Ent. Bull. #1, p. 150 (f) 1905.

Female: Matema Islands, Santa Cruz Group, July 8, 1933.

Pipunculus matema Curran, new species

Black, the bases of the femora, tibiae and tarsi yellow; third antennal segment yellow. Length, 3.25 mm.

Male: face and front white; occiput cinereous white pollinose, becoming pale brown at the vertex; vertical triangle shining black. Eyes touching for a distance equal to the length of the frontal triangle. Proboscis and palpi yellow. Antennae brown; third segment yellow, acute below but not produced; arista brown, stout on the basal seventh.

Thorax black in ground color, the humeri yellow, cinereous pollinose, the mesonotum and scutellum brown pollinose, the former broadly cinereous in front of the base of the wings, the pollen on the lower edge of the scutellum with cinereous tinge. Hair brown, inconspicuous.

Coxae, femora and apical tarsal segment blackish, the coxae rather thickly pollinose and with pale apices; trochanters, bases and apices of the femora, tibiae and the basal four tarsal segments reddish yellow; femora thinly pale pollinose, with small setulae below apically, the tibiae without unusual hairs. Claws and pulvilli normal in size, yellow, the former with black apices.

Wings cinereous hyaline; stigma pale brown; third costal section one-fourth shorter than the fourth; anterior crossvein situated well before the middle of the discal cell. Squamae and halteres yellow.

Abdomen black, brown pollinose, the sides cinereous pollinose except on the broad bases of the segments, the pale pollen extending onto the dorsum but not forming entire bands, the inner ends of the spots acute; first segment wholly cinereous, the sides with black bristles. Fifth segment one-half longer than the fourth, longest on the right side. Genitalia brown, thinly pollinose, the appendages yellow, the apex with a moderately large, transverse, oval depression.

Holotype: male, No. 4036, Mus. Calif. Acad. Sci., Ent., **Matema Island, Santa Cruz Group**, July 7, 1933.

This species is related to *javanensis* de Meijere, but has the legs more extensively pale in color.

OTITIDAE

This family, generally known as Ortalidae or Platystomidae, is represented by seven species, belonging to four genera.

Rivellia Desvoidy

Two species, both widely distributed, are in the collection.

Rivellia basilaris (Wiedemann)

Trypeta basilaris Wiedemann, Aussereur. Zweifl., ii, p. 510, 1830.

Two specimens, one from Malaita Island, May 28, 1933, and one from Matema Islands, July 9, 1933.

Rusty reddish yellow, the abdomen usually mostly brown.

Rivellia fusca (Thomson)

Herina fusca Thomson, Eugenes Resa, Dipt., p. 575, 1868.

Three specimens from Malaita Island, May 30, 1933.

Blackish, the base of the abdomen more or less distinctly reddish or reddish yellow.

Scholastes Loew

Three species are before me from the Islands, all differing from described forms. I have enlarged Hendel's key to include these.

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Scholastes palmyra Curran, new species

Plate 1, figure 5

Shining black, reddish yellow and stramineous, the wings hyaline and brown; arista with brown lamella in both sexes. Length, 7 to 8 mm.

Male: front brown, with a transverse, more or less interrupted median reddish fascia; a pale yellowish fascia extending over the lunula and reaching the orbits, and the vertex stramineous. One pair of frontal bristles and two pairs of verticals. Occiput yellowish, brown on about the upper third, the posterior orbits stramineous. Cheeks one-third as wide as the eye-height, broadly stramineous above. Face stramineous, with the parafacials and a broad band on the lower third brown or black. Proboscis and palpi reddish yellow. Antennae brownish red, the arista moderately long plumose to beyond the middle, and bearing a preapical black lamella, the apex whitish. Hair yellowish, the bristles black.

Mesonotum and scutellum shining black, with appressed tawny hair; a broad stramineous stripe extends from the humeri to the posterior calli, and broadly borders the scutellum except at the apex, the pale stripe being separated from the lateral margins behind the humeri and above the wings. Two pairs of weak dorsocentrals, the scutellum with three pairs of marginal bristles. Pleura mostly reddish yellow, but the mesopleura and sternopleura mostly black or reddish brown, the metanotum blackish; hair reddish yellow.

Legs reddish yellow, the apical three tarsal segments of the posterior legs black, the front tarsi black, with the basal segment mostly reddish yellow; tibiae each broadly brown apically on the upper half; hair rather golden from most views; bristles on front femora black.

Wings checkered with brown and cinereous hyaline as shown in figure 5 of Plate 1. Squamae white; halteres yellow.

Abdomen shining steel blue, the third and fourth segments with narrow yellow apices; hair yellow, sometimes broadly black on the sides. Genitalia mostly reddish.

Female: ovipositor brown.

Holotype: male, No. 4037, *allotype*: female, No. 4038, Mus. Calif. Acad. Sci., Ent.; *paratypes*: male and female, **Palmyra Island**, April 2, 1933. Paratypes in American Museum of Natural History.

Scholastes solomensis Curran, new species

Plate 1, figure 4

Blackish, the abdomen steel blue; pleura mostly black; legs reddish yellow, the anterior femora more than half brown. Wings cinereous hyaline and brown as in figure 4 of Plate 1. Length, 6 mm.

Female: front slightly longer than wide, brown, with a narrow median reddish fascia; lunula pale yellowish; one pair of frontals and two pairs of verticals. Occiput, cheeks and face reddish yellow; cheeks with a large brown spot above; face with a broad black fascia extending across the lower third, the parafacials brown. Proboscis brownish red, the palpi pale orange. Antennae reddish, the third segment broadly brown above and apically; arista plumose, the rays absent on the apical half of the upper surface; no lamella. Hair yellow, black on the palpi.

Thorax blackish brown; mesonotum with a lateral stramineous vitta which extends around the free border of the scutellum, the pale stripe separated from the lateral margins except on the humeri, and with indications of three reddish vittae

on the disc; from anterior view, thinly brown pollinose; two pairs of dorsocentral bristles and three pairs of marginal scutellars. Pleura with a broad stramineous stripe above in front of the wings, the pectus reddish in the middle. Hair black.

Legs reddish yellow; anterior femora rather extensively brown; apical two or three tarsal segments blackish; hair black, yellow on the ventral surfaces of the tibiae and on the pale tarsal segments.

Wings with brown markings as in figure 4 of Plate 1. Squamae cinereous; halteres pale yellow.

Abdomen steel-blue with the base broadly reddish; hair black, yellow on the basal segment; ovipositor brownish yellow.

Holotype: female, No. 4039, Mus. Calif. Acad. Sci., Ent., **Star Harbor, San Cristoval Island**, July 1, 1933.

Scholastes whitneyi Curran, new species

Plate 1, figure 3

Front as wide as long; pleura and legs reddish yellow, the apical two or three tarsal segments black; mesonotum shining black; abdomen steel blue; ovipositor reddish on the apical half; wings with irregular brown fasciae. Length about 9 mm.

Female: head dark rusty reddish, the cheeks and face somewhat paler; hair yellow, brown on the front; the hairs along the inner edge of the parafacials below, a few of the upper orbital cilia and most of the hairs on the palpi black. Arista brown on the apical half, plumose on the basal four-fifths; first antennal segment with a long, fine bristle below.

Mesonotum shining black, reddish in front of the suture except toward the sides, and with a faint reddish vitta connecting with a pale yellow stripe originating on the posterior calli, the free margin of the scutellum also broadly pale yellow; humeri mostly reddish, a yellow triangle immediately behind them, narrowly separated from the lateral margin; hair black; three pairs of dorsocentrals and three pairs of marginal scutellars. Pleura pale orange, with paler stripe above, the hair almost all reddish yellow, the mesopleura and pteropleura with some fine black hairs above.

Legs reddish yellow, the apical two or three tarsal segments black; hair yellowish, black on the apical tarsal segments.

Wings cinereous hyaline, with irregular brown fasciae as in figure 3 of Plate 1. Squamae dull yellowish; halteres reddish yellow.

Abdomen metallic steel blue, the basal segment broadly reddish on the sides; hair black, yellow on the basal segment. Venter mostly reddish, becoming brown apically. Ovipositor shining black, the narrow portion reddish.

Holotype: female, **Guadalcana Island**, July 1927 (Whitney South Sea Expedition).

Euprosopia lepida Curran, new species

Plate 1, figure 2

Differs from *fusifacies* Walker in having the apical two transverse brown fasciae on the wings broadly united posteriorly; abdomen sparsely clothed with scales. Length, 7 to 10.5 mm.

Male: head yellowish in ground color, the upper half of the occiput and a very broad band extending to the anterior part of the oral margin black; frontal vitta dark reddish with a brownish area above the lunule; occiput, narrow frontal orbits and the upper half of the parafacials white pollinose; facial keel very broad and transversely wrinkled. Proboscis brown; clypeus and palpi deep black, the former with a more or less distinct reddish triangle in the middle, the palpi with a narrow white tip. Antennae light ferruginous, the arista with moderately long rays on practically its whole length. One pair of vertical bristles. Head distinctly higher than wide.

Thorax slate-colored, the pleura and sides of the mesonotum thickly cinereous white pollinose, the mesonotum with a moderately broad ashy median vitta, the transverse suture narrowly whitish. Scutellum clothed with appressed yellow hair and bearing four marginal bristles, the apex convex or very slightly concave, without shining areas; mesonotum and mesopleura with short black hair, the former with some pale hairs on the median vitta and on the humeri; pleural hair pale yellow.

Legs black, the femora in part more or less reddish, the tibiae dull reddish beneath on about the basal half.

Wings brown and hyaline, as shown in figure 2 of Plate 1. Squamae grayish white, the halteres yellow.

Abdomen slate-colored, with short, appressed black hair, the middle of the dorsum with a broad, longitudinal stripe of pale yellowish hair, the whole with sparse, appressed, yellow scales. Venter with yellow hair, the third sternite broad and with rather dense, bright yellow hair. Genitalia shining brown, clothed with white hair.

Female: ovipositor shining black, pale haired below, black laterally; third sternite without abundant hair.

Holotype: male and *allotype*: female, **Guadalcánar Island**, July, 1927 (Whitney South Sea Expedition) in American Museum of Natural History; *paratype*: male, **Guadalcánar Island**, May 23, 1933, in the Museum of the California Academy of Sciences.

Naupoda Osten Sacken

The single species, collected by the Whitney South Sea Expedition, is apparently undescribed.

Naupoda ventralis Curran, new species

Plate 2, figure 7

Black, the head, most of the legs and the abdominal venter orange; pleura with stramineous stripe above; wings brown basally and bearing three rows of brownish yellow spots. Length, 4.5 to 5 mm.

Female: head orange, the front above with a pair of large, shining, darker areas occupying most of the vertical region; occiput black on the upper half except along the orbits. Hair black, yellow on the occiput. Arista mostly brown, sparsely long pubescent.

Thorax shining black, with sparse black hair, the mesonotum with an impressed, closely setulose line toward either side; pleura with a narrow stramineous line above. Scutellum with a subrectangular bare area apically, bearing two pairs of marginal bristles on the apical half.

Legs orange; the posterior four coxae and femora black, the latter orange on about the apical third; hair yellowish, mostly black on the black portions of the femora.

Wings brown, brownish yellow and hyaline, as in figure 7 of Plate 2.

Abdomen shining black above, the venter and ovipositor orange. Hair on the middle of the dorsum rather long, erect and yellow, laterally short, appressed and black.

Holotype: ♀, **Choiseul Island**, November 26, 1927; *paratype*: female, **Malaita Island**, both collected by the Whitney South Sea Expedition. Type in the American Museum of Natural History, the paratype deposited in the Museum of the California Academy of Sciences.

In Hendel's key (1914), traces to *platessa* O.S. but may be at once distinguished by the much larger discal cell and probably the orange venter. Osten Sacken described the abdomen as "black."

TRUPANEIDAE

Of the five species in the collections before me three are evidently undescribed.

Bactrocera umbrosa (Fabricius)

Dacus umbrosus Fabricius, Syst. Antl., p. 274, 1805.

Dacus umbrosus Wiedemann, 1830, Aussereur. Zweifl., ii, p. 517.

One female, Matema Islands, Santa Cruz Group, July 8, 1933.

Themarohystrix Hendel

1914, Wien. Ent. Zeitung, xxxiii, p. 78.

1915, Ann. Mus. Nat. Hung., xiii, p. 432.

The single specimen belonging to this genus differs from *erinaceus* Hendel in wing markings, entire black abdominal fasciae, etc.

Themarohystrix exul Curran, new species

Plate 1, figure 6

Length, 7.5 mm.

Female: head dark reddish yellow, the face with a rectangular black spot in the middle, the front with a wide brown vitta extending from the black ocellar triangle to the anterior border. Front with almost parallel sides, one-third the width of the head; three pairs of frontals, the upper pair reclinate; frontal vitta with very fine hair; ocellars quite weak; outer verticals apparently weak. Occipital cilia black. Cheeks a little wider than the third antennal segment. Proboscis and

palpi orange, the latter normally clavate. Antennae dull orange, the third segment more or less tinged with brown; arista black with the base pale, the rays of moderate length.

Thorax reddish yellow, with ten black vittae, six on the mesonotum and four on the pleura. The dorsocentral black vittae extend the whole length and are united with each other and with the short sublateral vittae by a black prescutellar band, the sublateral vittae extending forward to the suture; the lateral vittae extend from the humeri to the base of the wing; the upper vitta on the pleura extends from the middle of the propleura to the middle of the pteropleura, while the lower vitta extends from above the front coxae almost to the posterior edge of the sternopleura. Hair and bristles black; one pair of dorsocentrals, situated well behind the supra-alars; scutellum with six strong marginals; mesopleura with several weak bristles in the middle below; propleural hair reddish.

Legs dark reddish yellow, the posterior femora more or less brown in front; hair and bristles black; the hair yellow on the tibiae and tarsi; middle femora with a row of bristles on the apical third in front; posterior femora with a bristle on the ventral surface before the middle, two preapical dorsal bristles, a row of weak anteroventral bristles on the apical fourth; posterior tibiae with three to five weak anterodorsal and anteroventral bristles.

Wings brown and pale orange as in figure 6 of Plate 1, the first, third and fifth veins bristled. Halteres yellow.

Abdomen pale orange, with black fasciae; second segment black with the anterior and posterior borders broadly pale, the third and fourth segments each with a broadly interrupted black fascia, the fifth short with the sides black, the black fasciae connected along the lateral margins; ovipositor black. Hair black, the second to fourth segments with weak marginal bristles, those on the fourth becoming strong laterally. Venter wholly pale orange.

Holotype: female, **Mouo Island**, December 7, 1927 (Whitney Expedition).

Rhabdochaeta de Meijere

The genus was established in 1904 for a new species (*pulchella*) from Java. The species before me differs mainly in the radiations extending to the margin of the wing.

Rhabdochaeta crockeri Curran, new species

Plate 2, figure 6

Black, reddish and yellow, with cinereous pollen. Length, 2.25 mm.

Female: head reddish yellow, thinly white pollinose. Front anteriorly half the width of the head, widening posteriorly, bearing two pairs of large black frontals and a pair of black verticals, and three pairs of shorter white frontals: across the middle a row of four intrafrontals and immediately in front of the middle pair a second pair. Hair and bristles white. Palpi with a narrow black border and with small black bristles apically. Third antennal segment rather long and pointed, sub-triangular, gently convex below; arista yellow, pubescent.

Thorax black, cinereous pollinose; sides of the mesonotum, upper and broad anterior border of the pleura reddish yellow in ground color, the pleural sutures more or less reddish yellow. Hair very pale yellow, a few black hairs on the middle of the mesonotum in front; bristles black or brown, the lateral ones more or less

yellowish; two pairs of dorsocentrals, the anterior pair situated close to the suture; two pairs of scutellars, the basal pair black and long, the apical pair sub-erect, short and pale yellow; a pair of black hairs on the tip of the scutellum, the disc bare.

Legs wholly reddish yellow, the hairs and bristles yellow.

Wings (Pl. 2, fig. 6) cinereous hyaline, yellowish on the basal third, with large, black discal spot and dark brown radiations, the markings brown behind the spot, the dark area with some pure white punctures and shining areas; third vein bare; costal border deeply incised at the tip of the subcostal vein, the costal bristles moderately long.

Abdomen black, cinereous pollinose, the disc reddish on the basal half; ovipositor shining reddish with the base, and apex of the preceding segment, shining black. Hair and bristles pale yellow, the fifth segment with a black apical bristle on each side; a few tiny black hairs laterally on the apical segments.

Holotype: ♀, No. 4040, Mus. Calif. Acad. Sci., Ent., **Matema Island, Santa Cruz Group**, July 9, 1933; *paratype*: ♀, **Tai Lagoon, Malaita Island**, May 30, 1933.

***Paroxyna parca* (Bezzi)**

Oxyna parca Bezzi, Mem. Ind. Mus., iii, p. 159, 1913 (f).

Female: Tai Lagoon, Malaita Island, June 30, 1933.

***Platensina* Enderlein**

This genus is closely related to *Xanthomyia* Phillips (North America), but differs in having the palpi of ordinary size. In *Xanthomyia* the palpi are greatly broadened. Both genera have the costal bristles quite long and the wing venation is similar.

***Platensina malaita* Curran, new species**

Plate 1, figure 1

With wing markings as in *zodiacalis* Bezzi but with two pairs of scutellar bristles. Length, 4 mm.

Female: head dull reddish; face yellow, the frontal orbits with a broad cinereous border anteriorly; four pairs of black frontals, the upper pair reclinate and a pair of weaker, mostly yellowish reclinate frontals; parafrontals with tiny yellowish hairs; ocellars long and black; occipital hairs and bristles pale yellowish. Cheeks narrow, with a row of tiny black hairs below and a black bristle posteriorly. Proboscis and palpi reddish yellow, the palpi narrow and with black bristles apically. Antennae reddish yellow; third segment sharply rounded at upper apex; arista brown, pubescent.

Thorax black above and posteriorly, cinereous pollinose, the humeri, pleura except behind, and the pectus dull reddish; hair brassy yellow; bristles black or brown; mesonotum with trace of four brown vittae, the dorsocentrals arising from brown spots. Scutellum with the free border shining dull reddish, bearing two pairs of marginal bristles.

Legs reddish, with black hair, the bristles on the anterior femora black.

Wings dark brown, with hyaline spots as shown in figure. Halteres yellow with brown knobs.

Abdomen blackish brown, the first to third segments cinereous pollinose with very broad, interrupted brown posterior fasciae, the following segments and ovipositor shining brown. Hair black.

Holotype: female, No. 4041, Mus. Calif. Acad. Sci., Ent., **Tai Lagoon, Malaita Island**, May 30, 1933.

LONCHAEIDAE

The two species are known to science, *L. aurea* being widely distributed in Africa and the Oriental Region.

Lonchaea aurea Macquart

Lonchaea aurea Macquart, Dipt. Exot., Suppl. iv, p. 300, 1850.

Male: Matema Islands, Santa Cruz Group, July 10, 1933; ♂, Anuda Island, July 15, 1933.

Lonchaea atratula Walker

Lonchaea atratula Walker, Proc. Linn. Soc. London, iv, p. 146, 1840.

Male: Santa Catalina Island, July 2, 1933; ♂, Santa Ana Island, July 3, 1933; ♀, San Cristoval Island, July 4, 1933.

It is impossible to be certain of the identity of *atratula* but the specimens agree well with the description. The arista is rather short plumose, the scutellum bears three hairs on the margin outside the apical bristles and usually a pair between the apicals. The wings are brown, becoming gray posteriorly.

CALOBATIDAE

I have before me, from Malaita Island (Whitney Expedition), a poorly preserved specimen belonging to the genus *Mimegralla* Enderlein.

NERIIDAE

Telostylus lineolatus (Wiedemann)

Nerius lineolatus Wiedemann, Aussereur. Zweifl., ii, p. 552, 1830; Kertész, Termes Fuzetek, xxii, p. 181; Enderlein, Arch. Naturg., lxxxviii, A, Heft 5, p. 143.

Two ♂, 3 ♀, Anuda Island, June 17, July 15, 1933; ♀, San Cristoval Island, July 1, 1933; ♀, N.W. end of Bellona Island, June 19, 1933; 2 ♀, Matema Island, Santa Cruz Group, July 7, 1933.

I am by no means certain that the determination of these specimens is correct, since the identity of *lineolatus* is rather uncertain.

The species was described from a female, and the males previously associated with it are said to have reddish antennae. In my specimens the antennae are brown with the inner side mostly red in both sexes, and the arista has a narrow, sub-basal whitish band; the legs are brown, the tibiae being of a more reddish shade, the posterior femora sometimes with a trace of a reddish, preapical band. The wings are rather grayish, the tips of the second and third veins clouded with brown, the costal area somewhat luteous on the basal half. The yellow median vitta on the mesonotum extends to the tip of the scutellum and the sides of the latter are broadly translucent brownish yellow. The males lack the short bristles on the front coxae.

Wiedemann makes no mention of the median vitta on the mesonotum, but Enderlein, who examined the type, stated that it agreed with the description of *mocsaryi* Kertész, in which the vitta is well marked. Kertész had *lineolatus* before him when he described *mocsaryi*, but gave no description. *Nerius striatus* Doleschall, from Java, agrees, insofar as the very brief description goes, with my specimens, except that the wings are stated to be hyaline, and the figure on plate II might well represent the specimens before me.

The form recorded by Bezzi from the Fiji Islands has a row of bristles on the front coxae, in addition to the apical ones, and, if my determination is correct, represents a different species.

SEPSIDAE

There are three species of *Sepsis* in the collection, separable as follows:

1. Wings with subapical black spot. *plebeia* de Meijere
- . Wings without apical spot. 2
2. Thorax mostly reddish. *spectabilis* de Meijere
- . Thorax black; mesonotum brownish pollinose and without acrostical setulae; legs mostly yellowish. *javanica* de Meijere

Sepsis plebeia de Meijere

Sepsis plebeia de Meijere, Ann. Mus. Nat. Hung., iv, p. 171, 1906 (f).

♂, ♀, Matema Islands, Santa Cruz group, July 8, 1933; ♂, 2 ♀, Matema Island, Santa Cruz Islands, July 2, 1933.

Sepsis spectabilis de Meijere

Sepsis spectabilis de Meijere, Ann. Mus. Nat. Hung., iv, p. 178, 1906 (f).

♀, N.W. end of Bellona Island, June 22, 1933.

Sepsis javanica de Meijere

Sepsis javanica de Meijere, 1904, Bijdr. Dierkunde, Afl. 17-18, p. 107; 1906, Ann. Mus. Nat. Hung., iv, p. 184 (f).

Two ♀, Matema Island, Santa Cruz Group, July 7, 1933; 2 ♀, Guadalecanar Island, May 20, 1933 and ♀, San Cristoval Island, July 1, 1933.

LAUXANIIDAE

The collection contains several undescribed species in addition to a number recorded from other islands. It is possible that some of the species identified may be distinct, since many of the species in the family are very similar in appearance and descriptions based entirely on color are not satisfactory.

Steganopsis solomensis Curran, new species

Plate 2, figure 5

Related to *multilineata* de Meijere but at once distinguished by the yellow halteres and wing pattern; front dull metallic green, with two or three transverse ridges, the sides broadly pollinose. Length, 2.5 to 3 mm.

Female: head black, the face and front green in ground color; face and occiput white pollinose, the face with an incomplete longitudinal bare stripe in the middle; frontal orbits thickly cinereous yellow pollinose; the frontal stripe with two or three low, transverse ridges, sometimes more extensively wrinkled. Cheeks white pollinose above, narrower than the third antennal segment. Proboscis brown; palpi black. Antennae reddish, the third segment brown on the apical three-fourths, about four times as long as wide, gently concave above, its apex obtusely rounded; arista black, moderately long plumose.

Mesonotum broadly brown pollinose in the middle, with alternate, irregular cinereous and black stripes laterally (about eight cinereous vittae); three or four pairs of acrostical bristles, the anterior ones weak, and an irregular row of hairs outside them; three pairs of dorsocentrals, the anterior ones weaker; no intra-alar; two sternopleurals, the pteropleura bare. Scutellum large, very gently convex, brownish pollinose, the immediate border cinereous. Pleura with a large silvery white spot below the humeri and another along the upper edge of the sternopleura.

Legs black, the basal three segments of the posterior four tarsi, and two of the anterior pair, pale yellow.

Wings brown and cinereous hyaline as in figure 5 of Plate 2. Squamae pale yellow, the fringe partly brown. Halteres yellow.

Abdomen brownish black, obscurely yellowish brown pollinose.

Holotype: ♀, No. 4042, Mus. Calif. Acad. Sci., Ent., and 2 ♀ *paratypes*: **Santa Catalina Island, Solomon Islands, July 2, 1933.**

Steganopsis ceres Curran, new species

Related to *annulipes* Malloch, but at once distinguished by the color of the wings and legs. Length, 2.5 mm.

Female: head brown in ground color; occiput white, face cinereous, more than the lateral fourth of the front cinereous yellow pollinose, the middle two-fifths of the front dull green, very thinly pollinose, without transverse ridges; ocellars minute. Cheeks very narrow, white above. Proboscis and palpi brown. Antennae reddish, the broad apex of the third segment brown; arista brown, with long rays above and short ones below.

Mesonotum cinereous pollinose, with brown dots and eight irregular brown vittae; four or five pairs of acrostichals and three pairs of dorsocentrals. Scutellum brownish, the free border and a small lateral spot on each side near the base cinereous. Pleura brown, thinly pale pollinose behind, with a large cinereous white spot below the humeri produced almost to the posterior edge of the mesopleura above, a large area covering the middle of the mesopleura and a broad band on the upper border of the sternopleura similarly pollinose; pteropleura bare.

Legs black, the basal three segments of the tarsi yellow.

Wings brown and cinereous hyaline as in *solomensis*.

Abdomen slightly shining brown.

Holotype: female, No. 4043, Mus. Calif. Acad. Sci., Ent., **Guadalupe Island**, May 23, 1933.

Maquilingia Malloch

1929, Proc. U. S. Nat. Mus., lxxiv, Art. 6, p. 35.

There are two species before me agreeing in having four rows of acrostichal hairs, the lateral rows situated on brown vittae and therefore not conspicuous. In one species the anterior frontal bristles are decidedly convergent, but in the other they are probably reclinate: it is not possible to be certain as the single remaining anterior bristle has been bent out of position.

Key to Species

1. A brown spot on the facial grooves below the antennae..... 2
- . No brown spot on the face below the antennae..... *malaita*, n. sp.
2. Front with a median brown vitta extending forward from the ocelli..... 3
- . Front without median vitta (Philippines)..... *facialis* Malloch
3. Cheeks with a row of three or four bristles below; abdomen pale brownish with a median vitta and the segmental apices broadly yellow....
- *malema*, n. sp.
- . Cheeks with a single strong bristle below; abdomen yellow with the segmental apices narrowly brown (Philippines)..... *hirticeps* Malloch

Maquilingia malaita Curran, new species

Yellow, thinly white pollinose, marked with brown. Length, 2.5 mm.

Female: head yellow; ocellar spot, an incomplete, narrow median vitta, a broad stripe extending from the orbits to the antennae and the occiput behind the middle of the eyes brown. Anterior frontal bristle probably reclinate (perhaps incurved),

the front moderately haired on the anterior half. Cheeks with sparse hair and a strong bristle near the anterior third below. Proboscis, palpi and antennae reddish yellow, the arista brown, very short pubescent.

Mesonotum with a pair of narrow dorsocentral vittae, a narrow subdorsal vitta on either side behind the suture and the sides, very broadly pale brown, the metanotum brown. Hair black; presutural bristle weak. Scutellum reddish yellow, with a brown vitta on each side.

Legs with only the apical tarsal segment brown.

Wings cinereous hyaline, the veins luteous. Squamae and fringe yellow. Halteres yellow.

Abdomen yellow, the second to fifth segments each with the apical third brown. Hair black.

Holotype: female, **Malaita Island** (Whitney Expedition).

Maquilingia matema Curran, new species

Readily distinguished from *malaita* by the presence of a large brown spot on the sternopleura, entire brown frontal vitta, mostly brown abdomen, etc. Length, 2.75 mm.

Female: head yellow, ocellar spot, a broad spot extending from the orbits to the base of the antennae and a large spot on either side below the antennae dark brown; front with a slender, entire median vitta, the anterior frontals convergent, the hair sparse; cheeks with a slender brownish fascia anteriorly and another behind, the occiput more or less brown behind the eyes. Cheeks wide, with sparse hairs and a row of four or five bristles below. Proboscis and palpi yellow. Antennae brownish red, the arista brown, reddish basally, pubescent.

Mesonotum brown, with a very broad median yellow vitta and narrow ones along the line of the dorsocentrals; acrostichal hairs in four rows; scutellum with a pair of large, subtriangular, medianly connected, brown spots basally. Metanotum brownish; pleura and scutellum pale yellow, the sternopleura with a large brown spot above. Presutural bristle strong.

Legs yellow with the tarsi slightly darkening apically; anterior femora with a row of posteroventral bristles.

Wings cinereous hyaline, the veins luteous; crossveins narrowly and weakly clouded with brown. Squamae, their fringe and the halteres pale yellow.

Abdomen yellow, the basal half of the second to fifth segment, expanding to the whole length on either side of the broad median vitta, pale brown, the sixth segment with less than the basal third brownish on either side. Hair black.

Holotype: female, No. 4044, Mus. Calif. Acad. Sci., Ent., **Matema Islands, Santa Cruz Group**, July 8, 1933.

In both the above species the head is shaped very much as in *Trigonometopus* Loew.

Minettia Desvoidy

In the following key I have included two species that apparently belong in *Homoneura*. These two have the intra-alar bristle distinctly developed but it is not as strong as is usual in *Minettia*.

1. Mesonotum blackish, grayish, or with brown vittae..... 2
- . Mesonotum wholly shining rusty reddish; arista plumose.... *H. orientis* Hendel
2. Mesonotum mostly black in ground color..... 3
- . Mesonotum yellowish, with two brown vittae..... *ethelia*, n. sp.
3. Mesonotum grayish, with four distinct brown vittae..... *obscura* de Meijere
- . Mesonotum not vittate..... 4
4. Mesonotum shining, at most weakly pollinose..... *surda*, n. sp.
- . Mesonotum cinereous pollinose..... *H. anuda* Curran

Minettia surda Curran, new species

Shining black; arista plumose; two sternopleurals. Length, 3.5 mm.

Female: head brownish, thinly cinereous pollinose, except on the front, the parafrontals thinly pollinose, except anteriorly. Ocellars much weaker than the anterior frontals; cheeks narrow. Proboscis brownish red; palpi reddish. Antennae reddish, the third segment mostly brown, about one-half longer than wide; arista black, moderately long plumose.

Thorax shining brownish black, the anterior border and postalar calli reddish; pleura thinly pollinose. Eight rows of acrostichal hairs; three pairs of postsutural dorsocentrals, the anterior pair situated close to the suture; two sternopleurals; pteropleura bare.

Legs reddish yellow, the anterior coxae black in front; posterior four femora black with the apices broadly reddish yellow. Anterior femora with a row of posteroventral, posterior and posterodorsal bristles and with the comb of tiny bristles; middle femora with very weak anteroventral and posteroventral bristles, with four stronger anterior bristles on the apical half; posterior femora with a very weak row of anteroventral bristles and without a preapical anterodorsal bristle.

Wings cinereous hyaline, the veins luteous; border of the squamae and the fringe brown. Halteres reddish yellow.

Abdomen shining brownish black, the bristles weak.

Holotype: female, No. 4045, Mus. Calif. Acad. Sci., Ent., Uras Cove, Malaita Island, May 28, 1933.

Minettia ethelia Curran, new species

Plate 2, figures 1, 4

Rusty reddish yellow; mesonotum with two brown vittae; abdomen usually with two or three pairs of small brown spots. Length, 3.5 to 4 mm.

Male: head reddish yellow, thinly white pollinose, the face white. Ocellars much weaker than the anterior frontals. Cheeks much narrower than the third antennal segment. Proboscis and palpi reddish yellow, the palpi with the apices brownish. Antennae reddish yellow, the third segment slightly darkened on the apical half, one-half longer than wide, arista blackish, long pubescent.

Thorax yellowish, the mesonotum pale rusty reddish, with a pair of broad, brown vittae lying just inside the dorsocentral bristles and extending weakly over the scutellum, between the vittae with evident whitish pollen. Eight rows of acrostichal hairs; three pairs of dorsocentrals; two sternopleurals, the pteropleura bare.

Legs reddish yellow. Anterior femora with a row of strong posteroventral and posterodorsal bristles and two weaker bristles below the dorsal row apically, and with the comb of tiny bristles; middle femora with very weak ventral bristles on both edges and with a row of strong anterior bristles on the apical half; posterior femora with a row of weak anteroventral bristles on the apical third and with a weak, preapical anterodorsal bristle.

Wings cinereous hyaline. Squamae with brown border and brownish yellow fringe. Halteres yellow.

Abdomen yellow or reddish yellow, toward either side on the fourth to sixth segments with a small, round blackish spot, the first and third pairs sometimes absent or almost so. Bristles moderately strong. Genitalia reddish yellow.

Female: the abdominal spots appear to be more diffuse, slightly larger, but less conspicuous.

Holotype: ♂, No. 4046, *allotype*: ♀, No. 4047, Mus. Calif. Acad. Sci., Ent., and *paratypes*: 4 ♂, 2 ♀ **Nupani Island, Santa Cruz Group**, May 8, 1933; *paratypes*: two males, **Matema Island, Santa Cruz Group**, July 2, 7, 1933.

Two of the females have the abdomen somewhat crushed, so I am unable to determine the amount of variation in the dark spots.

Homoneura Wulp

A key is given below to the species contained in the collection, four of which are described for the first time.

Table of Species

- | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 1. Arista plumose, the rays arising on the upper and lower surfaces. | 2 |
| -. Arista pubescent, the rays usually arising from all surfaces, or little more than twice as long as the basal thickness of the arista. | 7 |
| 2. Shining blackish species. | <i>signatifrons</i> Kertesz |
| -. Not shining black. | 3 |
| 3. Mesonotum uniformly yellowish. | 5 |
| -. Mesonotum vittate or cinereous. | 4 |
| 4. Mesonotum yellowish, with six brown vittae; wings with brown spots in addition to those on the crossveins. | <i>punctipennis</i> de Meijere |
| -. Mesonotum cinereous with the sides blackish; crossveins slightly clouded with brown. | <i>viatrix</i> de Meijere |
| 5. Anterior border of the wing broadly brownish. | <i>laticosta</i> Thomson |
| -. Wings not brown in front, at most the crossveins clouded. | 6 |
| 6. Abdomen without black spots; pteropleura with several hairs. | <i>distincta</i> Kertesz |
| -. Abdomen with one or two pairs of round blackish spots apically; pteropleura bare. | <i>orientis</i> Hendel |
| 7. Mesonotum black in ground color, cinereous pollinose. | <i>anuda</i> , n. sp. |
| -. Mesonotum reddish yellow in ground color. | 8 |
| 8. Abdomen with three series of black spots, at least on one segment. | 10 |
| -. Abdomen with only paired black spots. | 9 |
| 9. Abdomen with only one pair of black spots, on the sixth segment. | <i>acrostichalis</i> de Meijere |
| -. Abdomen with black fasciae. | <i>whitneyi</i> , n. sp. |

10. Abdomen with median black spots on the third to fifth segments.*monticola* de Meijere
 —. Abdomen with median black spot only on the fifth or sixth segment. 11
11. Pteropleura with several small black hairs; median black spot situated
 on the sixth abdominal segment.*crockeri*, n. sp.
 —. Pteropleura bare; median black spot on the fifth abdominal segment.
*sikaiana*, n. sp.

***Homoneura signatifrons* (Kertész)**

Sapromyza signatifrons Kertész, Termes. Fuzet., xxiii, p. 264, 1900.

Nine ♂, 3 ♀, Santa Catalina Island, Solomon Group, July 2, 1933; ♂, Malaita Island, May 28, 1933.

***Homoneura viatrix* (de Meijere)**

Lauxania viatrix de Meijere, Tijds. v. Ent., lviii, suppl., p. 51, 1915.

♂, ♀, Santa Catalina Island, Solomon Group, July 2, 1933;
 ♂, N. W. end of Bellona Island, June 21, 1933.

***Homoneura punctipennis* (de Meijere)**

Sapromyza punctipennis de Meijere, Tijds. v. Ent., li, p. 143, 1908.

Twelve ♂, 3 ♀, Santa Catalina Island, Solomon Group, July 2, 1933.

***Homoneura laticosta* (Thomson)**

Geomyza laticosta Thomson, Eugenes Resa, p. 598, 1868.

Sapromyza singaporensis Kertész, Termes. Fuzet., xxiii, p. 261, 1900.

Two females, Tai Lagoon, Malaita Island, May 30, 1933.

***Homoneura orientis* Hendel**

Sapromyza orientalis Kertész, Termes. Fuzet., xxiii, p. 272, 1900; (not Wiedemann).

Sapromyza orientis Hendel, Gen. Insectorum, No. 68, p. 42, July, 1908.

Sapromyza Kerteszii de Meijere, Tijds. v. Ent., li, p. 145, September, 1908.

Lauxania bioculata de Meijere, 1914. Tijds. v. Ent., lvii, p. 225, 1914.

H. bioculata and *kerteszii* Malloch, Proc. U. S. N. M., lxxiv, Art. 6, p. 78, 1929.

Rusty reddish yellow; arista plumose. Length, 3 mm.

Male: head thinly whitish pollinose except on the frontal vitta; ocellars not more than two-thirds as long as the anterior frontals; cheeks narrow. Proboscis pale orange, the palpi yellow. Antennae pale orange, the third segment brown on

the apical half, slightly tapering, about one-half longer than wide; arista black, with moderately long rays above and short ones below.

Thorax reddish yellow, the mesonotum darker; eight rows of acrostical hairs; three pairs of postsutural dorsocentrals, the anterior pair close to the suture; two sternopleurals; pteropleura bare. The intra-alar bristle is distinct.

Legs reddish yellow; anterior femora with strong posteroventral and postero-dorsal bristles, with two weaker bristles apically below the posterodorsal row and with the comb of tiny setulae; middle femora with only bristles on the apical half of the anterior surface; posterior femora with a preapical anterodorsal and poster-oventral bristle.

Wings cinereous hyaline, with slight luteous tinge. Squamae and halteres yellow.

Abdomen rusty reddish yellow, the abdomen with one or two pairs of lateral black spots on the fourth and fifth segments, and, rarely, a narrow black median dash on the anterior half of the fifth; bristles moderately strong.

Five ♂, 1 ♀, Santa Catalina Island, July 2, 1933; 6 ♂, 4 ♀, Anuda Island, July 15, 16, 18, 1933; ♂, Matema Island, Santa Cruz Islands, July 7, 1933; 2 ♂, ♀, Matema Island, July 8, 1933.

There are two females from Nupani Island that are evidently different since the orbits are strongly tinged with brown. Both are somewhat teneral, and the color may not be natural. It is possible that this may not be *orientis* but the specimens agree with the descriptions given by Kertész and de Meijere. Some specimens have the third antennal segment a little more than half brownish while others have it wholly reddish. About half the specimens have two pairs of black spots on the abdomen while others have only those on the fifth segment and only one shows the central black streak on this segment.

***Homoneura distincta* (Kertész)**

Sapromyza distincta Kertész, Termes. Fuzet., xxiii, p. 275, 1900.

Three ♀, Santa Catalina Island, Solomon Group, July 2, 1933.

***Homoneura acrostichalis* (de Meijere)**

Lauxania acrostichalis de Meijere, Tijd. v. Ent., lviii, suppl. p. 51, 1915.

Two ♂, 3 ♀, Anuda Island, July 15, 18, 1933; ♀, Sikaiana Island, Stewart Group, May 15, 1933.

***Homoneura monticola* de Meijere**

Lauxania monticola de Meijere, Tijd. v. Ent., lix, p. 203, 1916.

Female, Kungava Bay, Rennell Island, June 16, 1933.

Homoneura anuda Curran, new species

Plate 2, figure 8

Arista pubescent; thorax blackish, cinereous pollinose; abdomen with broad brown bands. Length, 4.5 mm.

Male: head reddish in ground color; front brownish yellow pollinose, the orbits yellowish; occiput with whitish pollen, the cheeks and face brownish yellow pollinose, except for a paler spot below each antenna. Cheeks moderately wide, a small brown spot immediately below each eye, a brown line extending across the upper edge of the supra-oral depression; sides of face not or scarcely swollen below. Proboscis brownish; palpi reddish yellow. Antennae dull orange, the third segment not twice as long as wide; arista brown except basally, moderately long pubescent.

Thorax blackish in ground color, the humeri and an adjacent spot inside them, the posterior calli and the broad free border of the scutellum yellow, the dark part densely cinereous pollinose. Acrostical hairs in eight rows, only the prescutellars strong; three pairs of strong postsutural dorsocentrals, the anterior pair situated close to the suture; a weak intra-alar bristle; pteropleura with a few black hairs; two sternopleurals.

Coxae and femora black, the apices of the latter reddish; tibiae and tarsi reddish yellow. Anterior femora with the anterior comb of tiny bristles, an incomplete row of posterodorsal bristles and a complete row of posteroventrals; middle femora with a row of anterior bristles on the apical half and complete rows of antero- and posteroventral bristles; posterior femora with a row of anteroventral bristles that become weak basally and a moderately strong preapical anterodorsal bristle; tibiae with only the preapical and apical bristles.

Wings cinereous hyaline, the veins luteous, yellow at the extreme base. Squamae with luteous tinge. Halteres yellow.

Abdomen with the third and fourth segments brown with the apices very broadly yellow, the first and second segments ferruginous with yellow apices, the fifth yellow with a large black spot on each side, the sixth small and wholly yellow. Genitalia reddish yellow; second to sixth segments with moderately strong marginals.

Holotype: ♂, No. 4048, Mus. Calif. Acad. Sci., Ent.; *paratypes*: 2 ♂, **Anuda Island, Santa Cruz Group**, July 17, 18, 1933.

The intra-alar bristle is situated rather close to the dorsocentral line and is poorly developed. The species can scarcely be placed in *Minettia*.

Homoneura whitneyi Curran, new species

Rusty reddish yellow, the abdomen with broad, interrupted shining black fasciae. Length, 2.5 mm.

Female: head shining, the hair black; cheeks narrow; palpi and proboscis reddish. Antennae reddish, the third segment only a little longer than wide; arista black, short pubescent.

Thorax strongly shining; five pairs of acrosticals and three pairs of postsutural dorsocentrals; intra-alar bristle absent; apparently two sternopleurals; pteropleura bare.

Legs reddish yellow; anterior tarsi brown, with the apical three segments distinctly broadened, the apical two or three segments of the posterior four tarsi

brownish. Anterior femora with three posteroventral bristles on the apical half and a row of four posterodorsal bristles; middle femora with two weak anterior bristles apically; posterior femora without ventral bristles, with a weak preapical anterodorsal. No comb of tiny bristles on the anterior femora.

Wings cinereous hyaline; veins luteous, yellow basally. Squamae luteous, with pale fringe. Halteres yellow.

Abdomen shining; first and second segments rusty yellowish, the second with a narrow, broadly interrupted apical black fascia; third to sixth segments each with the apical two-thirds or three-fourths black except very broadly along the middle line, the black spots somewhat tapering toward the lateral margins of the segments, not extending to the edges of the tergites, the spot on the sixth segment reaching the base and about as broad as long.

Holotype: ♀, and ♀ *paratype*: **Malaita Island** (Whitney Expedition).

***Homoneura crockeri* Curran, new species**

Plate 2, figure 10

Rusty yellowish, the frontal orbits and occiput behind the eyes yellowish brown. Length, 4.5 mm.

Male: head dull, the frontal orbits and upper part of the occiput shining, the orbits with brown tinge; front narrowing anteriorly, the occiput with thin whitish pollen below. Cheeks as wide as the third antennal segment. Face with weak swellings below. Proboscis and palpi reddish yellow. Antennae pale orange, the third segment one-half longer than wide; arista black, pubescent.

Thorax wholly shining; four or five pairs of well developed acrosticals, the anterior ones becoming short; three pairs of dorsocentrals, the anterior pair situated close to the suture; no intra-alar; pteropleura with a few black hairs; two sternopleurals.

Legs reddish yellow; anteroventral and anterodorsal bristles on front femur not extending to the base, the comb of tiny black bristles present; middle femur without bristles below, the apical half with a row of anterior bristles; posterior femur with a preapical anterodorsal bristle and three or four weak anteroventral bristles apically.

Wings cinereous hyaline, the veins luteous. Squamae brownish yellow. Halteres yellow.

Abdomen shining, yellowish, the fifth and sixth segments each with an irregularly orbicular brown spot posteriorly on either side, the sixth with a subtriangular median spot on the apical half. Bristles moderately strong. Genitalia yellowish.

Holotype: male, No. 4049, Mus. Calif. Acad. Sci., Ent., **Guadalupe Island**, May 23, 1933.

***Homoneura sikaiana* Curran, new species**

Plate 2, figure 9

Reddish yellow, the fifth abdominal segment with black lateral and median spots; arista pubescent. Length, 3.5 mm.

Male: head dull rusty reddish, with brownish yellow pollen; hair black; cheeks moderately narrow; face with weak swellings below. Proboscis and palpi reddish. Antennae reddish, the third segment oval, reddish brown beyond the arista except on the broad lower border; arista brown except basally.

Mesonotum shining rusty reddish, the pleura and scutellum paler. Acrostical hairs in six rows, the middle row with four or five pairs of bristles, the anterior ones weak; intra-alar entirely absent; pteropleura bare; two sternopleurals.

Legs reddish yellow; anterior femora with comb of tiny bristles and complete rows of posterodorsal and posteroventral bristles; middle femora without strong bristles but with a weak anterior row on the apical third; posterior femora with a very weak preapical anterodorsal bristle and with only three or four anteroventral bristles apically.

Wings cinereous hyaline, the veins luteous, becoming yellow basally. Squamae with brownish fringe. Halteres yellow.

Abdomen rusty reddish yellow, the hair and bristles black. Fifth segment with a small median black spot extending the whole length and with a large, orbicular black spot on each side. Genitalia rusty reddish.

Holotype: male, No. 4050, Mus. Calif. Acad. Sci., Ent., **Sikaiana Island, Stewart Islands**, May, 15, 1933.

DROSOPHILIDAE

Of the seven species in the collection five are apparently undescribed. The relationships of the new forms are indicated in connection with the descriptions, but it may happen that the species are not closely related to species indicated, since I do not have examples for comparison.

***Leucophenga xanthobasis* Curran, new species**

Differs from *gibbosa* de Meijere in having the wings clouded on the median half, the anterior crossvein not included in the brown area. Length, 2.25 mm.

Female: front brownish red, the sides somewhat darker, the broad anterior border dull dark orange; no interfrontal hairs; anterior reclinate strong, arising a little above the proclinate bristle; postocellars weak. Occiput brown, reddish below. Cheeks narrow, yellow, the hairs arising from a brown stripe. Face reddish brown with yellow parafacials; a single vibrissa. Proboscis dark reddish; palpi large, black. Antennae reddish, the third segment brown, large, pubescent; arista black, with six long rays above and three below.

Thorax rusty reddish above, yellow on the sides and sternum; mesonotum with a large transverse darker rectangle before the scutellum; scutellum with the free border broadly yellow, preceded by a pale brown band and with two pairs of equally strong marginals; acrostical hairs not in rows; prescutellars as strong as the anterior pair of dorsocentrals; three sternopleurals in an almost straight line, only the posterior bristle strong.

Legs yellow. Wings cinereous hyaline, with a large brown cloud in the middle extending back to the fifth vein and enclosing the posterior, but not the anterior crossvein; third costal section a little more than half as long as the second; ultimate section of the fourth vein somewhat more than twice as long as the preceding section, the fourth vein reaching the wing margin very weakly. Halteres yellow.

Abdomen shining black; first segment, basal half or more of the second and third, sixth in the middle, the ovipositor and venter, yellow; second segment with a small brown spot on each anterior corner; ovipositor short and broad. Hair black.

Holotype: female, No. 4051, Mus. Calif. Acad. Sci., Ent., **Kau Kau Plantation, Guadalcanar Island, May 23, 1933.**

***Drosophila willowsi* Curran, new species**

Rusty reddish yellow, the third antennal segment brownish. Length, 1.5 to 2 mm.

Male: front anteriorly about equal to its length, strongly widening posteriorly; broad anterior band paler than the upper portion, the broad orbits pale and with thin, pale yellowish or whitish pollen; middle of the front with three or four fine hairs on either side; median frontal bristle half as strong as the anterior; ocellars long and strong; postocellars moderately long. Occiput black immediately above the neck, with a single row of orbital hairs. Cheeks narrow. Facial keel narrow, broadening below, convex below. Proboscis and palpi yellow. Antennae reddish yellow, the third segment brownish red to brown; arista black, with six long rays above and four below.

Thorax dull, with eight rows of acrostichal hairs and no trace of prescutellars, two pairs of dorsocentrals; scutellum flattened, bare except for the two pairs of marginals. Lower half of the pleura yellow; sternopleura with two bristles and usually a strong hair above the posterior one, below them a row of hairs extending downward and ending in front of the hairs on the pectus.

Legs reddish yellow, the coxae paler; anterior femora with a row of tiny, approximate setulae on the subapical half of the anteroventral surface; basal segment of the front tarsi distinctly longer than the two following segments together.

Wings cinereous hyaline, with luteous tinge, the crossveins weakly clouded; ultimate section of the fourth vein about one-fourth longer than the preceding section.

Abdomen wholly dull rusty reddish yellow, the genitalia yellow; hair black.

Holotype: ♂, No. 4052, Mus. Calif. Acad. Sci., Ent., and *paratype*: ♂, **Matema Island, Santa Cruz Group, July 7, 1933.**

Differs from *calceolata* Duda in having yellow tarsi, color of the abdomen, etc.

***Drosophila ananassae* Doleschall**

Drosophila ananassae Doleschall, Nat. Tijds. Ned. Ind., xvii, p. 128, 1858.

Drosophila caribbea Sturtevant, Ann. Ent. Soc. Amer., ix, p. 335, 1916.

Eight ♂, 27 ♀, Anuda Island, July 15, 1933; ♂, Puka Puka Island, Cook Islands, April 9, 1933; 2 ♀, Matema Islands, Santa Cruz Group, July 8, 1933.

In the males the abdomen is usually wholly reddish, but may have the apices of the segments very narrowly brown, as in the females. The rows of acrostical hairs vary in number from six to eight. There are two sternopleurals, the anterior moderately strong, and sometimes a bristly hair above the posterior one; the posterior surface of the first two segments of the anterior tarsus bears a row of short, approximate hairs or tiny bristles in the male, the femora simple. The specimens before me agree with the type of *caribbea*.

***Drosophila mitis* Curran, new species**

Apparently belongs in *Scaptodrosophila* Duda, but the prescutellars are not regularly present, one frequently being absent. Differs from *scaptomyzoides* Duda in having the abdomen banded with brown or black. Length, 1.25 to 1.5 mm.

Male: front narrower anteriorly than long, widening posteriorly, metallic brownish red, the anterior border broadly dull orange, the orbits broadly pale pollinose; small reclinate frontal situated opposite, or a little behind the proclinate frontal; no hair on the middle of the front. Occiput mostly brownish in ground color, thinly pale pollinose. Face and cheeks yellow, the latter very narrow; carina high but narrow; parafacials and cheeks with thin white pollen; a single pair of vibrissae. Proboscis and palpi reddish yellow. Antennae reddish, the third segment mostly brown; arista with four rays above and two below.

Thorax rusty reddish yellow, the pleura darker on the upper half and usually brownish just above the middle; acrostical hairs in six rows, the prescutellars moderately strong, sometimes only one present; two pairs of dorsocentrals; scutellum bare except for the marginal bristles, the basal pair not half as strong as the apicals; three pairs of sternopleurals; a row of tiny hairs extending down the middle of the sternopleura.

Legs wholly rusty reddish yellow, without unusual hairs or bristles; basal segment of the front tarsi about as long as the remaining segments.

Wings cinereous hyaline; second costal segment twice as long as the third; ultimate section of the fourth vein about two and one-half times as long as the preceding section. Halteres reddish yellow.

Abdomen rusty reddish yellow, the segments each with a very broad brown or black stripe posteriorly, the sixth segment wholly black, the fifth more than half black or brown, the dark bands usually narrowed in the middle but not distinctly interrupted. Hair black.

Female: brown abdominal fasciae usually paler, the sixth segment usually banded with reddish basally; basal segment of front tarsi about as long as the remaining segments combined, but the tarsi shorter than in the male.

Holotype: ♂, No. 4053, *allotype*: ♀, No. 4054, Mus. Calif. Acad. Sci., Ent., and *paratypes*: 4 ♂, 4 ♀ **Santa Catalina Island, Solomon Group**, July 2, 1933.

***Drosophila anuda* Curran, new species**

Belongs in *Paradrosophila* Duda and traces to *latifascia* de Meijere in Duda's key (1924), and agrees in wing venation with his figure 61. Duda's identification cannot be correct because *latifascia* was described as having the sides of the scutellum blackish brown and the black abdominal fasciae on the second and third segments well in front of the posterior borders.

Male: front subtranslucent brownish orange, dark orange anteriorly, the orbital stripes and ocellar triangle with pale pollen; anterior reclinate frontal situated slightly above the proclinate; three or four hairs on either side of the median vitta in an oblique row; postocellars well developed. Middle of the occiput brown in ground color, pale pollinose. Face and cheeks yellow, the latter very narrow; parafacials and cheeks with whitish pollen; one pair of strong vibrissae. Proboscis and palpi reddish yellow. Antennae reddish, the third segment reddish brown; arista black, with four rays above and two below.

Thorax rusty reddish; six rows of acrostical hairs and a pair of weak prescutellars; two pairs of dorsocentrals and marginal scutellars, the basal pair of scutellars about half as long as the apicals, the scutellum otherwise bare. Pleura rather brown on the upper half, reddish yellow below; three sternopleurals and a row of hairs extending down the middle of the sternopleura.

Legs reddish yellow, without unusual hair or setulae; first segment of the front tarsus about as long as the remaining segments combined.

Wings cinereous hyaline; second costal section about twice as long as the third; ultimate section of fourth vein more than twice as long as the preceding section. Halteres reddish yellow.

Abdomen black, rather dull, the apical segment shining; very broad bases of the fourth and fifth segments, base of the second and the whole middle of the first pale reddish yellow, the fifth segment sometimes lacking the yellow fascia or it is obscure and narrow. Hair black. Venter reddish yellow.

Female: front tarsi shorter; abdomen more brown, the third segment also with a broad pale fascia, but variable, all the fasciae sometimes reddish or not well marked; in fully colored specimens almost as in the male.

Holotype: ♂, No. 4055, *allotype*: ♀, No. 4056, Mus. Calif. Acad. Sci., Ent.; *paratypes*: ♂, 5 ♀ **Anuda Island**, July 15, 1933 and ♂, **Nupani Reef Island, Santa Cruz Group**, May 8, 1933.

***Drosophila crockeri* Curran, new species**

Traces to couplet 61 in Duda's key (1924), where it disagrees with all the alternatives, and particularly from *lineata* de Meijere in having reddish yellow scutellum bearing two brown vittae and lacking white vittae on the mesonotum. Length, 2.25 mm.

Female: front distinctly narrower than long, rusty reddish, with a pair of broad, anteriorly converging brown vittae extending from before the ocellar triangle to the anterior margin, the sides yellow anteriorly, the orbital stripes with whitish pollen; ocellar triangle brown; anterior reclinate frontal situated behind the proclinate; a row of four or five tiny hairs on each brown vitta; postocellars moderately strong. Occiput reddish, brown between the vertex and neck. Cheeks very narrow, reddish yellow, the hairs arising from a black stripe. Face dull reddish yellow, thinly whitish pollinose. Proboscis dull orange; palpi brown, moderately large. Antennae reddish, the third segment mostly brown; arista black, with four long rays above and two below.

Thorax yellow, the mesonotum posteriorly and the scutellum reddish yellow; mesonotum with six brown vittae, the lateral ones extending only to the base of the wings, the median pair extending to the end of the scutellum, the sublaterals spreading over the posterior calli; pleura with a brown stripe above narrowly separated from the lateral mesonotal vitta; acrostical hairs in six rows, the median row becoming longer behind but not bristle-like; two pairs of dorsocentrals; scutellum bare except for the two pairs of equally strong bristles; one strong and two weak sternopleurals.

Legs yellow. Wings with brown tinge; second costal section not twice as long as the third, the ultimate section of the fourth vein about one-fourth longer than the preceding section. Halteres reddish yellow.

Abdomen rusty reddish yellow or yellow, the second to fifth segments each with a broad, posterior brown fascia and very broad median vitta, the median vitta widened anteriorly on each segment; sixth segment wholly pale; venter wholly reddish yellow; ovipositor of medium length.

Holotype: female, No. 4057, Mus. Calif. Acad. Sci., Ent., **Matema Island, Santa Cruz Group**, July 8, 1933.

***Drosophila metallescens* de Meijere**

Drosophila metallescens de Meijere, Tijds. v. Ent., lvii, p. 265, 1914.

Liodrosophila metallescens Duda, Arch. f. Naturg., A, Heft 2, p. 160, 1922.

Two ♂, Matema Island, Santa Cruz Islands, July 8, 10, 1933; ♀, N.W. end of Bellona Island, June 21, 1933; ♀, Santa Catalina Island, Solomon Group, July 2, 1933.

Despite the poorly developed anal vein I do not believe that *Liodrosophila* can be maintained, since this condition is approached by species retained in *Drosophila*.

***Drosophila*, species**

In addition to the species listed above there are three others, each represented by a single specimen. In view of the fact that both sexes are necessary for the identification of species in the group to which they belong, it is not possible to determine them.

AGROMYZIDAE

There are two specimens in the collection representing different, and apparently undescribed, species of *Agromyza*, but, as they are not in good condition, descriptions are not presented. One is from Rennell Island, the other from Matema Island, Santa Cruz Group.

PHYLLOMYZIDAE

There are two species in the collection, one of them undescribed.

***Desmometopa* Loew**

The species recorded from Java and New Guinea are separable as follows.

- | | |
|---------------------------------------------------|----------------------------|
| 1. Palpi black..... | 2 |
| -. Palpi yellow, sometimes with brown band..... | 3 |
| 2. Legs, antennae and halteres black..... | <i>xulpi</i> Hendel |
| -. Tarsi yellow..... | <i>tarsalis</i> Loew |
| 3. Palpi with a brown band before the middle..... | <i>palpalis</i> de Meijere |
| -. Palpi wholly yellow..... | <i>anuda</i> , n. sp. |

Desmometopa anuda Curran, new species

Black, the palpi, tarsi, halteres and under side of the third antennal segment yellowish. Length, 1.25 mm.

Female: head black, the front slightly shining, the orbits and ocellar triangle shining or with slight grayish tinge, the intrafrontal stripes not differentiated; anterior border rather narrowly reddish. Face cinereous pollinose. Palpi elongate, reddish yellow. Antennae black, the third segment broadly reddish below on the basal half.

Thorax black, the mesonotum and scutellum thinly cinereous pollinose, the pleura shining except above.

Legs black, the tarsi reddish yellow with the apical segment brown; anterior coxae reddish on the inner half or more, the knees narrowly yellow.

Wings cinereous hyaline, rather broad. Halteres yellow.

Abdomen shining black, slightly dulled by brown pollen.

Holotype: female, No. 4058, Mus. Calif. Acad. Sci., Ent.; and two female *paratypes*: **Anuda Island**, July 15, 1933.

Phyllomyza flavipalpis de Meijere

Phyllomyza flavipalpis de Meijere, Tijds. v. Ent., lvii, p. 252, 1914.

Two specimens, Santa Catalina Island, Solomon Islands, July 2, 1933.

CHLOROPIDAE

Of the seven species in the collection six are described as new, and the identification of the other is somewhat doubtful.

Steleocerus obscurellus Becker

Steleocerus obscurella Becker, Ann. Mus. Nat. Hung., ix, p. 45, 1911.

Female: Santa Catalina Island, Solomon Islands, July 2, 1933. Originally described from New Guinea and Java.

In the specimen there is a large reddish abdominal triangle extending forward from the base to beyond the middle. It may not represent the true *obscurellus*.

Chlorops lithofrons Curran, new species

Upper surface black or brown, the under surface yellowish; third antennal segment practically all black. Length, 2.5 mm.

Female: vertical triangle shining ferruginous, reaching as a narrow point practically to the anterior margin of the front, its sides raised, in the middle, anteriorly, with a longitudinal ridge, and on either side with two rounded V-shaped ridges extending forward from the vertex, the smaller of the two with its base near the middle of the triangle, the outer one wholly parallel with it; front dull reddish out-

side the triangle and bearing a few short black hairs, a row of stronger hairs along the outer edge of the triangle. Occiput reddish yellow, brown below the vertex; cheeks half as wide as the third antennal segment, bare. Face and cheeks yellowish. Proboscis and palpi reddish yellow, the apices of the palpi broadly brown. Antennae brownish red, the third segment black, except at the immediate base, rather small, slightly longer than wide, its upper apex obtusely rounded; arista white, reddish at the base.

Mesonotum with three broad and two narrow black, brownish gray pollinose vittae, covering most of the surface, the pale vittae yellow in front, where they are united with the yellow humeri, becoming reddish posteriorly, where they unite and spread over the whole of the posterior border; the lateral yellow vittae extend from the humeri to the base of the wings, the lateral margins broadly reddish behind the suture; scutellum dull reddish in ground color, bearing two or three pairs of marginal bristles, the upper surface with sparse short black hairs, except in the middle. Mesonotal hair black and extremely short. Pleura yellow; sternopleura with a large triangular black spot, a smaller spot above the posterior coxae, one beneath the anterior spiracle, one on the lower part of the mesopleura and an obscure one on the lower part of the pteropleura.

Legs reddish yellow, the tarsi with the apical one or two segments brown; posterior femora with a very broad, pale brownish band near the middle. Hair very short, black.

Wings cinereous hyaline; posterior crossvein oblique, situated about twice its length from the wing margin. Halteres yellow.

Abdomen black above, the tip yellow; base brownish or brownish red, at least in the middle; hair black. Venter and genitalia reddish yellow.

Holotype: ♀, No. 4059, Mus. Calif. Acad. Sci., Ent.; *paratypes*: 2 ♀, **Matema Islands, Santa Cruz Group**, July 8, 1933.

Apparently related to *ochracea* Becker but darker and without yellow border to the frontal triangle which is narrower.

***Oscinella vixen* Curran, new species**

Black, the pleura yellow above; mesonotum densely cinereous white pollinose. Length, 1.75 mm.

Female: front reddish brown, broadly yellow in front, the ocellar triangle cinereous pollinose, the pale pollen extending somewhat beyond the triangle; vertical triangle not differentiated; hair and bristles yellow. Occiput black. Cheeks brown, cinereous pollinose, about half as wide as the third antennal segment. Parafacials and parafrontals whitish pollinose. Antennae black, the basal segments more brownish; third segment a little longer than wide; arista slender, thickened only at the base.

Thorax black or brown, the mesonotum and upper half of the pleura densely cinereous white pollinose, the hair and bristles yellow; mesonotum with a pair of obscure yellow vittae on the dorsocentral lines, the sides, the prothorax and the broad upper border of the mesopleura expanding behind, yellow in ground color, the humeri and scutellum wholly yellow; scutellum flattened, with two pairs of marginals and about ten hairs on the disc.

Legs brown, the coxae reddish brown; knees yellow; tips of the tibiae and the posterior four tarsi brownish yellow, the tarsi paler below. Hair wholly pale.

Wings cinereous hyaline; veins brown. Halteres pale orange.

Abdomen brown, thinly pale pollinose, the hair yellow. Venter reddish, the sides brown and thickly pollinose.

Holotype: female, No. 4060, Mus. Calif. Acad. Sci., Ent., **Matema Island, Santa Cruz Group**, July 7, 1933.

Differs from *taeniata* Becker in the color of the legs, mesonotal pollen, etc.

***Oscinella solomensis* Curran, new species**

Shining black; abdomen broadly yellow basally; tibiae and tarsi white. Length, 1.5 mm.

Male: head black, the vertical triangle polished and reaching to the anterior sixth of the front; four pairs of orbitals and a row of hairs adjacent to the sides of the triangle, the anterior pair strong and decussate. Cheeks and parafacials with dark brown pollen, the former linear. Face very narrow. Proboscis and palpi black. Antennae reddish, the third segment brown on more than the apical half, subtriangular, twice as wide as long, the median and upper and lower angles rounded, the brown arista arising on the outer side near the upper end and distinctly pubescent.

Thorax shining black, white haired, the bristles black. Scutellum with black hair and two pairs of black bristles, the apical pair arising from tiny tubercles.

Anterior four femora black with the apices broadly reddish yellow, the posterior pair rusty reddish yellow with an incomplete, broad brown band beyond the middle. Tibiae and tarsi whitish. Hair pale yellow.

Wings pale brownish, becoming hyaline at the base, the costal border more intensely brown in front. Posterior crossvein one and one-half times its length from the wing margin. Halteres yellow.

Abdomen brown, the base very broadly yellow; hair black.

Holotype: male, No. 4061, Mus. Calif. Acad. Sci., Ent., **Santa Catalina Island, Solomon Group**, July 2, 1933.

Differs from *noctilux* Walker in the wholly black head, etc. The species might almost be placed in *Gaurax*, but I can see only a single notopleural bristle and the pubescence on the arista is shorter than in typical species of *Gaurax*.

***Hippelates tenuifacies* Curran, new species**

Traces to couplet 3 in Becker's key (1911), but differs in having the mesonotum shining black with reddish sides; differs from *nigricornis* Thomson in having a narrow face and much shorter spur on the posterior tibia. Reddish, the dorsum of the thorax and abdomen black. Length, 1.5 to 1.75 mm.

Male: head reddish, or yellow, shining, the cheeks and parafacials silvery white pollinose; occiput black below the vertex, the face brownish yellow or yellow, the middle part not twice as wide as either parafacial; vertical triangle extending very broadly to the anterior margin of the front, somewhat darker than the parafrontals; hair sparse, black, each side with four rather strong, reclinate bristles. Occiput thinly pale pollinose; cheeks very narrow. Proboscis and palpi reddish or yellowish, the "knee" of the proboscis sometimes brown. Antennae black above,

yellow below, the third segment yellow on more than the lower half, elliptical, more or less pointed dorsally; arista sub-apical, long pubescent.

Mesonotum shining black, with black hair and bristles, the sides broadly reddish, the pale color extending inwards before the scutellum and at the sides of the suture, the humeri yellow. Scutellum yellow with the margin ferruginous or at least darkened, except at the apex, bearing two pairs of marginals, the disc with appressed black hair, rather flattened. Pleura shining reddish yellow.

Legs reddish yellow, the anterior tibiae and tarsi and the apical third of the front femora darkened, brownish yellow; apical tarsal segment pale brown; hair black. Spur of the posterior tibia apical, little longer than the tibial width.

Wings cinereous hyaline; last section of fifth vein almost twice as long as the posterior crossvein. Halteres yellow.

Abdomen shining black above, with the base very broadly reddish yellow; venter yellow, the genitalia rather large and shining black. Hair black, pale on the venter.

Holotype: ♂, No. 4062, Mus. Calif. Acad. Sci., Ent.; *paratype*: ♂: **Nupani Reef Island, Santa Cruz Group, May 8, 1933** and *paratype*: ♂, **Matema Island, Santa Cruz Group, July 10, 1933.**

The two specimens from Nupani Island differ in that the face of the paratype is yellow, while that of the type is dark. The second paratype agrees in all respects with the type.

Hippelates matema Curran, new species

Rusty reddish yellow, the mesonotum with three brown vittae; third antennal segment angularly produced above. Length, about 2.5 mm.

Female: head pale ferruginous, the front paler; vertical triangle widely separated from the eyes, produced as a narrow point to the anterior margin of the front; frontal hair inconspicuous; three rather weak approximated orbitals on either side. Cheeks very narrow, white pollinose; face moderately narrow, the parafacials with whitish pollen; hair on lower edge of cheeks yellow, the vibrissae black. Proboscis and palpi brown. Antennae reddish yellow, the upper border black, the third segment much wider than long, produced angularly upward; arista black, pubescent, arising on the outer side of the third antennal segment well below the angle.

Thorax rusty reddish yellow, the mesonotum darker, with a median and lateral brownish vittae, the hair yellowish, black above the bases of the wings, the bristles black; scutellum flattened, bearing a pair of strong and a pair of weak marginals, the disc with two or three small hairs on either side, bordered with brown except at the apex.

Legs wholly reddish yellow, the hair yellow, but at least partly black or brown on the upper surfaces of the femora and tibiae; tarsi not darkened apically. Spur of the posterior tibia curved, decidedly longer than the tibial width.

Wings cinereous hyaline; posterior crossvein oblique, situated one and one-half times its length from the wing margin. Halteres yellow.

Abdomen reddish yellow, darkened above except on the broad base; hair black.

Holotype: female, No. 4063, Mus. Calif. Acad. Sci., Ent., **Matema Island, Santa Cruz Group, July 7, 1933.**

This species differs from *bilineatus* de Meijere in the shape of the antennae, narrower face and slightly larger size.

Parahippelates variabilis Curran, new species

Related to *aequalis* Becker, but with reddish halteres and tarsi, and usually reddish tibiae, but the latter may have broad, brown median bands. Length, 2.25 to 3 mm.

Male: head reddish, the sides of the front on the upper half rich reddish brown, the occiput brown in ground color on the upper two-thirds. Front about half as wide as the head, moderately narrowing anteriorly; orbitals not or scarcely stronger than the scattered hair on the anterior half of the front; vertical triangle extending to the anterior fourth of the front, its apex broadly yellow, otherwise cinereous; occiput with cinereous, the cheeks and face with white pollen; cheeks as wide as the third antennal segment, with two irregular rows of short black hairs. Proboscis brown; palpi dull reddish yellow. Antennae reddish yellow, the upper edge brown; the third segment suborbicular; arista black, with long rays. Cheeks with a yellow bristle at the posterior angle.

Thorax blackish or brown in ground color, thickly cinereous or cinereous yellow pollinose, the mesopleura largely brown; mesonotum with three brownish vittae, or with the disc mostly brownish, the color of the pollen quite variable, but the sides always pale. Four pairs of dorsocentrals, the anterior three rather short. In pale specimens the hair and bristles arise from tiny dark spots. Scutellum with two pairs of marginals and with or without a pair of discals, cinereous pollinose. Sternopleura with yellow hair. Border of the scutellum usually reddish in ground color.

Legs reddish; femora brown with the broad apices reddish, cinereous pollinose, clothed with black hair above and yellow below; posterior tibiae sometimes very broadly brown in the middle, the anterior four sometimes more or less brown beyond the middle, usually wholly reddish; tarsi reddish with the apical segment brown; hair black. Coxae brownish red, with yellow hairs and bristles. Spur on hind tibia slightly longer than the tibial width.

Wings cinereous hyaline, the veins pale brown. Halteres reddish yellow.

Abdomen black or brown, brown pollinose, the apices of the segments broadly cinereous yellow, their tips perhaps reddish in ground color; genitalia dark reddish; hair black. The disc of the abdomen may be more or less brownish red and the under surface is more or less reddish with rather thick cinereous pollen.

Female: the scutellum is reddish or brownish yellow in ground color, the disc more or less brown and the pleura are practically all cinereous, there being only a trace of brown on the mesopleura.

Holotype: ♂, No. 4064; *allotype*: ♀, No. 4065, Mus. Calif. Acad. Sci., Ent.; and *paratypes*: 2 ♂, 8 ♀, **Kau Kau Plantation, Guadalcanar Island**, May 20, 1933; 5 ♂, 2 ♀, **Santa Ana Island**, July 3, 1933, and ♂, **Matema Islands**, July 9, 1933.

EPHYDRIDAE

(By EZRA T. CRESSON, JR.)

A small collection of this family totalling eleven specimens, representing five species, was submitted to me for study. One of these I consider, with some uncertainty, undescribed; the other four have been previously recorded from several Indo-Australian Islands, particularly Samoa, New Guinea, Guam, Formosa and Java. It is very probable that many of the species occurring on those islands and northern Australia will be found on the Solomons.

Stratiothyrea matema Cresson, new species

This is possibly *Stratiothyrea femorata* Meijere¹ the type-species of that genus, originally described from the island Waigeu. However there being some discrepancies in Meijere's description I am considering the present species distinct. The figure of the face of *femorata* does not show the evenly semicircular-like profile of the facial tumourosity of the present species, but shows the entire lower part of the face angularly convex, with the tormae prominent but not projecting forwards. The scutellum here is not at all suberect, and is provided with four marginal bristle-bearing tubercles. The description of the fore femora is in agreement but their tibiae in the present species are not particularly enlarged, nor are the wings relatively narrow.

I have little doubt as to my generic determination, but here I may be wrong and for this reason I am describing the species in more detail than would otherwise be necessary.

Black; third antennal segment especially the lower portion, mid and hind tarsi except apical segment, yellow. Halter-knobs and the two proximal segments of fore tarsi white. Wings clear with pale costa and veins, becoming darker basally.

Entirely shining to polished without any trace of brown dusting, except sparingly on the legs and spots in protected places.

Structurally similar to the species of *Gymnopa* and *Athyroglossa*. Head distinctly broader than high. Eyes large. Frons slightly broader than long, oblique and convex in profile; outer verticals absent; a few microscopic, proclinate orbital setulae; ocellars strong, parallel, widely separated, aligned with anterior ocellus; mesofrons rather ample, rounded anteriorly and attaining anterior margin; frontalia scarcely differentiated; parafrontalia linear. Face about one-half as broad as frons, much longer than broad; in profile convex above with lower two-thirds very prominent, almost evenly semicircularly convex; parafacialia very narrow, scarcely dilating except at cheeks; facialia linear, marked as a series of bristle-bearing pimples, the uppermost of which is above middle of facial profile, bearing the one pair of almost cruciating facials, those below bearing short setulae; foveae well excavated but with little evidence of median carina; medifacies very prominent, almost sub-hemispherically convex, almost attaining the slightly reflexed epistoma. Tormae as in *Athyroglossa*, narrow, projecting directly forwards. Cheeks almost as broad as length of third antennal segment; postbucca of same width, with posterior margin sharp and reflexed. Antennae situated above center-line of eyes; second segment almost bare except the short dorsal hair and a short proclinate dorsal seta; third segment almost discoidal, with long arista bearing six long hairs above.

Mesonotum densely setulose which are not seriated; a strong prescutellar near lateral roots of scutellum, a postalar and one notopleural, present. Scutellum broader than long, rectangular in outline, flat but slightly convex along apical margin, sparingly setulose, with two widely separated apical, and a slightly smaller subapical, elongate, bristle-bearing tubercles, the apical pair longer than their diameter and removed from each other about three to four times their length. Mesopleura sparingly setulose with some long bristles at posterior margin.

Abdomen broadly ovate, smooth, very sparingly setulose; second to third segments subequal in length, fourth much longer, fifth very short.

Legs with few setulae; fore femora greatly enlarged in dorso-ventral diameter, with a triangularly produced flexor tooth at proximal third, making the width of the femora there about equal to its length; the posterior flexor ridge distad of this

¹ Bijdr. Dierk., XIX, p. 66, pl. 20, fig. 26 (1913).

tooth microscopically serratulate; an anterior flexor series of long hairs. Fore tibiae distinctly curved, with series of short flexor hairs.

Wings with normal venation; costa with subbasal bristle and several long setae on first section beyond humeral crossvein; second vein long, almost straight to tip, making second section of costa three times as long as third; third and fourth veins parallel, with third section of fourth twice as long as second; posterior crossvein about one-third as long as second section of fourth, more than its length from margin of wing; alula linear.

Length, 2 mm.

Holotype: ♂, No. 4066, Mus. Calif. Acad. Sci., Ent., **Matema Island, Santa Cruz Group**, July 7, 1933; *paratypes*: 1 ♂, topotypical with same data. 1 ♂, **Star Harbor, San Cristoval Island**, Solomon Group, July 3, 1933.

Allotrichoma alium Cresson

Allotrichoma alium Cresson, Trans. Am. Ent. Soc., LV, p. 173, 1929 (New Guinea).

One female, Matema Island, Santa Cruz Islands, July 7, 1933.

This species was described, and was previously known to me only from New Guinea.

Trypetomima Meijere

Trypetomima Meijere, Tijds. v. Ent., LIX, p. 265, 1916. (Java.)

Trypetomima Cresson, Trans. Am. Ent. Soc., LV, p. 171, 1929. (Error.)

Eupsilopa Malloch, Ins. Samoa, VI, p. 315, 1934. (Genotype, *E. fascipennis* n. sp.: Samoa.)

This genus was erected for *T. pulchripennis* n.sp. from Java, and as here understood is separated from its allied genus *Actocetor* Becker by the narrower, *Psilopa*-like face with a subcarinate upper portion, the bristles situated well below the middle of the facial profile, and the very abrupt bend of the second vein before entering the costa, the bend generally with an appendage into the submarginal cell. The description of the genotype does not mention, nor does the figure of the wing show, this character of the second vein. This may have been an oversight on the part of the author, but if not, there are probably other characters not mentioned which will give us an entirely different generic concept. If such is the case Malloch's name is available for the genus containing the species here considered.

Clear spots of the wings arranged in three transverse series; only one spot in submarginal cell besides that at its apex; costa not strongly setose; arista with six hairs; Black species with sparse grayish vestiture (Guam).....*solitaria* Cresson

Clear spots conjoined to form three complete bands.

(Guam).....*completa* Cresson
(Samoa).....*fascipennis* Malloch

Clear spots not arranged in transverse series or bands; two clear spots beyond first vein in submarginal cell not including that at its apex (if latter is present); costa strongly spinose; arista with eight hairs. Grayish species with black, gray banded abdomen (Formosa). *formosanus* Becker²

² This may not be congeneric with the other species. The costal spines are very strong.

Trypetomima solitaria Cresson

Trypetomima solitaria Cresson, Trans. Am. Ent. Soc., LV, p. 172, 1929. (Type: ♀; Guam.)

This species was also recorded from New Guinea (Cresson, 1929), and before me are two males and a female from Matema Island, Santa Cruz Islands, July 9, 1933.

Discomyza maculipennis (Wiedemann)

Homalura maculipennis Wiedemann, Anal. Ent., p. 57, 1824.

One male; Santa Catalina Island, Solomon Group, July 2, 1933.

This is a well distributed species in the Indo-Australian region, but not known to me as occurring nearer the Solomon Islands than Guam.

Leptopsilopa pollinosa (Kertész)

Ephygrobia pollinosa Kertész, Term. Fuzet., XXIV, p. 81, 1901. (Singapore.)

Leptopsilopa pollinosa Cresson, Trans. Am. Ent. Soc., LI, p. 251, 1925. (Generic change; distributional records.)

Psilopa irregularis Malloch, Ins. Samoa, VI, p. 314, 1934. (Samoa.) (New Syn.)

This seems to be a widely distributed Indo-Australian species, and I have (1925) reported it from India, Formosa, New Guinea, Australia and the Samoa Islands. There is considerable variation in the metallic coloration. In some individuals there is none; in others we have brilliant greens and blues. I do not have any doubt as to the synonymy of *Psilopa irregularis* Malloch.

A small series is before me containing a male and a female from Santa Catalina Island, Solomon Group, July 2, 1933. One male from Anuda Island, Solomon Group, July 15, 1933.

BORBORIDAE

Two widely distributed species were taken by the Expedition.

Leptocera curvinervis (Stenhammar)

Limosina curvinervis Stenhammar, Coprom. Scand., p. 406, 1855; Zetterstedt, Dipt. Scand., xiv, p. 6412, 1860.

Limosina salatigae de Meijere, Tijd. v. Ent., lvii, p. 269 (f).

Four specimens from Anuda Island, July 15, 1933.

Duda has indicated the synonymy of *salatigae* and shown that the species is very widely distributed.

Leptocera angulata (Thomson)

Borborus angulata Thomson, *Eugenies* Resa, v, p. 602, 1868.

One specimen from Matema Island, Santa Cruz Group, July 2, 1933.

CLUSIIDAE

The single specimen represents an undescribed species.

Czernyola pleuralis Curran, new species

Shining black and yellow, the bristles yellowish. Length, 2.75 mm.

Male: front shining black, the orbits reddish; a large V-shaped orange spot anteriorly; three pairs of frontals, the upper pair weak; ocellars and postocellars weak. Cheeks and face white, the hairs and bristles pale yellow. Proboscis and palpi reddish yellow. Antennae yellow, the upper border more orange, the third segment brown at the base of the brown, pubescent arista.

Thorax shining black, the lower half of the pleura and the pectus yellow; hair and bristles yellowish; scutellum with a pair of strong yellow marginals and two pairs of weak black bristles on the sides.

Legs reddish yellow, the posterior femora with the apical fifth or less reddish brown or reddish; hair yellow.

Wings grayish, the apical two-fifths brown, the color fading to gray posteriorly. Halteres yellow.

Abdomen shining black or brown, the sternites basally, and the genital appendages, yellow.

Holotype: male, No. 4067, Mus. Calif. Acad. Sci., Ent., Santa Catalina Island, Solomon Group, July 2, 1933.

Differs from *biseta* Hendel in the color of the pleura, face, etc.

PSILIDAE

The single specimen belonging to this family represents a new genus.

Lasiopsila Curran, new genus

Head short and high, twice as high as long; front anteriorly almost as wide as one eye, slightly narrowing above; two pairs of frontals, the ocellars very weak; postocellars widely separated and convergent; cheeks wider than the third antennal segment; palpi broad; antennae reaching to the lowest fifth of the face, the third segment about one-third as wide as long; arista sparsely plumose; eyes thickly haired, except on the orbits. Mesonotum rather flat, with bristles posteriorly and laterally; one pair of dorsocentrals, one humeral, two notopleural and two bristles on the posterior calli; no pleural bristles. Femora rather robust, the anterior pair

with weak posteroventral bristles and rather coarse hair behind. Wings as in figure 2 of Plate 2. Abdomen twice as long as wide, slightly tapering, sub-cylindrical, the male genitalia large, sub-spherical; no distinct bristles, the hair conspicuous. Genotype. *L. fasciata* Curran, new species.

This genus may be readily distinguished from others in the family by the haired eyes and slightly produced oral margin. The single known species bears a strong resemblance to certain Trupaneids and Otitids but is at once distinguished by the wing venation.

***Lasiopsila fasciata* Curran, new species**

Plate 1, figure 11, Plate 2, figure 2

Black, the head and legs partly pale orange and yellow. Length, 4 mm.

Male: anterior two-fifths of the front pale orange, the orbits very narrowly white pollinose; a line extending across the vertex and the narrow posterior orbits yellow, white pollinose; cheeks brown below; face yellowish, with a brown spot on either side below the middle and slightly darkened on the lower third. Proboscis and antennae pale orange, the palpi white. Hair white, the bristles yellow.

Thorax shining black, with moderately abundant golden yellow hair and bristles, the pleural hair paler than that on the mesonotum. Scutellum with two pairs of bristles, the basal pair weak, the upper surface with short appressed hair. The mesonotal hair is subappressed, that on the pleura erect.

Coxae blackish; anterior four femora with about the basal half brown, the apical half reddish yellow, the pale color extending well toward the base on the under surface of the anterior pair, and less so on the upper surface of the middle pair; posterior femora brown with the apex broadly reddish above. Tibiae and tarsi yellow, the tarsi pale basally. Hair and bristles yellow.

Wings brown and cinereous hyaline as in figure 2 of Plate 2.

Abdomen shining black, with rather short, appressed black hair and longer, suberect black hair laterally; genitalia with erect yellow hair.

Holotype: male, No. 4068, Mus. Calif. Acad. Sci., Ent., **Matema Islands**, May 28, 1933.

MUSCIDAE

One of the species belonging to this family is undescribed.

***Atherigona pallidipalpis* Malloch**

Atherigona pallidipalpis Malloch, Ann. Mag. Nat. Hist., xii, p. 183, 1923.

Eight males and seven females, Anuda Island, June 17, July 15, 18, 1933; ♀, Kungava Bay, Rennell Island, June 16, 1933.

The third antennal segment is wholly brown and the palpi of the female are blackish. Some of the males have the palpi brown basally.

Atherigona matema Curran, new species

Plate 2, figure 3

Related to *nudiseta* Malloch but with the anterior tarsi wholly blackish, and differently shaped trifoliate process on the male genitalia. Reddish yellow, the disc of the mesonotum brown or black in ground color and thickly ochraceous pollinose; front tibiae mostly black or brown, their tarsi wholly so; abdomen with two pairs of brown spots. Length 3.5 to 4 mm.

Male: head reddish yellow, the occiput, except below, and the vertex black, cinereous white pollinose, the pollen also covering the frontal orbits; face and cheeks with ochraceous pollen; bristles black. Proboscis brown; palpi orange, white haired except for a group of short bristles near the base on the outer side. Antennae broad, reaching almost to the vibrissae, orange, the third segment mostly brown; arista reddish brown, the penultimate segment more than twice as long as wide.

Thorax with ochraceous pollen that may appear lighter over the black disc of the mesonotum and broad base of the scutellum, the black color extending to the anterior and posterior margins; two pairs of equally strong scutellars, the apical pair decussate; three sternopleurals, the lower decidedly weaker than the others.

Legs reddish yellow, the front tarsi brown, their tibiae brown on the apical half to two-thirds, the apical tarsal segment yellowish; anterior femora simple and without unusual bristling.

Wings cinereous hyaline; third and fourth veins distinctly converging apically. Squamae and halteres pale yellowish.

Abdomen pale orange, slightly shining, the second and third segments each with a pair of small roundish brown spots; second tergite produced downward, the lower edges ending subrectangularly, without unusual bristling; fourth segment very small. Knob-like genital process with rounded apex from lateral and dorsal view, posteriorly emarginate only above; trifoliate process of the posterior forceps as shown in figure 3 of Plate 2, the stem yellow.

Female: agrees well with the male, but the anterior femora are black or brown on the apical half to three-fourths, their tibiae wholly blackish, the brown abdominal spots are situated on the third and fourth segments and the genital lamellae are brown; the apical segment of the front tarsi paler than the others, usually brownish yellow.

Holotype: male, No. 4069; and *allotype*: female, No. 4070, Mus. Calif. Acad. Sci., Ent., **Matema Island, Santa Cruz Group**, July 7, 1933. *Paratypes*: 2 ♂, 4 ♀, **Matema Island**, July 2, 7, 1933; ♂, ♀, **Matema Islands**, July 8, 1933; 2 ♂, 3 ♀, **Guadalcana Island**, May 23, 1933.

Pygophora torrida (Wiedemann)

Cænosiæ torrida Wiedemann, Aussereur. Zweifl., ii, p. 437, 1830.

Female, Tai Lagoon, Malaita Island, May 30, 1933.

Limosia tumidiventris (Stein)

Cænosiæ tumidiventris Stein, Tijds., v. Ent., xlvii, p. 112, 1904.

Male, Matema Islands, July 9, 1933.

Limosia sp.

Two females from Matema Island, July 7, 1933, do not agree with any published descriptions.

Limnophora plumiseta Stein

Limnophora plumiseta Stein, Mitt. Zool. Mus. Berlin, ii, p. 109, 1903.

One ♂, 5 ♀, Anuda Island, July 15, 18, 1933; 18 ♀, Kungava Bay, Rennell Island, June 14, 16, 1933; ♀, Tai Lagoon, Malaita Island, May 30, 1933; ♀, Guadalcanar Island, May 20, 1933; ♀, Star Harbor, San Cristoval Island, July 1, 1933.

Helina propinqua (Stein)

Spilogaster propinqua Stein, Ann. Mus. Civ. Genova, xx, p. 386, 1900.

Twelve males and eighteen females, Anuda Island, July 15, 18, 1933.

Dichaetomyia rufa Stein

Spilogaster rufa Stein, Termés. Fuzet., xxiii, p. 132, 1900.

Two males and 30 females, Anuda Island, June 17, July 15, 18, 1933; ♀, Nupani Reef Island, May 8, 1933; ♀, Matema Islands, July 9, 1933.

One male has the third and fourth abdominal segments and the broad apex of the second in the middle, and the sternites black but I can find no structural differences. The female from Matema Island has the third and fourth abdominal segments black.

Dichaetomyia atratula Malloch

Dichaetomyia atratula Malloch, Phil. Journ. Sci., xxvi, p. 325, 1925.

Female, Santa Catalina Island, July 2, 1933; ♀, Guadalcanar Island, May 22, 1933.

Dichaetomyia quadrata Wiedemann

Female, Guadalcanar Island, May 21, 1933.

Orthellia timorensis Desvoidy

Male, Guadalcanar Island, May 23, 1933; 4 ♂, 8 ♀, Santa Catalina Island, July 2, 1933; 10 ♂, 12 ♀, Kungava Bay, Rennell Island, June 14, 1933.

Byomya vetustissima Walker

Musca vetustissima Walker, List. Dipt. Brit. Mus., iv, p. 902, 1849.

Twenty-three ♂, 28 ♀, Anuda Island, July 7, 15, 16, 18, 1933; 9 ♂, 21 ♀, Kungava Bay, Rennell Island, June 14, 16, 1933; ♂, N. W. end of Bellona Island, June 19, 1933.

Byomya xanthomelas (Wiedemann)

Musca xanthomelas Wiedemann, Anal. Ent., p. 49, 1824.

Male and eight females, Anuda Island, June 15, 1933.

Resembles *nebulo* Fabricius, but has the propleura bare.

Musca nebulo Fabricius

Musca nebulo Fabricius, Ent. Syst., iv, p. 321, 1794.

Two males, Anuda Island, July 15, 18, 1933.

The propleura are haired in the middle and there are four pairs postsutural dorsocentral bristles.

METOPIIDAE

The genera in the collection may be separated by the following key.

Key to Genera

1. Arista pectinate, with rays on upper surface only. *Stomorphina* Rondani
- . Arista plumose. 2
2. Lower lobe of squamae haired above. 7
- . Lower lobe of squamae bare above. 3
3. Ridge at inner end of squamae with long hairs. *Lucillia* Desvoidy
- . Ridge bare. 4
4. Propleura bare; two or more sternopleurals. 5
- . Propleura haired in the middle; two sternopleurals. 6
5. Abdomen tessellate. *Sarcophaga* Meigen
- . Abdomen densely pollinose, not tessellate. *Chrysosarcophaga* Townsend
6. Abdomen tessellate. *Notochaeta* Aldrich
- . Abdomen densely pollinose, not tessellate. *Phalacrodiscus* Enderlein
7. Stem vein haired posteriorly. *Chrysomya* Desvoidy
- . Stem vein bare. *Calliphora* Desvoidy

Stomorhina quadrinotata (Bigot)

Idia quadrinotata Bigot, Ann. Soc. Ent. France, p. 238, 1874.

Rhinia quadrinotata Malloch, Ann. Mag. Nat. Hist., xviii, p. 504, 1926.

There is a good deal of confusion regarding the identity of this species, *discolor* Fabricius, and some related forms. The typical *discolor* has the basal third or more of the posterior femora reddish and the tibiae only darkened at the apex while *quadrinotata* has the femora practically all black and the apical third of the posterior tibiae black or brown. Malloch expressed the belief that the two names applied to the same species. The question is an open one and can be decided only by an examination of the type of *discolor*, if it still exists. The chaetotaxy of the posterior femora furnishes an excellent means of distinction between some of the species, and the females of some can be separated by the color of the first tergite. I think there can be no doubt that the specimens recorded below are referable to *quadrinotata*.

Six ♀, Kungava Bay, Rennell Island, June 14, 16, 1933.

I might point out here that the species recorded by Malloch as *simplex* Walker can not be that species since Walker states that the palpi are "pale testaceous."

Chrysomya megacephala Fabricius

Twenty-five ♂, 43 ♀, Kungava Bay, Rennell Island, June 14, 1933.

A common and widely distributed species.

Lucillia, species

One specimen from Malaita Island is in too poor condition to be determined.

Calliphora melinda Curran

Calliphora melinda Curran, Amer. Mus. Novit. No. 375, p. 8, 1929.

Male and two females, Santa Ana Island, July 3, 1933.

Helicobia australis Johnson and Tiegs

Helicobia australis Johnson and Tiegs, Proc. Roy. Soc. Queensland, xxxiii, p. 50, 1921.

Female, Malaita Island, May 30, 1933.

Sarcophaga Meigen

Of the two species in the collections one is evidently undescribed, or the genitalia have not been figured. The species cannot be recognized without figures of the male genitalia.

Sarcophaga orchidea Boettcher

Sarcophaga orchidea Boettcher, Ann. Mus. Nat. Hung., xi, p. 375, 1913 (f).

Sarcophaga gamma Johnson and Tiegs, Proc. Roy. Soc. Queensl., xxxiii, p. 6 (f).

Sarcophaga brunneopalpus Johnson and Tiegs, Proc. Roy. Soc. Queensl., xxxiv, p. 184 (f).

Sarcophaga gamma Hardy, Proc. Linn. Soc. N. S. W., xlviii, p. 125 (f).

Male: Florida Island, September 11, 1927 (Whitney Expedition); ♀, Guadalcanar Island, May 23, 1933.

The male genitalia do not quite agree with the figures published by Hardy and Boettcher, but there can be little doubt about the specimen belonging to *gamma*, which seems to be a synonym of *orchidea*. Senior White's figure also differs from the other two mentioned, but all the figures agree in essential details. The palpi are reddish or brownish red, thus distinguishing the species from the others recorded from the islands.

Sarcophaga zethus Curran, new species

Plate 1, figure 9

Related to *orchidea* Boettcher, but much larger, the arms of the posterior forceps of the male genitalia without the angular lobe before the apex on the inner side. Length, 12 to 16 mm.

Male: head golden yellow pollinose, the frontal vitta black; hair black, reddish yellow on the occiput and lower half of the cheeks. Front about half as wide as one eye; twelve to fourteen pairs of frontals, the upper pair reclinate; ocellars weak; a pair of bristles behind the verticals; a row and partial double row of black hairs behind the occipital cilia. Cheeks five-twelfths as wide as the eye-height, rather grayish above. Parafacials with a row of hairs; vibrissae almost level with the oral margin. Proboscis and palpi black. Antennae black, the third segment twice as long as the second.

Dorsum of the thorax pale golden yellow, the pleura paler pollinose; median black vitta narrower than the others and extending well onto the scutellum; no acrosticals; two strong and two weak postsutural dorsocentrals; scutellum with three pairs of marginals, the apical pair weak and decussate, and a pair of weak discals; propleura bare; three sternopleurals; hair black.

Legs black, the coxae and under surface of the anterior femora pale pollinose; pulvilli long, black with reddish margins. Middle tibiae with a single anterodorsal bristle, not ciliate; middle femora with long hair below on the basal two-thirds, the apex with anterior comb; posterior tibiae with long, fine hair on both ventral surfaces, their femora with rather long hair below and long bristly hairs behind, the anteroventral row of bristles incomplete, obsolete on the basal third.

Wings cinereous hyaline, brownish yellow basally and along the veins. Squamae white with yellow rim; halteres reddish with brown knob.

Abdomen black, cinereous pollinose, tessellate, with a narrow median brown vitta and brown longitudinal stripes on the basal half of the second and third segments toward the sides. Second segment with pair of weak median marginals, the third segment with a stronger pair, the fourth with a row; ventral edges of the fourth segment bearing abundant long hair. Genitalia shining brown, the first segment pollinose, without bristles. Lateral view of genitalia as in figure 9 of Plate 1.

Female: front almost four-fifths as wide as one eye; bearing two pairs of fine orbitals; outer verticals strong; apical scutellars absent; legs without long hair, the middle tibiae with a second small, anterodorsal bristle; second abdominal segment without median marginals, the apices of the segments more or less brown pollinose except laterally.

Holotype: ♂, **Guadalcana Island**, July 1927 (Whitney Expedition); *allotype*: ♀, No. 4071, Mus. Calif. Acad. Sci., Ent., N. W. end of **Bellona Island**, June 21, 1933; *paratypes*: 3 ♀, same data as allotype; ♀, **Malaita Island**; female, Matema Islands, Santa Cruz Group, July 8, 1933.

***Notochaeta indusa* Curran, new species**

Plate 1, figure 10

Differing from the described species by the shape of the male genitalia; posterior tibiae with a few long hairs on the apical half of the ventral edges. Length, 11 mm.

Male: head pale golden yellow pollinose, the occipital pile reddish yellow. Front less than half as wide as one eye; about eleven pairs of frontals, the upper two reclinate; ocellars long and fine; a weak bristle behind the vertical; a row of black setae behind the occipital cilia; yellow pile encroaching on the cheeks posteriorly. Cheeks four-ninths as wide as the eye-height; vibrissae situated practically level with the oral margin; parafacials with a row of fine hairs. Proboscis and palpi black. Antennae black, the third segment brownish red.

Thorax cinereous yellow pollinose; mesonotum with three broad black vittae, the median one extending to beyond the middle of the scutellum; a pair of weak prescutellar acrosticals; two strong and two weak pairs of postsutural dorso-centrals; three pairs of marginal scutellars, the apical pair long and decussate; no discal scutellars; propleura haired in the middle; two sternopleurals.

Legs black; middle femora with long hair below toward the posterior edge, and bearing the usual apical comb; middle tibiae not villous, bearing a single anterodorsal bristle; posterior femora with moderately long hair below, with two anteroventral bristles near the middle, their tibiae with long hairs on the apical half of both ventral edges; pulvilli long, brown with reddish edges.

Wings cinereous hyaline, the veins bordered with pale brown; third vein bristled half way to the small crossvein; bend of fourth vein angular. Squamae white with yellow rim; halteres yellow with brown knob.

Abdomen tessellate, cinereous pollinose, a median vitta and the apices of the segments brown. Second and third segments each with a pair of strong median marginals, the fourth with a row; lobes of the fifth sternite with rather long fine bristles on the inner edge. Genitalia shining brown, the basal segment pale pollinose, without bristles; lateral view of genitalia as in figure 10 of Plate 1.

Holotype: male, **Florida Island**, September 11, 1927 (Whitney Expedition).

This genus has not been recorded from the Indo-Australian region, but I believe that the specimen properly belongs here.

Chrysosarcophaga superba Townsend

Chrysosarcophaga superba Townsend, Journ. N. Y. Ent. Soc., xl, p. 442, 1932.

Female, Guadalcanar Island, July 20, 1927 (Whitney Expedition).

The bristles are all fine and short, the prescutellars very weak. The species recorded by Baranov under this name is not the same, but is undoubtedly the following since there are three black mesonotal vittae.

Phalacrodiscus ? whitneyi Curran, new species

?*Chrysosarcophaga superba* Baronov, Veterin. Arhiva (Zagreb), p. 475 (f), 1934.

Differs from *P. dahlianus* Enderlein in having black genital segments and the median vitta wider than the posterior fascia on each abdominal segment. I am not sure that this species belongs to *Phalacrodiscus* since Enderlein makes no mention of the propleura. Head and upper surface golden yellow, the under surface black, the dorsum with black markings. Length, 17 mm.

Female: head golden yellow, the frontal vitta, facial grooves, proboscis, palpi and antennae black; hair pale golden, very sparse and black on the front and parafacials. Frontal vitta scarcely widening anteriorly; frontals fine, extending to below the middle of the second antennal segment, the upper pair reclinate; orbitals fine, the upper pair weak; ocellars long and fine; outer verticals three-fourths as long as the verticals; occipital cilia extending to the lowest third of the eyes. Third antennal segment brown; arista with long rays on the basal two-thirds.

Black mesonotal vittae shining, moderately wide, the median one narrowest but broadened behind and extending to the middle of the scutellum. Bristles rather weak; prescutellars moderately long; four or five pairs of postsutural dorso-centrals. Pleura golden yellow on the upper half in front of the wings, but with a black vitta between the humeri and wings; lower half shining black, very thinly cinereous pollinose; hair black, yellow on the middle of the propleura. Scutellum without discals, with four pairs of equally strong marginals. Prosternum weakly haired laterally.

Legs black. Wings cinereous hyaline, tinged with brown basally. Squamae yellow, the disc with white reflection in some lights. Halteres reddish, the base of the knob tinged with brown.

Abdomen golden above, with the apices of the segments and a median vitta shining black; first segment black with golden pollinose spot on either side. The black posterior border occupies one-fifth of the second segment and is narrower than the median vitta; on the third segment the median vitta is narrower than on the second and the black fascia is very narrow; the median vitta on the fourth segment is about as wide as the preceding fascia, the tip of the segment without

conspicuous fascia. Under side of abdomen and the genital segments shining black. Hair wholly black; third and fourth segments each with a row of fine marginals, that on the third segment broadly interrupted on either side of the median marginals.

Holotype: female, **Guadalupe Island**, July 20, 1927 (Whitney Expedition).

TACHINIDAE

The collection contains two species belonging to the genus *Actia*.

***Actia hyalinata* Malloch**

Actia hyalinata Malloch, Journ. Fed. Malay States Mus., xvi, p. 138, 1930.

Male, Matema Islands, Santa Cruz Group, July 10, 1933.

Agrees with the description, but has the third antennal segment black on the upper half beyond the arista, and the mesonotal pollen is grayish yellow instead of grayish.

***Actia subaequalis* Malloch**

Actia subaequalis Malloch, Journ. Fed. Malay States Mus., xvi, p. 142.

Female, Tai Lagoon, Malaita Island, May 30, 1933.

PLATE 1

- Fig. 1. *Platensina malaita* Curran, new species.
Fig. 2. *Euprosopia lepida* Curran, new species.
Fig. 3. *Scholastes whitneyi* Curran, new species.
Fig. 4. *Scholastes solomensis* Curran, new species.
Fig. 5. *Scholastes palmyra* Curran, new species.
Fig. 6. *Themarohystrix exul* Curran, new species.
Fig. 7. *Maira whitneyi* Curran, new species. Lateral view of ♂ genitalia.
Fig. 8. *Maira willowsi* Curran, new species. Lateral view of ♂ genitalia.
Fig. 9. *Sarcophaga zethus* Curran, new species. Lateral view of ♂ genitalia.
Fig. 10. *Notochaeta indusa* Curran, new species. Lateral view of ♂ genitalia.
Fig. 11. *Lasiopsila fasciata* Curran, new species.

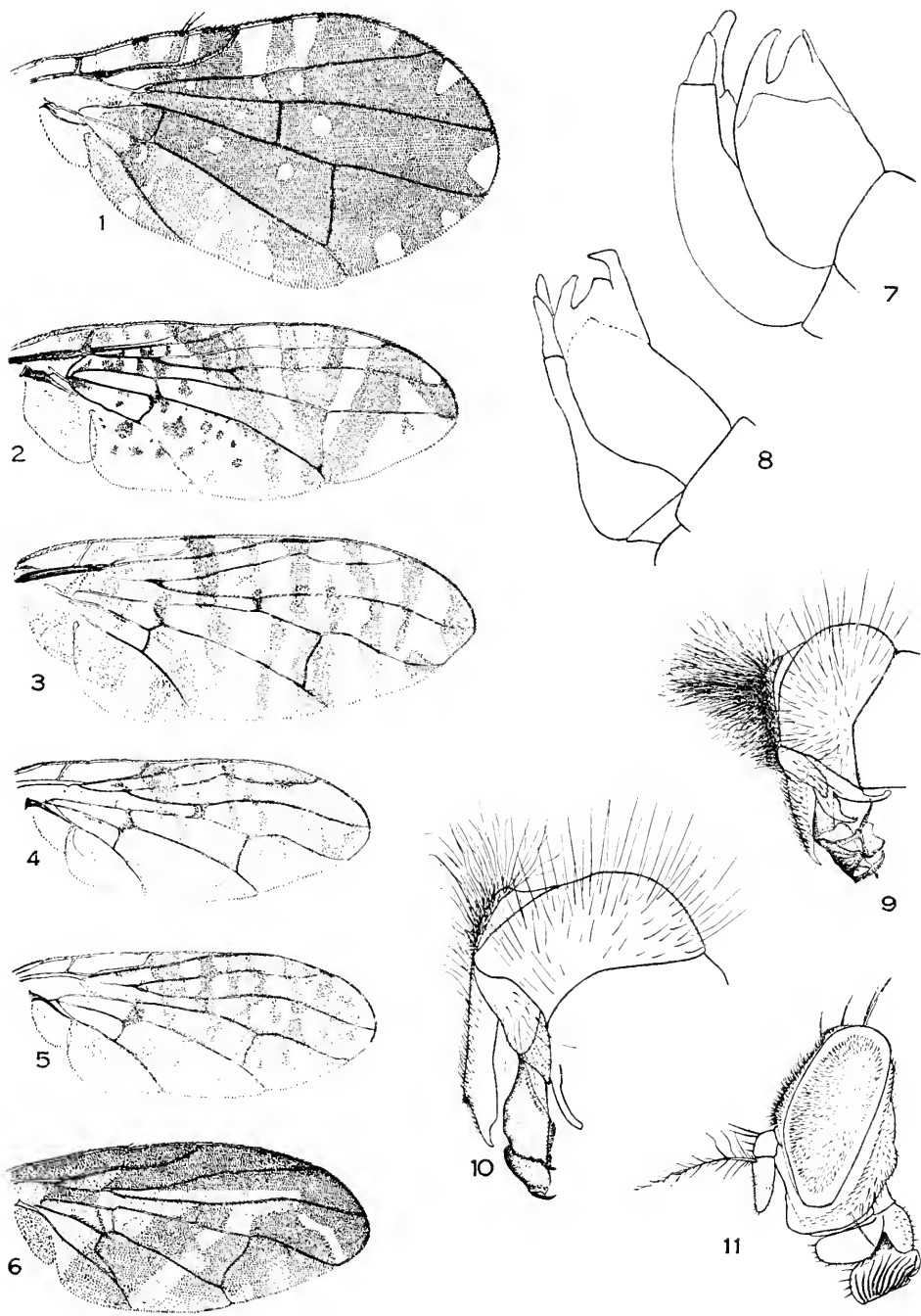


PLATE 2

Fig. 1. *Minettia ethelia* Curran, new species. Ventral view of ♂ genitalia.

Fig. 2. *Lasiopsila fasciata* Curran, new species.

Fig. 3. *Atherigona matema* Curran, new species. Ventral (a) and lateral (b) views of trifoliate genital process of ♂.

Fig. 4. *Minettia ethelia* Curran, new species. Lateral view of ♂ genitalia.

Fig. 5. *Steganopsis solomensis* Curran, new species.

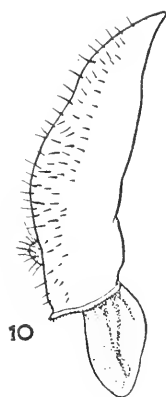
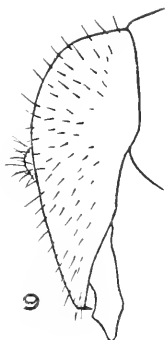
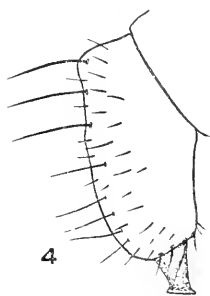
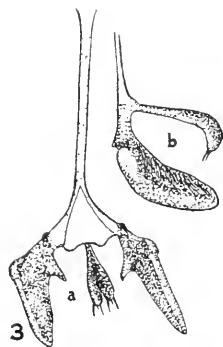
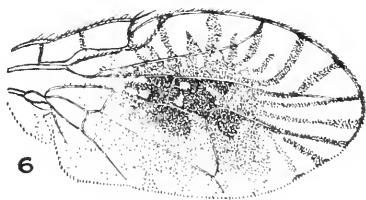
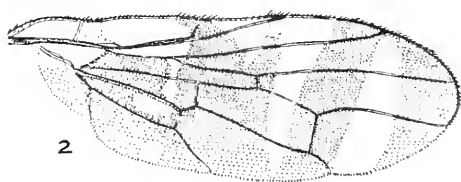
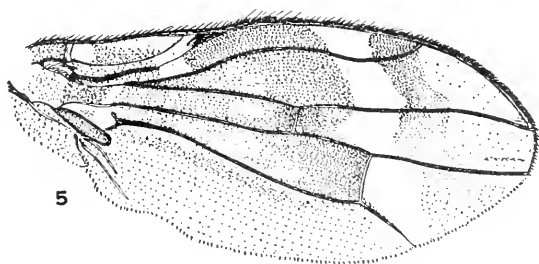
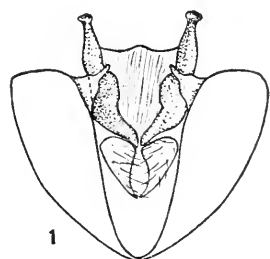
Fig. 6. *Rhabdochaeta crockeri* Curran, new species.

Fig. 7. *Naupoda ventralis* Curran, new species.

Fig. 8. *Homoneura anuda* Curran, new species. Lateral view of ♂ genitalia.

Fig. 9. *Homoneura sikaiana* Curran, new species. Lateral view of ♂ genitalia.

Fig. 10. *Homoneura crockeri* Curran, new species. Lateral view of ♂ genitalia.



PROCEEDINGS
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**THE TEMPLETON CROCKER EXPEDITION OF THE
CALIFORNIA ACADEMY OF SCIENCES, 1932
No. 31**

A PRELIMINARY REPORT ON THE ALGAE

BY

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The most of the botanical collections of the expedition were made by Mr. John Thomas Howell, Assistant Curator of the Herbarium of the California Academy of Sciences, who was especially concerned with the Phanerogams, the collection of algae being more or less incidental. However, up to the present time our studies have revealed at least one hundred and twenty-five genera and approximately two hundred and fifty species.

Collections of algae were made at thirty-two different stations, principally among the Galapagos Islands. A considerable number of species were collected along the coast of Lower California, interesting principally in giving us new data on the southern extension in the known distribution of many species common along the coast of California. A few interesting species were collected on the coast of Costa Rica, at Guadalupe Island off the northern coast of Lower California, and at Clarion Island, Revillagigedo Group.

The present paper deals with the new species, varieties, and combinations that have been identified during our studies up to the present



time. Possibly before completing the study we may come across a few more.

Of these new species 18 are Myxophyceae, 1 Chlorophyceae, 3 Melanophyceae, and 23 Rhodophyceae.

It is hoped that we may be able to render the complete account in the near future.

Polycystis clarionensis Setchell and Gardner, sp. nov.

Plate 3, figures 2a, 2b

Coenobia forma magnitudineque valde variabilis, gelina firma ultra massam cellularum minime extendente margine levi inclusa, usque ad 600 μ in diametro longiore; cellulis atrocyaneo-viridibus, dense conglobatis, homogeneis, sphericis usque ad ellipsoideis, 3-7 μ diam. (vulgo 4-5 μ).

Colonies extremely variable in shape and size, enclosed by a firm jelly extending only slightly beyond the cell mass, making a smooth margin, up to 600 μ in longest diameter; cells dark blue-green, densely congested, homogenous, spherical to ellipsoidal, 3-7 μ diam. (mostly 4-5 μ).

On rocks among encrusting algae.

Type: No. 236504, Herb. Calif. Acad. Sci., collected by J. T. Howell (No. 569a) Mar. 24, 1932, at **Sulphur Bay, Clarion Island**.

Dermocarpa simulans Setchell and Gardner, sp. nov.

Plate 3, figure 3

Cellulis sphericis, liberis, 35-38 μ diam., protoplastis homogeneis, aeruginosis; parietibus levibus, hyalinis, 4-4.5 μ crassis; gonidangiis cellulis magnitudine similibus; gonidiis 2-2.5 μ diam.

Cells spherical, not attached, 35-38 μ diam., protoplast homogeneous, aeruginous; cell wall smooth, hyaline, 4-4.5 μ thick; gonidangia same size as the cells; gonidia 2-2.5 μ diam.

Floating free among *Rhizoclonium robustum*.

Type: No. 236530, Herb. Calif. Acad. Sci., collected by J. T. Howell (No. 170b) June 11, 1932, at **North Seymour Island, Galapagos**.

The specimens were very sparse and floating free, making it difficult to determine much in regard to the variations in size, etc. among the individuals, but the specimens represented are quite constant in shape and size and all seemed to be mature.

They differ very little from *D. sphaerica* S. and G., from the California coast. They are two to three times greater in diameter than that species.

Dermocarpa sphaerica var. **galapagensis** Setchell and Gardner,
var. nov.

Cellulis sphericis, 15-18 μ diam., parietibus 4 μ crassis, conspicuis; gonidangiis 16-20 μ diam.

Cells spherical, 15-18 μ diam., cell wall 4 μ thick, conspicuous; gonidangia 16-20 μ diam.

Growing on the surface of colonies of *Aphanocapsa salinarum*.

Type: No. 236517, Herb. Calif. Acad. Sci., collected by J. T. Howell (No. 576) June 1, 1932, **southeast side of Narborough Island, Galapagos.**

Xenococcus angulatus Setchell and Gardner, sp. nov.

Plate 3, figures 6a, 6b

Cellulis in parietibus externis cellularum superficialium hostis numerosis, valde angulatis et forma magnitudineque irregularibus, sed vulgo ut in sectione hostis visis radialiter elongatis, in gregibus 1-6 aggregatis.

Cells embedded in the outer walls of the surface cells of the host, very angular and irregular in shape and size but usually somewhat elongated radially as seen in section view of the host, occurring in groups of one to six; gonidangia not observed.

Endophytic in the walls of *Callymenia angustata*.

Type: No. 236508, Herb. Calif. Acad. Sci., collected by J. T. Howell (739a) Aug. 12, 1932, from 16 fathoms depth, at **Santa Maria Bay, Lower California.**

This species of *Xenococcus* is extremely abundant on the surface walls on both sides of the host of which we have but a single specimen. The cells are small and angular, dividing in two planes perpendicular to each other and both planes perpendicular to the surface of the host. The manner of cell division leads us to place the species in the family Chamaesiphonaceae rather than in the Chroococcaceae, although we have seen no gonidia.

Xenococcus endophyticus Setchell and Gardner, sp. nov.

Plate 3, figures 1a, 1b, 1c

Endophyticus, plus minusve distortionem cellularum efficiens, ante divisionem lenticularis, demum vulgo coenobia 4-12-cellularia formans; cellulis singulis maturis 14-20 $\mu \times$ 8-12 μ , in planis duobus dividitibus; colore aeruginosis; gonidiis nondum observatis.

Plants endophytic, causing more or less distortion of the cells of the host, lenticular in form before division, then usually forming colonies of 4-12 cells; single mature cells 14-20 $\mu \times$ 8-12 μ , dividing in two planes only; gonidangia not observed; color aeruginous.

Embedded in the cell wall of *Rhizoclonium riparium*.

Type: No. 236509, Herb. Calif. Acad. Sci., collected by J. T. Howell (429b) May 22, 1932, **five miles northeast of Webb Cove, Albemarle Island, Galapagos.**

***Lyngbya adherens* Setchell and Gardner, sp. nov.**

Plate 5, figure 13

Filamentis vulgo per longitudinem totam epiphyticis, plus minusve tortuosis, sed interim rectis; trichomatibus 2.8-3.2 μ diam., apicibus rectis, obtusis, attenuatisque, ad dissepimentis valde conspicuis constrictis; vaginis tenuissimis, hyalinis, moderate gelatinosis; cellulis quadratis aut quam longis parum brevioribus; protoplasto homogeneo.

Filaments epiphytic mostly throughout their entire length, but in part with free ends, usually more or less tortuous, although occasionally straight; trichomes 2.8-3.2 μ diam., with straight, blunt, non-attenuated apices, constricted at the very conspicuous cross-walls; sheath very thin, hyaline, somewhat gelatinous; cells quadrate to slightly shorter than the diameter; protoplast homogeneous.

Clinging closely to various small species of Rhodophyceae.

Type: No. 236520, Herb. Calif. Acad. Sci., collected by J. T. Howell (278) May 17, 1932, at **Charles Island, Galapagos.**

Lyngbya Holdenii DeToni from Connecticut seems to be a very close relative of this species from the Galapagos Islands, judging from the similarity in structure. The cross-walls of the Galapagos material are more conspicuous, the cells are narrower and shorter, and the filaments are attached mostly by their whole length and are much shorter.

***Lyngbya prostrata* Setchell and Gardner, sp. nov.**

Plate 3, figures 4a, 4b

Filamentis tortuosis, per longitudinem totam adhaerentibus, 0.8-1.1 μ diam., ad dissepimentis constrictis, neque apice attenuatis neque capitatis; cellulis quadratis usque ad parum longioribus brevibusve; vaginis inconspicuis.

Filaments tortuous, adhering to the host by their entire length, 0.8-1.1 μ diam., constricted at the cross-walls, neither attenuated at the apices nor capitate; cells quadrate to very slightly longer or shorter; sheath inconspicuous.

Adhering to *Polysiphonia* sp.

Type: No. 236511, Herb. Calif. Acad. Sci., collected by J. T. Howell (608a) Aug. 4, 1932, dredged from **20 fathoms depth at San Jose del Cabo, Lower California.**

This species of *Lyngbya* was observed on but one specimen of *Polysiphonia*. The filaments are short and adhere very firmly to the

host throughout their entire length, not having the ends free like certain members of the *Leibleinia* group. The paucity of specimens observed is to be regretted, but specimens of the host are exceedingly scarce among the collections.

***Lyngbya epizooica* Setchell and Gardner, sp. nov.**

Filamentis inter apices liberas adhaerentibus, vulgo minus quam $300\ \mu$ longis; trichomatibus neque attenuatis, constrictis neque capitatis, arcuatis $5\text{--}5.4\ \mu$ diam.; cellulis $1\text{--}1.5\ \mu$ longis, protoplastis homogeneis usque ad minute granulatis, aeruginosis; vaginis tenuissimis, hyalinis, homogeneis.

Filaments attached between the free ends, mostly less than $300\ \mu$ long; trichomes neither constricted nor attenuated nor capitate, straight or arcuate, $5\text{--}5.4\ \mu$ diam.; cells $1\text{--}1.5\ \mu$ long, with homogeneous to finely granular aeruginous protoplasts; sheath very thin, hyaline, homogeneous.

Attached to very small worm tubes.

Type: No. 236523, Herb. Calif. Acad. Sci., collected by J. T. Howell (497) Mar. 24, 1932, at **Sulphur Bay, Clarion Island.**

A few small worm tubes were found among algae which had an abundance of this diminutive species of *Lyngbya* attached to them. It belongs to the *Leibleinia* section of the genus, and of the known species is probably closest to *L. gracilis* Rabenhorst, originally from Europe. The filaments are narrower, not constricted, of a different color, and the cells are much shorter.

***Lyngbya Willei* var. *galapagensis* Setchell and Gardner,
var. nov.**

A typo per trichomata aeruginea usque ad $175\ \mu$ longa, $2.4\text{--}2.8\ \mu$ diam., et per cellulas quam diametro $\frac{1}{2}$ brevioras, abludens.

Trichomes aeruginous, up to $175\ \mu$ long, $2.4\text{--}2.8\ \mu$ diam.; cells $\frac{1}{2}$ as long as the diam.; otherwise as the species.

Attached to the filaments of *Boodlea* sp.

Type: No. 236513, Herb. Calif. Acad. Sci., collected by J. T. Howell (413a), Apr. 27, 1932, at **Villamil, Albemarle Island, Galapagos.**

***Lyngbya Kuetsingiana* var. *pacifica* Setchell and Gardner,
var. nov.**

A typo per filamenta comparate longa tortuosaque, per vaginas distinctissimas, trichomata $3.6\text{--}3.8\ \mu$ diam.; et per cellulas $\frac{1}{3}\text{--}\frac{1}{2}$ breviora, protoplastis homogeneis, abludens.

Filaments relatively long and tortuous; sheath very distinct; trichomes $3.6\text{--}3.8\ \mu$ diam.; cells $\frac{1}{3}\text{--}\frac{1}{2}$ as long as broad, with homogeneous protoplast; otherwise like the species.

Intermingled with other Myxophyceae, in tide pools.

Type: No. 236510, Herb. Calif. Acad. Sci., collected by J. T. Howell (776) July 2, 1932, at **Braxillito Bay, Costa Rica.**

***Lyngbya sinuosa* Setchell and Gardner, sp. nov.**

Plate 4, figure 7

Filamentis brevibus, usque ad 400 μ longis; trichomatibus lente regulariterque sinuosis aut plus minusve tortis; ad dissepimenta lente constrictis, apicibus leviter attenuatis, 5 μ diam., cellulis 1.6-2.4 μ longis; cellula terminali non capitata.

Filaments short, up to 400 μ long; trichome gently and regularly sinuous or more or less irregularly contorted, slightly constricted at the cross-walls, slightly attenuated at the apices, 5 μ diam., with cells 1.6-2.4 μ long; end cell blunt, not capitate.

Sparsely distributed among other microscopic algae scraped from rocks.

Type: No. 236512, Herb. Calif. Acad. Sci., collected by J. T. Howell (310) Mar. 22, 1932, at **Sulphur Bay, Clarion Island.**

This species does not seem to be abundant and is probably in the juvenile stage, the longest filaments being only about 400 μ long. Structurally it resembles very closely *Lyngbya spiralis* Geitler, from a hothouse at the University of Vienna. It differs in being slightly attenuated at the apices and constricted at the cross-walls.

***Lyngbya codicola* Setchell and Gardner, sp. nov.**

Trichomatibus singulis aut in fasciculis parvis, 2.4-2.7 μ diam., cellulis quadratis aut quam longis leviter brevioribus, rectis, neque attenuatis neque constrictis, cellula apicali neque capitata neque pariete terminali incrassato; vaginis tenuibus sed distinctis.

Trichomes single or in small fascicles, 2.4-2.7 μ diam., with quadrate cells or slightly shorter than broad, straight, neither attenuated nor constricted; end cell neither capitate nor with a thickened end wall; sheath thin but distinct.

Among the utricles of *Codium Geppii*.

Type: No. 236521, Herb. Calif. Acad. Sci., collected by J. T. Howell (806) July 2, 1932, at **Braxillito Bay, Costa Rica.**

***Lyngbya consociata* Setchell and Gardner, sp. nov.**

Trichomatibus singulis aut lente fasciculatis, 1-1.3 μ diam., cellulis quadratis aut quam crassis leviter longioribus, rectis, neque attenuatis neque constrictis; dissepimentis inconspicuis; protoplastis homogeneis; vaginis tenuissimis inconspicuisque.

Trichomes single or in small fascicles, 1-1.3 μ diam., with cells quadrate or very slightly longer than broad, straight, neither attenuated nor constricted; cross-walls inconspicuous; contents homogeneous; sheath very thin and inconspicuous.

Among utracles of *Codium Geppii*.

Type: No. 236522, Herb. Calif. Acad. Sci., collected by J. T. Howell (807) July 2, 1932, at **Braxillito Bay, Costa Rica**.

Near to *L. subtilis* but has narrower and shorter cells.

***Microcoleus subtorulosus* var. *pacificus* Setchell and Gardner,**
var. nov.

A typo per trichomata in vaginis communibus 12-15, 8.5-9 μ diam.; cellulis 3-4 μ longis; cellula apicali quadrata aut quam crassa leviter longiore; dissepimentis valde distinctis; abluens.

Trichomes 12-15 in a sheath, 8.5-9 μ diam.; cells 3-4 μ long; apical cell quadrate to slightly longer than broad; cross-walls very distinct; otherwise as the species.

Dredged from 20 fathoms depth.

Type: No. 236516, Herb. Calif. Acad. Sci., collected by J. T. Howell (614a) Aug. 14, 1932, at **San Jose del Cabo, Lower California**.

The species, *M. subtorulosus* of Gomont, was founded on *Phormidium subtorulosum* Brébisson, who collected it at Falaise, France. It has been reported since from Sweden, Florida, and the Indo-Malaysian Archipelago, always in fresh water.

The material of the variety proposed here is marine, exceedingly sparsely represented in this collection, and was brought up in the dredge among other diminutive algae.

***Microcoleus Howellii* Setchell and Gardner, sp. nov.**

Plate 3, figure 5

Filamenta per algas alias sparsa, non stratum formantia; vaginis firmis, hyalinis, comparate levibus, trichomata usque ad 25 arcte collecta includentibus; trichomatibus aeruginosis, 6-6.5 μ diam., ad apices lente attenuatis, neque capitatis neque constrictis; cellulis 2-3 μ longis, protoplastis homogeneis.

Filaments scattered among other algae, not forming a stratum; sheath firm, hyaline, relatively smooth, enclosing up to 25 trichomes tightly bound together; trichomes aeruginous, 6-6.5 μ diam., slightly tapering at the apices, not capitate, not constricted; cells 2-3 μ long, with homogeneous protoplast.

Mingled with other small algae on rocks.

Type: No. 236515, Herb. Calif. Acad. Sci., collected by J. T. Howell (413), Apr. 27, 1932, in tide pools at **Villamil, Albemarle Island, Galapagos**.

Calothrix Laurenciae Setchell and Gardner, sp. nov.

Filamentis epiphyticis, per totam longitudinem ad hostem adhaerentibus, parte terminali solummodo libera; trichomatibus basi tumidis, usque ad pilos valde graciles ($2\ \mu$ diam.) attenuantibus, proxime $100\ \mu$ longis usque ad plus minusve, basi $8-10\ \mu$ diam., eramosis; cellulis quam diam. $\frac{1}{2}-\frac{1}{3}$ -plo brevioribus; heterocystis basalibus, subsphericis; vaginis valde tenuibus, totaliter arcte applicatis, hyalinis, homogeneis; sporis nondum visis.

Filaments epiphytic, adhering to the host by their entire length or only the apical portion free; trichome swollen at the base, tapering to a very slender ($2\ \mu$ thick) hair, approximately $100\ \mu$ long to slightly more or less, $8-10\ \mu$ diam. at the base, unbranched; cells $\frac{1}{2}$ to $\frac{1}{3}$ as long as broad; heterocysts basal, subspherical; sheath very thin, close fitting throughout, hyaline, homogeneous; spores unknown.

Growing on *Laurencia* sp.

Type: No. 236525, Herb. Calif. Acad. Sci., collected by J. T. Howell (231b) Mar. 24, 1932, at **Sulphur Bay, Clarion Island, Galapagos.**

The species seems to be near to *C. codicola* S. and G., from Guadalupe Island. It is a smaller plant and is unbranched. Its habitat is strikingly different.

Scytonema guyanense var. **marinum** Setchell and Gardner,
var. nov.

Filamentis $28-40\ \mu$ diam.; trichomatibus $10-18\ \mu$ diam.; cellulis quadratis usque ad in filamentorum partibus vetustioribus duplo longioribus in apicibus increscentibus $\frac{1}{2}-\frac{1}{3}$ brevioribus; vaginis vulgo homogeneis sed pro parte leviter lamellosis.

Filaments $28-40\ \mu$ diam.; trichome $10-18\ \mu$ diam.; cells quadrate to 2 times as long as the diam. in the older parts of the filament, $\frac{1}{2}-\frac{1}{3}$ as long at the growing apices; sheaths mostly homogeneous but in part slightly lamellous.

Forming a dense stratum on a lava flow in tide pools exposed at low tide.

Type: No. 236480, Herb. Calif. Acad. Sci., collected by J. T. Howell (819) May 28, 1932, at **northeast side of Narborough Island, Galapagos.**

Mastigocoleus corallinae Setchell and Gardner, sp. nov.

Plate 4, figure 8

Filamentis valde tortuosis, $2.5-3.5\ \mu$ diam., cellulis quam diam. $3-5$ -plo longioribus; protoplastis homogeneis dilute cyaneo-viridibus; vaginis valde inconspicuis; heterocystis sparsis, $3-5\ \mu$ diam., in ramulis curtis terminalibus aut sessilibus, non intercalariis.

Filaments very tortuous, $2.5-3.5\ \mu$ diam., with cells 3-5 times as long as the diam.; protoplast homogeneous, pale blue-green; sheath very inconspicuous; heterocysts sparse, $3-5\ \mu$ diam., terminal on short branches or sessile, not intercalary.

Growing among crustaceous Corallines.

Type: No. 236514, Herb. Calif. Acad. Sci., collected by J. T. Howell (570) Mar. 24, 1932, at **Sulphur Bay, Clarion Island.**

This species of *Mastigocoleus* closely resembles *M. testareum* Lagerh., usually found in the shells of various species of mollusks. The filaments are narrower and the cells are longer and the heterocysts smaller than in that species.

***Rhizoclonium robustum* Setchell and Gardner, sp. nov.**

Plate 5, figure 11

Filamentis comparate curtis (1-2 cm. longis) tortuosisque, 350-400 μ (usque ad 650 μ) diam.; segmentis diametro 1-3-plo longioribus; parietibus crassis, in segmentis vetustioribus usque ad 40 μ ; rhizoideis frequentissimis, magnis, segmento singulo, attenuato, tortuoso, simplice ramosove aut pro parte in segmentis propriis diversis instructo; pyrenoideis numerosissimis parvisque.

Filaments relatively short (1-2 cm. long) and tortuous, 350-400 μ (up to 650 μ) diam.; cells 1-3 diameters long; walls thick, up to 40 μ thick in the older segments; rhizoids numerous, large, composed of a long, tapering, tortuous, unbranched or branched segment, or in part separated by cross-walls into several segments; pyrenoids very numerous and small.

In tide pools at low tide.

Type: No. 236507, Herb. Calif. Acad. Sci., collected by J. T. Howell (170a) June 11, 1932, at **North Seymour Island, Galapagos.**

The specimens representing the species are very sparse, there being but a small tuft among specimens of *Bifurcaria galapagensis*, making it extremely difficult to determine much as to the range of variation in the species. It is one of the very largest species thus far described as regards the diameter of the filaments, but the filaments are very short. The rhizoids are large, some being a hundred microns in diameter at the point of origin. Some are simple, others more or less branched, segmented or unsegmented. Some are attenuated to a point and others are divided into hapteres. The species is apparently a very close relative of *Rhizoclonium grande* Boergesen recently published from Bombay, India. The filaments and rhizoids average larger but not modified for attachment, and are segmented. The filaments were not attached.

***Ectocarpus granuloides* var. *pygmaeus* Setchell and Gardner,
var. nov.**

A typo per frondem 1 cm. aut minus altum, cellulis filamentorum primariorum 40-45 μ diam., iis ramulorum ultimorum 12-15 μ diam., ramulis ultimis pro parte piliferis; gametangiis sessilibus, 35-45 μ longis, 11-15 μ diam.; filamentis corticibus sparsis; zoosporangiis nondum visis; abludens.

Fronds 1 cm. or less high, cells of the main filaments 40-45 μ diam., those of the ultimate ramuli 12-15 μ diam.; ultimate ramuli in part piliferous; gametangia sessile, 35-45 μ long, 11-15 μ diam., corticating filaments sparse; zoosporangia unknown. Otherwise as the species.

Growing on *Cystoseira osmundacea*.

Type: No. 236518, Herb. Calif. Acad. Sci., collected by J. T. Howell (625) Aug. 20, 1932, at **San Martin Island, Lower California**.

The general size of the plants, the dimensions of the cells and of the gametangia are all less than those of the species, the type locality of which is San Pedro, California.

***Ralfsia pangoensis* var. *galapagensis* Setchell and Gardner,**
var. nov.

Thallus peripherice valde irregularis, 4-6 mm. latus; filamentis erectis cellulis 25-35 compositis; sporangiis inter filamenta erecta sparsis non in nematheciiis aggregatis, 28-34 $\mu \times$ 115-125 μ , in pedicellis filamentorum erectorum, cylindricis, 5-7 μ diam., diametro 1-2-plo longiore, apicalibus pyriformibus usque ad subglobosis.

Thallus very irregular in outline, 4-6 mm. wide, erect filaments composed of 25-35 cells; sporangia scattered among the erect filaments, not in nemathecii, 28-34 $\mu \times$ 115-125 μ , on 8-12-celled pedicels; cells in erect filaments, cylindrical, 5-7 μ diam., 1-2-times as long as broad, apical cell pyriform to subglobose.

Adhering firmly to rocks by the whole under surface.

Type: No. 236506, Herb. Calif. Acad. Sci., collected by J. T. Howell (781) June 8, 1932, at **Conway Bay, Indefatigable Island, Galapagos**.

The variety is probably much more widely distributed among the islands of the Galapagos than is indicated here. The plants grow among other encrusting algae and are not readily recognizable.

***Spatoglossum Howellii* Setchell and Gardner, sp. nov.**

Plate 9, figure 27, text figure 1

Frons linearis, 20-38 cm. alta, 4-7 mm. lata, 400-500 μ crassa, basi dense stuposa, breviter stipitata, marginibus regulariter et crasse serrata, dichotomo ramosa dichotomiis paucis, colore atro-fusca, siccitate fere atra; medullae cellulis parietibus tenuibus, 4-stratis; cellulis superficialibus chromatophoris sphericis dense conglobatis impletis, quadratis usque 2-plo longioribus a superno visis, maturitate in partibus fructificantibus in sectione radiater elongatis; oogoniis (?) ellipsoideis, 90-110 μ longis, 55-65 μ crassis, numerosissimis, singulis aut valde rare binis super partes magnas laterum binorum frondis sparsis; antheridiis tetrasporisque nondum visis.

Fronds linear, 20-38 cm. high, 4-7 mm. wide, 400-500 μ thick, with a dense stupose base, a short (1-2 cm.) stipe, and irregularly and coarsely serrate margins, dichotomously branched, but with few dichotomies; color dark brown, almost black on

drying; medulla mostly composed of four layers of thin-walled cells; surface cells filled with densely congested, spherical chromatophores, square to 2 times as long as broad in surface view, elongated radially in section view at maturity in the fruiting parts; oogonia (?) ellipsoidal, 90-110 μ long, 55-65 μ wide, very numerous, scattered singly or very rarely in pairs over a large part of both sides of the frond; antheridia and tetraspores not observed.

In tide pools.

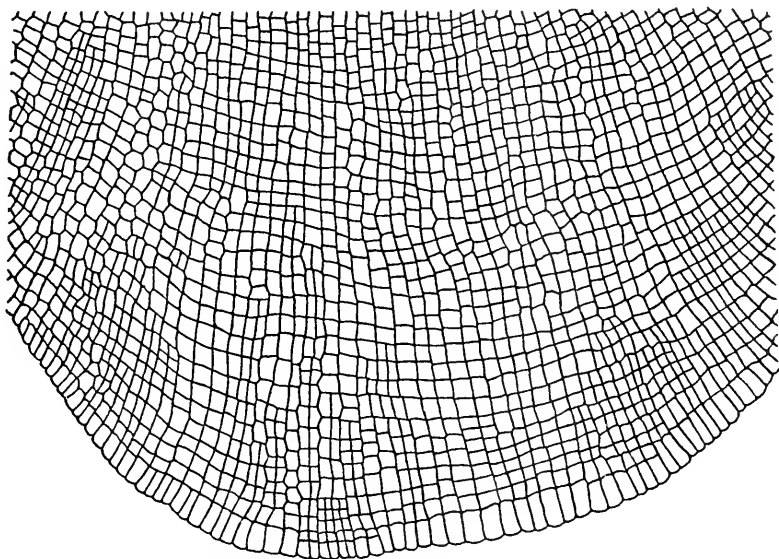


Fig. 1. *Spatoglossum Howellii* Setchell and Gardner, new species. Apical portion of a frond showing the character of the cells. $\times 45$.

Type: No. 236485, Herb. Calif. Acad. Sci., collected by J. T. Howell (958) May 22, 1932, **five miles northeast of Webb Cove, Albemarle Island, Galapagos.**

***Gelidium (Pterocladia) Okamurai* Setchell and Gardner,**
sp. nov.

Plate 6, figure 16; plate 17, figure 38

Frondibus complanatis, vulgo e rhizomatibus repentibus orientibus, 3-4-plo dense pinnatis, 3-5 cm. altis, axibus primariis 1-1.5 mm. latis, ramulis basi $\frac{1}{2}$ -plo aut plus constrictis et apice nullo modo aut leviter attenuatis et rotundatis; cellula apicali parvissima inconspicuaque, medulla cellulis cylindricis arcte compactis, 20-25 μ diam. 2-3-stratis subcorticalibus leviter minoribus composita; corticibus 2-stratis cellulis coloratis 5-7 μ diam. compositis; filamentis rhizoidalibus in partibus frondium nonnullis apparentibus, in partibus nullis copiosis, per medullam totam maxime inaequaliter distributis et angustissimis; tetrasporangiis in soris linearibus aggregatis et in ramulis ultimatis subultimatisque positis; cystocarpiis antheridiisque nondum visis.

Fronds complanate, mostly arising from a creeping rhizome, 3-4 times densely pinnate, 3-5 cm. high, main axes 1-1.5 mm. wide, with the ramuli constricted one-half or more at the base and not at all or only slightly tapering and rounded at the apices; apical cell very small and inconspicuous; medulla composed of closely compacted cylindrical cells 20-25 μ diam., the 2-3 subcortical layers slightly smaller; cortex composed mostly of 2 layers of color-bearing cells 5-7 μ diam.; rhizoidal filaments present only in certain parts of a frond, in no parts very abundant, distributed very unevenly throughout the entire medulla and very narrow; tetrasporangia in linear sori on the ultimate and subultimate ramuli; cystocarps and antheridia unknown.

Type: No. 236482, Herb. Calif. Acad. Sci., collected by J. T. Howell (462) Mar. 24, 1932, at **Clarion Island**.

The extreme flatness of the frond coupled with its pinnate method of branching lead us to suspect that it belongs to the genus *Pterocladia* rather than to *Gelidium*. Positive determination must be deferred until the cystocarps are found, since the character of these seems to be the only reliable method of distinguishing the two genera. The presence of rhizoidal filaments in the center of the medulla, as proposed by Okamura as a method of distinguishing the two genera, does not seem to hold in all cases. The species here described has these rhizoids, when present, distributed throughout the whole interior of the frond except among the cortical cells. In some parts of the frond they are entirely lacking and in no part are they abundant.

The species seems closely related to *Pterocladia nana* Okamura (Icon. Jap. Alg., 6:53, pl. 278, figs. 1-14, 1931). It differs chiefly in details of the inner structure of the frond and the abundance and distribution of the rhizoidal filaments as illustrated by Okamura (loc.cit.) and in a more recent paper (Journ. Imp. Fish. Inst. 29: 1934). This new species is respectfully dedicated to the memory of Dr. K. Okamura of Tokyo, Japan, in recognition of his able exposition of the *Gelidiums* and *Pterocladias* of Japan.

Weeksia Templetonii Setchell and Gardner, sp. nov.

Plate 10, figure 28

Frondibus disco parvo affixis, mucilagineis, flaccidis, linea exteriore orbicularibus, 8-12 cm. altis, 200-250 μ crassis; stipite curto gracilique, venis falsis (textu non differentiato) paucis obscurisque; medulla reticulo filamentarum cellulis comparate rectis 5-7 μ diam., diam. 8-12-plo longiorum, composita; corticibus strato singulo cellulis chromatophoriferis leviter radialiter clongatis, 7 \times 10 μ compositis; stratis subcorticalibus 2-stratosi, cellulis sphericis subsphericisve, pauce chromatophoriferis compositis; cystocarpiis numerosis, parvissimis, super superficies frondium uniformiter sparsis; ramellis auxiliariis curvatis, plurime 6-8-cellularibus; cellulis proxime 7 μ diam.; tetrasporangiis late ellipsoideis usque ad subsphericis, 18-22 μ \times 22-26 μ , cruciatis; antheridiis nondum visis.

Fronds attached by a small disk, mucilaginous, flaccid, orbicular in outline, 8-12 cm. high, 200-250 μ thick, with a very short slender stipe and a few faint, radiating, false veins, but no differentiation of tissues to form them; medulla composed of a network of filaments with relatively straight cells 5-7 μ diam., 8-12 times as long;

cortex composed of a single layer of color-bearing cells slightly elongated radially, $7 \times 10 \mu$; subcortex composed of mostly 2 layers of spherical or subspherical cells with few chromatophores; cystocarps numerous, very small, distributed uniformly over the surface of the frond; curved auxiliary branchlets composed of 6-8 cells mostly; cells of these branchlets approximately 7μ diam.; tetrasporangia broadly ellipsoidal to subspherical, $18-22 \mu \times 22-26 \mu$, cruciately divided; antheridia unknown.

Dredged from 20 fathoms.

Type: No. 236484, Herb. Calif. Acad. Sci., collected by J. T. Howell (703), Aug. 15, 1932, at **Cedros Island, Lower California.**

***Weeksia Howellii* Setchell and Gardner, sp. nov.**

Plate 11, figures 29 and 30

Frondibus elongatis usque ad suborbicularibus, disco parvo affixis stipite in frondem ipsam directe transiente, irregulariter lobatis aut marginibus laciniatis, tenuibus flaccidisque, 20-30 cm. altis; medulla filamentis comparate rectis, cellulis $6-8 \mu$ diam. et 8-12-plo longioribus composita; corticibus 1-stratosi cellulis parum radialiter elongatis, plus minusve conicis; subcorticibus 2-stratosi cellulis forma magnitudineque irregularibus, plerumque angulatis et granulis dense fartis; cystocarpiis frondis omnis sparsis in medulla immersis; ramellis auxiliaribus curvatis 7-9-cellulis, $10-13 \mu$ diam. compositis; tetrasporangiis uniformiter sparsis, non frequentibus, sphericis usque ad subsphericis, $18-22 \mu$ diam., antheridiis nondum visis.

Frond elongated to suborbicular, attached by a small disk with stipe merging almost directly into the frond, irregularly lobed or lacinate margins, thin and flaccid, 20-30 cm. high; medulla composed of moderately straight filaments with cells $6-8 \mu$ diam. and 8-12 times as long; cortex composed of a single layer of cells slightly elongated radially and more or less conical; subcortex composed of 2-3 layers of cells irregular in shape and size, mostly angular and densely filled with granules; cystocarps distributed over the frond, deeply embedded in the medulla; curved auxiliary branchlets composed of 7-9 cells; cells of auxiliary branchlets $10-13 \mu$ diam.; tetrasporangia distributed evenly over the frond, not abundant, spherical to subspherical, $18-22 \mu$ diam.; antheridia unknown.

Dredged.

Type: No. 236496, Herb. Calif. Acad. Sci., collected by J. T. Howell (89) Aug. 17, 1932, at **Natividad Island**, between Cedros Island and the main land, **Lower California.**

***Callymenia angustata* Setchell and Gardner, sp. nov.**

Plate 12, figure 32

Frondibus linearibus, in lobis paucis, angustis, stipitatis fissis et proliferationibus paucis marginalibus, tenuibus, membranaceis flaccidis, basi cuneata, stipite gracili, 7 cm. altis, usque ad 18 mm. latis, $50-60 \mu$ crassis; medulla fibris laxis, comparate sparsis in diam. irregularibus composita; corticibus strato uno cellulis proxime isodiametricis, angustis, $5-8 \mu$ diam. et strato uno cellulis plus minusve ellipsoideis quam cellulis superficialibus leviter majoribus, compositis; cystocarpiis comparate magnis, latere uno leviter et latera altero prominente protuberantibus, clausis; tetrasporangiis antheridiisque nondum visis.

Frond linear, deeply split into a few narrow, stipitate lobes and a few marginal proliferations, thin, membranaceous and flaccid, with a cuneate base and very slender stipe, about 7 cm. high, widest part 18 mm. wide, 50-60 μ thick; medulla composed of loose, relatively sparse fibers irregular in diameter; cortex composed of a single layer of nearly equidiametric, angular cells 5-8 μ diam. and a layer of more or less ellipsoidal cells slightly larger than the surface cells, cystocarps relatively large, protruding slightly on one side and prominently on the other side of the frond, without an ostiole; tetrasporangia and antheridia unknown.

Dredged from 16 fathoms depth.

Type: No. 236489, Herb. Calif. Acad. Sci., collected by J. T. Howell (739) Aug. 12, 1932, at **Santa Maria Bay, Lower California.**

We have but a single cystocarpic specimen of the above species from which to make the determination and description. The plant was in formaldehyde and was considerably softened and blistered, as may be seen from the illustration on plate 12.

The determination can thus necessarily be only tentative. Tetrasporic and young cystocarpic plants will be required before a thoroughly satisfactory classification can be attained.

***Gymnogongrus martinensis* Setchell and Gardner, sp. nov.**

Plate 12, figure 31

Frondibus dense caespitosis, cartilagineis, pluribus e basi communi confluentibus complanatis 2-3.5 cm. altis, infra furcam primam 2-4 mm. latis, 0.5-0.75 mm. crassis, basi cuneatis, fere astipitatis, dichotomis sed per occasionem marginibus pinnato-ramosis; medulla cellulis crassi-parietalibus subsphericis 100-125 μ diam., adversus superficiem minoribus, composita, in subcortice et in seriebus anticlinis transeuntibus; protoplastis cellularum iis series anticlinas exceptis profuse anastomosantibus; cystocarpiis parvis, proxime 1 mm. diam., e superficie una tantum protuberantibus.

Fronds densely caespitose, cartilaginous, several arising from a common confluent base, complanate, 2-3.5 cm. high, 2-4 mm. wide below the first forking, 0.5-0.75 mm. thick, cuneate at the base, almost without stipe; dichotomously branched, with occasional pinnate branching from the margin; medulla composed of thick-walled subspherical cells, 100-125 μ diam., smaller toward the surface, merging into the subcortex and into the anticlinal rows of cortical cells; protoplast of all cells except the anticlinal rows profusely anastomosing; cystocarps small, approximately 1 mm. diam., projecting only on one side of the frond.

Growing on rocks in the lower littoral belt. San Martin Island, Lower California, Aug. 19, Howell No. 192; San Bartolome Bay, Lower California, Aug. 14, Howell No. 697.

Type: No. 236483, Herb. Calif. Acad. Sci., collected by J. T. Howell (192) Aug. 19, 1932, at **San Martin Island, Lower California.**

Gracilaria secundata Setchell and Gardner, sp. nov.

Frondibus cartilagineis, cylindricis usque ad leviter compressis, ramis curtis, secundatis et ramulis fructiferis numerosis; medulla cellulis subsphericis comparate tenuiparietalibus, 135 μ diam.; in subcortice gradatim deminuentibus; corticibus seriebus anticlinis cellularum 2-3, coloratis, subsphericis et a superficie visis 4-9 μ diam., compositis; in planta tetrasporangialibus radialiter elongatis; cellulis subcorticalibus anastomosantibus; tetrasporangiis numerosis, in ramulis fructiferis et supra partes vetustiores frondis sparsis, subsphericis, 24-28 μ diam.; magnitudine plantae totae et reproductione altera ignota.

Frond cartilaginous, cylindrical to slightly compressed, with short second branches and numerous fructiferous ramuli 1-3 mm. long; medulla composed of subspherical, relatively thin-walled cells, up to 135 μ diam., gradually diminishing in size in the subcortex; cortex composed of short anticlinal rows of 2 or 3 color-bearing cells, subcircular and 4-9 μ diam., as seen in surface view, elongated radially in the tetrasporic plant; subcortical cells anastomosing; tetrasporangia numerous on the fructiferous ramuli and also scattered over other parts of the frond, subspherical, 24-28 μ diam. Size of whole plant and other forms of reproduction unknown.

Dredged from 20 fathoms depth.

Type: No. 236481, Herb. Calif. Acad. Sci., collected by J. T. Howell (733b) Aug. 4, 1932, at **San Jose del Cabo, Lower California.**

A single branching fragment of the upper part of a species of *Gracilaria* was found among other species of algae dredged at San Jose del Cabo. The fragment shows abundance of tetrasporangia, mostly immature. These are produced most abundantly in short papillae distributed promiscuously on the part of the frond at our disposal.

In general, the naming of species from such fragmentary parts should be decried, but the form, structure and distribution of the asexual spores of this fragment seem to us to be so distinct from all described species as to make it desirable to place it on record.

Sarcodiotheca meridionalis Setchell and Gardner, sp. nov.

Plate 13, figure 33

Frondibus magnitudine variabilibus, 8-16 cm. altis, 5-16 mm. latis, flaccidis, colore saturate carminatis, infero ad stipitem curtum angustumque leviter attenuatis, per discum parvum ad saxa, etc., affixis, 2-4-plo furcatis et per occasionem ramo parvo laterali instructis; medulla 2-3-stratosa, cellulis magnis, subsphericis et parietibus crassis minutis in lateribus quibusque strati tenuis centralis filamentorum, nonnullorum quam diam. 40-plo longiorum; corticibus 2-stratosi, cellulis in plantis tetrasporangialibus forma irregularibus; tetrasporangiis 50-56 \times 82-88 μ ; cystocarpis antheridiisque nondum visis.

Fronds variable in size, 8-16 cm. high, 5-16 mm. wide, flaccid, of a rich carmine color, tapering gradually below to a short narrow stipe, attached to rocks, etc. by a small disk, 2-4 times furcate and with an occasional small lateral branch; medulla composed of 2-3 layers of large, thick-walled, subspherical cells on either side of a

thin central layer of filaments, some of which are 40 times as long as broad; cortex composed mostly of two layers of irregularly shaped cells in the tetrasporic plant; tetrasporangia $50-56 \times 82-88 \mu$; cystocarps and antheridia unknown.

Dredged from 15-20 fathoms depth.

Type: No. 236487, Herb. Calif. Acad. Sci., collected by J. T. Howell (72) Aug. 20, 1932, at **San Martin Island, Lower California.**

***Sarcodiotheca cuneata* Setchell and Gardner, sp. nov.**

Plate 14, figure 34

Frondibus usque ad 14 cm. altis et infra furcam primam 3 cm. latis, 5-6-plo dichotomis, ramis ad furcam quamque deminuentibus, ad occasionem proliferatione marginali, per discum parvum affixis, stipite ex usu carente sed supra discum basi cuneata directe mergentibus; colore saturate carminato; medulla 3-stratosa, cellulis vulgo magnis subsphericis, $75-100 \mu \times 120-180 \mu$, in lateribus quibusque reticuli angusti fibrarum cellulis $5-8 \mu$ diam. et 15-20-plo longioribus, composita; corticibus 1-stratosi, cellulis chromatiferis leviter radialiter elongatis compositis; subcorticibus 1-2-stratosi cellulis majoribus dilute coloratis compositis; cystocarpis comparate paucis magnisque, a uno latere plus protuberantibus, corticibus supra parte protuberante usque ad 7-10 strata incrassatis, pericarpis fibris cellulis curtis et protoplasmate faretis inclusis; carposporis in glomerulis magnis densisque conglobatis, $45-55 \mu$ diam., forma subsphericis usque ad irregularibus, non angulatis; antheridiis tetrasporangisque nondum visis.

Fronds up to 14 cm. high, up to 3 cm. wide below the first forking, 5-6 times dichotomously branched, branches diminishing in size at each forking, with an occasional marginal proliferation, attached by a small disk, practically without stipe, merging directly into the cuneate base; color dark carmine; medulla composed of three layers, for the most part, of large subspherical cells, $75-100 \times 120-180 \mu$, on either side of a narrow mesh of central fibers with cells $5-8 \mu$ diam., 15-20 times as long; cortex composed of a single layer of color-bearing cells slightly elongated radially; subcortex of 1-2 layers of larger cells with little color; cystocarps relatively few and largely protruding much more prominently on one side than the other, with the cortex thickened to 7-10 layers of cells over the bulging part, enclosed by a dense pericarp composed of fibers intermingled with short cells rich in protoplasmic content; carpospores in large dense clusters, $45-55 \mu$ diam., subspherical to irregular in form, not angular; antheridia and tetrasporangia unknown.

Dredged in 15-20 fathoms.

Type: No. 236488, Herb. Calif. Acad. Sci., collected by J. T. Howell (72a) Aug. 20, 1932, at **San Martin Island, Lower California.**

***Sarcodiotheca linearis* Setchell and Gardner, sp. nov.**

Plate 5, figures 12a, 12b; plate 15, figure 35

Frondibus linearibus, 6-13 cm. altis, 2-6 mm. latis, comparate tenuibus flaccidisque, 2-5-plo furcatis, ramificatione in speciminibus nonnullis prope basim oriente, per totam longitudinem in latitudine prope aequalibus, basim usque ad stipitem curtam attenuatis, per discum parvum affixis; medulla cellulis magnis subsphericisque in subcortice magnitudine deminuentibus, centro filamentis paucis

angustique interspersis; corticibus 2-3-stratosis, cellulis chromatiferis leviter radialiter elongatis, compositis; cystocarpiis in centro frondis locatis et a lateribus quibusque symmetrice protuberantibus, per pericarpium proprium inclusis; antheridiis per superficiem frondis sparsis, numerosis, radialiter elongatis; tetrasporangiis per superficiem frondis sparsis, 25-60 μ diam.

Fronds linear, 6-13 cm. high, 2-6 mm. wide, relatively thin and flaccid, 2-5 times furcate, in some specimens beginning to branch very close to the base approximately the same width throughout the greater portion of the length, tapering at the base to a short stipe, attached by a small disk; medulla composed of large subspherical cells diminishing in size in the subcortex, with a few narrow filaments interspersed in the center of the frond; cortex composed of two to three layers of color-bearing cells slightly elongated radially; cystocarps located in the center and bulging equally on both sides of the frond, surrounded by a definite pericarp; antheridia distributed over the surface of the frond, numerous, elongated radially; tetrasporangia distributed over the surface of the frond, 25-60 μ diam.

Dredged from 20 fathoms depth. San Lucas Bay, Lower California, Howell Nos. 41, 44a, 48.

Type: No. 236479, Herb. Calif. Acad. Sci., collected by J. T. Howell (48) Aug. 5, 1932, at **San Lucas Bay, Lower California.**

***Laurencia clarionensis* Setchell and Gardner, sp. nov.**

Plate 7, figures 19-21

Frondibus carnosus, microscopicis, usque ad 3 mm. altis, 150-225 μ diam., pro parte erectis pro parte prostratis; ramulis fructiferis cylindricis, basi non constrictis; cellulis superficialibus ad apices ramulorum non radialiter elongatis; crassitudinibus lenticularibus parietalibus cellularum medullae in axibus frondium et vulgo ad basim ramorum sparsis; cystocarpiis urceolatis, prope apices ramuli fructiferorum laterali-bus; tetrasporangiis comparate magnis sparsisque, 100-125 μ diam., 2-4-prope apices ramorum fructificantium positis.

Fronds carnose, microscopic, up to 3 mm. high, 150-225 μ diam., in part erect and in part prostrate; branching sparse and irregularly alternate; fruiting ramuli cylindrical, not constricted at the base; surface cells not radially elongated at the apices of branches, lenticular thickenings in the walls of the medullary cells sparse in the main axes, usually at the base of the branches; cystocarps urn-shaped, lateral near the apices of fruiting ramuli; tetrasporangia relatively large and sparse, 100-125 μ diam., 2-4 near the apices of fruiting branches.

Growing on rocks among other diminutive algae. Sulphur Bay, Clarion Island, Mar. 24, Howell Nos. 231, 234, 305 and 308a.

Type: No. 236503, Herb. Calif. Acad. Sci., collected by J. T. Howell (305) Mar. 24, 1932, at **Sulphur Bay, Clarion Island.**

Laurencia densissima Setchell and Gardner, sp. nov.

Plate 16, figure 36; plate 17, figure 37

Frondibus cylindricis, cartilagineis, disco parvo affixis, fere valde abundanter multifarie e basi ramosis, ramis primariis et ordinibus 3-4 quibusque successivis prope basim axis majoris longissimis deinde gradatim longitudine usque ad apices ex iis oriendis deminuentibus, peripheriam conicam efficientibus; cellulis superficialibus apicalibus frondium neque protuberantibus neque radialiter elongatis et palisadiformibus; crassitudinibus parietalibus lenticularibus comparate in medulla frequentissimis; ramulis fructiferis cylindricis usque ad leviter clavatis; pro parte compositis, vulgo simplicibus.

Fronds cylindrical, cartilaginous, attached by a small disk, branching very profusely on all sides beginning near the base; primary branches and each succeeding three or four orders longest near the base of the main axis and each order likewise in turn, then gradually diminishing in length to the apices of the axes from which they spring, producing a conical effect to the outline; cells neither protruding nor elongated and arranged like palisades at the apices of the fronds; medullary cells provided with fairly abundant lenticular thickenings; fructiferous ramuli cylindrical to slightly clavate, compound in part, but mostly simple.

Albamarle Island, May 22, Howell Nos. 352, 389, 405, 428a, 443, 484; Charles Island, May 15, Howell Nos. 435, and May 17, Howell No. 506; Narborough Island, May 31, Howell No. 875; all Galapagos.

Type: No. 236486, Herb. Calif. Acad. Sci., collected by J. T. Howell (405) May 22, 1932, at **Albamarle Island, Galapagos**.

Laurencia turbinata Setchell and Gardner, sp. nov.

Plate 19, figure 40

Frondibus a disco et a ramulis rhizoidalibus prope basim orientibus affixis, usque ad 25 cm. altis, cylindricis, robustis, cartilagineis, rubro-purpureis, ramificatione abundantis, multifaria, ramis ordinum successivarum regulariter in longitudine deminuentibus, frondem total conicam efficientibus; axibus primariis percurrentibus; ramulis fructiferis immaturis compositis, turbinatis, cellulis superficialibus proxime isodiametricis; crassitudinibus lenticularibus in parietibus cellularum medullarum frequentibus; plantis omnibus sterilibus.

Fronds attached by a disk and by numerous rhizoidal branches from near the base, up to 25 cm. high, cylindrical, robust, cartilaginous, reddish-purple, branching profusely on all sides, the branches of different orders reduced regularly and gradually in length, giving the frond as a whole and the branches of each order a conical appearance; main axes percurrent; fructiferous ramuli compound, turbinate, their surface cells approximately equidiametric; lenticular thickenings abundant in the walls of the medullary cells; reproductive organs unknown.

San Martin Island, Lower California, Aug. 17, Howell No. 66; northeast side of Narborough Island, May 31, Howell No. 147; Albamarle Island, May 22, Howell No. 37.

Type: No. 236494, Herb. Calif. Acad. Sci., collected by J. T. Howell (147) May 31, 1932, at **Narborough Island, Galapagos**.

In habit, this species resembles *L. virgata* very closely, from which it differs in being more densely branched and the branches of various orders forming more regularly conical fronds, and in having turbinate instead of cylindrical fruiting branches, as illustrated by Kuetzing (Tab. Phyc., 15:pl. 73) for *L. ericoides*, considered by Yamada (Notes on Laurencia, Univ. Calif. Publ. Bot., 16:208, 1931) to be a synonym of *L. virgata*.

***Laurencia mediocris* Setchell and Gardner, sp. nov.**

Plate 18, figure 39

Frondibus a disco parvo affixis, cartilagineis, cylindricis, 4-7 cm. altis, axi centrali percurrenti, modice irregulariterque ramosis, ramis ramulisque curtis, compositis, turbinate, fructiferis indutis; cellulis corticalibus in apicibus ramulorum fructiferorumque non radialiter elongatis sed a superficie visis quam longae 2-plo latioribus; crassitudinibus lenticularibus in parietibus cellularum medullae modice frequentibus; speciminibus omnibus sterilibus.

Fronds attached by a small disk, cartilaginous, cylindrical, 4-7 cm. high, with a central percurrent axis, moderately and irregularly branched, the branches being densely clothed with short, compound, turbinate, fruiting ramuli; cortical cells not radially elongated in the ultimate and fruiting ramuli, but approximately twice as wide as long, as seen in surface view at the apices of the ramuli; lenticular thickenings moderately abundant in the cells of the medulla. Specimens all sterile.

Type: No. 236492, Herb. Calif. Acad. Sci., collected by J. T. Howell (404) May 22, 1932, at **Albemarle Island, Galapagos.**

The plants of this species are relatively small. They resemble in gross morphological characters certain forms of *L. paniculata* but lack the palisade arrangement of the cortical cells and have characteristic lenticular thickenings in the walls of the medullary cells, a character lacking in *L. paniculata*.

This species of *Laurencia* seems to be closely related to *L. pannosa* Zanardini, the type locality of which is Sarawak, Borneo, the description of which is incomplete so far as the details of cellular structure are concerned. We have not examined the type, but are relying upon Yamada's observation (*loc. cit.*, p. 199) on the material in the herbarium of Weber von Bosse from the Malay Archipelago and identified by her as *L. pannosa* Zan. Our plants do not show the projecting cells radially elongated and forming a palisade-like layer, reported present in the material from Malay. They are also considerably smaller.

Chondria pacifica Setchell and Gardner, sp. nov.

Plate 20, figure 41

Frons gracilis flaccidaque, 7-12 cm. alta, 0.5-0.75 mm. diam., axi percurrente abeunte; ramificatione alterna, multifaria, in 3-4 ordinibus, moderate abundanti; ramulis ultimis fructiferis, simplicibus, cylindricis, basi valde constrictis, apice truncatis; medulla cellulis ($75 \times 300 \mu$, in partibus vetustioribus multo longioribus) parietibus tenuibus, et cum axi centrali percurrenti cellulis usque ad 800μ longis prebita; cortice axium primariorum cellulis longis angustisque, $10-15 \times 90-150 \mu$ composito; puncto vegetationis in depressione distincto apicali cum flocco pilorum curtorum, ramosorum, protrudentium immerso; tetrasporangiis generis typicis; antheridiis cystocarpiisque nondum visis.

Fronds slender and flaccid, 7-12 cm. high, 0.5-0.75 mm. diam., without a distinct percurrent axis; branching alternate on all sides, of 3-4 orders, moderately abundant; ultimate, fruiting ramuli simple, cylindrical, much constricted at the base, with truncate apices; medulla composed of large ($75 \times 300 \mu$, much longer in older parts) thin-walled cells and a distinct percurrent central filament with cells up to 800μ long; cortex composed of a single layer of long, narrow cells, $10-15 \times 90-150 \mu$, on the main axes; growing point a distinct apical depression with a tuft of short, branched, protruding hairs; tetrasporangia typical of the genus; antheridia and cystocarps unknown.

Dredged in shallow water.

Type: No. 236491, Herb. Calif. Acad. Sci., collected by J. T. Howell (674) Aug. 14, 1932, at **San Bartolome Bay, Lower California.**

This species belongs to the section *Coelochondria* of Falkenberg (p. 191, 1901), the growing point being sunken in an apical depression, the central filament there giving rise to a dense tuft of short branched hair filaments which fill the depression and protrude only slightly.

Heterosiphonia erecta Gardner (emend.)

Plate 21, figures 42-43; plate 22, figure 44; plate 23, figure 46

Fronds 2-5 cm. long, in part prostrate and attached to the substratum by rhizoids and in part erect, both the prostrate and the erect parts branched; the system of branching being sympodial, producing a more or less zigzag appearance in various axes; the main axis divided into few to many similar axes; all axes clothed with ramuli of limited growth which in turn bear ultimate subulate, monosiphonous ramuli 8-12 cells long, some of which become fructiferous; all branches in one plane; main axes approximately 400μ diam. and composed of 4 large pericentral cells; normally two or three segments between each successive pair of alternate branches but at times four; mature tetrasporangial stichidia approximately 1 mm. long, cylindrical with a conical apex; tetraspores tetrahedral; cystocarps sparse, sessile near the base of ultimate ramuli, relatively large, $600-700 \mu$ diam. at the base, flask-shaped with relatively long neck and definite ostiole.

Growing on various species of jointed Corallines, etc., abundant on the southern coast of California. San Nicholas Island, California, Mar. 13, H. W. Clark, No. 444; San Bartolome Bay, Lower Cali-

fornia, Aug. 14, Howell No. 760b. Specimens all fragmentary and immature.

Heterosiphonia subsecundata Setchell and Gardner, Proc. Calif. Acad. Sci., 19:164, 1930.

Exsiccatae. The species was distributed from the Herbarium of the University of California, centuries, No. 255, sub *Heterosiphonia subsecundata* (Suhr) Falkenb., collected at about three miles north of Santa Monica, Calif., by N. L. Gardner, Jan. 1913, and by Collins, Holden and Setchell, Phyc.Bor.Amer., No. 146, sub *Dasya subsecunda* Suhr, collected at La Jolla, Calif., June 1895, by Mrs. E. Snyder.

Gardner, Univ. Calif. Publ. Bot., 14:98, 1927.

Recently in connection with the study of the very scanty material collected on the Crocker Expedition we became suspicious as to the identity of our California species with the *Dasya subsecundata* of Suhr, the type locality of which is Valparaiso, Chile. Through the courtesy of Prof. Dr. E. Irmscher of the herbarium at Hamburg we have been able to examine the type specimen coming from Herb. Binder (plate 21, figs. 42 and 43), and probably the same as the one from which Suhr drew his description, certainly the same specimen from which Harvey (Ner.Austr., p. 67, pl. 27, 1847) made his description and drawings. We find that the species has seven pericentral cells as described and figured by Harvey (loc.cit.), but the pericentral cells are not so uniform in length as Harvey shows them, nor are they so uniformly divided crosswise in each segment as figured by Falkenberg in his Rhodomelaceae (plate 18, fig. 20). The California species has uniformly four large, undivided, uniform, pericentral cells.

Heterosiphonia erecta Gardner was described from a single specimen which has uniformly two segments between the successive branches of different orders, and was thus figured, and was compared with a seemingly typical specimen of the species passing currently as *Heterosiphonia subsecundata* (Suhr) Falkenb., which had uniformly three segments between branches, and consequently the new species, *H. erecta*, was based upon this seeming difference in character. In the present study we have examined a large number of individuals and find that the number of intervening segments is exceedingly variable, some individuals having uniformly two, others three, and still others in which there is a mixture, and finally there are occasionally four segments between branches. This character therefore, being variable, cannot be used as a specific difference, and we are extending the original description to include what apparently was two species. There is much variation in the length and thickness of the fronds, in the branching, and in the extent of attachment, but we have not been able to discover at present any permanent basis for segregation into species.

Antithamnion sublittorale Setchell and Gardner, sp. nov.

Plate 6, figure 15

Frondibus diminutivis, pro parte repentibus pro parte erectis, 6-10 mm. altis, axibus primariis 55-65 μ diam.; furcatione axium primariorum comparate rara, semper ramulo ramis lateralibus ejusmodi opposito; cellulis infero diam. 3-4-plo longioribus; ramificatione disticha; ramulis binis geminatisve alternis et distiche ramosis, 3-5-ramulosis; ramulis binis 12-15-cellulis longis, cellula basali curtiora, cellulis mediis fere 15 \times 45 μ ; ramificatione ramulorum binorum in cellula e basi tertia incipiente, supra cellula quaque succedente ad finem superiorem 3-5 ramulos succedentes, alternos, ultimos steriles generante; tetrasporangiis basim 1-2, ad latera superum ramulorum geminatorum et ad cellulas primas et secundas, vulgo secundas, eo e cellula basali abortante, cellulis glandularibus comparate magnis, per ramulos distributis sparsis; antheridiis in ramulis ultimis geminatisque positis, glomerulos parvos ramulosque formantibus; cystocarpis nondum visis.

Fronds diminutive, partially creeping and partially erect, 6-10 mm. high, main axes 55-65 μ diam.; forking of the main axes relatively sparse, always a ramulus opposite to such lateral branches; cells below 3-4 times as long as broad, shorter in the upper erect part; branching distichous; paired, or geminate ramuli branched alternately and distichously, 3-5 branches; paired ramuli 12-15 cells long, the basal cell being shorter than the other cells, those in the median part being about 15 \times 45 μ ; branching of the paired ramuli beginning on the third cell from the base, each successive cell above giving rise at the upper end to the 3-5 successive alternate, ultimate, sterile ramuli; tetrasporangia 1-2 at the base, on the upper side of the paired ramuli and on the first and second cells, usually the latter, the one from the basal cell being abortive; gland cells relatively large, scattered among the ramuli, sparse; antheridia in small branched clusters on the geminate and the ultimate ramuli; cystocarps not observed.

Epiphytic on other algae, dredged from 20 fathoms depth.

Type: No. 236524, Herb. Calif. Acad. Sci., collected by J. T. Howell (613) Aug. 4, 1932, at **San Jose del Cabo, Lower California.**

The species seems to be closely related to *Antithamnion antillanum* Boergesen but differs much in details of branching.

Antithamnion sp.

A few sterile specimens of a species of *Antithamnion* seemingly very closely related to *A. sublittorale* described above were noted among the specimens of that species. They are constructed very much the same, but the ultimate and the geminate ramuli do not taper, and the cells are shorter and cylindrical.

Neomonospora Setchell and Gardner, nom. nov.

Monospora Solier, in Castagne, Cat. Pl. Mars., p. 242, 1845; non *Monospora* Hochstetter, Flora, 2: 660, 1841.

Neomonospora multiramosa Setchell and Gardner, sp. nov.

Plate 4, figures 10a-10c

Frondibus flaccidissimis, caespitosis, 6-10 cm. altis, basi 250-300 μ diam., usque ad apices leviter et gradatim attenuatis, parietibus cellularum vetustiorum et prope basim incrassatis lamellosisque; cellula apicali obtuse acuta, 20-30 μ diam.; ramificatione valde profusa, vulgo alterna sed simulate dichotoma, ramis 1-3-cellulis post cellulam apicalem orientis, primum prope apicem cellulae suppositae sed mox ad apicem progressis et magnitudinem axis primarii aequantibus; protoplastis subtiliter granulosis; chromatophores numerosis parvissimisque; tetrasporangiis subsphericis, singulis in pedicellis curtis 1-3-cellulosis suffultis, positionem ramorum in apicibus cellularum occupantibus, 50-65 μ diam., cruciatis; cystocarpis antheridiisque nondum visis.

Fronds very flaccid, caespitose, 6-10 cm. high, 250-300 μ diam. at the base, tapering gradually to the apices, cell wall in the older cells near the base thick and lamellose; apical cell bluntly acute, 20-30 μ diam., branching very profusely, mostly alternate though seemingly dichotomous, the branches arising from one to three cells back of the apical cell and laterally near the top of the cell but soon moving around to the top of the cell and becoming equal in size to the main axis; protoplast finely granular; chromatophores numerous and very small; tetrasporangia subspherical, borne singly on short, 1-3-celled pedicels occupying the position of branches on the upper ends of cells, 50-65 μ diam., cruciately divided; cystocarps and antheridia not observed.

Type: No. 236490, Herb. Calif. Acad. Sci., collected by J. T. Howell (720) Aug. 4, 1932, dredged from 20 fathoms depth at **San Jose del Cabo, Lower California.**

We hesitate to place this species of Rhodophyceae in the genus *Monospora* of Solier. The material is all nonsexual. In addition, the absence of monospores—propagula—a prominent character of *M. pedicellata*, the type species of the genus, renders it still more problematical.

Following strict rules of nomenclature, the generic name *Monospora* for a genus of algae must be suppressed, having been antedated by a genus of flowering plants, proposed by Hochstetter, Flora, 2:660, 1841. Solier's *Monospora* was proposed in 1845, in Castagne, Catalogue des plantes, Marseille, page 242. We are here proposing the generic name *Neomonospora* for the entity.

The branches arise not by the splitting of the apical cell, but laterally, at the upper end of the second, third, or even fourth cell back of the apical cell, and soon catch up in length with the branches from which they spring, at the same time its base moving around and assuming a position on top of the mother cell, giving the appearance of a true dichotomy, whereas in reality they are alternate.

Typically the species seems to be dichotomously branched, but occasionally two branches arise simultaneously on opposite sides of the filament, finally giving the appearance of a trichotomy. More frequently than this, a branch seems to arise from the middle of a cell, or if from the top of the cell it is not carried up with the increasing length of the mother cell.

Typically there is a single sporangium at a node, occupying the position of one fork, but occasionally there are two by the side of the main axis, or one between two forks. They have from one- to three-celled pedicels.

***Ceramium Howellii* Setchell and Gardner, sp. nov.**

Plate 6, figure 14

Frondibus 4-7 mm. altis, 180-220 μ diam., rhizoideis affixis, pro parte prostratis, pro parte erectis, ramis sparsis, filamentorum prostratorum secundis, erectorum irregulariter alternis, curtis, et patentibus, in toto corticatis, nodis a superficie visis nullis; cellulis corticantibus angulatis, 4-7 μ diam., inordinatis, unistratosis; cellulis centralibus magnis cylindricisque, appoxime isodiametricis; tetrasporangiis omnino immersis, numerosis, irregulariter in ramellis lateralibus, curtis, et paululum tumidis positis; antheridiis partes superiores frondis tegentibus; cystocarpiis nondum visis.

Fronds 4-7 mm. high, 180-220 μ diam., attached by rhizoids, partly prostrate and partly erect, branching relatively sparse, secund on the prostrate filaments, irregularly alternate and short and widespreading on the erect filaments, completely corticated throughout with no indication, on the surface, of nodes; corticating cells angular, 4-7 μ diam., without definite arrangement, one layer only; central filament composed of large cylindrical cells, approximately as long as broad; tetrasporangia completely embedded, numerous and without definite order on short, somewhat swollen lateral branches with irregular cruciate division; antheridia covering the upper part of the frond; cystocarps unknown.

Growing on rocks, southeast side of Narborough Island, June 2, Howell Nos. 283, 379, 668.

Type: No. 236527, Herb. Calif. Acad. Sci., collected by J. T. Howell (379) June 2, 1932, at the southeast side of **Narborough Island, Galapagos.**

This species of *Ceramium* is apparently a close relative of *C. bicorn* S. and G. (New Mar. Alg. 1924, p. 773, pl. 28, fig. 64 and pl. 74) from Isla Partida, Gulf of California. It differs from that species in the character of the apices, in being less branched, and in being completely corticated.

***Ceramium fimbriatum* Setchell and Gardner**

Plate 7, figure 18

Tetrasporangiis verticillatis, sphericis, 55-65 μ diam., protuberantibus, bracteatis, bracteis in parietibus tetrasporangiis indutis.

Tetrasporangia in whorls, spherical, 55-65 μ diam., protruding, bracteate, bracts within the sporangial wall.

Dredged from 20 fathoms depth, San Jose del Cabo, Lower California, Aug. 4, Howell No. 618b.

Setchell and Gardner, New Mar. Alg., Calif., Acad. Sci., 12: 777, 1924.

Among some other small algae dredged at San Jose del Cabo were found a few specimens of the above species reported from Gulf of California, at Eureka, by Setchell and Gardner (loc.cit.) The type material was sterile. The specimens reported here are in excellent tetrasporic fruit and show very plainly that they belong to J. G. Agardh's series *Brachygonia*, in which the tetrasporangia are borne in whorls.

***Ceramium zacae* Setchell and Gardner, sp. nov.**

Plate 8, figures 22a-22c

Frondibus epiphyticis, hostem per rhizoidea curta, penetrantibus, 3-6 mm. altis, 100-130 μ diam., dichotomo-ramosis, ad nodos solummodo corticatis; cingulis corticantibus proxime 5 seriebus cellularum tametsi magnopere angulatarum et irregulariter positarum, infero truncatis, supero cellulis paululum elongatis et irregularibus, non tumidis, marginibus frondium levibus; cellulis filamenti centralis subsphaericae, paululum longioribus quam crassis; tetrasporangiis protrudentibus in lateribus frondum et adaxialibus et abaxialibus, ebracteatis; antheridiis cystocarpisque nondum visis.

Fronds epiphytic, attached to the host by short, branched, penetrating rhizoids, 3-6 mm. high, 100-130 μ diam., dichotomously branched, corticated only at the nodes; corticating bands composed of approximately 5 horizontal rows of cells although quite angular and irregularly placed, truncate on the lower side and cells somewhat elongated and irregular on the upper side of the band, not swollen, making the frond smooth on the margin; cells of the central filament subspherical, being slightly longer than broad; tetrasporangia protruding on both adaxial and abaxial side of the frond, not bracteate, antheridia and cystocarps unknown.

Growing on *Codium fragile*.

Type: No. 236529, Herb. Calif. Acad. Sci., collected by J. T. Howell (757) Aug. 14, 1932, at **San Bartolome Bay, Lower California.**

This species of *Ceramium* clearly belongs to J. Agardh's Series 2, *Dicholinea*, in which the tetrasporangia are arranged in two fairly regular rows, one on each flank (abaxial and adaxial) of the last three to four dichotomies of the frond. Its nearest known relatives seem to be *C. Ledermannii* Pilger and *C. leptosiphon* Pilger, both imperfectly described, diminutive species, epiphytic on other algae.

***Ceramium codiophila* Setchell and Gardner, sp. nov.**

Plate 8, figure 23

Frons epiphytica, floccosa, per filamenta rhizoidalia plus minusve apicibus bulbosa affixa, 4-6 mm. altis, proxime 0.25 mm. diam., vulgo simplex, rare bifurcata et ramulis paucis curtisque, lateralibus vestita, lente basi apiceque attenuata, pilis numerosis longis, angustis unicellularis, dense prorsusque a nodis et c cellulis parvioribus verticillater orientibus vestitis; cellulis corticantibus comparate magnis,

usque ad 38 μ diam., subsphaericis, chromatophoris parietalibus sparsis instructis; cellulis filamentis centralis magnis, sphericis; tetrasporangis verticillatis, internodalibus, immersis sed interdum protrudentibus, 55-65 μ diam.; antheridiis nondum visis.

Fronds epiphytic, tufted, attached by rhizoidal filaments more or less bulbous at the apices, 4-6 mm. high, approximately one-fourth of a millimeter in diameter, mostly simple though occasionally bifurcate, and with a few short lateral ramuli, tapering slightly at the base and the apex, densely corticated throughout, and clothed with numerous long, narrow, unicellular hairs arising in whorls between the nodes and from smaller cells; cortical cells relatively large, up to 38 μ diam., subspherical, with scattered parietal chromatophores; cells of central filament large, spherical; tetrasporangia in whorls between the nodes, embedded within the frond but occasionally slightly bulging outward, 55-65 μ diam.; antheridia not observed; cystocarps near the apices of the principal axes, surrounded by 2-3 relatively large involucre branches.

Attached to *Codium fragile*.

Type: No. 236526, Herb. Calif. Acad. Sci., collected by H. W. Clark (229) Mar. 18, 1932, at **Guadalupe Island**.

***Ceramium Templetonii* Setchell and Gardner, sp. nov.**

Plate 8, figures 25, 26

Frondibus diminutivis, 5-10 mm. altis, 110-130 μ diam., dichotomo-ramosis, apicibus forcipatis, corticatione, zonata, cylindricis, nodis fructiferis exceptis non tumidis; cingulis nodalibus proxime 5 seriebus cellularum, proxime isodiametricarum tametsi infero lente majorum longiorumque quam supero; axibus centralibus cellulis subsphericis usque ad triplo longioribus chromatophoris longis, flexuosis et pro parte ramosis compositis; tetrasporangiis comparate magnis, 55-65 μ diam.; 4-6-verticillatis, bracteatis, bracteae simulate in parietibus sporangiorum; antheridiis cystocarpiisque nondum visis.

Fronds diminutive, 5-10 mm. high, 110-130 μ diam., dichotomously branched, forcipate apices, with zonate cortication, cylindrical, not swollen except at the fruiting nodes; nodal bands composed of approximately five horizontal rows of cells, nearly equally truncate above and below and composed of cells of nearly uniform dimensions although slightly larger and longer below than above the center of the band; central axis composed of cells subspherical to three times as long as broad, with long, crooked, in part branched, narrow chromatophores; tetrasporangia relatively large, 55-65 μ diam., in whorls of 4-6, bracteate, the bracts seemingly within the sporangial wall; antheridia and cystocarps unknown.

Growing on rocks.

Type: No. 236528, Herb. Calif. Acad. Sci., collected by J. T. Howell (276) May 17, 1932, at **Post Office Bay, Charles Island, Galapagos**.

This species of *Ceramium* belongs to J. Agardh's Series 3, *Periclinia*, in which the tetrasporangia develop in whorls at the nodes on the last few dichotomies of the frond.

Hildenbrandtia galapagensis Setchell and Gardner, sp. nov.

Frondibus tenuibus, ad saxa per superficies inferas totas adhaerentibus, rhizoides carentibus, 300-350 μ crassis, speciminibus usque ad 4 cm. plura expansis; filamentis erectis arcte compactis, cellulis 3.5-4 μ diam. et proxime isodiametricis; cavitatibus fructiferis subsphericis, ostiolo angusto; tetrasporangiis 10-14 $\mu \times$ 22-28 μ , irregulariter divisus.

Fronds thin, adhering very firmly to rock by the entire under surface, without rhizoids, 300-350 μ thick, some specimens several centimeters in expanse; erect filaments very closely compacted, with cells 3.5-4 μ diam. and approximately as long as broad; fruiting cavities subspherical, with a small aperture; tetrasporangia 10-14 \times 22-28 μ , irregularly divided.

Apparently very abundant on rocks in the lower littoral and upper sublittoral belts.

Indefatigable Island, June 8, Howell No. 162a; North Seymour Island, June 11, Howell Nos. 171, 177; Charles Island, Apr. 26, Howell Nos. 242, 273, 537; Cedros Island, Lower California, Aug. 15, Howell No. 703a; Indefatigable Island, June 9, Howell No. 975; southeast side Narborough Island, June 2, Howell No. 984.

Type: No. 236519, Herb. Calif. Acad. Sci., collected by J. T. Howell (537) Apr. 26, 1932, at **Charles Island, Galapagos.**

The combination of characters which distinguishes the species from all other marine species of this genus is the thinness and expanse of the thallus, the small size of the cells, and the globular shape of the tetrasporangial cavities.

Polyopes clarionensis Setchell and Gardner, sp. nov.

Plate 4, figure 9; plate 6, figure 17; plate 23, figure 45

Frondibus erectis, infero cylindricis rigidisque, supero complanatis ligulatisque, 2.5 cm. altis, parteligulato 1-1.5 mm. lato et 125-150 μ crasso, subdichotome ramoso, medulla $\frac{1}{8}$ -plo partis complanatae occupante et fibris complexis, 5-7 μ diam. composita; corticibus filamentis anticlinis cellulis 4-6 coloratis compositis; tetrasporangiis numerosis, in nematheciis latera utraque et prope apices segmentorum terminalium occupantibus, 25-30 μ longis, 10-13 μ latis, cruciatis; cystocarpis antheridiisque nondum visis.

Fronds erect, cylindrical and rigid below, flat and ligulate above, 2.5 cm. high, the ligulate portion 1-1.5 mm. wide and 125-150 μ thick, subdichotomously branched; medulla occupying approximately one-third of the thickness of the flattened portion and composed of compound fibers 5-7 μ diam.; cortex composed of anticlinal filaments with 4-6 color-bearing cells; tetrasporangia numerous, in nemathecia on both sides and near the apices of the terminal segments, 25-30 μ long, 10-13 μ wide, cruciately divided; cystocarps and antheridia not observed.

Type: No. 236505, Herb. Calif. Acad. Sci., collected by J. T. Howell (462a) Mar. 24, 1932, at **Clarion Island.**



A single tetrasporic plant of this diminutive species was detected among specimens of *Gelidium Okamurai*. It is therefore impossible at present to state anything of the variation in size of the plants of this species.

Its nearest known relative is probably *Polyopes sinicola* S. and G., from the Gulf of California. This species is more markedly differentiated into stipe and blade than is *P. sinicola*, and there is a distinct difference in the internal structure of the two species.

Phycodrys elegans Setchell and Gardner, sp. nov.

Plate 24, figure 47

Frondibus tenuissimis flaccidisque, axi centrali percurrente, appoxime 12 cm. altis, basi usque ad stipitem gracilem erosis, profuse alterneque ramosis, ramis primariis basi angustatis, prope apices manifeste amplificatis et in lobis numerosis, linearibus, rotundatis, magnitudine variabilibus divis; costa in axi centrali et ramis primariis conspicuis, in partibus superis evanescentibus; venulis aut nerviis microscopicis, alternis; cystocarpiis antheridiisque nondum visis; tetrasporangiis maxima parte in soris binis distinctis prope apices loborum ultimorum posit.

Frond very thin and flaccid, with central percurrent axis, approximately 12 cm. high, wearing away to a slender stipe at the base, profusely and alternately branched, beginning near the base, the lower primary branches being approximately 6 cm. long, primary branches narrowed at the base, decidedly broadening near the apices and divided into numerous linear, rounded, ultimate lobes very variable in size; midrib conspicuous in the central axis and primary branches, vanishing in the upper parts; veinlets, or nerves microscopic, alternate; cystocarps and antheridia unknown; tetrasporangia for the most part in two distinct sori near the apices of the ultimate lobes.

Type: No. 236493, Herb. Calif. Acad. Sci., collected by Albert Stewart (No. 2327) Feb. 23, 1905, at **Chatham Island, Galapagos.**

Ochtodes Crockeri Setchell and Gardner, sp. nov.

Plate 25, figure 48

Frondibus cartilagineis, purpureo-rubris, comparate robustis, vulgo pluribus e disco confluento oriendis, praecipue supero, abundanter ramosis; ramificatione irregulari, subdichotoma usque ad irregulariter alterna aut pro parte subsecunda; ramulis curtis acutis, neque longis neque leviter attenuatis; medulla axium primarium et ramorum majorum cellulis crassi-parietalibus, subparenchymaticis, subsphericis composita; corticibus seriebus anticlinis in partibus senioribus cellularum 3-4, in ramuli plurium compositis; cystocarpiis valde prominentibus, simplicibus aut in nemathecii inconspicuis pluribus plus minusve confluentibus immersis; tetrasporangiis zonatis, $5.5-6.6 \times 28-32 \mu$ in seriebus anticlinis corticis ramulorum suppositis; antheridiis nondum visis.

Fronds cartilaginous, relatively robust, generally several arising from a confluent disk, 7-18 cm. high, profusely branched, especially so in the upper parts; branching irregular, subdichotomous to irregularly alternate, or in part subsecund; ramuli short, acute, but not long and gradually tapering; medulla in the main axes and

principal branches composed of thick-walled, subparenchymatous, subspherical cells; cortex composed of anticlinal rows of 3-4 cells in the older parts, more in the ramuli; cystocarps very prominent, simple or several, more or less confluent; tetrasporangia in inconspicuous nemathecium on ramuli, terminal on anticlinal filaments of the cortex, $5.5-6.5 \times 28-32 \mu$, zonate; antheridia unknown; color purplish-red.

Growing on rocks. Five miles northeast of Webb Cove, Albe-marle Island, May 22, Howell Nos. 395, 403, 424, 967; northeast side of Narborough Island, May 31, Howell Nos. 139, 876; June 2, Howell No. 829; southeast side of Narborough Island, June 1, Howell No. 147a.

Type: No. 236495, Herb. Calif. Acad. Sci., collected by J. T. Howell (139) May 31, 1932, at **northeast side of Narborough Island, Galapagos.**

Two species of this interesting genus have previously been described, viz., *O. secundiramea* (Mont.) Howe, from Martinique, and *O. capensis* J. Ag. from the Cape of Good Hope. The first species was doubtfully referred to the genus *Hypnea* by Montagne and has been variously referred by different authors since. The species here described differs from both of these species in being very much more robust, some of the specimens measuring eighteen centimeters high and the chief axes about two millimeters in diameter, in not tapering so gradually in the upper parts, the attenuation being principally at the apices of the ultimate ramelli, and in being much more profusely branched. The cells of both the cortex and medulla seem to be larger in general than those of the other two species mentioned above, those of the medulla becoming over 100μ in diameter.

A conspicuous character of the genus, well represented in *O. Crockeri*, is the prominent seriate cystocarps, often several coalescing. The presence of tetraspores has apparently hitherto been unobserved and they are here reported for the first time. They occur in quite numerous but inconspicuous nemathecium on the ramuli of the upper parts of the fronds. The sporangia are formed by the elongation of terminal cells of the anticlinal rows of cells, or anticlinal filaments. Practically all of the terminal cells of a nemathecium area are thus transformed. They are narrow and zonately divided.

PLATE 3

Figs. 1a, 1b, 1c. *Xenococcus endophyticus* Setchell and Gardner, sp. nov. Showing various stages in development in the walls of the host, *Rhizoclonium*. $\times 400$.

Fig. 2a. *Polycystis clarionensis* Setchell and Gardner, sp. nov. Showing various shapes and sizes of colonies, diagrammatic and much enlarged.

Fig. 2b. *Polycystis clarionensis* Setchell and Gardner, sp. nov. A single small colony. $\times 300$.

Fig. 3. *Dermocarpa simulans* Setchell and Gardner, sp. nov. Several typical plants, some vegetative and some with gonidia. $\times 300$.

Fig. 4a. *Lyngbya prostrata* Setchell and Gardner, sp. nov. Diagrammatic.

Fig. 4b. *Lyngbya prostrata* Setchell and Gardner, sp. nov. Typical trichomes. $\times 1000$.

Fig. 5. *Microcoleus Howellii* Setchell and Gardner, sp. nov. Terminal portion of three trichomes. $\times 450$.

Fig. 6a. *Xenococcus angulatus* Setchell and Gardner, sp. nov. Several groups as seen in surface view on the host. $\times 500$.

Fig. 6b. *Xenococcus angulatus* Setchell and Gardner, sp. nov. Groups as seen in sectional view of the host. $\times 500$. The host is *Callymenia angustata* Setchell and Gardner, sp. nov.

PLATE 4

Fig. 7. *Lyngbya sinuosa* Setchell and Gardner, sp. nov. Part of a single normal filament. $\times 500$.

Fig. 8. *Mastigocoleus corallinae* Setchell and Gardner, sp. nov. A group of normal trichomes. $\times 700$.

Fig. 9. *Polyopes clarionensis* Setchell and Gardner, sp. nov. A fragment of a longitudinal section of a tetrasporic plant. $\times 350$.

Fig. 10a. *Neomonospora multiramosa* Setchell and Gardner, sp. nov. Terminal parts of filaments showing various stages in the development of branches. $\times 50$.

Fig. 10b. *Neomonospora multiramosa* Setchell and Gardner, sp. nov. A fragment taken from near the base of a filament showing thick, laminated walls. $\times 50$.

Fig. 10c. *Neomonospora multiramosa* Setchell and Gardner, sp. nov. Three filaments showing variation in position and length of pedicels of tetrasporangia. $\times 50$.

PLATE 5

Fig. 11. *Rhizoclonium robustum* Setchell and Gardner, sp. nov. Showing simple, branched, and septate rhizoids. $\times 25$.

Fig. 12a. *Sarcodiotheca linearis* Setchell and Gardner, sp. nov. Section of antheridial plant. $\times 200$.

Fig. 12b. *Sarcodiotheca linearis* Setchell and Gardner, sp. nov. Longitudinal section of sterile plant. $\times 200$.

Fig. 13. *Lyngbya adherens* Setchell and Gardner, sp. nov. A few filaments attached to the host. $\times 500$.

PLATE 6

Fig. 14. *Ceramium Howellii* Setchell and Gardner, sp. nov. Fragment showing surface cells and a tetrasporangial branch. $\times 150$.

Fig. 15. *Antithamnion sublittorale* Setchell and Gardner, sp. nov. A piece of a tetrasporic frond showing the position of tetrasporangia and gland cells and the method of branching. $\times 100$.

Fig. 16. *Gelidium (Pterocladia) Okamurai* Setchell and Gardner, sp. nov. Cross section of frond showing the position of rhizoids. $\times 200$.

Fig. 17. *Polyopes clarionensis* Setchell and Gardner, sp. nov. Cross section of a frond. $\times 350$.

PLATE 7

Fig. 18. *Ceramium fimbriatum* Setchell and Gardner. A fragment of a tetrasporangial plant. $\times 150$.

Fig. 19. *Laurencia clarionensis* Setchell and Gardner, sp. nov. Apical portion of a ramulus showing a single lateral cystocarp. $\times 320$.

Fig. 20. *Laurencia clarionensis* Setchell and Gardner, sp. nov. A portion of a prostrate filament with erect branches with tetraspores. $\times 40$.

Fig. 21. *Laurencia clarionensis* Setchell and Gardner, sp. nov. The same as fig. 20 but not fruiting. $\times 40$.

PLATE 8

Fig. 22a, 22b. *Ceramium zacaë* Setchell and Gardner, sp. nov. Apical portions of tetrasporic fronds. $\times 150$.

Fig. 22c. *Ceramium zacaë* Setchell and Gardner, sp. nov. Portion of lower part of frond showing corticating bands. $\times 150$.

Fig. 23. *Ceramium codiophila* Setchell and Gardner, sp. nov. Apical portion of a frond. $\times 100$.

Fig. 24. *Ceramium codiophila* Setchell and Gardner, sp. nov. Portion of a tetrasporic frond. $\times 100$.

Fig. 25. *Ceramium Templetonii* Setchell and Gardner, sp. nov. Apical portion of a tetrasporic frond. $\times 150$.

Fig. 26. *Ceramium Templetonii* Setchell and Gardner, sp. nov. Segment from the lower part of the frond showing corticating bands and chromatophores in central cells. $\times 150$.

PLATE 9

Fig. 27. *Spatoglossum Howellii* Setchell and Gardner, sp. nov. Photograph of dried plants, the type.

PLATE 10

Fig. 28. *Weeksia Templetonii* Setchell and Gardner, sp. nov. Photograph of a battered specimen, the type. $\times 1$.

PLATE 11

Fig. 29. *Weeksia Howellii* Setchell and Gardner, sp. nov. Photograph of the type specimen of a dried cystocarpic plant.

Fig. 30. *Weeksia Howellii* Setchell and Gardner, sp. nov. Photograph of the type specimen of a dried tetrasporic plant.

PLATE 12

Fig. 31. *Gymnogongrus martinensis* Setchell and Gardner, sp. nov. Photograph of a group of normal plants. $\times 1$.

Fig. 32. *Callymenia angustata* Setchell and Gardner, sp. nov. Photograph of the type specimen of a cystocarpic plant. $\times 1$.

PLATE 13

Fig. 33. *Sarcodiotheca meridionalis* Setchell and Gardner, sp. nov. Photograph of the type specimens.

PLATE 14

Fig. 34. *Sarcodiotheca cuneata* Setchell and Gardner, sp. nov. Photograph of the type specimen of a cystocarpic plant. $\times 1$.

PLATE 15

Fig. 35. *Sarcodiotheca linearis* Setchell and Gardner, sp. nov. Photograph of a series of typical plants. $\times 1$.

PLATE 16

Fig. 36. *Laurencia densissima* Setchell and Gardner, sp. nov. Photograph of the type specimen of a tetrasporic plant. $\times 1$.

PLATE 17

Fig. 37. *Laurencia densissima* Setchell and Gardner, sp. nov. Photograph of a branch of the type specimen of a tetrasporic plant. $\times 4$.

Fig. 38. *Gelidium (Pterocladia) Okamurai* Setchell and Gardner, sp. nov. Photograph of the type specimen. $\times 1$.

PLATE 18

Fig. 39. *Laurencia mediocra* Setchell and Gardner, sp. nov. Photograph of the type specimen. $\times 1$.

PLATE 19

Fig. 40. *Laurencia turbinata* Setchell and Gardner, sp. nov. Photograph of the type specimen of a tetrasporic plant.

PLATE 20

Fig. 41. *Chondria pacifica* Setchell and Gardner, sp. nov. Photograph of a group of dried plants. $\times 1$.

PLATE 21

Fig. 42. *Dasya subsecunda* Suhr. Photograph of the type specimen.

Fig. 43. *Dasya subsecunda* Suhr. Photograph of a branch of the type specimen. $\times 10$.

PLATE 22

Fig. 44. *Heterosiphonia erecta* Gardner. Photograph of a much branched erect frond.

PLATE 23

Fig. 45. *Polyopes clarionensis* Setchell and Gardner, sp. nov. Photograph of the type specimen. $\times 2$.

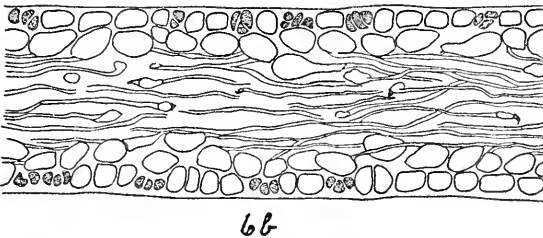
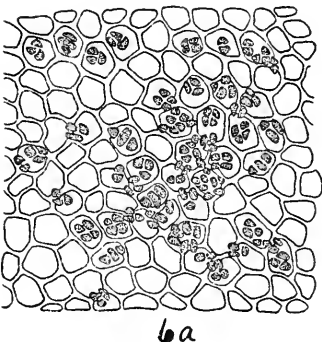
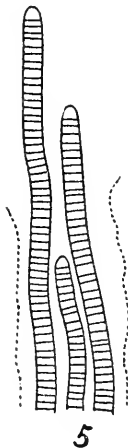
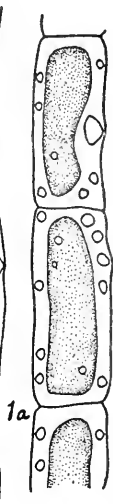
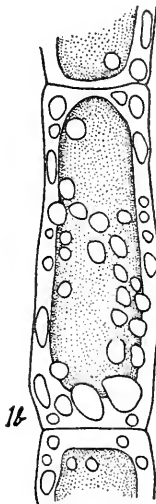
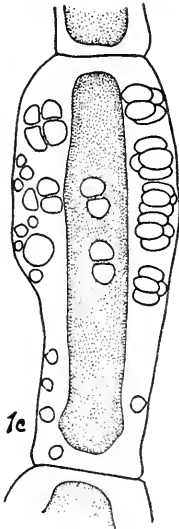
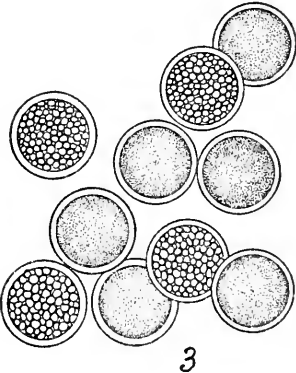
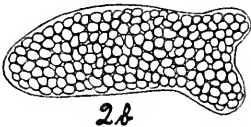
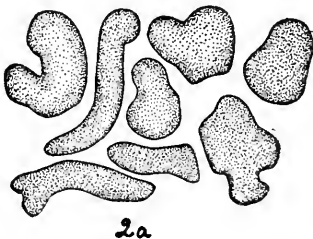
Fig. 46. *Heterosiphonia erecta* Gardner. Photograph of a group of typical tetrasporic plants. $\times 1$.

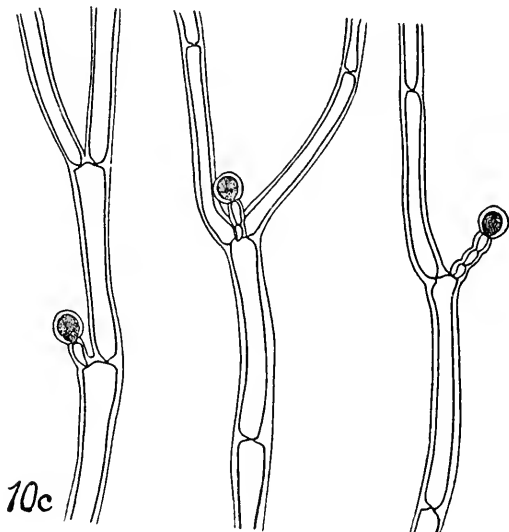
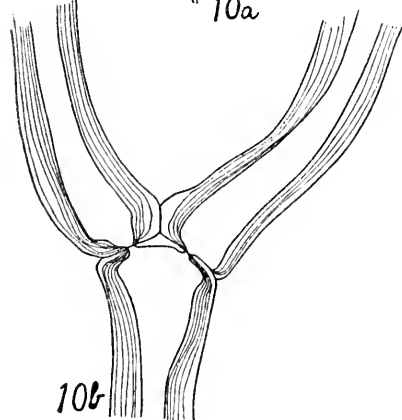
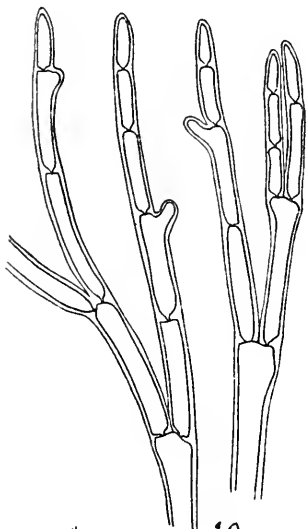
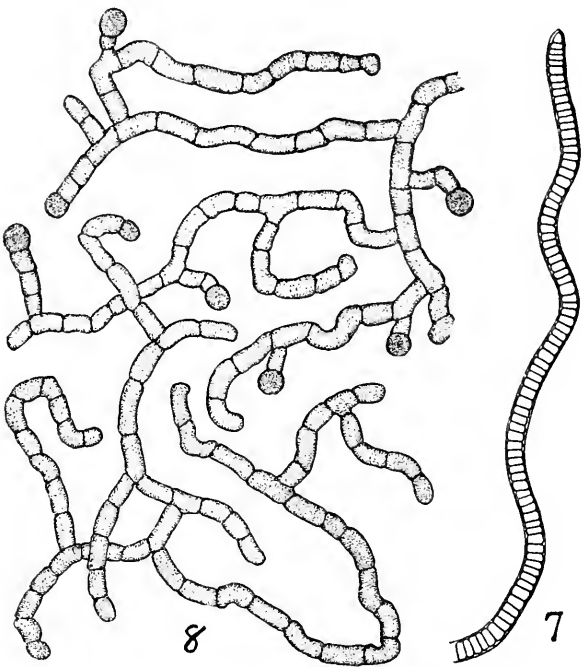
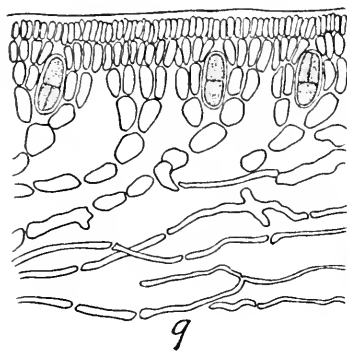
PLATE 24

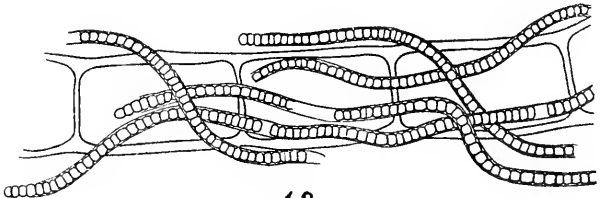
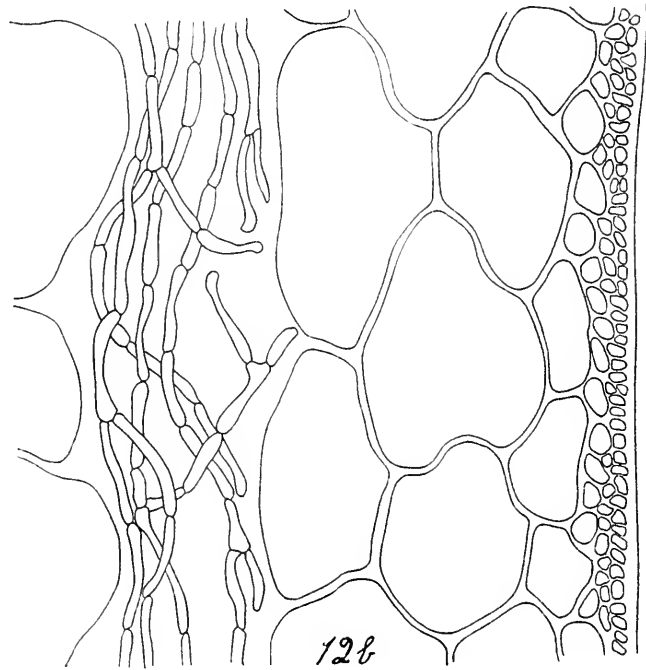
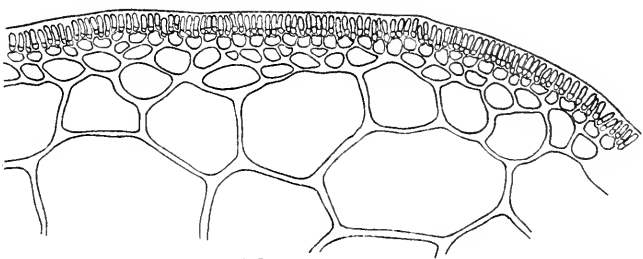
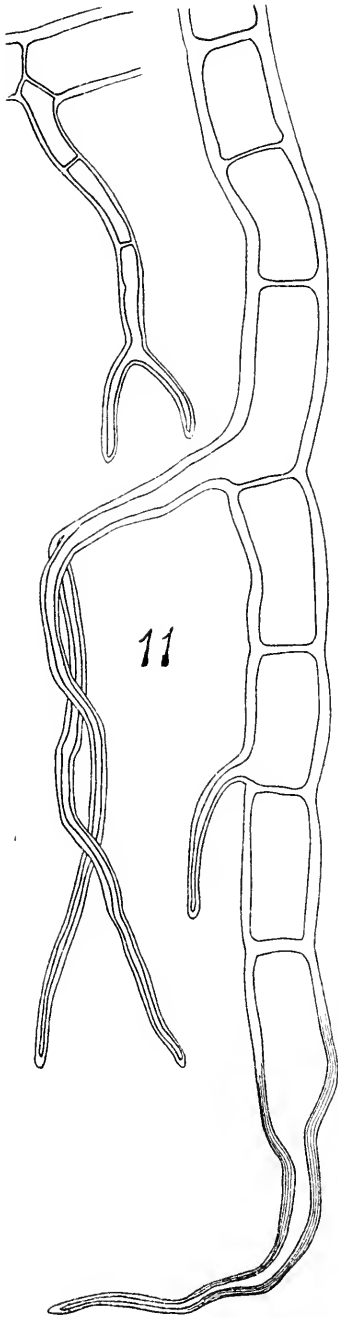
Fig. 47. *Phycodrys elegans* Setchell and Gardner, sp. nov. Photograph of the type specimen. $\times 1$.

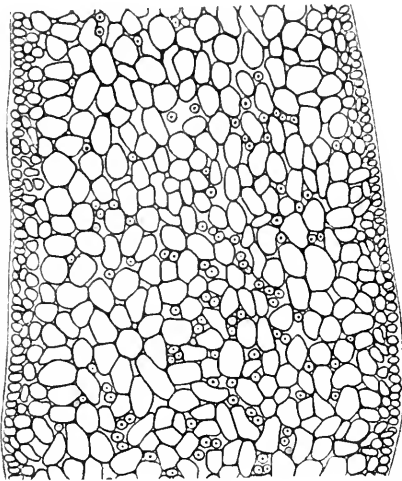
PLATE 25

Fig. 48. *Ochtodes Crockeri* Setchell and Gardner, sp. nov. Photograph of the type specimen. $\times 1$.

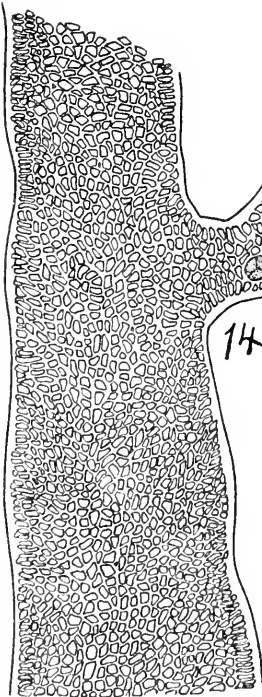
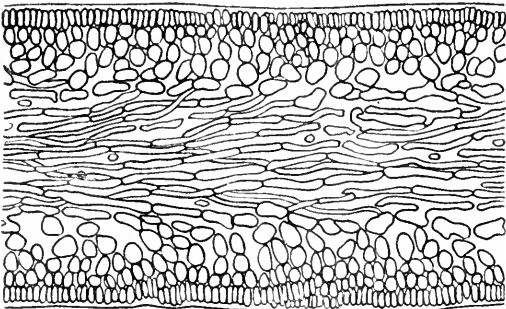




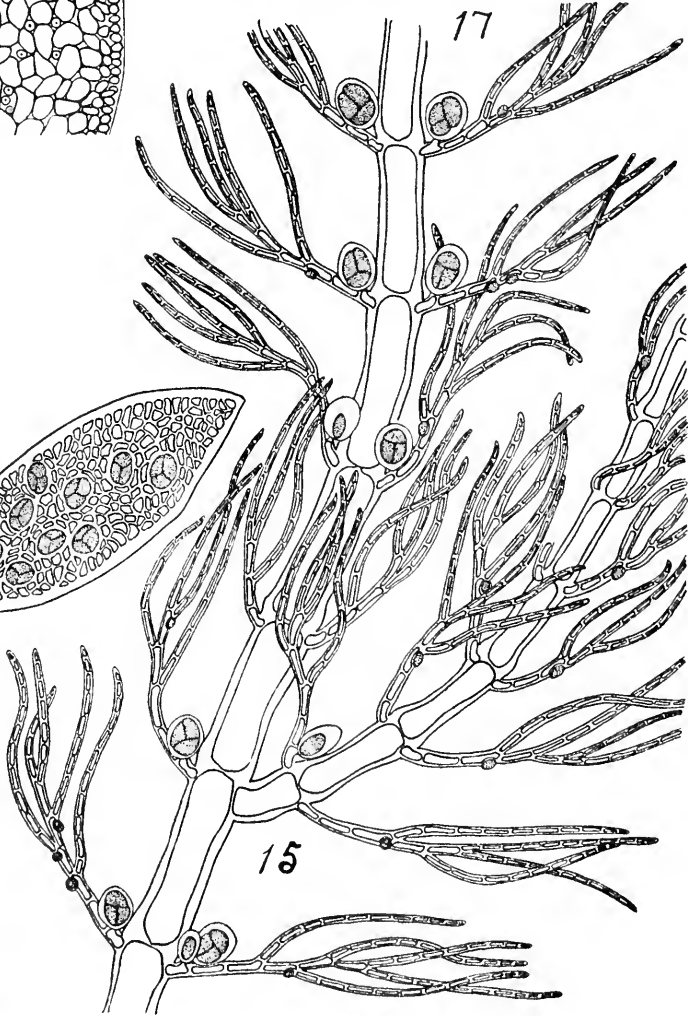




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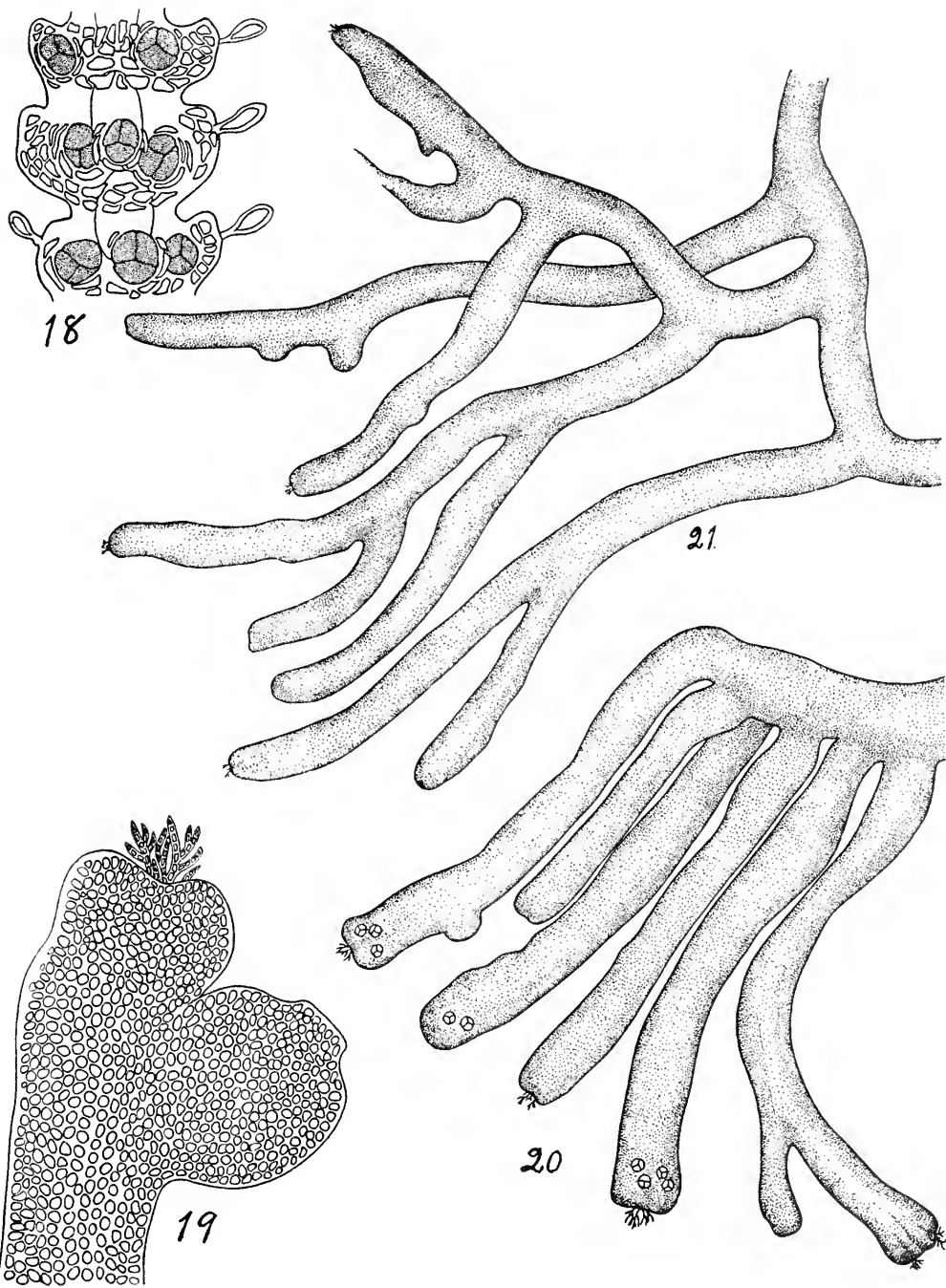


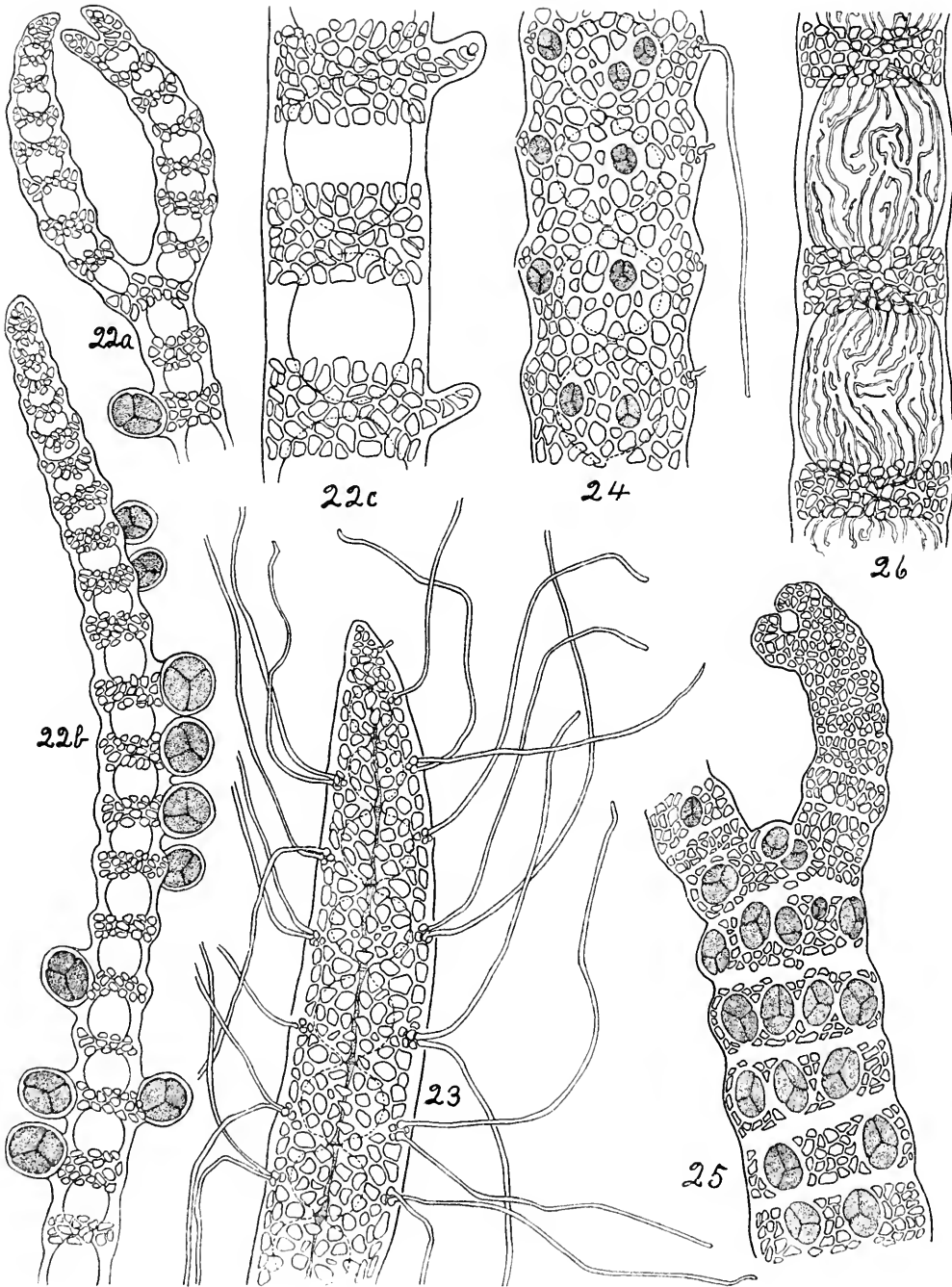
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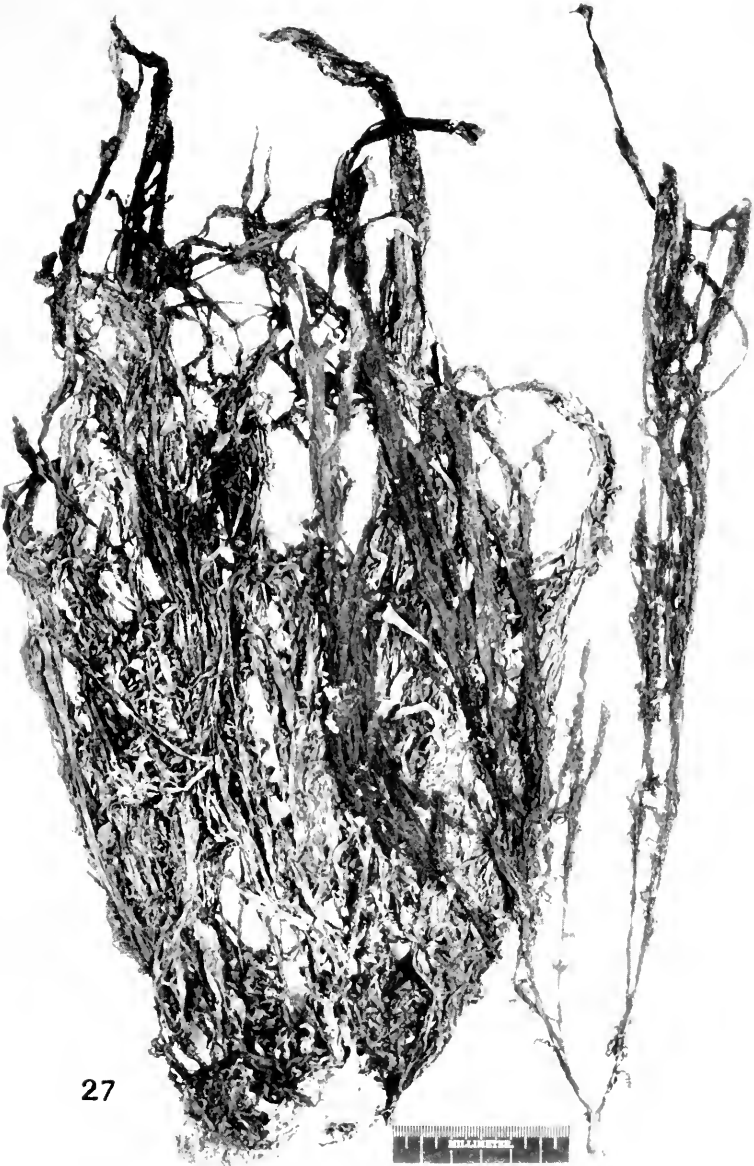


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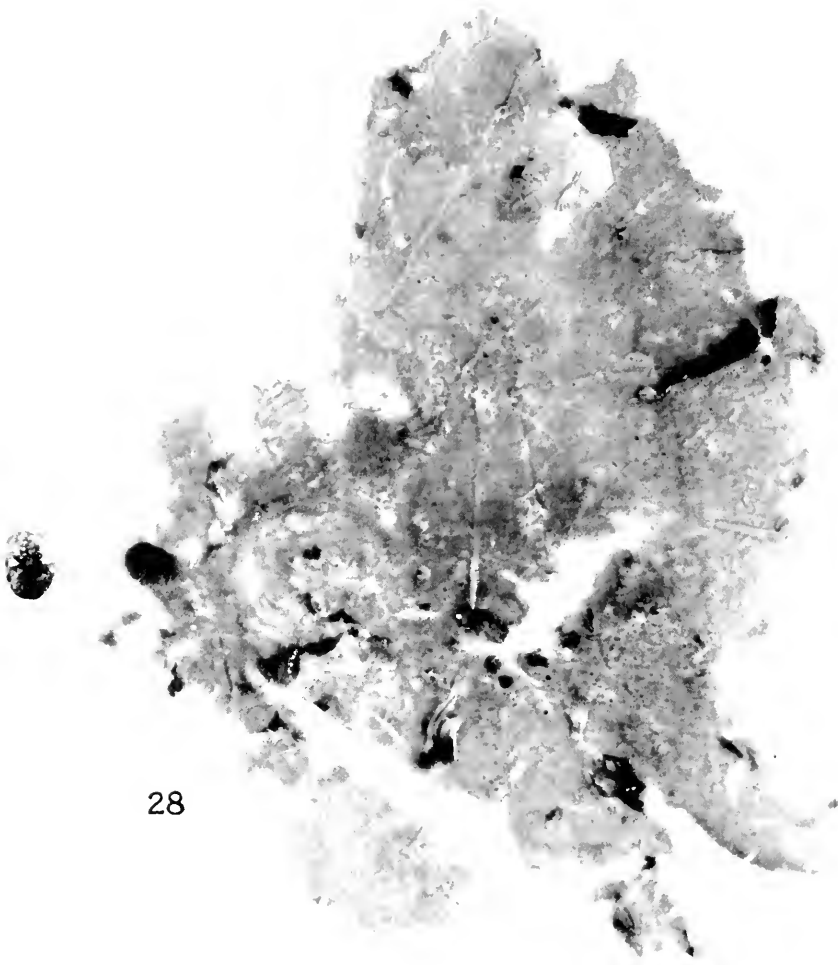
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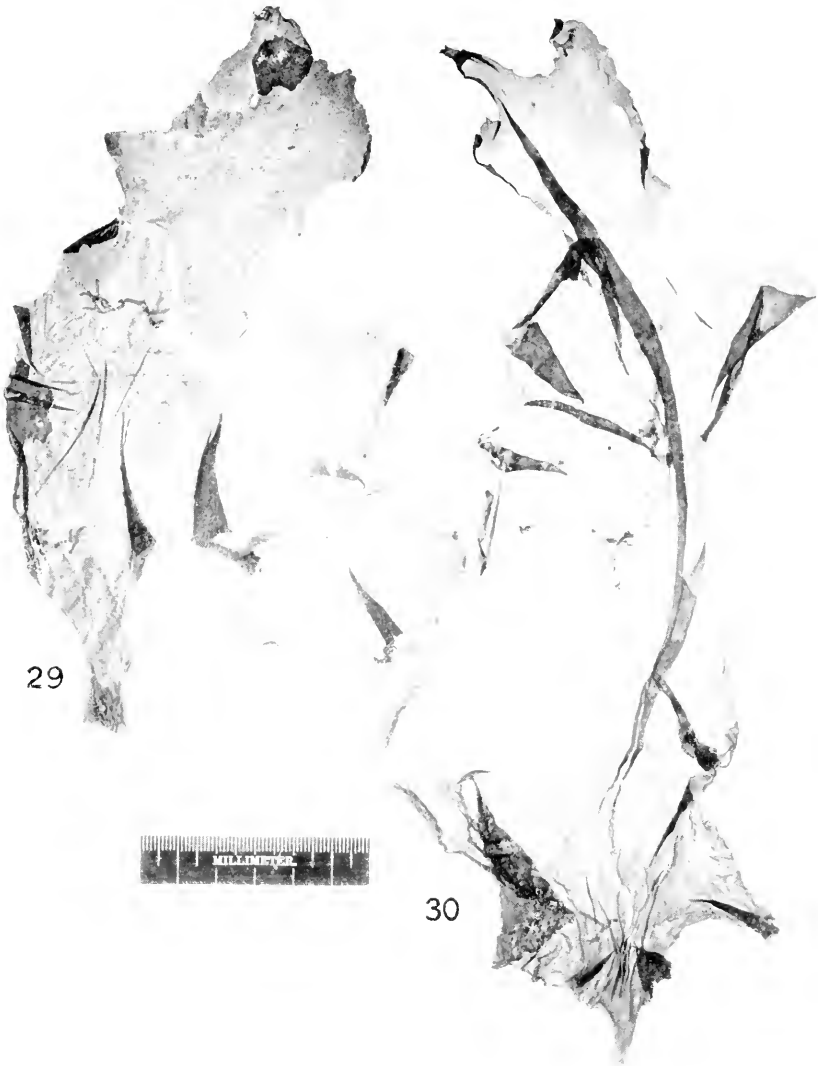




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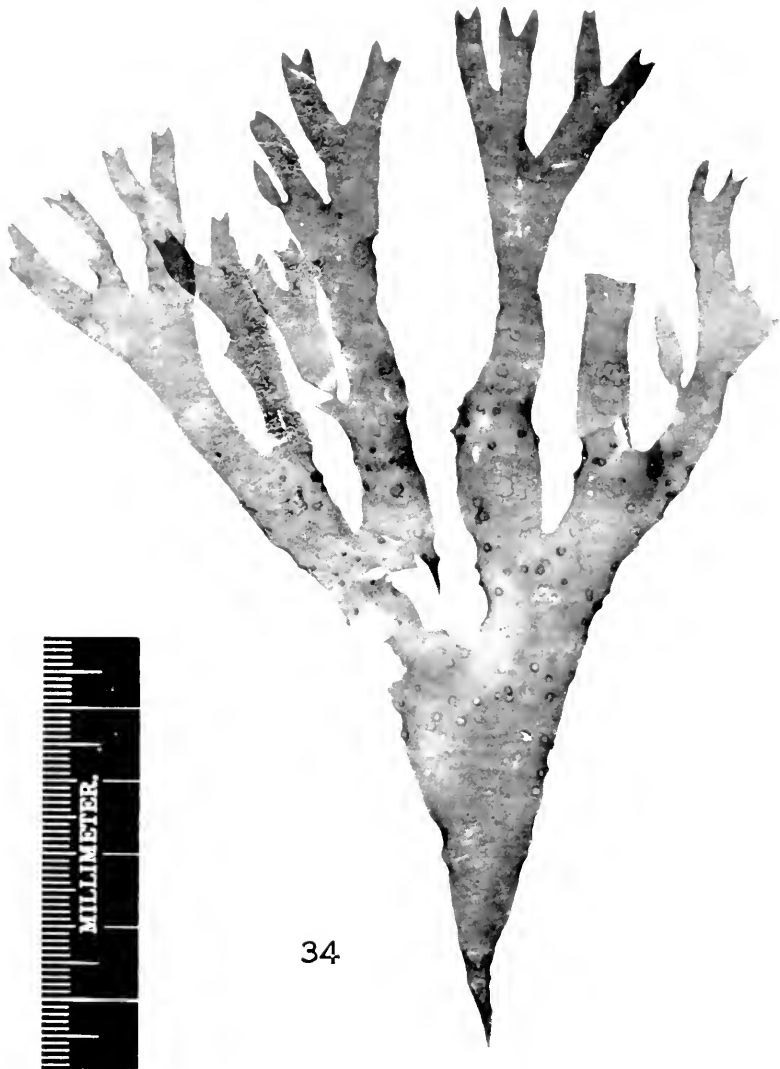
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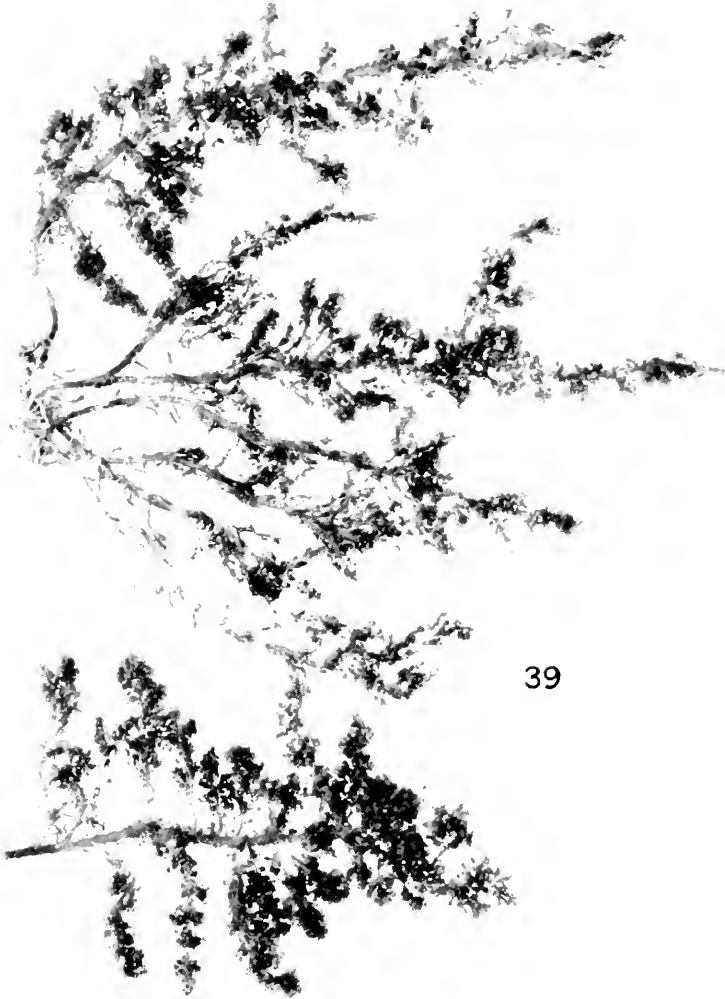
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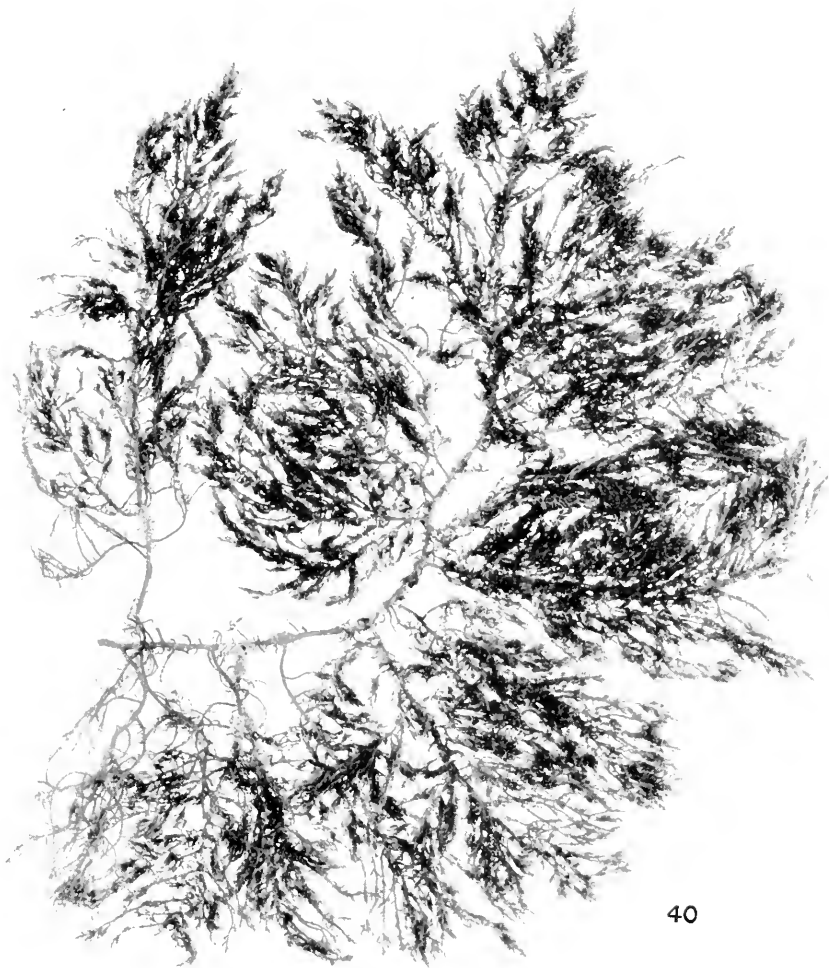






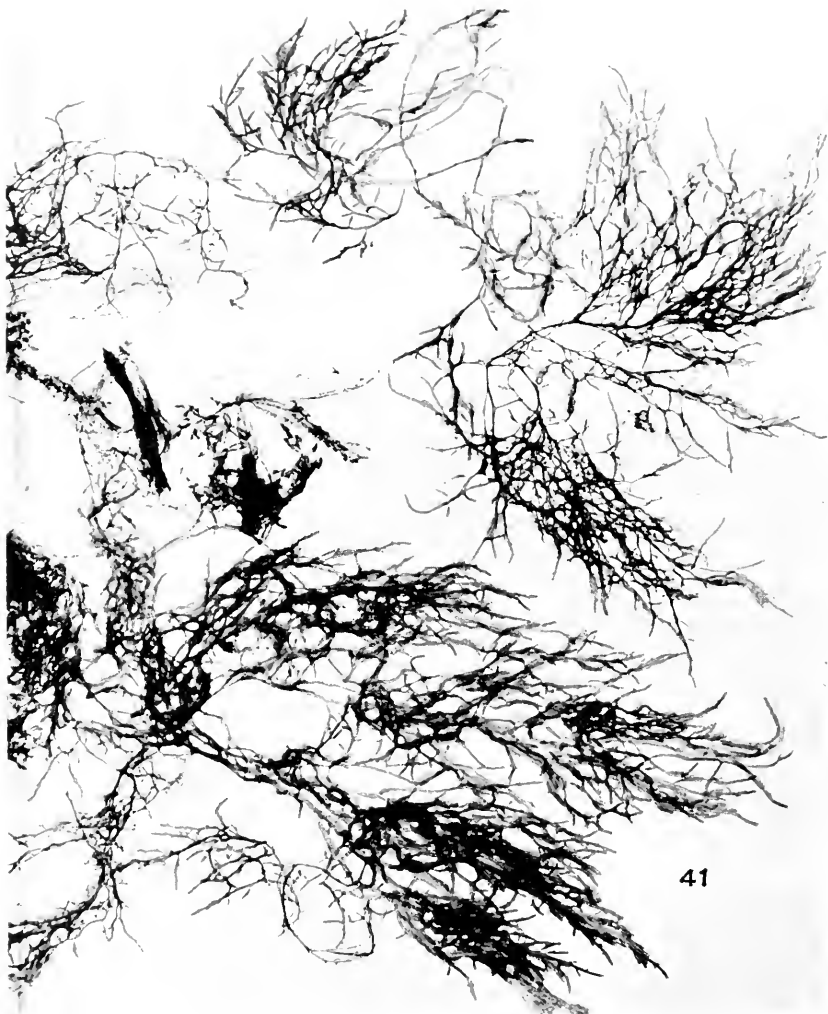






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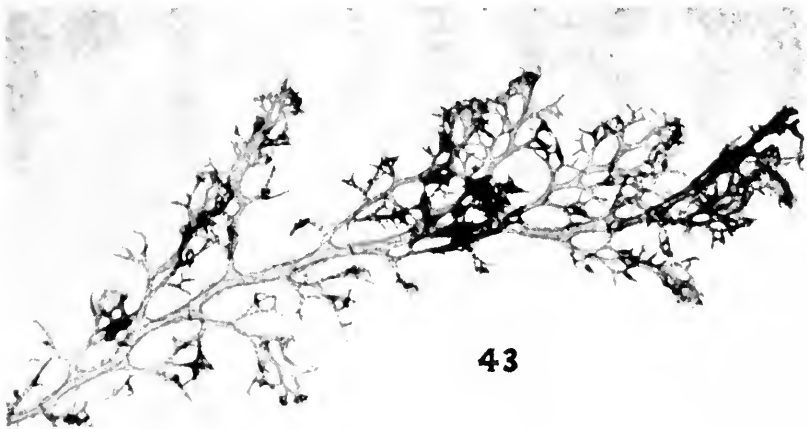






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Nasya subocculta Setch.
Palmaraiso

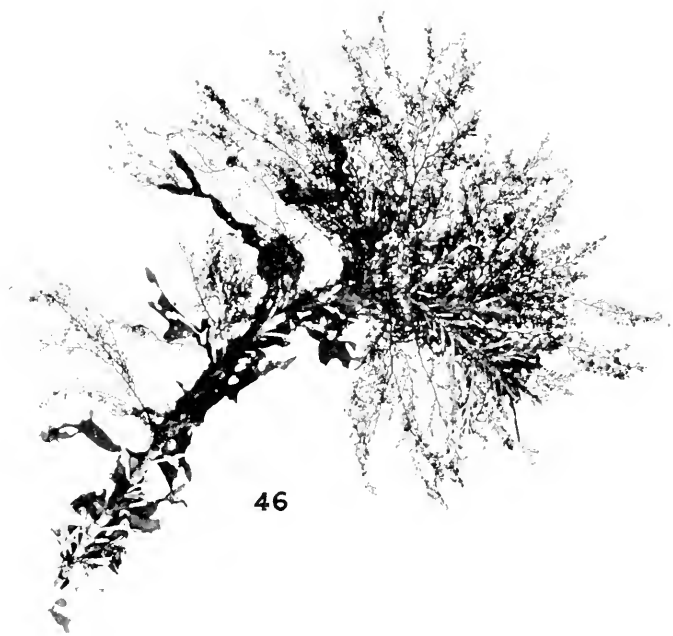


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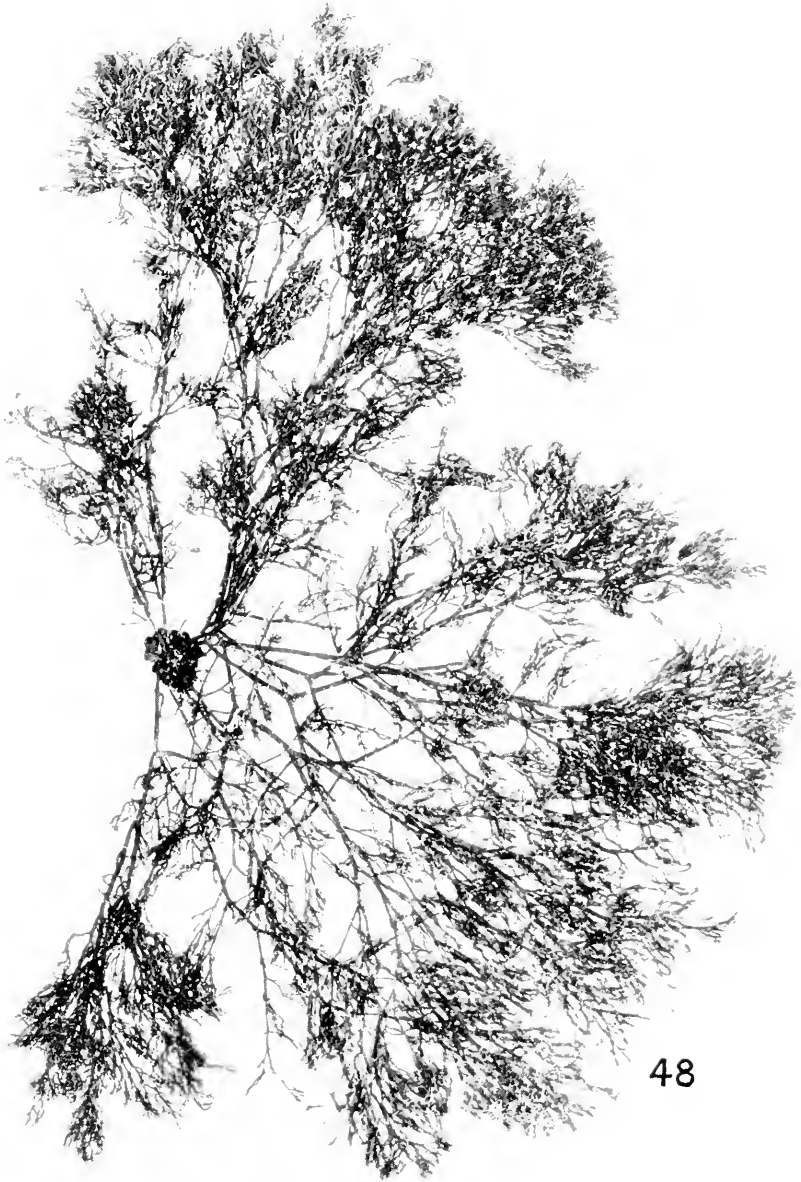


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CALIFORNIA ACADEMY OF SCIENCES
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APRIL 26, 1937

THE TEMPLETON CROCKER EXPEDITION OF THE
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THE PLANT GENUS *COLDENIA* IN THE
GALAPAGOS ISLANDS

BY
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INTRODUCTION

History. The first species of *Coldenia* (*Boraginaceae*) to be known from the Galapagos Islands were described in 1847 as species of *Galapagoa*, a genus specially erected by Hooker f. to care for them (Trans. Linn. Soc. 20: 196, 197). In the rather meager material before him, Hooker distinguished two species, *G. Darwini* and *G. fusca*, differentiated in his descriptions chiefly by pubescence. Not many years later in 1862, these were recognized as species of *Coldenia* by Asa Gray and this generic disposition of the plants was accepted by Bentham and Hooker in the *Genera Plantarum*, by Hooker and Jackson in the *Index Kewensis*, by Gürke in *Die Natürlichen Pflanzenfamilien*, and by all later workers who have considered them. Until Johnston prepared his "Tentative Classification of the South American *Coldenias*" (Contrib. Gray Herb., n. ser., 70: 55-61, 1924), Hooker's two original species were maintained and specimens from the islands were referred to them chiefly on characters of pubescence. But in his survey of the island material, Johnston could distinguish no specific line, remarking: "I . . . am forced to the conclusion that the archipelago has but one variable

species of *Coldenia*. The island plants vary considerably in compactness, size and pubescence of leaves, but these differences seem clearly responses to different habitats" (pages 59, 60).

Such a disposition of the island material would probably have been followed in the present instance had I not become convinced in the field, as botanist on the Templeton Crocker Expedition of the California Academy of Sciences in 1932, that more than one species of *Coldenia* could be readily distinguished. In the course of my collecting of *Coldenia*, I regret that I was not particularly critical, and it was only during my last days on the islands that three distinct plants were found in close proximity in the vicinity of Sullivan Bay on James Island, two actually growing together. Although these two plants might have been passed as variants of the same species by a too casual collector, only the slightest attention to them immediately revealed that they were entirely distinct. Other instances of this sort and further variations might have been detected at other stations had I been more alert and critical earlier. But certainly in habit and gross aspect the coldenias closely resembled each other and a closer scrutiny of plants was not deemed necessary. At Sullivan Bay it was variation in color and shape of corollas in neighboring plants which all too late focused my attention on dissimilarities in plants superficially alike; but, nevertheless, the observation was in time for me to realize that critical points could be adduced from a consideration of the flower.

About two years ago, when I came to examine critically all collections of Galapagian *Coldenia* in the Herbarium of the California Academy of Sciences (C), it was at once discovered that added to characters of habit and flower which had been noted in the field were even more important characters in the fruit, some plants having nutlets smooth and shining and others having nutlets tuberculate and dull. Four major entities and several minor forms came to be recognized; but when I sought to apply Hooker's original specific names to two of them, I was unable to do so. Hooker in his original description of *Galapagoa fusca* neglected to describe the fruit, and, from the characterization given, it was impossible to determine whether the characters described should be correlated with smooth or rough nutlets. It was at this point that I was able to examine the collections by Darwin, Macrae, and Edmonston in Herbarium Hookerianum (Herb. Hook.) at Kew in the summer of 1935, and to determine to which two of the entities the specific names *Darwini* and *fusca* should be applied.

Even at Kew all was not so simple as might be anticipated, and no little difficulty was encountered in determining which specimens should serve as types for Hooker's species. Because the specific nomenclature of the island plants depends on the decisions made, the notes prepared at Kew and at the herbarium of the University of Cambridge (Herbarium Cantabrigense, Herb. Cantab.) are given here in full.

Selection of Types. From the description of *Galapagoa Darwini*, it is clear that in Herb. Hook. at Kew there is only one sheet that has mounted on it plants which can be taken as the ones described by Hooker. (Plate 26.) On this sheet three specimens are mounted and the following data are given: Charles Island, *Edmonston*; Albemarle Island, *Macrae*; and, Charles Island, *Darwin*. The data are so placed that it is not evident at first which specimen goes with which data, and this is important to determine, since only two of the three specimens are cited by Hooker; and, moreover, in the light of present knowledge at least two species are represented. By reference to Darwin's specimens in Herb. Cantab., it is immediately evident that the specimens on the right side of the sheet in Herb. Hook. are the Darwin specimens, and this is as it should be because the Darwin label is placed immediately beneath them. And by reference to the specimens in Herbarium Benthamianum (Herb. Benth.) at Kew, it is evident that the specimen in the lower left hand corner is a part of Macrae's collection from Albemarle Island: and again this is as it should be, because not only does the position of the Macrae label show the closest possible affiliation for this particular specimen but also the specimen at one point overlies the Edmonston data which are written on the sheet, thus showing that the specimen taken to be Macrae's was added subsequently to the mounting of Edmonston's specimen and to the writing of his data. Thus the Edmonston data go with the two plants in the upper left hand corner of the sheet.

From a careful examination of these three specimens and a comparison of them with the original description of *Galapagoa Darwini* and with drawing of dissections prepared by Hooker, it is evident that the description and drawings do take care of both the Darwin and Macrae specimens but do not fit the Edmonston collection. This agrees with Hooker's statement in the original description that *G. Darwini* is based on collections of Darwin and of Macrae. For the type of the species, there should be no hesitancy in choosing Darwin's specimens in Herb. Hook. because (1.) the material is adequately covered by the original description of *G. Darwini* and is clearly included in Hooker's drawings of dissections; (2.) it is the first cited collection; (3.) the species named after Darwin should have as the type this specimen collected by him, if his plant is included in the original description. This decision is reached and held in spite of the fact that Darwin's collection in Herb. Hook. is labelled "Charles Island," while the island named both in the original description and in the data accompanying the specimen in Herb. Cantab. is Chatham Island; and also in spite of the fact that the specimen from Charles Island by Darwin in Herb. Benth., which is labelled *G. Darwini*, is *C. fusca* and exactly corresponds to Edmonston's plant from Charles Island in Herb. Hook.

The choice of a specimen to serve as type for *Galapagoa fusca* is likewise difficult because of conflicting data and discrepancies in

labelled specimens. In the original description, the locality given for the type and only collection cited is "Charles Island" by Darwin. Now, in Herb. Hook. the only collection by Darwin, and that given as from Charles Island, has been cautiously and critically chosen as the type for *G. Darwini*. In Herb. Benth. there is a Darwin collection from Charles Island labelled *G. Darwini* but even a casual glance shows the plant so labelled to be identical with Edmonston's collection from Charles Island in Herb. Hook.; and although the leaves of this collection are almost "destitute of those curious large setae, . . . so prominent in *G. Darwini*," the plants are not "of a lurid brown color" and the leaves are not conspicuously "rugose on the upper surface between the lateral nerves." In Herb. Cantab. there is a second specimen of *Galapagoa* said to have been collected by Darwin. Although it is labelled *G. fusca*, it cannot be that species according to the original description of *G. fusca*, and most closely resembles Macrae's collection from Albemarle Island that Hooker cited with *G. Darwini*.

So the problem narrows down to the question whether there is a specimen collected by Darwin or by someone else which was available to Hooker at the time he described *Galapagoa fusca*, which, agreeing with the original description, may be selected as the type. There is such a specimen, a second collection by Macrae from Albemarle Island, represented in Herb. Hook. by a very full sheet and also by an adequate specimen in Herb. Benth. This specimen fills so perfectly all the particular requirements given by Hooker in the original description of *G. fusca*, that it is unavoidable to conclude that the description of the species was based on this Macrae collection, and that an error was made in citing the original locality and collector in the literature. This conclusion is still further fortified by the drawings made by Hooker which are details evidently taken from the Macrae plant, and which are at present pinned to that specimen. That these drawings have always been attached to the Macrae specimen can be readily deduced by a study of the several sets of pin-holes on the edge of the drawing paper and along the edge of the herbarium sheet. Hence the Macrae collection from Albemarle Island in Herb. Hook. is chosen as the type of *G. fusca*.

Ecology and Relationships. The species of *Coldenia* are widespread in the Galapagos Islands, and have been reported from all of the larger islands, except Duncan, as well as from several of the smaller islands. They are most frequent in loose porous soils of sandy or ashy character, and are to be counted as a characteristic element in the vegetation of sandy flats and low dunes immediately inland and above the calcareous beaches. In fact all of the species and most of the collections have been recorded from such a littoral habitat. Only *C. Galapagoa* has been commonly noted as occurring away from the strand on rocky slopes in shallow soil; and the closely re-

lated *C. fusca* is found inland on gentle slopes or flats of volcanic ash, or, more rarely, in crevices of lava pavements.

Certainly the species resemble each other closely in general aspect; the difference in appearance between individuals of the same species in youth and age is at times more pronounced than that between individuals of different species of about the same age. But there are real differences in the species as they are seen growing, although, again, to the casual observer they may seem very much alike. Both *C. Darwini* and *C. fusca*, as far as the writer has observed, are truly prostrate even to the tips of the branchlets. Where these two species grew together at Tagus Cove, they were superficially indistinguishable, and it was only after a critical examination of the collection in the laboratory that the two species were separated (Howell No. 9514 and 9514A). *Coldenia Galapagoa* and *C. conspicua* are more decidedly divergent, not only between themselves but also from the true mat-plants, *C. Darwini* and *C. fusca*. Neither forms a perfectly prostrate mat. Of the two, *C. Galapagoa* has the more sprawling habit but its assurgent branches develop at least a low loose habit. From all species of *Coldenia* in the Galapagos Islands, the suffrutescent habit assumed by *C. conspicua* is different, forming as it does a low broad shrubby growth, perhaps up to a half meter in height. In habit, it was in notable contrast to the prostrate mats of *C. Darwini* with which it was associated.

Johnston (*l. c.*, page 57) refers the plants of the Galapagos Islands to the section *Eddya* of the genus *Coldenia*, and considers them closely allied to the continental species *C. paronychioides* Phil., which ranges from northern Chile to Bolivia and northern Peru. The section, which also includes several species in the Mexican region, is to be recognized by the unappendaged corolla and the ventrally attached nutlets with an anterior grooved keel (cf. Johnston, *l. c.*, page 56). Without a critical knowledge of the relations on the mainland, it is scarcely feasible to propose a possible phylogeny for the insular complex, unless it would be to suggest that the variations in the Galapagian group appear to have arisen through hybridization, with consequent partial stabilization through segregation and isolation. It only remains to be stated that, although the Galapagian species are closely allied, not only genetically, but also physiologically and ecologically, nevertheless the several species seem very distinct and adequate taxonomically.

Acknowledgments. In the preparation of this review of the Galapagian coldenias, specimens have been borrowed from the Gray Herbarium of Harvard University (G) and from the Herbarium of the Brooklyn Botanic Garden (B). In Europe, studies were made in England at the Royal Herbarium, Kew (Kew.), and the Herbarium of the University of Cambridge (Cantab.); and, in Sweden, in the Herbarium of the Kungliga Riksmuseum (Holm., *i. e.*, Herbarium Holmiense). To the officers and assistants of all of these institutions,

I am deeply grateful for the opportunity for study and for the many courtesies and privileges I have enjoyed. Particularly do I wish to thank Dr. T. A. Sprague, Deputy Keeper of the Royal Herbarium, Kew, for his valuable advice and assistance in helping me to interpret the confusion of *Coldenia* specimens; as always, I am grateful to Mr. Templeton Crocker, not only for the advantages he gave me as botanist on his expedition in 1932, but for his continued interest in the studies of the collections obtained; and, I wish to express my gratitude to Miss Alice Eastwood who made possible my European summer and all that it has meant to me.

TAXONOMIC TREATMENT

KEY TO THE GALAPAGIAN SPECIES OF *Coldenia*

- A. Nutlets nearly or quite smooth and shining.
 - B. Plants prostrate; corolla sordid-white, the tube campanulate-funnelform; hairs on the stem spreading or appressed-ascending 1. *C. Darwini*
 - B. Plants bushy, to 3 or 4 dm. tall; corolla pure white, the tube cylindrical; hairs on the stem mostly retrorse 2. *C. conspicua*
- A. Nutlets granular to finely tuberculate, dull.
 - C. Stems prostrate; corolla 1-2 mm. long, the tube campanulate-funnelform; stamens about 1 mm. long; style-branches distinct or united only near the base 3. *C. fusca*
 - C. Stems somewhat assurgent; corolla 3-4 mm. long, the tube cylindrical; stamens 3.5 mm. long; style-branches united 0.5-1 mm. above base 4. *C. Galapagoa*

1. *Coldenia Darwini* (Hook. f.) Gray

Plate 26, Plate 27, figure 1

Galapagoa Darwini Hook. f., Trans. Linn. Soc. 20: 196 (1847)

Coldenia Darwini (Hook. f.) Gray, Proc. Am. Acad. 5: 341 (1862)

Stems prostrate, forming a mat 4-8 dm., or perhaps even a meter, in diameter, woody and dark at base, the branchlets numerous, cinereous, tomentellous, or more frequently the pubescence upwardly appressed and strigose or subhirsute; leaves small, elliptic to narrowly ovate, acute, the midrib depressed above, very prominent below and nearly filling the concavity formed by the strongly revolute margins, lateral veins not evident, the hairs of two sorts, the shorter hairs substrigose and not so stout, the longer hairs setose and scattered, sometimes abundant, sometimes nearly lacking; calyx-lobes more or less unequal, free nearly to the base, 1-2 mm. long in anthesis; corolla 1.5-2.5 mm. long, campanulate-funnelform, the lobes spreading, rounded; stamens attached near the bottom of the tube, about 1 mm. long; style about 1 mm. long, the branches distinct nearly or quite to the base; nutlets narrowly ovate dorsally, 0.75 mm. long, black, smooth and shining above and on the back, very minutely reticulate-roughened and only subglucid on the sides near the base, the groove on the ventral angle scarcely widened upward.

Collections studied. Type collection, *Darwin in 1835* ("Charles Island," Kew. in Herb. Hook., frag. G; "Chatham Island," Herb. Cantab.). Galapagos Islands: *Edmonston in 1846* (G); *Andersson No. 135* (Kew.). Abingdon: on lava beds near the shore, *Stewart No. 3144* (C). Albemarle: *Macrae in 1825* (Kew. in Herb. Hook. and Herb. Benth.); east side, 3 miles south of Equator, *Howell No. 9610* (C); Tagus Cove, *Stewart No. 3146* (C, G), *Howell No. 9514A* (C). Bindloe: *Baur No. 383* (G); *Snodgrass & Heller No. 764* (G); *Stewart No. 3147* (C); northwest coast, *Howell No. 8566* (C). Charles: *Darwin in 1835* (Cantab., a specimen different from the type collections); on sand beaches, *Stewart No. 3148* (C); Black Beach, *Svenson No. 181* (B, G, Kew.), *Howell No. 9383* (C); Post Office Bay, *Howell No. 8810* (C). Chatham: *Andersson in 1852* (G, Holm., frag. C); Bassa Point, *Stewart No. 3149* (C, G). James: Orchilla Bay, *Baur No. 384* (G); Sullivan Bay, *Howell No. 10011* (C); Bartholomew Island at Sullivan Bay, *Howell No. 10060* (C).

The collections of this species present two extremes in the character of pubescence. A few collections from Chatham and Charles islands have the stems almost villous-tomentose with soft spreading hairs. The majority of specimens, however, have the stems more or less bristly-hairy as well as strigose with usually closely appressed hairs. The type collection belongs to the former variant that is rare; the plants generally collected belong to the second variant. The recognition of these differences by named forms would perhaps be desirable, although the character is variable, and a precise definition and separation is scarcely possible.

Of all the specimens of *C. Darwini*, only one has been seen which seems to agree with the type in every detail, and this is Stewart's collection from Bassa Point, Chatham Island. This fact lends strong support to the writer's belief that the original collection is correctly labelled in Herb. Cantab. and that the specimen in Herb. Kew., which is to be taken as the type, is incorrectly labelled Charles Island. (Cf. discussion in Introduction.) It is true that Stewart's collection from Charles Island also resembles Darwin's plants in critical details of pubescence, but the plant does not have the very close, almost identical resemblance, which is shared by the type collection and Stewart's plants from Chatham.

2. *Coldenia conspicua* Howell, spec. nov.

Plate 27, figure 1

Fruticulus argenteus, 3–4 dm. altus; caulibus assurgentibus vel suberectis, basi lignosis et vestitis cortice fusco tenuiter sulcato, ramulis numerosis, cinereis pilis retrorsis vel subpatentibus; foliis ovatis vel ovato-lanceolatis, strigoso-canescens, 1.5–2 mm. longis, petiolis villosis-hirsutis, costa prominenti, costis lateralibus haud manifestis; floribus fere latentibus inter folia congesta ramulorum nanorum; segmentis calycis oblongis, inaequalibus, longissimis 2 mm. longis, brevissimis 1.5 mm. longis, post anthesin maioribus et coriaceis; corolla candida, 3 mm. longa,

tuba fere cylindracea, inappendiculata; staminibus glabris, 2 mm. longis; stylo 2 mm. longo, ramis 1.5 mm. longis; nuculis circa 0.75 mm. longis, partim inclusis basibus segmentorum calycis, laevibus, nitentibus, atris, angusto-ovatis, subacutis, rotundatis dorso, acutis ventre, sulco ventrali subaequaliter lato omnino.

Low pale bushes, 3-4 dm. tall, the stems loosely spreading or suberect, woody below and covered with a shallowly furrowed light brown bark, much-branched above, the upper stems cinereous with mostly close retrorse or somewhat spreading pubescence, the primary internodes long, the secondary branches abbreviated, spur-like and bearing rosette-like clusters of numerous small crowded leaves; leaves ovate or ovate-lanceolate, strigose-canescens, 1.5-2 mm. long, petioles hirsute-villous, those of the primary leaves longer, midvein prominent but lateral veins not at all evident; flowers nearly concealed among the congested leaves of the dwarf shoots; calyx-divisions oblong, unequal, in flower the longest 2 mm. long, the shortest 1.5 mm. long; corolla white, not sordid, 3 mm. long, the tube nearly cylindrical, without appendages; stamens glabrous, 2 mm. long; style 2 mm. long, the branches about 1.5 mm. long; nutlets partly enveloped by the concave base of the calyx-divisions, smooth, shining, black, narrowly ovate, subacute, rounded dorsally, acute ventrally, the ventral groove about equally wide throughout.

Type: Herb. Calif. Acad. Sci., No. 229734, collected on the **north-west side of Bartholomew Island at Sullivan Bay, James Island, Howell No. 10059**, June 14, 1932. The plants were abundant on an ashy talus, conspicuously mottling the dark brown slope with bright silvery patches. This species was also collected on the mainland of James Island where it grew in sandy stretches along the shore of Sullivan Bay, *Howell No. 10010*, June 13, 1932. It has not been seen in any other collection from the Galapagos Islands. At both stations where this very distinct species was detected, it grew with the strictly prostrate *C. Darwini*, but no intermediates or notable variants of either species were seen.

From the particular combination of characters which mark *C. conspicua*, it would appear that it may have arisen through the hybridization of *C. Darwini* and *C. Galapagoa*, the two species which are locally abundant at Sullivan Bay. If that be the case, the distinctness and stability of the *C. conspicua* population would seem to indicate that the interspecific crossing occurred long ago, and, that from the possibly variable filial descendants, the extremely rigorous desert condition at Sullivan Bay has selected the single successful survivor.

3. *Coldenia fusca* (Hook. f.) Gray

Plate 26

Galapagoa fusca Hook. f., Trans. Linn. Soc. 20: 197 (1847)

Coldenia fusca (Hook. f.) Gray, Proc. Am. Acad. 5: 341 (1862)

Stems prostrate, forming cinereous or fuscous mats 1.5-8 dm. across, woody and dark below, the branchlets cinereous, pubescent with ascending subappressed hairs, or the hairs rarely spreading; leaves small, elliptical to ovate or subrotund, obtuse or subacute, pubescence strigillose with the hairs appressed or subhirsute with the hairs suberect and bristly, loosely subsericeous below, both the midrib

and lateral veins prominently impressed above and evident below, margins very narrowly revolute; calyx 1.5 mm. long, the tube half as long; corolla campanulate-funnelform, 1–2 mm. long, the tube tending to be cylindrical; stamens about 1 mm. long, attached somewhat above the bottom of the tube; style 1–2 mm. long, the branches distinct to the base or sometimes united a very short distance; nutlets dark brown or black, 0.75 mm. long, lanceolate-ovate dorsally, subobtusate, dull, granular or tuberculate, the ventral groove somewhat widened upward.

Collections studied. Type collection, Albemarle Island, *Macrae in 1825* (Kew. in Herb. Hook., type, and in Herb. Benth., frag. G). Albemarle: Tagus Cove, *Snodgrass & Heller No. 180* (G), *Howell No. 9514* (C); southern part, *Baur No. 382* (G); Villamil, *Stewart No. 3145* (C, G), *Howell No. 8919* (C); in lower region on trail to Santo Tomás, *Howell No. 8969*. Barrington: *Snodgrass & Heller No. 468* (G), *Stewart No. 3155* (C, G). Brattle: *Stewart No. 3156* (C, G). Chatham: lower region, southwest end, *Baur No. 217* (G); Wreck Bay, *Howell No. 8612* (C). Hood: *Baur No. 218* (G); *Stewart No. 3153* (C, G); beach at Gardner Bay, *Howell No. 8647* (C). Indefatigable: on sand beaches, southeast side, *Stewart No. 3150* (C, G); Academy Bay, *Svenson No. 10* (B, G, Kew.), *Howell No. 9057* (C), *Schimpff No. 9* (C, Holm.). James: James Bay, *Howell No. 9712* (C).

Three collections of *C. fusca* have been seen with very dubious data. Two are in Herb. Kew. from Charles Island, one by Darwin (Herb. Benth.), the other by Edmonston (Herb. Hook.). Critical study of the specimens would seem to indicate that they are parts of the same collection. Until *C. fusca* is again collected on Charles Island, these collections cannot be regarded seriously in distributional studies in the archipelago. The third dubious collection is what is taken to be a mixture of *C. fusca* and *C. Galapagoa*, said to have been collected by Andersson on "insula Indefatigable" (Herb. Gray.). Undoubtedly the data are authentic for the specimen of *C. Galapagoa*, but it is likely that Andersson collected the material of *C. fusca* at either Tagus Cove, Albemarle Island, or at James Bay, James Island, at both of which places the frigate *Eugenie* visited and at both of which *C. fusca* is known to grow. No specimen of *C. fusca* collected by Andersson was noted at the herbarium in Stockholm.

Variations in *C. fusca* appear to be the only ones decided enough to offer entities worthy of taxonomic recognition. Because of the nature of these variations, the logical treatment of them would be to name a series of forms, one for nearly every one of the islands where the species occurs. Plants typical of the species are found on Albemarle and James islands; and, what is probably a typical plant, has been collected on the southeast side of Indefatigable (*Stewart No. 3150*). As noted above, it is doubtful whether the Darwin and Edmonston collections reported from Charles Island are correctly labelled, but the collections represent typical *C. fusca*. All the other collections, distributed across the southern end of the archipelago, are variable in pubescence, leaves, flowers, and nutlets. All have

leaves averaging slightly larger than those of typical *C. fusca*, a character in which they approach *C. Galapagoa*. There is a tendency for the pubescence to be spreading, either hirsutulous or subvillous, this character being especially noticeable in specimens from the widely separated Hood and Brattle islands. The plants on Hood Island have the undivided part of the style longer than in any other Galapagian *Coldenia* except *C. Galapagoa*. The most notable divergence from typical *C. fusca* is found in the fruit of plants from Chatham Island, Barrington Island, and Academy Bay, Indefatigable Island. Instead of having the nutlets finely but distinctly tuberculate as is typical for the species, these plants have the nutlets dull and very minutely granular. For the present it seems desirable to consider all these variations as simply *C. fusca*, though eventually some should perhaps be recognized taxonomically. The group might well afford exhaustive study in the problems of the origin of small entities or incipient species through segregation and isolation in a variable complex.

4. *Coldenia Galapagoa* Howell, spec. nov.

Plate 27, figure 2

Planta humilis, subhirsuta, ramosissima; caulibus patentibus, non vere prostratis, subassurgentibus, 0.8–5 dm. longis, basi lignosis, cortice tenui, atro-fusco, ramulis villosis vel subhirsutis; foliis ovatis oblongo-ovatis vel oblongo-obovatis, raro angustioribus et oblongo-lanceolatis, 4–6 mm. longis, 2–4 mm. latis, subhirsutis ad hispidis, nervis profunde impressis supra et prominentibus infra, petioliis dense et hirsute floccoso-ciliatis; floribus sessilibus et fere latentibus inter folia congesta; calyce 2–3 mm. longo, tuba circa 1 mm. longa, lobis subinaequalibus, lineari-oblongis, pilosis, pilis longis, albis, erectis, setiformibus; corolla sordido-alba, 3–4 mm. longa, tuba subcylindracea, 2.5 mm. longa, inappendiculata; staminibus glabris, 3.5 mm. longis; stylo 2.5–3 mm. longo, ramis 1.5–2 mm. longis; nuculis minute tuberculatis, atris, subovatis, apice oblique acutis, 0.75 mm. longis, rotundatis dorso, angulatis sulcatisque ventre, sulco superne paulum dilatato.

Plants low and spreading, forming loose mats 1.5–10 dm. across, the stems not strictly prostrate, somewhat assurgent, woody at the base and covered with a thin black-brown bark, the branches numerous, villous or subhirsute, the longer hairs straight, the shorter hairs generally somewhat retrorse, the primary internodes long, the secondary branches short and leafy-congested; leaves ovate, oblong-ovate, oblong-obovate, or rarely narrower and oblong-lanceolate, 4–6 mm. long, 2–4 mm. wide, subhirsute to hispid, the veins deeply impressed above and prominently raised below, the petioles densely and hirsutely tufted-ciliate; flowers sessile and nearly concealed among the leaves; calyx 2–3 mm. long, the tube nearly 1 mm. long, the lobes somewhat unequal, linear-oblong, long-hairy with white bristly erect hairs; corolla sordid-white, 3–4 mm. long, the tube subcylindrical, 2.5 mm. long, without appendages, the lobes rotund-oblong, entire or undulate, a little more than 1 mm. long; stamens glabrous, attached at base of corolla-tube, 3.5 mm. long; style 2.5–3 mm. long, the branches 1.5–2 mm. long; nutlets finely tuberculate, black, ovatis, obliquely acutish, 0.75 mm. long, rounded dorsally, angled and grooved ventrally, the groove somewhat widened upward.

Type: Herb. Calif. Acad. Sci., No. 229733, from **higher reaches of the beach, Conway Bay, Indefatigable Island, Howell No. 9862, June 8, 1932.**

Other collections studied. Galapagos Islands, *Andersson No. 136* (Kew.). Daphne: *Wheeler Rose & Beebe No. 81* (G); Daphne Major, *Pool No. 294* (B, G). Indefatigable: *Andersson in 1852* (G, Holm., frag. C); Conway Bay, *Baur No. 385* (G), *Chapin No. 1143* (B); north side, *Snodgrass & Heller No. 679* (G), *Stewart No. 3151* (C, G), *Howell No. 9882* (C). James: *Sullivan Bay, Howell No. 10033* (C). Jervis: at 950 ft. elevation, *Stewart No. 3152* (C); slopes above north end of island, *Howell No. 9767* (C). Seymour (South): *Snodgrass & Heller No. 587* (G); *Wheeler Rose & Beebe No. 3* (G); in sand, *Svenson No. 264* (B, G); middle western part, *Howell No. 9937* (C).

Coldenia Galapagoa is obviously related to *C. fusca* but it differs in gross appearance and in the larger size of all its parts. Although distinct as a specific entity, it is a variable plant and the several islands support races which may be worthy of formal recognition when they are more fully known. Most conspicuous among these forms is the very pale one which grows on the volcanic slopes above Sullivan Bay, James Island; and the narrow-leaved one which is found on South Seymour Island. The center of distribution of the species is in the north central part of the archipelago. It is believed appropriate and fitting that this species should bear as a specific name the old generic name given by Hooker to the coldenias of the Galapagos Islands.

PLATE 26

The sheet carrying the type specimen of *Coldenia Darwini* in Herb. Hook. at Kew. The type of *C. Darwini* consists of the two specimens on the right. The lower specimen on the left is also *C. Darwini*, collected by Macrae on Albemarle Island and cited by Hooker. The two upper specimens on the left, collected by Edmonston, are *C. fusca*. Photographed at Kew.

PLATE 27

Fig. 1. *Coldenia conspicua* and *C. Darwini* on ashy slopes of Bartholomew Island at Sullivan Bay, James Island. Plants of *C. conspicua* are larger and bushy, those of *C. Darwini* are prostrate. A portion of a plant of *Opuntia galapageia* Hensl. is in the immediate foreground. Photographed by Toshio Asaeda.

Fig. 2. Looking east from James Island to Sullivan Bay and Bartholomew Island. The low pale plants in the foreground are *Coldenia Galapagoa*. Photographed by J. T. Howell.

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**THE HEMIPTERA OF THE TEMPLETON CROCKER
EXPEDITION TO POLYNESIA IN 1934-1935¹**

BY

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In the fall of 1934 and early part of 1935 Mr. Templeton Crocker spent several months in scientific exploration with his yacht the *Zaca*, covering certain of the island groups in eastern Polynesia, embracing the Marquesas, Tuamotus, Austral and Gambier Islands, with stops at Pitcairn, Ducie and Rapa Islands, and the South American islands of Juan Fernandez and the Galapagos, on the return journey. This expedition was made primarily in the interest of the American Museum of Natural History², but Mr. Crocker very kindly turned over to the California Academy of Sciences the Hemiptera taken. Mr. Maurice Willows accompanied Mr. Crocker on the earlier part of the expedition and while with the *Zaca* did much of the insect collecting. After he was called home further insect material was taken by Mr. Crocker himself or under his immediate supervision. The material turned over to the Academy of Sciences by Mr. Crocker consisted of 276 specimens representing 44 species, of which nine were hitherto undescribed and a number of the others proved to be new to the Academy collection.

¹NOTE: Vol. XXI of the Proceedings was originally planned to contain only the reports upon the Templeton Crocker Expedition of the California Academy of Sciences in 1932. Mr. Crocker's further expeditions to the South Pacific have added so much new material to the Academy's collections that it has seemed desirable to incorporate the reports upon this later material with those of the earlier expedition. Volumes XXI and XXII have accordingly been set aside for this purpose. Consecutive numbering of the reports has been adhered to.—*Editor*.

²For an account of this expedition see *Natural History* for April, 1935.

The study of this material has proved most valuable, especially from the point of view of geographical distribution. It has served as a cross-section, as it were, of eastern Polynesia, including some small isolated islands such as Pitcairn, Ducie and Rapa. The Chilean island of Juan Fernández and the Galapagos added some important forms pertaining to the South American fauna. The Hawaiian Islands seem to have a distinct insular insect fauna, while that of the Philippines and the islands to the south are Indo-Australian. Much more material is needed from the islands of Polynesia and Micronesia before we can trace their relationships with any degree of certainty. Work such as Mr. Crocker is doing is of the greatest importance to an understanding of these relationships. Few groups of animals can compare with the insects in the opportunities they afford for the study of faunal origins. In their relationships may be found an important key to the complex geologic history of those island groups.

HETEROPTERA

Family CYDNIDAE

***Geotomus pygmaeus* Dallas**

One specimen of this widely distributed Cydnid was taken at Taio Hae Bay, Nuku Hiva, Marquesas Islands, October 1934.

Family PENTATOMIDAE

***Thyanta perditor* Fabricius**

Three examples of this common American insect were taken by Mr. Crocker at Conway Bay, Indefatigable Island, March 22, 1934. The insect fauna of the Galapagos Islands is strictly tropical or subtropical American. Many of the species are identical, others, especially those that have migrated to the higher interior portions of the islands, have become differentiated into species more or less distinct from their continental relations. The area of distribution of the Galapagos insect fauna apparently embraces the West Indies and Panama with a smaller representation of the Peruvian and Equadoran fauna, possibly indicating a former land connection to the north rather than to the east.

***Glaucias venusta* Van Duzee**

One specimen of this handsome green Pentatomid was taken October 18, 1934, at Taio Hae Bay, Nuku Hiva, Marquesas Islands, by Mr. Crocker. This species was described by me in a paper on the Hemiptera taken by the Pacific Entomological Survey, published by the Bishop Museum, (Bulletin 114, Article 26, p. 314,

1935.) Of the four previously known closely allied species, *vitiensis* China inhabits the Fiji Islands, *samoanus* China, Samoan Islands, *marcidus* Cheesman the Tuamotu Islands and *sulcatus* Montrouzier New Caledonia and the Island of Woodlark. Other species are found in Malayasia and as far west as India.

Nezara viridans Stål

Conway Bay, Indefatigable Island, March 23, 1935. This insect seems to be confined to the Galapagos Islands where it is not uncommon.

Piezodorus hybneri Gmelin

South side of Rurutu Island, Austral Islands, November 28, 1934, three individuals, two of which are not fully pigmented. A widely distributed oriental species formerly known under its preoccupied name *rubrofasciatus* DeGeer.

Oechalia consocialis Boisduval

Nine specimens of this insect were taken January 23, 1935, on Ducie Island, eastern Polynesia, three on Rapa Island, December 7, 1934, and one on Raivavae Island, Austral Islands.

Platynopus melacanthus Boisduval

Raivavae (Vavitao) Island, Austral Islands, December 2, 1934. Mr. Crocker secured three examples of this "Soldier bug".

Family COREIDAE

Liorhyssus hyalinus Fabricius

South side of Rurutu Island, Austral Islands, November 28, 1934, one example. This is practically a cosmopolitan species occurring throughout the southern Palearctic and Nearctic Regions as well as in the tropics of Asia, Africa and America and in the islands of the south Pacific.

Family LYGAEIDAE

Paromius pallens Montrouzier

Rikitea, Mangareva (Gambier) Island, December 16, 1934, 13 examples; south side of Rurutu Island, November 28, 1934, and Raivavae Island, Austral Islands, December 2, 1934, one example; Pitcairn Island, December 23, 1934, one example. A species of the South Pacific Islands.

***Orthaea ventralis* China**

Rurutu Island, south side, November 28, 1934, four adults and one nymph. Described from the Samoan Islands. These agree in every particular with Mr. China's description. They greatly extend the range of the species.

***Orthaea pacifica* Stål**

Rikitea, Mangareva Island, December 16, 1934, nine examples; south side of Rurutu Island, November 28, 1934, eleven examples; Pitcairn Island, December 31, 1934, eleven examples. This species is more clearly marked and quite distinct from *vincta* Say, a species that seems to have found its way into the Hawaiian Islands. *O. pacifica* is widely distributed in Oceanica.

***Nysius marginalis* Dallas**

Indefatigable Island, March 16-20, 1935, six examples. It seems to be peculiar to the Galapagos Islands.

***Nysius baeckstroemi* Bergroth**

Mas-a-Fuella Island, Juan Fernandez Islands, Chile, January 20, 1935, two specimens. This interesting species was described by Dr. Bergroth in 1923 from material taken by the Skottsberg Expedition to these Islands (Nat. Hist. Juan Fernandez Is., III, p. 395.)

Family NABIDAE***Nabis capsiformis* Germar**

Rikitea, Mangareva Island, December 2, 1934, seven specimens; Rapa Island, December 7, 1934, nine examples; Rimatara Island, Austral Islands, November 25, 1934, one example; Virgin Bay, Futa Hiva, Marquesas Islands, October 8, 1934; Raivavae Island, December 2, 1934, seven examples; Easter Island, January 15, 1935, six examples; Pitcairn Island, December 31, 1934, twenty-eight examples. This cosmopolitan species seems to have been common on the islands of the south Pacific visited by Mr. Crocker. Many immature individuals were taken with the adults. It inhabits the more open coastal areas of the islands.

***Nabis punctipennis* Blanchard**

Mas-a-Fuella Island, Juan Fernandez Islands, Chile, January 30, 1935, two adults and two young. This insect occurs also in continental Chile and in Argentina.

Family REDUVIIDAE

Ploiaria dohrni Signoret

Juan Fernandez Islands, Chile, January 31, 1935, one example.

Repipta annulipes Barber

Indefatigable Island, March 22, 1935, one example. This individual was taken at Conway Bay by Mr. Crocker. Mr. Willows took another on the same island on Mr. Crocker's 1932 expedition.

Family MIRIDAE

Creontiades fuscus Barber

Indefatigable Island, March 22, 1935, five examples from Conway Bay. Apparently precinctive. A very distinct species.

Creontiades insularis Poppius

South side of Rurutu Island, Austral Islands, November 28, 1934, two females; Rikitea, Mangareva Island, December 16, 1934, one female; Pitcairn Island, December 31, 1934, six males.

The males are more deeply colored than the females and have the clavus more or less infuscated. Other specimens were taken at Virgin Bay, Futa Hiva, Marquesas Islands, October 21, 1934, seven examples; Taipa Bay, Nuku Hiva, Marquesas Islands, October 8, 1934, three examples.

This fine series of nineteen specimens is of much interest from the distributional standpoint. Poppius described this species from a single damaged female from New Caledonia. The present series extends its range eastward through the Austral, Mangareva and Marquesas groups to Pitcairn. Mr. Crocker did not secure this species on Easter Island, so it is possible that Pitcairn Island represents about the eastern extension of its range. Toward the west it is found as far as the Solomons where he secured specimens on his expedition of 1933. On the expedition of the California Academy of Sciences to the Gulf of California in 1921 I found an allied American species, *C. femoralis* Van Duzee, on *Salicornia*, a salt marsh plant growing along the shores of a number of the islands in the Gulf of California, and it is not unlikely that *C. insularis* has similar habits which may account for its wide distribution.

Creontiades willowsi Van Duzee

Indefatigable Island, March 28, 1934, one female. This specimen is somewhat immature and does not show the point at base of the hind tibiae, but it has the same exceptionally prominent tylus, not

found in *insularis*, and wants the obscure dark irrorations of that species. *C. willowsi* can readily be distinguished from *femoralis* by the less protuberant front. The black point at the base of the hind tibiae is present in all fully pigmented examples of *femoralis* known to me.

The references for these species are:

insularis Poppius, Of. Finska Vet.-Förh., LIII, Afd. A, No. 3, p. 1, 1911.

femoralis Van Duzee, Trans. San Diego Soc. Nat. Hist., II, p. 19, 1914.

willowsi Van Duzee, Proc. Calif. Acad. Sci., (Ser. 4), XXI, p. 28, 1933.

Engytatus geniculatus Reuter

Academy Bay, Indefatigable Island, March 24, 1935, four males; Chinche Island, Peru, one male. This widely distributed American insect has recently been introduced into the Hawaiian Islands where it is doing some damage to the tomato crop.

Poeciloscytus insularis Van Duzee, new species

Aspect of *Lygus rubicundus* Fallén. Ovate, castaneous brown, closely pale pubescent, elytra indistinctly mottled or irrorate with pale spots on which the vestiture is closer; apex of corium and inner margin of clavus more or less red, the tip of the cuneus black; membrane maculate; tibial spines black. Length 4 mm.

Head two-thirds as wide as humeral width of pronotum, eyes large, vertical, their height, as viewed from the side, twice their width, overlapping the anterior pronotal angles; face broad, smooth, the clypeus and cheeks tumidly convex. Antennae long, slender, reaching to tip of cuneus; segments as 11:34:20:11. Rostrum attaining apex of hind coxae, segment I only thickened. Pronotum closely, obsoletely punctured, hind margins evenly feebly arcuate, not at all emarginate medianly. Scutellum scarcely broader than long, somewhat convex. Elytra obsoletely chagreened, the costa scarcely arcuate.

Color castaneous brown becoming more yellowish on the head, pronotum anteriorly, apex of scutellum, antennae, legs and beneath; costal area and much of cuneus paler and subhyaline; extreme tip of antennals I, II, and III and all of IV embrowned; apex of corium and base of cuneus more or less sanguineous, extreme tip of the latter blackish; tip of rostrum, tibial spines and a dot at their base black; a cloud on the metasternum and sometimes one on the metapleurae infuscated. Vestiture pale, rather long and dense on the elytra where it is segregated into paler maculations. Membrane faintly smoky hyaline except the apex of the areoles and two large spots beyond, veins pale; venter sometimes showing a mottling of sanguineous; femora with a broad area of brownish or sanguineous, of variable extent, before their apex.

Holotype: female, No. 4153, Mus. Calif. Acad. Sci., Ent., and six female *paratypes*, taken by Mr. Crocker on **Pitcairn Island**, December 31, 1934. This insect has much the aspect of *Lygus rubicundus* but the eyes are broader, the pronotum is not distinctly punctate and the antennae are much longer and more slender. It is now placed provisionally in *Poeciloscytus*. A single male and

one female labeled "south side of Rurutu Island, November 28, 1934" probably belong here but more material is needed to decide this point.

Poeciloscytus modestus (Blanchard)

Mas-a-Fuella Island, Juan Fernandez Islands, January 30, 1935, one male, two females. The females agree well with the Blanchard description except that the scutellum is transversely rugose rather than punctate and the punctation of the pronotum is very close and fine, giving a shagreened effect. One female is 4 mm. long; the head above, pronotum and sides of the scutellum are deep piceous, almost black; the slender margin of the vertex, a median longitudinal line on the vertex, sides of the clypeus and the cheeks and a longitudinal vitta on anterior lobe of the pronotum, not attaining the anterior margin, yellowish; base of antennal I, and base and apex of II piceous; cuneus red, a basal lunule and the narrow inner edge and tip whitish, the extreme inner angle black; membrane fuscous, veins whitish; legs pale, the hind femora piceous, tibial spines and apex of tarsi black; anterior and intermediate femora and coxae marked with brown. The second female differs only in being smaller and in wanting the pale basal edge to the vertex, and the antennae are a shade darker. The male is deep black instead of piceous, without the pale marks on the head and pronotum, and only the tip of the scutellum is yellow. In the larger female the slender hind edge of the pronotum is pale. These differences are not greater than we find in our related North American species and I have little doubt but the present material pertains to Blanchard's species.

Poeciloscytus sp.

Conway Bay, Indefatigable Island, March 16, 1935, one specimen that I have not been able to identify to my satisfaction.

Mr. Barber in his paper on the Heteroptera of the Galapagos Islands (Medd. Zool. Mus., Oslo, No. 42, p. 288, 1934) places my *Poeciloscytus vegatus* in the genus *Polymerus*, evidently following Poppius and some others in uniting these genera. I still consider them distinct. The short rostrum, opaque surface and general habitus, it seems to me, are quite sufficient for generic distinction. There may be annectant species but so there are between many of our accepted genera. I can see nothing to be gained in uniting them.

Europiella mella Van Duzee, new species

Minute, ovate, croceus; elytra honey-yellow, membrane smoky with the areoles hyaline, beneath pale yellowish with the pleurae croceous; impunctate, clothed with deciduous scale-like hairs. Length 2 mm.

Head vertical, clypeus prominent below, its basal suture distinct, placed above the line of the antennal scrobes. Antennae rather stout; segment I scarcely attaining apex of clypeus; II as long as head and pronotum together, a little thicker apically; III and IV together a little shorter than II. Prosternal xyphus subtuberculate. Rostrum attaining intermediate coxae. Pronotum trapezoidal, nearly twice as wide as long, humeri sharply rounded. Scutellum scarcely wider than long. Elytra broad, costa feebly arcuate, disk of corium subhyaline; membranaral veins concolorous.

Color more or less croceous; legs and abdomen pale yellowish; the elytra honey-yellow; membrane smoky, the areoles hyaline; femora unspotted, sometimes somewhat infuscated; tibial bristles, extreme apex of tibiae and the tarsal claws black; antennae dusky yellowish.

Holotype: male No. 4154, and *allotype*, female No. 4155, Mus. Calif. Acad. Sci., Ent., secured by Mr. Crocker at **Conway Bay, Indefatigable Island**, March 16 (type) and 22nd, 1935. This is a very small ruddy species of much interest in extending the distribution of this genus of inconspicuous mirids well to the South.

Family GERRIDAE

Halobates robustus Barber

Academy Bay, Indefatigable Island, March 24, 1935, two examples. Mr. Barber's types were taken by the Williams Galapagos Expedition at Conway Bay, on the same island.

HOMOPTERA

Family CICADIDAE

Tettigades chilensis Amyot and Serville

Southern Chile. Mr. Crocker brought back four specimens of this interesting species that were presented to him by a Chilean entomologist. They made a valued addition to the Academy collection.

Family FULGORIDAE

Oliarus galapagensis Van Duzee

This species was founded upon a unique female secured by Mr. Crocker on his 1932 expedition. The present material contains two males, taken at Conway Bay, Indefatigable Island, March 16, 1935, that make possible the definite placing of the species. It is very close to *franciscanus* Stål, a species that is common throughout California. However it is definitely darker in color with the elytral venation heavier, the vertex is more produced before the eyes and the basal segment of the hind tarsi is longer.

The genital characters of the male are somewhat similar but the median tooth of the pygofer is shorter and the plates are longer with their rounded apex much broader.

***Nymphocixia unipunctata* Van Duzee**

This interesting fulgorid was described by me (Proc. Calif. Acad. Sci., Ser. 4, XII, p. 189, 1923) from a series taken on Espiritu Santo Island, Gulf of California. I beat them from Mangroves (*Avicennia nitida*) that were growing along the shore and were partially submerged by the high tides. In the Galapagos another species of *Avicennia* (*officinalis*) grows along the shores of many of the islands and it is quite possible that it was from these that Mr. Crocker secured the present material. The records of the Crocker material are: Tagus Cove, Albemarle Island, March 10, 1935, 10 examples; Elizabeth Bay, Albemarle Island, March 9, 1935, and Conway Bay, Indefatigable Island, March 23, 1935, one each.

***Philatis cinerea* Osborn**

Tower Island, Galapagos Islands, March 25, 1935, seven examples. For description see Zoologica, VI, p. 78, 1924.

This genus was founded by Stål in 1862 (Rio Janeiro Hemip., II, p. 68) with *Mycterodus productus* Stål as type.

***Philatis productus* Stål**

Conway Bay, March 16, and Academy Bay, March 24, 1935, Indefatigable Island, three examples.

***Philatis major* Osborn**

With the preceding species, eleven examples.

***Euthiscia crockeri* Van Duzee, new species**

Size and aspect of *tuberculata* Van Duzee, from Lower California, but without the six dorsal tubercles and with less expanded elytra. Length 3.5-4 mm.

Head produced, horizontal, its length is to its width between the eyes as 14:21; vertex flat, median line carinate basally, its surface feebly transversely rugose; sides acute, slightly sinuate before the eyes. Front smooth, sparsely clothed with short hairs, a median carina feebly indicated, the produced apex subterete, beneath with obscure transverse rugae; sides parallel from eyes to antennae. Rostrum attaining hind coxae. Pronotum acutely produced to the middle line of the eyes, slightly broadly excavated behind. Scutellum excavated medianly and at basal angles, leaving a slightly oblique carina and the apex elevated; the median

line impressed. Elytra ovate, one fourth longer than wide, sinuate dorsally; a median bulla at basal fourth; costal area narrower than in *tuberculata*; longitudinal veins heavy, the reticulations weaker; inner area of corium with four whitish transverse veins. Tibiae unarmed. Last ventral segment of female with a semicircular sinus. In *tuberculata* this sinus is broad and shallow with the edge of the fundus thickened medianly, while in *signata*, the type species, the hind margin is produced in a large bifid tooth.

Color yellowish brown varied with darker, the elytra more fuscous toward the apex; front and legs more brownish.

Holotype: female, No. 4156, Mus. Calif. Acad. Sci., Ent., and one female *paratype*, secured by Mr. Crocker at **Academy Bay, Indefatigable Island**, March 24, 1935. It affords me pleasure to name this interesting species after its discoverer.

I took *tuberculata* on *Sideroxylon*, but as no closely related plant has been reported from the Galapagos Islands it is quite possible that the record from the islands of the Gulf of California may represent an accidental capture of a specimen that had gotten on *Sideroxylon* from some adjacent plant. As genus *Euthiscia* is virtually wingless it could not have flown there.

Tylana intrusa Melichar

Raivavae Island, Austral Islands, December 2, 1934, two females; Pitcairn Island, December 3, 1934, one male. These agree in all essential particulars with Melichar's description, but seem to be less highly colored. In the females the elytral veins are concolorous, in the male blackish; the brown marking either side of the pale discal spot of the elytra is feebly indicated in the females and is almost obsolete in the male, while in both sexes the black punctures on the face are absent, or are indicated only by scattering fuscous punctures on the lateral compartments of the front. These differences are in degree of pigmentation and are hardly of specific value. The distribution shown here is not unusual. The type locality of *intrusa* is about as far from the Austral Islands as those are from Pitcairn where Mr. Crocker took the male. It evidently is widely distributed in Polynesia.

Sogata placita Van Duzee, new species

Aspect of *furcifer* Horv. (*albolineosa* Fowler); black with a broad white median vitta on vertex, pro- and mesonotum, which is slenderly continued on the claval commissure; Legs pale. Length to tip of elytra 3 mm.

Macropterous male: vertex one fifth longer than its basal width, very slightly wider at base, extending one third its length beyond the eyes; carinae rather low and flat over the apex; front narrow, sides feebly arcuate from near the base; median carina of front and clypeus low and heavy, pale. Basal segment of antennae longer than wide, II about twice the length of I and much thicker. Pronotum a

third wider than head; median carina strong; lateral straight, nearly attaining the feebly emarginate hind margin well laterad of the scutellar carinae. Mesonotum tricarinate, the lateral carinae but slightly divergent posteriorly. Elytra exceeding the abdomen by one third their length; veins distinctly granulate. Hind tibiae bispinose, one basal the other medial; spur cultrate, moderately tectiform, its lower margin closely set with minute black-tipped teeth. Male stiles slender, approximate at base, but very feebly curved toward their base, nearly attaining the anal tube.

Color blackish fuscous; a broad dorsal vitta covering the vertex and median area of pro- and mesonotum between the carinae, a slender sutural line on basal two thirds of the clavus and the hind legs, ivory white; anterior and intermediate legs, rostrum, median carina of the front and clypeus, antennal II and extreme tip of I pale ochraceous, the metapleura in part white. Elytra with a whitish area covering most of the first three apical cells and the stigma.

Holotype: male, No. 4157, Mus. Calif. Acad. Sci., Ent., taken by Mr. Crocker on **Rapa Island, Austral Islands**, December 7, 1934. One male *paratype* was secured by Mr. Crocker on **Pitcairn Island**, December 3, 1934.

I am placing this insect in genus *Sogata* on account of its produced vertex and its close relationship with *furcifer* (= *albolineosa* Fowler). I wish to call attention here to the fact that Mr. Muir followed Kirkaldy in refusing to accept the statement by Stål that his genus *Liburnia* was the genus "*Delphax* of authors". Its type is not one of the species included by Stål in his Hemiptera Africana (IV, p. 179), a work devoted to the African fauna. I have gone fully into this matter in the Bulletin of the Buffalo Society of Natural Sciences, X, p. 504, 1912, and will not repeat it here. Whether we should sink *Liburnia* as a synonym of *Delphacodes* Fieber is another matter, but as Fieber sank his *Delphacodes* as a synonym of *Liburnia* in 1872 in his Catalogue, and again in his monograph of 1879, we may feel fairly certain that Stål's name had priority. The entomologists of those days were not more anxious, as an act of courtesy, to sink their own genera to one published later, than they are today.

Liburnia spp.

In this material there are females of three species of *Liburnia* and a male of another but their condition will not allow of definite determination. Mr. Crocker also secured a female of another large and interesting delphacid at Virgin Bay, Fatu Hiva, October 21, 1934, but I have found it difficult to place it without more material.

Family CERCOPIDAE

Lallemandia fenestrata rapana Lallemand

Lallemand, Ann. Mag. Nat. Hist., Ser. 10, I, p. 634, 1928

China, Bishop Mus., Bul. 113, p. 47, 1935

Rapa Island, Austral Islands, December 7, 1934, 11 males, 1 female, the latter somewhat teneral.

Mr. W. E. China very properly establishes a new genus for *Clovio fenestrata* (Fabricius) and its allied forms from Polynesia. Some of the present specimens have the black basal vitta on the vertex weakened or almost interrupted at the center between the ocelli, while one has it continued as a narrow median line to the transverse suture. The anterior edge may have a slender fuscous or black line from the eyes to the ocelli or it may be wanting.

Lallemandia crockeri Van Duzee, new species

Aspect of *fenestrata*, but apparently specifically distinct; elytra mostly coriaceous, the nervures obsolete in the black areas, nearly so in the pale, propleurae produced in a ligulate process each side of the anterior acetabulae; above black, most of the vertex, an irregular median band on the pronotum, scutellum and clavus ochre yellow, as is the lower surface; costal margin pale. Length 9 mm to tip of elytra.

Vertex flat, longer than in *fenestrata*, longer than the width between the eyes (28:21); distance between the ocelli greater than that to the eyes; carinate sides of the pronotum two-thirds the greatest length of the eyes; front more convexly prominent than in *fenestrata*; elytral nervures obsolete or hardly traceable on the whitish subapical costal spot.

Color pale ochraceous; sometimes with a slender marginal line above the antennal scrobes and a basal spot of variable size either side of the ocelli, black; pronotum, except a median vitta widened posteriorly, and the slender edges of the scutellum, black; elytra black medianly, the commissural margin with a broad pale yellowish vitta to the end of the clavus where it is slightly produced as a whitish mark on the corium, the commissural nervure slenderly black; costal margin broadly pale, connecting with an oval whitish subapical costal spot about as in *fenestrata rapana*; abdomen black, the segments edged with pale; apex of rostrum and the tarsal claws black; metapleura more or less infuscated; wings faintly smoky, especially apically; sides of pronotum inferiorly black behind the eyes. Whole upper surface closely punctate and clothed with short appressed golden hairs.

Holotype: male, No. 4158, and *allotype*, female, No. 4159, Mus. Calif. Acad. Sci., Ent., secured by Mr. Crocker at **Raivavae Island, Austral Islands**, December 2, 1934, and one male *paratype*, same date. This island sometimes is called Vavitao Island. This is a most interesting addition to the Polynesian cercopid fauna. The specific name is given in recognition of the important contributions Mr. Crocker has made to our knowledge of the insect fauna of the islands of the south Pacific.

Family CICADELLIDAE

Agallia mera Van Duzee, new species

Size and aspect of *sinuata* Mulsant and Rey, but with the veins of the corium pale and obsolescent; creamy white; two large spots on the vertex and two on the pronotum black; disk of the elytra milky with two vittae on the clavus and the claval suture fuscous. Length 4 mm.

Female: head obviously wider than the pronotum; anterior and posterior margins parallel. Pronotum almost twice as wide as long, very minutely shagreened; hind margin feebly emarginate. Scutellum short as in *sinuata*, the incised line but feebly impressed. Elytra nearly three times as long as their combined width when folded. Last ventral segment broadly feebly emarginate, the hind edge broadly lobed either side, oviduct much exceeding the pygofer.

Color pale creamy yellowish with a slightly dusky median cloud on the vertex and apical two thirds of pronotum; two large round dots on vertex, wider apart than are the ocelli, and a pair of larger ones near basal margin of pronotum; scutellum immaculate; clavus with adjacent margin and base of corium milky opaque, the rest of the corium hyaline; two longitudinal vittae on the clavus and a narrower one on the corium near the claval suture ferruginous brown; beneath with the tergum and legs uniformly pale, only the front tinged with cream yellow; tarsal claws black; ovipositor pale fulvescent.

Holotype: a unique female, No. 4160, Mus. Calif. Acad. Sci. Ent., taken by Mr. Crocker at **Conway Bay, Indefatigable Island**, Galapagos Islands, March 15, 1935. It is a little larger and paler than the European *sinuata* and wants the black tergum, the black dot below the eye, and the heavy fuscous corial veins of that species.

This insect runs to genus *Agallia* (sensu strict.) in the Oman key of 1933, but, wanting the male, it is impossible to place it more accurately. However a careful reading of the description of all the species not known to me, with the help of Mr. Oman's excellent figures, convinces me that it is new. The above comparison with *sinuata* will help to place it. Among our American species it seems to be nearest to *modesta* Osborn & Ball.

Platymetopius retusus Van Duzee, new species

Short, stout, with a blunt vertex, dull fulvous brown with a large fuscous mark at base and a smaller one at apex of the clavus, apex of the corium with a blackish cloud. Length 3.5 mm.

Male: head scarcely as wide as pronotum; vertex about as long as its width between the eyes at narrowest point; apex rounded-subangulate, its median length but little more than that next the eye (7:5); median impressed line distinct; front strongly convex, subparallel, a little widened at base and narrowed from basal angle of lorae to clypeus; clypeus nearly parallel, outer margin of cheeks but slightly sinuate below the eyes. Pronotum short, its width twice its length, the humeral angles obviously alate, base nearly rectilinear. Scutellum about one-half as long as its basal width. Elytra short, their width singly nearly one third their length;

about ten oblique veins in costal area; two cross veins in cell. Valve long, rounded at apex; plates exceeding valve by about the length of the valve, their apex obtuse, their sides scarcely sinuate and closely armed with stout spines.

Color dull fulvous brown, paler on base and apex of vertex and on inner angle and part of costal area; face minutely irrorate with darker brown, pale at base and apex; vertex pale at apex and on basal margin, incised median line dark; pronotum darker anteriorly, median line and lateral angles paler; scutellum pale yellow, the base interruptedly fuscous; elytra with a large fuscous commissural area broken by a pale band before the apex and enclosing a round pale spot a little before the pale band; corium faintly vermiculate; costal reflexed veins heavy; inner apical areole pale, carrying a sagitate fuscous mark at apex, the adjoining areole fuscous with a large white central area, third areole fuscous with a round white dot at base and a yellowish marginal line; fourth areole soiled white next the stigmal area, the three anteapical areoles each with a round white dot at apex; appendix with a black point at tip of clavus; beneath fuscous, the connexivum, genital segments and legs pale.

Holotype: No. 4161, Mus. Calif. Acad. Sci. Ent., a unique male, taken by Mr. Crocker at **Conway Bay, Indefatigable Island**, March 16, 1935. This species might be placed in Ball's subgenus *Convelinus* but it wants the "shark's mouth" pale vitta on base of front. It has the shortest vertex of any *Platymetopius* known to me.

***Jassus infestus* Van Duzee, new species**

Apparently allied to *galapagoensis* but differing in proportions of head and in genitalic characters. Length 8 mm.

Female: vertex as long as its width at inner angle of eye; median line and a point either side dusky; anteriorly broadly rounded; ocelli a little farther apart than their distance from the eyes (5:3); front above the antennae four times as wide as the tempora (14:3), twice as wide as at the ocelli, the median carina nearly obsolete; clypeus nearly one half longer than its apical width, abruptly expanded at apex of lorae, its apical margin sinuate; cheeks longitudinally wrinkled exterior to line of the lorae. Pronotum but little longer than the superior aspect of the head, feebly sinuate behind, granulate to near the hind margin. Apical lamina on inner margin of hind femora about half as wide as long, the basal segment of its tarsi a little longer than the apical. Last ventral segment strongly produced, extending about one third its length beyond the lateral angles, and emarginate-sinuate at median line.

Color pale yellowish; a brown line on base of vertex, slender margin of front below the antennae and of the base of the clypeus, black. Pronotum black above, yellow inferiorly, with a black spot against the eye and a broken croceous vitta behind base of vertex, the hind margin touched with the same color; scutellum croceous, the lateral angles and two median dots black; elytra dusky hyaline with the veins and a broad longitudinal vitta blackish; beneath pale, sternum, disk of the pectoral pieces and of the oviduct and the sides of the pygofer piceous; tips of the tibiae and tarsi rufo-piceous.

Holotype: a unique female, No. 4162, Mus. Calif. Acad. Sci. Ent., was secured by Mr. Crocker at **Academy Bay, Indefatigable Island**, March 24, 1935.

Professor Osborn has described *Jassus galapagoensis* from the opposite side of the same island but he says that the last ventral

segment of the female is scarcely produced posteriorly and but feebly sinuate while the present species has this segment strongly produced and deeply notched on the median line. It also differs in proportions and color. It seems best to consider it a distinct species.

Eugnathodus juvenus Van Duzee, new species

Closely allied to *hebe* Kirkaldy, paler, with the tergum scarcely touched with black and with different male genital characters. Length 3 mm. to tip of elytra.

Vertex evenly rounded before, with the anterior and posterior margins parallel; front flatter and broader below than in *hebe*. Valve of male longer and more obtuse at apex than in *hebe*, plates broader, but little narrowed to the obtusely rounded apex. In *hebe* the plates are more narrowed to their apex where they are produced in finger-like processes about as long as the sutural margin of the plates are produced beyond the valve; the sides also are armed with longer and stouter spines in *hebe*, in both species these are five in number.

Color very pale yellow, the elytra almost hyaline with the veins yellowish; wings more yellowish hyaline with deeper yellow veins, the apex slightly infuscated in the *Mangareva* female.

Holotype: male No. 4163, Mus. Calif. Acad. Sci. Ent., secured by Mr. Crocker on the south side of **Rurutu Island, Austral Islands**, November 28, 1934. One female taken December 7, 1934, on **Rapa Island** I designate as a *paratype*. It has the last ventral segment truncate but marked with a median triangular somewhat infuscated area. Another female taken on Rikitea, Mangareva Island, December 16, 1934, is a little larger with the dorsal surface of the abdomen touched with black at the base.

My comparison with *hebe* is made from a topotype from the Fiji Islands received by me from Mr. Kirkaldy at the time he published the description, and three others taken by Mr. Koebele at the same time and place, and presented by Mr. Muir with his determination. Professor Osborn's figure of the male genital plate does not show the very distinct spine-like apices and the long marginal setae and may represent a distinct species. The male plates of *juvenus* are shaped about as shown in Professor Osborn's figure of *areolata*, but the species are quite distinct.

In the Ohio Jl. Sci., xxxiii, p. 55, 1933, Mr. DeLong states that he has examined the type of my *Gnathodus abdominalis* and found it to be the same as my *Gnathodus impictus* studied by me at the same time and published on the same page. I well remember my work on these species. Prof. Baker's specimens on which he founded his genus *Eugnathodus* were determined by me and were compared with my type of *abdominalis*. There never before has been any question as to the identity of this species and it is very evident that the type

has become mixed, either in shipment or at some later date. My description of *abdominalis* calls for a species with a brown tergum and three fulvous lines on the pronotum and scutellum, also the color of the elytra and wings must differ. At that time I was much too familiar with this group of Jassids to describe the same species as two. The synonymy will stand as follows:

Eugnathodus Baker, Invertebrata Pacifica, I, p. 1, 1903.

Agellus DeLong and Davidson, Ohio Jl. Sci., xxxiii, p. 210, 1933.

Eugnathodus abdominalis (Van Duzee), Can. Ent., xxiv, p. 113, 1892 (*Gnathodus*).

neglectus DeLong and Davidson, Ohio Jl. Sci., xxxiii, p. 55, 1933.

Family CHERMIDAE

Mesohomotoma hibisci Froggatt

Rapa, Austral Islands, December 7, 1934, seven examples; south side of Rurutu, Australs, November 28, 1934, seven examples; Raivavae, Australs, December 2, 1934, one example; Rikitea Island, Mangarevas, December 16, 1934, one example.

Mr. Koebele took this species on New Caledonia and the Fiji Islands and Aulmann reports it from Queensland, Australia; it seems to be widely distributed in Oceanica. Froggatt reports it as very abundant on *Hibiscus tiliaceus*.

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**THE TEMPLETON CROCKER EXPEDITION OF THE
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No. 34**

REPORT ON THE SARGASSUMS

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The Sargassums of the Templeton Crocker Expedition of 1932, on the yacht *Zaca*, collected chiefly by John Thomas Howell, assist most materially in rounding out our knowledge not only of the species of this considerable and complicated group, but also of their morphological and distributional relations. The collections of marine algae of the expedition extending from Guadalupe Island on the north to the Galapagos Islands on the south, are both extensive and numerous, and this is particularly to be mentioned, since the plant collector was primarily concerned with the spermatophytic land flora.

The Sargassums of the Pacific coasts of both North and South America, and particularly of the latter, are still far from being well known. The first species of the genus to be credited to this extended area were from the coasts of Chile and were collected by D'Urville, of the corvette *La Coquille* on her voyage around the world during the years 1822 to 1825. In the botany of this voyage (pp. 119-131, published Feb. 1828), Bory de Saint Vincent enumerated and described all the Sargassums collected during the voyage and referred

specimens collected at Concepcion, Chile, to some five separate species, to which he assigned the following names:

- S. pacificum* Bory
- S. Esperi* C. Ag.
- S. granuliferum* C. Ag.
- S. acinaria* (Turn.) C. Ag.
- S. compactum* Bory

J. G. Agardh, in 1847 (Nya Alger från Mexico, p. 8), named some specimens collected at St. Augustin, on the Pacific Coast of Mexico, "*S. Liebmanni*," after their collector. In 1876, Farlow (List Mar. Alg.U.S., p. 16) listed two species from western North America, under the names:

- S. Agardhianum* Farlow mscr. (San Diego, California)
- S. piluliferum* (Turn.) C. Ag. (Guadalupe Is., Mexico)

In 1886, Grunow contributed to Antonio Piccone's account of the algae of the Vettor Pisani an enumeration of the Sargassums and listed or described and figured the following species from the Galapagos Islands:

- S. galapagense* Grun.
- S.* " var. *setifolia* Grun.
- S. lendigerum* var. *foliosa* Grun.
- S.* " " " f. *subdelicatula* Grun.
- S.* " " " f. *rigidiuscula* Grun.
- S.* " " *furcifolia* Grun.
- S.* " " " f. *denticula* Grun.

In 1914, Marshall A. Howe (Mar. Alg. Peru, pp. 66, 67, pl. 25) treated of one species, the *S. pacificum* Bory, found among Coker's Peruvian specimens.

In 1915-1916, there was published, posthumously, the "Addimenta ad cognitionem Sargassorum" of Grunow, and the following species are credited to the west coasts of the two Americas:

- S. Palmeri* Grun.
- S. Liebmannii* J. Ag.
- S. Agardhianum* Farl.
- S. ilicifolium* var. *compacta* (Bory) Grun.
- S. oocyste* J. Ag.
- S. pacificum* Bory.
- S. ambiguum* var. *americana* (Sonder) Grun.
- S. filiforme* var.? *chilensis* Grun.
- S. cymosum* var. *foliosa* Grun.
- S.* " " " f. *subdelicatula* Grun.
- S.* " " " f. *rigidiuscula* Grun.
- S.* " " *furcifolia* Grun.
- S.* " " " f. *denticulata* Grun.
- S. divaricatum* var.? *chilensis* Grun.
- S. galapagense* Grun.
- S.* " var. *setifolia* Grun.
- S. fuliginosum* var. *californica* Grun.

From Grunow's revision, there are seemingly between twelve and seventeen more or less distinct species, varieties, or forms to be looked for on the Pacific coasts of North and South America.

In 1924, however, Setchell and Gardner (Proc. Calif. Acad. Sci., ser. 4, 12 (29): 731-740, 20 figs.) found among the remarkably extensive collections made in the Gulf of California by Ivan M. Johnston during the 1921 expedition of the California Academy of Sciences, some 15 species or varieties of *Sargassum*, all of which still remain seemingly distinctive of, as well as endemic to, the Gulf of California, thus indicating what is borne out by the remaining marine flora of this body of water, that it forms a "pocket" of more than ordinary distributional interest. At the close of their account, Setchell and Gardner (*loc. cit.*, 739, 740) gave a synoptical list of nineteen species or varieties known from the Pacific Coast of North America. Besides the two species of the outer coast, *S. Liebmannii* J. Ag. and *S. Palmeri* Grun., there was added *S. paniculatum* J. Ag. This last species, which was based on a determination of Th. Reinbold, seems clearly distinct from the *S. paniculatum* J. Ag. and is probably the "*S. fuliginosum* var. ? *californica* Grun." Since, however, it seems equally distinct, primarily on account of its habit and apiculate vesicles, from true *S. fuliginosum* Kuetz., actually to be regarded as a variety of *S. Henslowianum* C. Ag., it may be placed under a new combination, as follows:

***Sargassum californicum* (Grun.) comb. nov.**

Sargassum paniculatum Setchell and Gardner, Proc. Calif. Acad. Sci., ser. 4, 12: 740, 1924, and Univ. Calif. Pub. Bot., 8 (3): 721, pl. 46, fig. 5, 1925 (non *S. paniculatum* J. Ag.). *S. fuliginosum* var. *californica* Grunow, Verh. k. k. zool.-bot. Gesell., Wien. 66: 173, 1916 (non *S. fuliginosum* Kuetz.).

In 1925, Setchell and Gardner (Univ. Calif. Pub. Bot., 8 (3): 711-721, pl. 39, fig. 46; pl. 41, fig. 55, 56; pl. 45, fig. 81; pl. 46, fig. 5; pl. 92 and pl. 94), in descriptions, figures, and key, attempted to include all information accumulated up until that time on the Sargassums of the Pacific Coast of North America.

The *Zaca* collections of Sargassums made chiefly by John Thomas Howell, as are those of the remaining marine flora, are extraordinarily ample. Those taken on, or adjacent to, the North American coast include three species, one of which seems to be undescribed, while those which were collected from the Galapagos Islands represent five species of South American affinities. The full collections from the Galapagos have presented difficulties of determination both of themselves, and because of the lack of access to the scattered authentic specimens of species already described from South Amer-

ica, for comparison. It seems best, because of the distinctness of each of the two assemblages, to describe the more northern group first and then the more southern, the Galapagos group.

NORTHERN SPECIES

Of the northern American group of Pacific Coast Sargassums, *S. Agardhianum* Farlow was not collected by the Templeton Crocker Expedition nor did it occur among the rather considerable collections of 1921 from the Gulf of California. It seems to be a subtropical species, confined, so far as present information goes, to the coasts of southern California and the immediately adjacent outer coast of Mexico (Ensenada, Mexico!). Nor were there any specimens of *S. californicum* (Grun.) Setchell, even in the collections from Guadalupe Island, where it is known to occur, although possibly in no great abundance. Three species, however, were collected in the northern waters: *S. Palmeri* Grun., *S. Liebmannii* J. Ag., and a species which it seems best to describe as new, thus making five species of *Sargassum*, presumably confined to the *outer* Pacific coasts of North America, with two, possibly three, of the species more subtropical and the other two more truly tropical.

1. *Sargassum Liebmannii* J. Ag. (orthogr. emend.)

Plate 28, figures 1-3

"*Sargassum Liebmannii*" J. G. Agardh, Nya Alger från Mexico, in Oefvers. af Kongl. Sv. Akad. Handl., no. 1: 8, 1847, Spec. Alg., 1: 326, 1848, Spec. Sarg. Austral., 91, pl. V, 1889; De Toni, Syll. Alg., 3: 52, 1895; Grunow, Add. Cog. Sarg., 1: 398, 1915 (with var. *nicoyana* Grun.); Setchell and Gardner, Proc. Calif. Acad. Sci., ser. 4, 12: 74, 1924, Univ. Calif. Pub. Bot., 8(3): 716, pl. 45, fig. 81, 1925.

Carpacanthus Liebmanni Kuetzing, Spec. Alg., 624, 1849, Tab. Phyc., 11: 13, pl. 41, 1861.

The attachment is an irregular disk, from which arises a rather stout primary axis (up to about 1-1.5 cm. in height) which is cylindrical, but with knobs representing the bases of the fallen spirally arranged primary branches. The primary branches vary in number, length and elongation of internode, presumably according to the habitat. They may reach a length of at least 45-50 cm., with internodes up to 1.5-4 cm. long below, cylindrical and smooth, although often twisted and seemingly angulate in dried specimens. The branchlets and leaves are alternate and approximately two-ranked. The leaves vary much in length and texture, according to habitat and possibly also according to the sex-dominance of the plant bearing them. The leaves in general have distinct but usually very short petioles, vary in length up to about 4 cm., and in width up to from 4-6 mm.; their general shape is broadly to oblong lanceolate, the

tip from rounded to sharply acuminate, the margins undulate to crispate, repandly spinose denticulate, and the whole leaf may be from twisted and crisped to almost flat. The costa is almost but usually not completely percurrent and rather heavy in the lower portion. The leaves of the type specimen (see pl. 28, fig. 3) are, seemingly, entirely devoid of cryptostomata and firm in texture, but the *Zaca* material shows few to fairly frequent cryptostomata, most abundant in the thinner leaves of antheridial plants and few and irregularly spaced in the thicker leaves of the oogonial plants. The vesicles are usually sparse, or even lacking in some specimens, but in some they are abundant. They are nearly spherical, with simple or compound, sharper or blunter apiculi, occasionally bicornute or even very rarely foliiferous, apparently also at times margined, 3–4 mm. in diameter, with rather stout, compressed pedicel, slightly broadened above and shorter than the vesicle. The “inflorescences” vary much in development, are in more loose or more compact, more or less flattened cymes, solitary and axillary or arranged in short terminal racemose panicles, 3–8 mm. high, dichotomous, the separate divisions separated below and stipitate, but confluent at the base above, ancipate to irregularly triquetrous, dentate above or along the whole or portions of the wings, the teeth sharp and short or long and bluntish, practically all androgynous, but varying, in the proportions of oogonial to antheridial conceptacles, usually one or the other dominant, but intermediates or “intersexes” occurring. When the receptacles are predominantly antheridial they are ancipate and toothed only at the apices; when predominantly oogonial they are triquetrous and strongly toothed along each longitudinal wing; but intermediate (or “intersex”) variations and “spotwise” modifications occur. The antheridial plants are the more slender, with leaves more delicate (pl. 28, fig. 1) and with the cryptostomata more numerous.

The type locality for the species is St. Augustin (near Pochutla on the coast of Oaxaca, Mexico), whence a specimen collected by Liebmann (cotype?) is preserved in the herbarium of the University of California. Grunow (*loc. cit.*) reports a collection from the Gulf of Nicoya in Costa Rica, which he describes as “var. *nicoyana*,” but which is probably an antheridial plant of quiet waters with thinner, more punctate leaves and less “spinulose” receptacles. The staff of the *Zaca* collected it off San José del Cabo, Baja, California, Mexico (Nos. 2, 5), at Manzanillo, Mexico (No. 740), both floating and brought up on the anchor of a fishing boat in Banderas Bay, Mexico (Nos. 109 and 735 A), at Port Parker, Costa Rica (Nos. 107, 797 and 799), and at Murcielago Bay, Costa Rica (No. 951).

Sargassum Liebmannii J. Ag. seems to be a true acanthocarpic species, with polymorphism of sexes and intersexes. It is closely related to *S. Hystrix* J. Ag., originally described from the Campeche Banks of Yucatan in the Gulf of Mexico, which seems to vary as to presence or absence of cryptostomata in a way similar to what is

being discovered in *S. Liebmannii* J. Ag. *Sargassum Hystrix* J. Ag. varies into the var. *buxifolia* (Cham.) J. Ag., and probably into *S. fluitans* (Bory) Boerg., as a floating form, and possibly even into *S. natans* (L.) R. Brown. At any rate typical *S. Liebmannii* J. Ag. and typical *S. Hystrix* J. Ag. constitute a vicarious (or supplemental) pair of species, the one on the Pacific coasts of Mexico and of Central America, the other on the Gulf of Mexico coasts of Mexico, Central America, etc., the very evident closeness of the morphological characters being readily seen from J. G. Agardh's illustrations of his types (Spec. Sarg. Austral., pl. V and VIII, figs. 1-5, 1889). The existence of such a pair of species, one on one side (Pacific), the other on the other side (Atlantic) of Mexico and Central America suggests harking back to the various epochs when the Caribbean Seas were connected with the later separated Pacific waters.

2. *Sargassum Howellii* Setchell, sp. nov.

Plate 28, figures 7-10; plate 31, fig. 49

Sargassum frondibus e disco irregulari oriendis, usque ad 20 cm. altitudinem attingentibus; axi primario usque ad 9 cm. alto, 2-4 mm. crasso, infero nudo, cylindrico, sed crasse tuberculato per bases ramorum primariorum deciduorum persistentes, supero ramis primariis multifariam vestito; ramis primariis vulgo 6-10, inferis usque ad 10 cm. longis, spiraliter in axi primario oriendis, moderate congestis, suberectis, cylindricis, tuberculis basium ramorum secundorum spiraliter ornatis; foliis alternis, quoqueversum et oblique superne radiantibus, sessilibus, lanceolatis, basi abrupte, apice longe, attenuatis, apicibus obtusis, textura firma, laete fuscis usque (exsiccatis) nigrescentibus, marginibus repandis, crasse et remote denticulatis, percostatis, cryptostomatibus parvis inconspicuisque in utroque latere costae sparsis, inferis usque ad 45 mm. longis et 5 mm. latis, superioribus 20 mm. longis et 3 mm. latis; ramulis curtis, folia parva et inflorescentias ferentibus; vesiculis deuntibus; inflorescentiis axillaribus, curtis (2-5 mm. altis), receptaculis laxae usque ad dense glomerulatis, 3-4-plo dichotomis, cymosis aut, aetate provecta, racemoso-paniculatis, apicibus subacutis, comparate robustis, lente compressis, superficie inermibus, lente tuberculatis, dioicis (?) androgynis (?).

Type: No. 249,327, Herb. Calif. Acad. Sci., **Clarion Island, Revillagigedo Group**, col. *Howell No. 104*, Mar. 23, 1932.

Also Clarion Island, Revillagigedo Group, col. *Howell No. 102*, Mar. 23, 1932.

Two collections of this species were made by John Thomas Howell, the one young and sterile, the other fruiting, but both from Clarion Island in the Revillagigedo Group, from which no specimen of this genus has hitherto come to our notice (*see* Setchell and Gardner, Proc. Calif. Acad. Sci., ser. 4, 19 (11): 109-215, pl. 4-15, 1930). It is distinctly of the habit of a group centering around *Sargassum lendigerum* (L.) C. Ag. (as represented by the types of Linnacus, well depicted by Turner, Fuci, 1:108, pl. 48, 1808). Under this group may possibly be included, not only the type plants of *S. lendigerum*

from Ascension Island, collected by Osbeck, but later collections from the same island collected by J. D. Hooker in 1843 (Herb. Kew!), as well as 2 sets of specimens, also from Ascension Island, collected by Henry T. Gordon, July 1889 (Herb. Kew!). *Sargassum lendigerum* (L.) C. Ag. was also collected on Ascension Island by the *Gazelle* Expedition (see Grunow, in Askenasy, *Forschungreise S.M.S. Gazelle*, IV, Th.:29, 1888). To these there may be added Nos. 224 and 225 of Welwitsch's "Iter Angolense Algae" from St. Vincent Island of the Cape Verdes (Herb. Kew!). All these have the primary axis persistent (up to about 5 cm. long), with the knobs, or tubercles, representing the bases of the fallen primary branches arranged multifariously. The leaves and very short ramelli are also multifarious. The leaves are dense in consistency, costate, and with the inconspicuous cryptostomata scattered irregularly on both sides of the costa. There are no vesicles in any of these specimens although Kuetzing (Tab. Phyc., 11: pl. 19, II, 1861) in his figure of the species (based on that of Turner) has seemingly represented the small, rounded leaflets of the inflorescence as vesicles.

To *Sargassum lendigerum* (L.) C. Ag., which seems never to have been a well understood species, J. G. Agardh in 1889 (Spec. Sarg. Austral., 110) referred a Bermudan species collected by Farlow (now *S. bermudense* Grun.) and assigned it to a position near to *S. cymosum* C. Ag., but differing in cryptostomata more abundant and more conspicuous. J. G. Agardh (*loc. cit.*) says, moreover, that this later (1889) conception was not his earlier one (Spec. Alg., 1:340, 1848), which confined the species to its type locality and W. African localities (Senegambia and Teneriffe). In his earlier (1848) conception, J. G. Agardh stressed the occurrence of the cryptostomata in a single series on each side of the costa. While in the type and other seemingly definite plants of *S. lendigerum* the upper leaves show at times some approximation to such an arrangement, the "single series" is seldom a regular series, and the majority of the middle and lower leaves show the cryptostomata irregularly placed and in no definite series at all.

Apparently following the 1889 diagnosis of J. G. Agardh for *S. lendigerum*, various plants of the Caribbean Sea and adjacent regions have been assigned to *S. lendigerum* (L.) C. Ag. (see M. A. Howe, in Britton and Millspaugh, *The Bahama Flora*, 592, 1920). In 1889, J. G. Agardh referred certain floating plants to *S. brachycarpum* J. Ag. (which Grunow refers as a variety under *S. rigidulum* Kuetz. (Tab. Phyc., 11: pl. 27, II, 1861). The specimens from St. Thomas, Danish West Indies (now the Virgin Islands), distributed by F. Boergesen (Mar. Alg. Danish W. I., part 2, Phaeophyceae, Dansk. Botanisk Arkiv., 2 (2): 221, 1914), are probably to be referred to *Sargassum rigidulum* Kuetz. (type locality: "American tropics," probably Jamaica), rather than to *S. lendigerum* (L.) C. Ag., and it also seems to be distinct from *S. cymosum* C. Ag., as limited to type.

Finally, Grunow, in his "Additamenta" (4th installment, 139, 1916) has seemingly shown his confusion of mind by placing *S. lendigerum* of Turner as a variety under *S. cymosum* C. Ag. Now, the plant of Turner as figured on plate 48 of his *Fuci* and described, is the plant of the herbarium of Linnaeus! Grunow, however, cites under his variety *lendigerum* plants not only from Ascension Island, but also plants from Senegambia and the Canaries (as did J. G. Agardh in 1848) and even plants from St. Thomas, W. I., Port Natal, and La Guayra, Venezuela. The remarkable constitution of the *S. cymosum* of Grunow's account will come to our attention later when the *Zaca* Sargassums from the Galapagos are under discussion. For the present and for purposes of inquiring into the relationships of *S. Howellii*, it may be borne in mind that it seems best to think of *S. Howellii* as a member of an assemblage including *S. lendigerum* (L.) C. Ag. (*verum!*) and its southeastern Atlantic variants, as well as *S. rigidulum* Kuetz. and its Caribbean and west Atlantic variants.

The *Lendigerum*-group of species are first of all fairly conspicuously provided with a persistently conspicuous and more or less elongated primary axis, laterally and closely beset with the primary branches above, and tuberculoid below, with the knobs of the bases of those primary branches which have fallen. In *Sargassum lendigerum* (*verum!*) and in *S. rigidulum* Kuetz., the primary axis, even of the most mature plants known, is short as compared with that of well developed plants of *S. Howellii*. The primary branches at the tip of the primary axes have a tendency to be erect, although this is more pronounced in *S. Howellii* than in either *S. lendigerum* or *S. rigidulum*. The receptacles are cymose, more or less densely glomerulate, becoming cymosely paniculate as they grow older, the receptacular branches short and frequently dichotomous, compressed, without spines or teeth, and blunt at the crowded apices. The leaves are thickish, with a strong tendency to be opaque, sessile, percostate, and with small, obscure, scattered cryptostomata, seldom, even in the uppermost leaves, arranged strictly biserially. Vesicles are either absent or certainly very rarely developed. The three species of the group, *S. lendigerum* (L.) C. Ag., of the southeast Atlantic, *S. rigidulum* Kuetz. of the west Atlantic and Caribbean Sea, and *S. Howellii* of the east Pacific area, are fairly close together, and *S. Howellii* possibly resembles more closely the true *S. lendigerum* than either of the two do *S. rigidulum*. *Sargassum Howellii* is of more erect habit than true *S. lendigerum*, its primary axis reaches a greater length, the leaves seem thicker and more opaque and it is widely separated in its distribution. The three species of the *Lendigerum*-group seem like vicarious multiple species or, at least, manifestations.

3. *Sargassum Palmeri* Grun.

Plate 28, figures 4-6

Sargassum Palmeri Grunow, Add. Cog. Sarg., (1), in Verh. k. k. zool.-bot. Gesell. Wien, 65: 338, 1915; Setchell and Gardner, Proc. Calif. Acad. Sci., ser. 4, 12: 739, 1924, Proc. Calif. Acad. Sci., ser. 4, 19: 150, 1930; Univ. Calif. Pub. Bot., 8 (3): 712, pl. 41, fig. 56, pl. 94, 1925.

Sargassum dissectifolium Setchell and Gardner, Univ. Calif. Pub. Bot., 6: 386, 1917.

Sargassum piluliferum, Farlow, Rept. U.S. Fish Comm. for 1875, 706, 1877, and in Farlow, Anderson and Eaton, Alg. Exs. Am. Bor., 3: No. 102; J. G. Agardh, Spec. Sarg. Austral., in Kongl. Sv. Vet. Akad. Handl., 23 (3): 55, 1889 p. p.; Collins, in Collins, Holden and Setchell, Phyc. Bor. Amer., 11: No. 537, 1898, (non *Fucus pilulifer* Turner, Fuci, 1: 145, pl. 65, 1808; see also Yendo, Jour. Coll. Sci. Imp. Univ. Tokyo, 22 (12): 57, 1907).

Setchell and Gardner, in the Melanophyceae of their Marine Algae of the Pacific Coast of North America (1925), described and illustrated this species, but omitted, unfortunately, to list the localities. The species has certainly been found growing at Guadalupe Island, off the coast of Mexico, and in Avalon Bay, Santa Catalina Island. Grunow (*vide* specn.! see also Grunow, *loc. cit.*) collected it at Santa Cruz, California (probably floating), and other collectors have found it cast ashore at Redondo, San Pedro, Laguna Beach, La Jolla, and San Diego, California. When growing it forms masses from midlittoral down to upper sublittoral zones. The Templeton Crocker Expedition collected it at Guadalupe Island (*Nos.* 103 and 551) and at Clarion Island (*No.* 355, floating or not is not indicated).

The *Zaca* material does not add much to the already fairly extensive knowledge of the species (see Grunow, 1915, Setchell and Gardner, 1917, 1930), but a general review of all the material, especially in connection with the related species, *Sargassum galapagense* var. *setifolia* Grun., has suggested some additional points of inquiry. The plant is said to be dioecious. Grunow (1915, *loc. cit.*) apparently saw only antheridial receptacles which he describes as substipitate cylindraceous. Setchell and Gardner (1925) speak of the species as dioecious, but do not indicate definite differences between the antheridial and the oogonial receptacles. Their figure (*loc. cit.*, pl. 41, fig. 56) seems to have been taken from an antheridial plant. Both antheridial and oogonial plants occur in the *Zaca* material and the receptacles of both sexes are represented in figs. 5 and 6 on pl. 28. The oogonial receptacles are shorter and thicker than the antheridial receptacles and ovoid (broader below).

Grunow places his *Sargassum Palmeri* in J. G. Agardh's subgenus I, *Phyllotricha*, Tribe *Dimorphae*, along with *S. piluliferum* (Turn.) C. Ag. (with *phyllodes*), while he removes *S. galapagense* var.

setifolia to subgenus V. *Eusargassum*, series III, *Malacocarpicae*, Tribe *Racemosae*, and near to *S. comosum* (Poir.) Mont. (*S. Desfontainesii* Auctt.) with true leaves. Since the two last mentioned species have with *S. Palmeri* so much in common, it seems natural to place the three species in one group. This matter will be discussed later on in connection with the Galapagos plant. It may be said here, however, that the lateral members seem to be true leaves of the *Eusargassum* type, rather than phyllodes, in that they are properly horizontal and of limited growth, with inflorescences of the "*Cymosae*" type. The three species constitute, at least, a subgroup and come near to that group of *S. cymosum* Ag. variants which have a strong tendency towards pinnatifid leaves.

SOUTHERN SPECIES

Of the South American group of Pacific Coast Sargassums, some thirteen (13) are listed, at least so far as recorded by Grunow in the Additamenta. So far as present distribution is indicated, they fall into two subgroups; the one, the more southern, described from Chile, including *S. ilicifolium* var. *compacta* (Bory) Grun., *S. oocyste* J. Ag., *S. pacificum* Bory, *S. ambiguum* var. *americana* (Sonder) Grun., *S. filiforme* var. *chilensis* Grun., and *S. divaricatum* var.? *chilensis* Grun.; the other, the more northern, thus far credited only to the Galapagos Islands, *S. cymosum* var. *foliosa* Grun., with two forms, f. *subdelicatula* Grun. and f. *rigidiuscula* Grun., *S. cymosum* var. *furcifolia* Grun., with its form *denticulata* Grun., and *S. galapagense* Grun., with its variety *setifolia* Grun. As may be seen from the foregoing enumeration, Grunow did not find (or does not recognize) any intermingling of the two groups. Of the Chilean group, *S. ilicifolium* var. *compacta* (Bory) Grunow (*S. compactum* Bory), *S. oocyste* J. Ag. (*S. Esperii* Bory, non aliorum), and *S. ambiguum* var. *americanum* (Sonder) Grun. belong, according to description, among those species in which the dominantly oogonial receptacles are spinulose or dentate. *Sargassum pacificum* Bory, *S. divaricatum* var. *chilensis* Grun. (*S. acinaria* Bory, non aliorum), *S. filiforme* var. *Chilensis* Grun., and all the Galapagos assemblage show receptacles devoid of teeth or spinules.

Perhaps it may be well to mention here the list of algae from the Galapagos Islands by W. G. Farlow (in B. L. Robinson, Flora of the Galapagos Islands, Proc. Amer. Acad., 38: 89-99, 1902) in which, among the collections of the "Hopkins-Stanford Expedition to the Galapagos Islands," made by Robert E. Snodgrass and Edmund Heller, he found certain specimens of *Sargassum* which he enumerated as follows:

- S. cymosum* Ag.
- S. galapagense* var. *setifolia* Grun.
- ?*S. graminifolium* J. Ag.

Among the comparatively abundant Galapagos specimens, collected by John Thomas Howell and other members of the expedition, careful study segregates five entities which seem worthy of specific rank. There is one striking tendency running through this group and that is the tendency to bear forked or lacinate leaves. Four of the species show these peculiar leaves in abundance; in the fifth, *Sargassum pacificum* Bory, they have been seen, but occur very rarely. Cryptostomata, too, are either entirely absent or sparse in the Galapagos species. The Galapagos species all seem to belong to the *Malacocarpicae* of J. G. Agardh, even in the restricted sense. They are also scattered through Agardh's three tribes, the *Fruticuliferae*, the *Cymosae*, and the *Racemosae*.

The three tribes of the series *Malacocarpicae*, even when that series is restricted to those members of the subgenus *Eusargassum*, whose receptacles, irrespective of the dominance of either sex, are always devoid of spines or teeth, are not to be segregated without some difficulty. The members of the *Fruticuliferae* have low, fairly compact inflorescences which tend usually towards racemose arrangement of branchlets, but both the main axis and the secondary axes should be continuous and entirely of receptacular tissue. The *Cymosae* also have low and compact inflorescences with the branches usually more or less deeply furcate and more cymose as to the individual clusters, but a terminal fertile branch or ramulus may have the inflorescences more or less closely aggregated into a sort of racemed panicle. The individual inflorescences, however, are sterile at the base with the main divisions sterile below into a stipe, but bearing forked branchlets entirely of receptacular tissue. The third tribe, the *Racemosae*, when taken in the strictest sense, have the receptacular divisions simple and each sterile-stipitate, the stipitate divisions or branches are then arranged simply racemosely, or racemosely paniculate on a sterile axis or series of axes.

There is usually a series of inflorescences in a plant, and these may more or less readily be referred to one or other of the three groups, the lowermost, or at least the lower, usually being the most characteristic, while the terminal inflorescences of the series may be modified, particularly those of the racemose-type, becoming cymose or fruticulose, or those of the cymose becoming fruticulose. Again, it seems to happen, but the instances need more study, that the dominantly antheridial receptacles may be the more characteristically fruticulose or cymose or even racemose, while the dominantly oogonial may be less characteristic and verging toward one of the other states. The following species, comprising the "southern group," as represented among the collections of *Sargassum* made at the Galapagos Islands, will illustrate the three groups and something of their variation in inflorescence.

4. *Sargassum zacae* Setchell, sp. nov.

Plate 29, figures 13, 14, and plate 31, fig. 50

Sargassum 36 cm. altitudinem excedens; axi primario nondum viso; ramis primariis usque ad 36 cm. altis, axi compresso folia ramulosque fertiles, moderate curtos bifariam ferente; foliis tenuiter membranaceis, laete fuscis, elongato-lanceolatis, simplicibus aut superne inaequaliter furcatis aut pinnatifidis, usque ad 5 cm. longis et 7 mm. latis, inferis longioribus, superis brevioribus, costatis, costis sub apicibus evanescentibus, marginibus undulatis, remote crasseque dentatis, apice obtuse plus minusve abrupte attenuatis, basi in petiolo curto attenuatis, cryptostomatibus vulgo paucis sparsisque; ramis secundariis comparate curtis (usque ad 5-6 cm. longis); vesiculis 1-3 mm. latis, sphericis, muticis usque ad longe apiculatis in petiolo gracili fere longiori suppositis; inflorescentiis axillaribus, 2-3 mm. longis, masculis singulis simplicibusque, usque ad cymoso-racemosis; receptaculis filiformi-lanceolato-compressis, fruticulosis, obtusis, inermibus, dioico-androgynis.

Type: No. 249,326 Herb. Calif. Acad. Sci., from **Charles Island at low tide**, *Howell Nos. 134B, 134C*, May 15, 1932.

Also Charles Island at low tide, *Howell Nos. 128, 134D, 134E*, May 15, 1932; Abemarle Island, Villamil, drift on beach, *Howell No. 133*.

Three specimens seem to answer fairly well to Grunow's description of "*Sargassum lendigerum* var. *furcifolia* forma *denticulata*" from Chatham Island (see Grunow, in Piccone, *Alge del viaggio di circumnavigazione della Vettor Pisani*, 50, 1886), and strongly, but superficially, resemble the next species which, both from the description as well as from an authentic fragment, seems to be the *S. lendigerum* var. *furcifolia* of Grunow (*loc. cit.*). In his later work, Grunow (Add. Cog. Sarg., (4): 139, 1916) placed *S. lendigerum* (as to Turner's plant), as a variety, under *S. cymosum* C. Ag., as well as his var. *furcifolia* (*loc. cit.*, p. 41). As indicated earlier, the *S. lendigerum*, both of Linnaeus and of Turner, are one and the same plant (same type!), and very different from true *S. cymosum* C. Ag. The var. *furcifolia* of Grunow, however, is typically more slender, more strict, and its more delicate and more slender leaves have entire margins and are practically devoid of cryptostomata, while his forma *denticulata* is more robust, with more rigid, darker-colored leaves whose surfaces show scattered cryptostomata and whose margins are definitely denticulate. The latter is the plant here described as *Sargassum zacae*, while the former is described below as *S. Templetonii*. The two species are close, but seemingly distinct as to vegetative organs. In receptacles they are very similar, having the same sort of dimorphism in the intersexes. Those predominantly oogonial have shorter and more lax inflorescences, forked below and sterile, but the forks are made up of receptacular tissue, and are short and broadly ovate, and somewhat racemosely once or twice laterally proliferous. The inflorescences dominantly

antheridial are slightly different in aspect, but constructed on the same general plan. They are forked and sterile at the base. The forks are elongated, slender, and racemosely (laterally) proliferous. The figures of *S. zacaë* (pl. 29, figs. 13, 14) show both types of inflorescences, as do those of *S. Templetonii* (pl. 29, figs. 17-19).

The two species here described seem rather of Atlantic than of Pacific relationship, both as regards vegetative structure and intersex dimorphism of receptacles. *Sargassum zacaë* resembles vegetatively *S. furcatum* Kuetz. (Kuetzing, Tab. Phyc., 11: pl. 32, II, 1861), unfortunately sterile, while *S. Templetonii* more closely resembles *S. ramifolium* Kuetz. (Kuetzing, loc. cit., 11: pl. 32, I, 1861), which is the *S. cymosum* var. *dichotomum* Mont., (Montagne, Voy. Bonite, Bot., 41, 1844). Both these species were described from the tropical Atlantic American coasts, the former, from the Island of St. Thomas, is usually referred to *S. vulgare* C. Ag., the latter to *S. cymosum* C. Ag., two species which have similar intersex dimorphism of the receptacles and which characterizes a group of Atlantic-Caribbean-Mediterranean species such as *S. Acinarium* (L.) C. Ag. (*verum!*), *S. vulgare* C. Ag. (*verum!*), *S. cymosum* C. Ag. (*verum!*), and *S. filipendula* C. Ag. The occurrence of close relatives of these Atlantic types in the Galapagos Islands must be not only of interest, but of fundamental distributional importance and, of course, raises the question as to the propriety of considering them autonomous species. *Sargassum zacaë* and *S. Templetonii* may be thought of as members of vicarious pairs of species, varieties, or forms, concerning which much more information and experience are highly desirable.

There is represented also in the Galapagos one other species of Atlantic-East Pacific affinities, and that is *Sargassum* (*galapagense* var.) *setifolia* Grun., which will be discussed later on. This plant, really an autonomous species, is closely related to both *S. Palmeri* Grun. of the California and Mexican coasts and *S. comosum* (Poir.) Mont. of the Canary Islands and adjacent coasts. In this species-group, the forking of the leaves has proceeded to a much greater extent than in the various "furcate" species of the *S. Acinarium-vulgare-filipendula-cymosum* group. In this latter group it is not always clear as to the status of the plants showing this tendency. The first of the series to be described was *Fucus diversifolius* Turner (Fuci, 2: 86, pl. 103, 1809, excl. syn. Forskål), now assigned by Grunow as a variety under *S. vulgare*, but seemingly likely to prove a form of *S. Acinarium* (*verum!*) or of *S. salicifolium* J. Ag., if this last species prove to be other than an oogonially dominant form of *S. Acinarium* (which, as usually described and figured, seems to be the antheridially dominant form). "Furcate" leaves are described under various species of *Sargassum*, either in connection with varieties, forms, or even as characteristic of the type of the species itself. As already implied, they are described as occurring at times under *S. Acinarium*, *S. vulgare*, *S. cymosum*, and *S. filipendula*. They are

characteristic of *S. zaca*, *S. Templetonii*, *S. galapagense* Grun. and its var. *setifolia* Grun., *S. Palmeri* Grun., and *S. comosum* (Poir.) Mont. They are frequent in *S. polyporum* Mont. and varieties of *S. polyphyllum* J. Ag. They recall the branched "phyllodes" of the species of the subgenera *Phyllotricha* and *Schizophycus* of J. G. Agardh. While the species of the subgenera *Bactrophycus*, *Arthrophycus*, and *Eusargassum* show phyllodes or leaves normally simple, scattering species within them show, or may be expected to show "furcate" or "pinnatifid" phyllodes or leaves. Both J. G. Agardh (Alg. Medit., 41, 1842) and Montagne (Phytogr. Canar., 134, 1840, and Voy. Bonite, Bot., 42, 1844) agree in not considering pinnatifid leaved plants as constituting particular sections but as usually constituting forms or varieties of known simple-leaved species. The fact that all Sargassums of the Galapagos Islands show furcate or pinnatifid leaves gives the discussion of this topic particular interest and possible, but unexplained, significance.

5. *Sargassum Templetonii* Setchell, sp. nov.

Plate 29, figures 15-19, and plate 31, figures 51-53

Sargassum 36 cm. altitudinem multo excedens; axi primario nondum viso; ramis primariis 36 cm. et ultra longis (incompletis!), axi compresso folia ramulosque fertiles comparate curtos bifariam ferente; foliis tenui-membranaceis, pallide aut laetefuscis, elongato-lineari-lanceolatis, apice acute longe attenuatis, vulgo profunde furcato-pinnatifidis, 2.5-7 cm. longis, 1-4 mm. latis, usque ad sub apice costatis, cryptostomatibus fere nullis; vesiculis sphericis, muticis, 1-4 mm. diam., in pedicellis 2-4 mm. longis, gracilibus, suppositis; inflorescentiis axillaribus, 2-3 mm. altis, pauci-ramosis, androgynis usque ad dioicas approximantibus, masculioribus basi furcatis, furcis basi breviter stipitatis, 1-3 racemoso-proliferis cylindricis, gracilibus et frequenter plantas juveniles adhaerentes ostendentibus, inermibus, feminiorebus basi-furcatis, furcis 1(-2) racemoso-proliferis, ovatis, lente compressis, inermibus.

Type: No. 249,327 Herb. Calif. Acad. Sci., Villamil, Albemarle Island, Galapagos, in tide pools. Col. Howell No. 128B, April 27, 1932.

Also Villamil, Albemarle Island, Howell No. 134F; floating, Wreck Bay, Chatham Island, Howell No. 137; Post Office Bay, Charles Island, Howell No. 992A, April 24, 1932.

Grunow, in his account of the Sargassums collected by Cesare Marcacci during the circumnavigation of the world by the Italian Corvette *Vettor Pisani* (see Piccone, Algh. de Viag. di circumnav. della Vettor Pisani, 50, 1886), described a *Sargassum lendigerum* var. *furcifolia* from Chatham Island in the Galapagos. From his description and from some fragments of his specimen in the herbarium of the University of California, it seems possible to identify certain plants of the Templeton Crocker Expedition as belonging to the

same variety. Later on (1916, p. 141) he placed this variety under *S. cymosum* C. Ag., where it seems more logically located than under true *S. lendigerum* (L.) C. Ag. Although the plants may be variants of *S. cymosum* C. Ag., whose limits are as yet rather vague, the extreme discontinuity of distribution as well as certain differences in habit seem to justify considering them, for the present at least, as constituting an autonomous species.

It may be questioned as to the desirability of giving independent rank to both *Sargassum Templetonii* and *S. zacaë*. Grunow considered the latter (his forma *denticulata*) to be only a form of the former (*S. lendigerum* var. *furcifolia* or *S. cymosum* var. *furcifolia*), distinguished by its broader denticulate leaves and its greater tendency to have cryptostomata, while his var. *furcifolia* (as to type) had much more slender leaves, with entire margins and practically devoid of cryptostomata. It may be that the two are ecological variants, but in the lack of more abundant series of plants of the two, it seems best, for the present, at least, to consider the two separately, the *S. zacaë* tending rather toward the *S. vulgare* complex, the *S. Templetonii* towards the *S. cymosum* complex.

6. *Sargassum galapagense* Grun.

Plate 29, figures 20–27, plate 30, figures 28–30, and plate 32, figures 54–57

Sargassum galapagense Grunow was founded on a specimen (or specimens?) collected by Cesar Marcacci of the Royal Italian corvette *Vettor Pisani* in the circumnavigation of the world between the years 1882 and 1885 (see Grunow, in Piccone, *Alge Vettor Pisani*, 48, pl. 1, figs. 2 and 3, 1886). The description and the brief remarks, while they give a technical idea of the species, do not touch upon some points which, in the absence of authentic specimens, would have been most helpful towards recognition of the species. Grunow (*loc. cit.*) compares it with *S. Acinarium* (in the sense of *S. Swartzii* and *S. divaricatum* Grev.), but states that it differs in its bifid, eglandulose leaves and its long apiculate vesicles. He also speaks of the leaves as rigid and blackish-brown. It seems, therefore, to be a species with thicker, denser leaves than *S. zacaë* or *S. Templetonii*. It has not been reported since the original collection, for while the var. *setifolia* Grun. is mentioned by Farlow as collected by the Hopkins-Stanford Expedition, the species itself is noted only on the authority of Grunow. Grunow, possibly, had only a fragment, for he seems to have been uncertain as to whether his material was of a branch or a branchlet. The inflorescences are entirely different from those of *S. zacaë* and *S. Templetonii* (see Grunow's figures), as they are also from those of his variety *setifolia* (see Grunow, *loc. cit.*, 48, 49, pl. 2, figs. 1 and 2). For this reason, which will be amplified later on, it seems best to consider the variety as a

distinct species, related more nearly to *S. Palmeri* Grun. of the north than to *S. galapagense* itself.

The Templeton Crocker Expedition brought back a comparatively considerable material which seems to be closely related to, if not identical with, *Sargassum galapagense* Grun., but of which no single specimen agrees exactly with either Grunow's description or plate. Of this material only one specimen (*Howell, No. 151C*, N. E. side of Narborough Island, May 28, 1932) is provided (except exceptionally a few specimens and then only at the very tip) with bladders. This specimen (only a fragment of the uppermost portion of a plant) agrees fairly well as to axis, leaves, and receptacles with Grunow's description and figures. The bladders, however, while slightly and often sharply apiculate, do not show any of the longer setaceous projections figured by Grunow, although a few are tipped by a short spine. The vesicles, otherwise, have the general shape and the rather stout pedicel of the "Acinariae" of J. G. Agardh. The receptacles, while androgynous, are overwhelmingly oogonial in this specimen, are about 2 mm. high, in a close axillary glomerule of forked receptacular branches, each inclining away from cylindrical toward lanceolate-ovoid. They lead one to suspect that Grunow's figure 3 (*loc. cit.*, pl. 1) was drawn from an inflorescence dominantly antheridial. The inflorescence seems rather towards those of the *Cymosae* than those of the *Racemosae*, and the *Zaca* plant comes nearer to *S. divaricatum* var. *chilensis* Grun. than to any other. The var. *chilensis* was founded on the *S. acinaria* Bory (non *Fucus acinarius* L.) (*see* Bory, Voy. Coquille, Bot., 126, 1828), collected by D'Urville at Concepcion, Chile, but that has, both according to Bory and to the type specimen (in Herb. Bory, in *Herb. Mus. Paris!*) large biserial cryptostomata. It seems fairly safe to refer *No. 151C* to *S. galapagense*, notwithstanding the minor (?) differences, and possibly as a plant of more quiet or perhaps deeper waters.

The majority of plants of the Templeton Crocker Expedition referred here to this species, seem to have come from exposed shores. They were collected at Post Office Bay, Charles Island, Galapagos, on May 17, 1932, and were evidently growing in abundance "in tide pools at the lowest tide." There is a considerable number of plants under *Nos. 385* and *969* (the one number in alcohol, the other dried), but all of the same collection. They are mostly complete plants, rather short (10 cm. to 35 cm. high), erect, of close habit, and very dark after drying. The primary axes arise singly or in clusters, range from 1 cm. up to 5 cm., covered with the multifarious knobs of the bases of the primary branches which have been lost, and bear at their tips several erect, strict, primary branches, clothed with simple or pinnatifid, thick, and rather fleshy leaves, with very short branchlets (if any) in their axils. The leaves are multifarious, closely imbricate and erect, are 1.5 cm. to 3 cm. long, according to position and as to plant. They are commonly pinnatifid (rather than properly furcate). At the tips they vary from long to short acuminate.

When moist they are rather thick and opaque, and very dark in color. When dried they seem thinner, although rigid, and show a thick, almost percurrent costa. No cryptostomata have been observed in these plants. Vesicles are wanting in the great majority of the plants, but towards the tips of a very few of the most elongated specimens a small number of small vesicles may be found, slightly longer than broad and with distinct but short setiform apicula. The receptacles are short, dense, flat-topped glomerules, cymose, with the branches slender and almost exclusively antheridial, closely resembling Grunow's figure 3 of his *S. galapagense*. It seems as if these plants from Charles Island are to be placed under *S. galapagense* Grun., as merely developmental stages or as tide-pool representatives. Grunow's plants (collected by Marcacci) were gathered on Chatham Island in March. The Narborough fragment (Howell, No. 151C) is probably also a plant belonging to *S. galapagense* Grun., but possibly from deeper water.

[Since writing the above account the writer has had, through the kindness and generosity of Professor Dr. Karl Keissler of the Naturhistorisches Museum at Vienna, the privilege of examining the type sheet of *Sargassum galapagense* Grun. (Coll. Grunow, No. 701). There are 4 larger fragments glued on to the sheet, none of which shows any basal portion. These seem to belong rather to the var. *setifolia* Grunow than to the species as described and illustrated. Leaves are not well represented, but are slender and setiform. The vesicles are rather those of the variety than those of the species and the same is true of the receptacles. There are, however, in a small envelope, four small fragments probably of a single plant, or probably a portion of a plant, which do agree with Grunow's figures in leaf, vesicle, and receptacles. These must represent the true type, the specimen from which they were separated possibly having been returned to Piccone. Comparison with these fragments of the true type fortifies the opinion that Grunow's species and variety are not so closely related as he supposed and that the plants referred above as belonging to the species are correctly assigned.]

7. *Sargassum setifolium* (Grun.) comb. nov.

Plate 28, figures 11, 12, and plate 32, figures 58, 59

Sargassum galapagense var. *setifolia* Grunow (in Piccone, *Alge-Vettor* Pisani, 48, 49, pl. 2, figs. 1, 2, 1886); Add. Cog. Sarg., in *Verh. k. k. zool.-bot., Gesell. Wien*, 66: 167, 1916; De Toni, *Syll. Alg.*, 3: 19, 1895; Farlow in B. L. Robinson, *Proc. Amer. Acad.*, 38: 92, 1902.

Grunow seems to have experienced little doubt but that this plant, which he compares to *Sargassum teretifolium* J. Ag., a member of the *S. Swartzii* group (*Acinariæ*, J. Ag., p. p.) as perhaps *S. galapagense* Grun., may well be as indicated above, was only a variant of his *S. galapagense*. J. G. Agardh (*Spec. Sarg. Austral.*, 122, 1889) says

that from the description and specimen of var. *setifolia* he had seen, he is inclined to place it near to *S. piluliferum* (in tribe *Dimorphae* of subgenus *Phyllotricha*) and does not think it closely related to either *S. acinaria* (Turn.) C. Ag., or *S. teretifolium* J. Ag. De Toni (*loc. cit.*) places both the species and the variety near to *S. comosum* (Poir.) Mont. (*S. Desfontainesii* (Turn.) C. Ag.), and Farlow (*loc. cit.*), who had only the var. *setifolia* for study, agrees with Agardh. Both J. G. Agardh and Farlow, however, were thinking of *S. piluliferum* chiefly in terms of what is now separated as *S. Palmeri* Grun. In the "Additamenta," Grunow (*loc. cit.*, 1916) places both the species and the variety along with *S. comosum* (Poir.) Mont., among the *Racemosae* of the Malacocarpic and Cladocarpic Eusargassums. There are, then, two questions concerning this plant; the one pertinent to its relationship with the type of *S. galapagense*, the other as to its relationship with other species and its consequent position within the genus *Sargassum*.

First, it seems desirable to consider the relationship of *Sargassum galapagense* Grun., type, to *S. galapagense* var. *setifolia* Grun. Grunow himself (*loc. cit.*) seems to have felt little, if any (?) doubt that the variety was a singular form of the species, in which the leaves are most narrow. The differences between the receptacles of the two, he explains by assuming that that of the species was more masculine and that of the variety more feminine. A careful examination of a considerable series of *setifolia* plants shows a remarkable uniformity in both leaf and receptacular morphology. In the species, the leaves and branchlets of the primary axis have a strong appearance (due to torsion?) of being multifarious, while *setifolia* has an equally strong appearance of being bifarious. The receptacles in the two, the variety and the species, judging both from a comparison of Grunow's figures and the fairly abundant material of the *Zaca* collections referred to each, are of entirely different types. Both are of the "dioico-androgynous" type, with dominance of one or the other sex-conceptacle. The receptacles of *S. galapagense*, both of oogonial and of antheridial dominance, form low, glomerulate inflorescences of the *Cymosae* type, the oogonial receptacles tending to be slightly compressed and also to be ovate-lanceolate, while those of antheridial dominance are more slender and torulose cylindrico-lanceolate (compare pls. 28, 29, and 30, figs. 11, 12 and 26-29). The inflorescences of *S. galapagense* resemble closely those of *S. divaricatum* Grev. (see Ann. & Mag. Nat. Hist., ser. 2, 3: pl. 10, 1849) and *S. Wightii* Grev. (*loc. cit.*, pl. 9). The receptacles of the var. *setifolia* are more strikingly dimorphic, and both sex dominants are distinctly racemose, with the individual receptacles, simple or slightly branched, but well separated (pl. 28, figs. 11, 12), the oogonially dominant (fig. 11) are shorter, while those of antheridial dominance (fig. 12) are elongated. A very similar difference is to be seen in the sex-differentiated receptacles of *S. Palmeri* (pl. 28,

figs. 5, 6) and also of *S. comosum* (see Kuetzing, Tab. Phyc., 11: pl. 35, I, 1861, oogonial).

The vesicles, also, of the two, *Sargassum galapagense* and the var. *setifolia* are very much more different than would seem from Grunow's figures. Those of the species are rounded-oblong to slightly piriform, more or less strongly apiculate, while those of the variety are broadly fusiform with usually fairly to very long setaceous apicula. It seems that *S. galapagense* (species) is closely related to the *S. divaricatum* var. *chilense* Grun. and belongs to the *S. Swartzii*-group of species, while the var. *setifolia* forms (with *S. Palmeri* Grun. and *S. comosum* (Poir.) Mont.) a group of species of most interesting distribution, possibly developed along the same lines as the pinnatifid forms (?) of the *S. vulgare* and *S. cymosum* groups. The erection of var. *setifolia* into an autonomous species seems reasonably justified.

Sargassum setifolium (Grun.) Setchell seems to be both abundant and widespread among the Galapagos Islands, where it appears to be endemic. The type was collected by Marcacci on Chatham Island in March. Heller and Snodgrass of the Hopkins-Stanford Expedition collected it at Tagus Cove and Turtle Point, Albemarle Island, Feb. 1899. The Templeton Crocker Expedition of 1932 brought back specimens as follows: Albemarle Island, Tagus Cove (No. 432, May 22, No. 121A, May 26, H. W. Clark); Villamil (Nos. 132, 134A, April 2, No. 150), Webb Cove (No. 960, deep water, May 2, No. 981B, at low tide); Indefatigable Island (No. 128A, Academy Bay, May 1, No. 470, May 1); Narborough Island, N. E. side (No. 151B, No. 872, H. W. Clark, May 28, No. 800, June 2); Charles Island, Post Office Bay (No. 991, April 24); Chatham Island, Wreck Bay (No. 1011, April 15).

8. *Sargassum pacificum* Bory (p.p.)

Plate 30, figures 31–40, and plate 33, figures 61–64

Sargassum pacificum Bory. Bory de Saint Vincent, Voy. Coquille, Bot., 123, Feb. 16, 1828; Dict. class. d'Hist. Nat., 15: 171, May 1829; Montagne, Flora Chilena (in Gay, Hist. fis. y polit. de Chile, Botanica, 8: 235, 236, 1852; Syll. gen. spec. Crypt., 387, 388, 1856; M. A. Howe, Algae of Peru (Mem. Torrey Bot. Club, 15:) 67, pl. 25, 1914; Grunow, Verh. zool.-bot. Gesell., Wien, 65: 438, 1915; non *S. pacificum* A. Richard, Sertum Astrolabianum, in Voyage de découvertes de l'Astrolabe, Bot., 142, 1834 (*S. Desvauxii* J. Ag., non *Fucus Desvauxii* Mertens, fide J. G. Agardh, Spec. Alg., 1: 338, 1848).

One may think of the account of the genus *Sargassum*, written by Bory for the Dictionnaire Classique, as expressing his general idea of the composition of the genus, as composed of three species (or groups of species). His first species, *S. Sargasso* Bory, included the more conspicuous floating forms and particularly the *Fucus natans* L.; his second, *S. atlanticum* Bory, typified the Atlantic

forms (*S. vulgare* C. Ag.); while the third, *S. pacificum* Bory, typified the Pacific forms.

In the Voyage Coquille, he enumerated with diagnoses and descriptions some fourteen species of *Sargassum* from various oceans and seas. His *S. pacificum* is described as being based on specimens from Chile, from Tahiti, and from Port Praslin in New Ireland. There is little question, but that Bory had at least two and possibly three species referred under his *S. pacificum*: (1) Howe (*loc. cit.*) and Grunow (*loc. cit.*) have both established the species on the plants collected at Concepcion, Chile, by Dumont D'Urville; (2) the plants from Port Praslin, referred by Grunow (*loc. cit.* p. 437) to *S. oocyste* J. Ag., a species with spinulose oogonial receptacles; and (3) a specimen from Australia in Herb. Bory (seen by Grunow, Add. Cog. Sarg. (3): 34, 1916) to be referred to *S. Desvauxii* J. Ag. (non *Fucus Desvauxii* Mertens).

Bory's diagnosis (Voy. Coquille) is brief and practically without emphasis of specific characteristics, while his description indicates a plant up to two feet long, very slender, provided throughout with rather short branches not exceeding two to four inches in length at any portion from the base to the apex (primary branch); with leaves as much as one or two inches in length and two lines (about 4 mm.?) in width, irregularly dentate on the margins, very minutely glandular-punctate on the surfaces, the dots neither very easily seen, nor arranged in regular lines as in the Atlantic species (*S. vulgare*); with spherical and short-stalked vesicles, also very small, rarely exceeding in size partridge or hare shot, the whole plant becoming brown-yellow to blackish on drying.

The description of Montagne (*loc. cit.*), which was seemingly drawn up with care, has been the one usually copied and relied upon. Grunow, however, who had seen and studied the plants in Herb. Bory, states (*loc. cit.*, p. 437) that he does not venture to decide what is the true *S. pacificum* Bory, and again (*loc. cit.*, p. 438), he states that there is no specimen in Herb. Bory agreeing with the description he quotes (from Montagne). There is, however, a specimen (!) in Herb. Bory at Paris, labelled by Bory as being "*Sargassum pacificum* N." and collected by D'Urville at Concepcion, which has been taken by M. A. Howe (*loc. cit.*) for the veritable type. There is, likewise, a specimen, also in Herb. Bory, and as definitely labelled by him, but evidently collected by D'Urville on his first voyage in the *Astrolabe*, on the shores of New Guinea, which has dentate receptacles and is probably to be referred rather to the *S. Desvauxii* as understood by J. G. Agardh, although J. G. Agardh seems convinced that it is not the plant designated as *Fucus Desvauxii* by Mertens (Mém. du Mus. d'Hist. Nat., Paris, 5: 183, pl. 14, 1819). Grunow (*loc. cit.*, p. 437) has referred the New Guinea plant (inscribed also on specimen 1) to *S. oocyste* J. Ag., which, in turn, was founded (in part at least) on a specimen collected at Concepcion by D'Urville and placed by Bory (Voy. Coquille, Bot., 124, 1828)

under *S. Esperi* (non *S. Esperi* C. Ag., *fide* J. G. Agardh), as well as specimens collected by Lesson at New Guinea. It seems not beyond reason to suspect that both J. G. Agardh's *S. Desvauxii* and his *S. oocyste* may be sex forms of one and the same species.

It seems most convenient to adopt the idea of M. A. Howe (*loc. cit.*) in "establishing" as the type of *Sargassum pacificum* Bory, the plant so designated by Bory and collected at Concepcion, Chile, by Dumont D'Urville in 1825. With this as a basis, the numerous plants collected by the staff of the *Zaca* in the Galapagos may be compared and placed. The type specimen is both slender and lax in habit. The plant figured by Howe (Mar. Alg. Peru, pl. 25, 1914) seems stouter and at least has the foliage much congested. Between the two are many intermediate types. It seems best to attempt segregation (although imperfect) among the lax and delicate, the more dense or rigid, and the densely congested forms, presuming that these are probably of environmental effect or reversible ecads of this wide spread and seemingly more or less plastic species.

FORMAE LAXAE

Sargassum pacificum f. *subdelicatulum* (Grun.) comb. nov.

Plate 30, figures 31–33, and plate 33, figure 61

Sargassum pacificum Bory, Voy. Coq., Bot., 123, 1828 (p. p.); *S. lendigerum* var. *foliosa* f. *subdelicatula* Grunow, in Piccone, *Alghe-Vettor Pisani*, 49, 1886; *S. cymosum* var. *foliosa* f. *subdelicatula* Grun., Verh. zool.-bot. Gesell., Wien, 66:139, 1916; *S. cymosum* Farlow, Proc. Amer. Acad., 38-92, 1902 (p. p.); *S. pacificum* M. A. Howe, Mar. Alg. Peru, 66, 1914 (as to type).

The type of *Sargassum pacificum* Bory, as established by M. A. Howe, is to be placed among the forms which Grunow has appropriately named "*subdelicatula*." Its primary axis is wanting in all the *Zaca* specimens referable to this form. The primary branches are smooth, slightly compressed below, becoming cylindrical above. The leaves tend to lie in two distinct ranks, are thin, membranaceous, light yellow-brown to somewhat darker, broad lanceolate, unequally cuneate at the base into very short, broad petioles (almost sessile), somewhat bluntly acuminate, at times almost emarginate at the tip, 1–2 cm. long, 3–4 mm. broad, costate to just below the apex, margins undulate and irregularly sinuate-dentate but basal margins entire, devoid or almost devoid of cryptostomata. The secondary branches are up to 8 cm. in length, alternate and much alike, whether basal, middle, or upper. The vesicles are spherical, smooth, mucous, 2–3 mm. in diameter, on smooth, slender pedicels, usually thickening slightly upwards, from as long as, to decidedly shorter than, the vesicles. The inflorescences are "axillary," in moderately loose to fairly dense clusters, 2–4 mm. high, short pedicellate,

their receptacles dichotomo-racemose, with branches smooth, androgynous, without pronounced dimorphism as to sex dominance.

The type specimen of Bory, from Concepcion, Chile, belongs here, as do Coker's *Nos. 110* and *117* from Bay of Ferrol, Peru (see M. A. Howe, *Mar. Alg.* Peru, 66, 1914), and also the type of Grunow's forma *subdelicatula* from Chatham Island; likewise Snodgrass and Heller's specimens from Tagus Cove on Albemarle Island and from Wenman Island, both of December, 1898. While it is not always easy to segregate this form from the next, the following specimens collected by the Templeton Crocker Expedition may also be referred here with confidence:—Chatham Island, Wreck Bay, April 15 (*No. 138*); Charles Island, Post Office Bay, April 23 (*No. 160A*), and rocky reef of same, April 24 (*No. 992*); Indefatigable Island, Academy Bay, floating, May 1 (*No. 130*); Albemarle Island, Tagus Cove, May 26, *H. W. Clark* (*No. 120*); Narborough Island, deep tide pools, N. E. side, May 28 (*No. 151A*). The plants seem clearly those of deeper waters or at least of more quiet waters, and are in great contrast as regards texture, color, and laxness to either of the two sets of forms still to be distinguished.

FORMAE DENSIORES

***Sargassum pacificum* f. *rigidiusculum* (Grun.) comb. nov.**

Plate 30, figure 34, and plate 33, figure 62

Sargassum lendigerum var. *foliosa* f. *rigidiuscula* Grunow, in Piccone, *Algae-Vettor Pisani*, 49, 1886; *S. cymosum* var. *foliosa* f. *rigidiuscula* Grunow, *Verh. zool.-bot., Gesell., Wien*, 66: 139, 1916; *S. cymosum* Farlow, *Proc. Amer. Acad.*, 38: 92, 1902 (p. p. fide spec'n!).

The numbers of the Templeton Crocker Expedition to be referred, with propriety, to Grunow's f. *rigidiuscula* show clearly that they grew in exposed situations and were collected from the rocks on which they grew. They are all provided with the primary axes and holdfasts, are fairly short, strict, fairly densely clothed with leaves, which are much more rigid, thicker, and cartilagino-chartaceous, as well as turning black on drying. The primary axes are up to 2 cm. high, moderately stout from an irregularly discoid holdfast, giving off primary branches multifariously. The persistent primary branches cluster at the tips of the primary axis and are of varying lengths up to 30 cm. They are clothed with leaves and (in typical forms) with extremely short (about 1 cm.) lateral branchlets, both arranged practically bifariously, but being crowded and crisped, often appear multifarious. The leaves are comparatively short (0.5–1 cm.) and broad (5 mm.), are more crisped and deeper undulate denticulate, but the unequally cuncate bases are not, in typical forms, provided with long teeth or "ciliate" curved pro-

cesses. The vesicles also show only "smooth" pedicels. The inflorescences are very much like those of *f. subdelicatulum*, but rather more compact, and the receptacles are more branched. Altogether the forma *rigidiusculum* has a very distinct habit, although at times there are found intermediates between it and the *f. subdelicatulum* as well as between it and the next form to be described. It seems clearly to be an ecological variant, despite its fairly distinctive habit.

Besides the type of the variety, collected by Marcacci on Chatham Island in March, the following specimens of the Templeton Crocker Expedition seem proper of reference to it:—Charles Island, Post Office Bay, April 23 (*No. 160B*); Albemarle Island, Webb Cove, May 22 (*Nos. 329, 346, 399, 961*) and 5 miles N. E. of Webb Cove, May 22 (*No. 981C*); Narborough Island, June 22 (*No. 801*), N. E. side, May 31 (*Nos. 152B* and *874*, by *Lanier*) and "California Cove," May 28 (*No. 373*). It was also brought back from Tagus Cove, Albemarle Island, by *Heller and Snodgrass* (collected. Feb. 1899).

FORMAE CONGESTAE

***Sargassum pacificum f. congestum* Setchell f. nov.**

Plate 30, figures 35–40, and plate 33, figures 63, 64

Sargassum pacificum, M. A. Howe, Mar. Alg. Peru, 66 (p. p. as to Lobos de Afuera plant), pl. 25, 1914.

A forma typica in foliis abbreviatis, crassis rigidioribusque congestis et in ramis secundariis comparate longioribus abludens; foliis vesiculisque vulgo cum dentibus curvatis basalibusque adornatis.

Type: No. 249,324 Herb. Calif. Acad. Sci., **Narborough Island, S. E. side**, collected by *J. T. Howell* No. 149, June 1, 1932.

Also Narborough Island, N. E. side, *Howell* No. 873, less typical; Albemarle Island, five miles N. E. of Webb Cove, *Howell* Nos. 959, 981; May 22, 1932; Post Office Bay, Charles Island, *Howell* No. 969B, April 23, 1932, less typical.

Also Lobos de Afuera, Peru, *Coker*, No. 279 (*M. A. Howe*, loc. cit.).

The figure of M. A. Howe (*loc. cit.*) of the plant from "Lobos de Afuera," Peru, is typical of what it seems best to regard as an extreme in density of foliage and the crispness of leaves which is associated with it. The primary axis is short (about 1 cm.) and bears a number of primary branches. These are often fairly long (up to 40 cm.), and they are densely clothed with short leaves (about 0.5–1 cm.) and fairly long to very short secondary branches. The longer-branched specimens seem the more characteristic. The

leaves are thick and strongly, but irregularly toothed and crispate. They commonly show a few rather long, stout and curved teeth at the very base, and this seems fairly characteristic of the form. Such teeth are also often found on the pedicels of the vesicles. The inflorescences are very much like those of *f. rigidiusculum*. The assumption of an appearance of a multifarious arrangement of leaves is usually very strong in this form.

Before leaving *Sargassum pacificum* Bory, it seems only proper to say something as to its possible relationship. The only species at all closely resembling it from the South American coast is *S. compactum* Bory (Voy. Coq., Bot., 126, 1828), which Grunow (Verh. zool.-bot. Gesell., Wien, 65: 405, 1915), after a study of the type, has referred to *S. ilicifolium* (Turn.) C. Ag. as a variety of the conduplicate-leaved group. The type of *S. compactum* (in Herb. Bory, in *Herb. Mus. Paris!*) presents a very similar appearance to certain of the longer branched forms of *S. pacificum* Bory, but the leaves (see pl. 30, figs. 41-48) (not conduplicate in the sense of double margins!), while closely resembling those of *S. pacificum*, have abundant small cryptostomata scattered over the surface and the costa disappears well below the apex. The androgynous (dominantly oogonial) receptacles are slightly compressed and denticulate above. Its type locality is Concepcion, the same as for *S. pacificum* Bory (as established by Montagne, M. A. Howe, etc.). While it seems best, for the present, to consider *S. compactum* distinct from *S. pacificum*, yet the close resemblances balanced over against the possibly minor differences, especially in the light of similar variations as to presence or absence of cryptostomata on leaves, and intersex variation, not only in receptacular morphology but also in vegetative characters, leads to association of the two species, at least in the same group, which finds its possible relationships among the "*Illicifolia*" group of J. G. Agardh (Spec. Sarg. Austral., 37, 1889) and its nearer associates. Grunow (*loc. cit.*, 400-418, 1915), in his presentation of the *Illicifolia*-group, calls attention to two pertinent facts: (1) that in *S. ilicifolium* (Turn.) C. Ag., both the dominantly oogonial receptacles and those dominantly antheridial, are ancipate and acutely spinose, while (*loc. cit.*, 411-412) the antheridial (dominantly?) receptacles of *S. berberifolium* J. Ag. are terete and inerm. Grunow considers that true *S. berberifolium* J. Ag., which is known only in the antheridial state, is similar to, perhaps is only, the antheridial plant, of *S. droserifolium* Bory and differs from *S. ilicifolium* (Turn.) C. Ag. solely in the very smooth "male" receptacles. While it is not possible, or perhaps even desirable in this place, to discuss the complexities, confusions, and possible extreme variabilities of the *Illicifolia*-group until much more material is available and much more study of its various members is possible, the questions raised by Grunow are pertinent to any suggestion of the proper place in the genus of *Sargassum pacificum* Bory. The general habit of both the more lax and the more dense

forms, the obliquity (or inequality) of the bases of the leaves, the tendency of the costa to fail to extend to the very apex, as well as the general characters of the inflorescences when taken with intersex and environmental modifications, tend towards arranging not only *S. compactum* Bory, but also *S. pacificum* Bory, with *S. ilicifolium* (Turn.) C. Ag., *S. berberifolium* J. Ag., *S. droserifolium* Bory, and others, in a polymorphous group, widespread in the tropics of the Indo-Pacific oceans and adjacent seas.

9. *Sargassum Skottsbergii* Sjöst . . (?) forma

Plate 32, figure 60

Sargassum Skottsbergii Sjöstedt, in Skottsberg, Nat. Hist. Juan Fernandez and Easter Is., 2, Bot., 2(3):311, fig. 105, 1924(?); “?*S. graminifolium*” Farlow, Proc. Amer. Acad., 38:92, 1902 (non *Fucus graminifolius* Turner).

It seems desirable to deal with one other set of specimens from the Galapagos, although nothing like them is to be found among the *Zaca* collections, in order that the account of the *Sargassums* of the Galapagos may be the more complete. Farlow (*loc. cit.*) refers to a single specimen, collected by Snodgrass and Heller, on Wenman Island. This specimen, consisting only of the upper fructiferous portion, has been divided between the Farlow Herbarium of Harvard University and the Dudley Herbarium (*No. 158509*) of Stanford University. Farlow referred it with much doubt to *Sargassum graminifolium* (Turn.) C. Ag., but it does not agree well with the type of *Fucus graminifolius* of Turner's collection at the Kew Herbarium (see Setchell, Hong Kong Nat., Suppl. No. 4:17–19, pl. 12, fig. 2 and pl. 17, 1935) either in leaves or in vesicles. The axes of the Wenman plant are compressed to complanate. The leaves (upper) are narrowly lanceolate, practically sessile, up to 4 cm. long and 3 mm. wide, with margins provided with spinulose teeth (up to 1 mm. or 1.5 mm. long), percostate, but *lacking cryptostomata*. The vesicles are spherical, muticous to blunt apiculate, 1 mm. to 1.5 mm. in diameter, borne on slender, rather long pedicels (2–4 mm. long). The individual receptacles are lanceoid-ovoid, up to 4 mm. high and 1–1.5 mm. broad, truncately rounded at the base and abruptly attenuated at the tip, usually simple but short-pedicellate and at times short-furcate above, arranged a few together in short racemose cymes about 6–8 mm. high in successive axils, androgynous, the upper third to one-half oogonial.

The placing of the material from Wenman Island can scarcely be done with any satisfaction at present. The plants are light yellowish, as if they had been growing in intense light or such as is characteristic of floating plants. The materials differ particularly from those from the type locality (Easter Island) in color and in

the lack of cryptostomata in the leaves. Sjöstedt supposed that his plants were dioecious, but an examination of the type collections has indicated that the receptacles are androgynous, but with strong dominance of either oogonia or antheridia, and a dimorphism as to stoutness or slenderness and length or breadth. Floating forms from near Easter Island collected by the non-magnetic ship *Carnegie*, show a yellowish color and a tendency to be without cryptostomata. The Galapagos plants may have been floating forms (Sargassotypes?) and not growing there.

The question of adopting the designation *Sargassum Skottsbergii*, Sjöstedt's name, even for the aberrant plant of Wenman Island, is connected with the identity of two species of J. G. Agardh, *S. stenophyllum* J. Ag. (non Martius) and *S. lanceolatum* J. Ag. (non Greville). Very possibly both the *S. lanceolatum* and *S. stenophyllum* of J. G. Agardh may belong to one and the same species cycle, for the tendency seems to be that the oogonially dominant plants have more strongly toothed leaves than those of the antheridially dominant plants, since the leaves of the latter may practically be entire on the margins. The tendency of floating forms to take on a yellow color (as in the case of *S. natans* (L.) R. Brown), and to cease developing cryptostomata (which will be dealt with in another paper treating of the pleuston of the non-magnetic ship *Carnegie*) is certainly suggestive. Whether the fragments might better be referred to *S. lanceolatum* J. Ag. (1848, sed non *S. lanceolatum* Grev., 1849) or to *S. Skottsbergii* Sjöst. may remain a question involving the identity of the two species as autonomous or not. It seems very possible that they may be. It is interesting, at least, to call attention once more to the fact that the species of the Galapagos are practically without cryptostomata (excepting, of course, *S. zacaë*, in which they vary from few to many).

PLATE 28

Sargassum Liebmannii J. Ag.

Fig. 1. Portion of a fructiferous ramulus of a cotype, dominantly oogonial (Herb. Univ. Calif., No. 141,536).

Fig. 2. Same of intermediate between type and var. *nicoyana* Grun., dominantly antheridial (Howell No. 109).

Fig. 3. Same of var. *nicoyana* Grun. (Howell No. 740), dominantly antheridial.

Sargassum Palmeri Grun.

Fig. 4. Portion of branchlet with receptacles dominantly antheridial (Guadalupe Island, Mason No. 1).

Fig. 5. Inflorescence from branch of same plant as figure 4, dominantly antheridial.

Fig. 6. Portion of branchlet with receptacles dominantly oogonial (from plant collected at Santa Cruz, California, by A. Grunow, Herb. Univ. Calif., No. 231,503).

Sargassum Howellii Setchell, sp. nov.

Fig. 7. Portion of a fructiferous ramulus of the Type No. 249,327, Herb. Cal. Acad. Sci. (Howell No. 104), Clarion Island, Revillagigedo Group.

Fig. 8. Similar to figure 7 (Howell No. 104).

Fig. 9. Inflorescences (Howell No. 104).

Fig. 10. Leaf (Howell No. 104).

Sargassum setifolium (Grun.) comb. nov.

Fig. 11. Portion of a ramulus dominantly oogonial (Howell No. 132).

Fig. 12. Portion of a ramulus with receptacles alternately and zonately oogonial and antheridial (Howell No. 960).

All figures drawn by Roy W. Donley under the direction of W. A. Setchell, and enlarged 2 diameters.

PLATE 29

Sargassum zacaë Setchell, sp. nov.

Fig. 13. Portion of a branchlet, with receptacles dominantly oogonial. Type No. 249,326, Herb. Calif. Acad. Sci. (Howell No. 134B), Charles Island, Galapagos.

Fig. 14. Portion of a branchlet, with receptacles dominantly antheridial. No. 249,326, Herb. Calif. Acad. Sci. (Howell No. 134C), Charles Island, Galapagos.

Sargassum Templetonii Setchell, sp. nov.

Fig. 15. Portion of middle of a primary branch with young receptacles (Howell No. 992 A).

Fig. 16. Upper portion of a primary branch (Howell No. 128A).

Fig. 17. Portion of a branchlet with receptacles dominantly oogonial (Howell No. 128A).

Fig. 18. Fructiferous ramulus with receptacles dominantly oogonial (Howell No. 992A).

Fig. 19. Fructiferous ramulus with receptacles dominantly antheridial (Howell No. 134E).

Sargassum galapagense Grun.

Fig. 20. Portion of a branchlet showing young vesicles (Howell No. 151C).

Fig. 21. Fructiferous ramulus (Howell No. 151C).

Fig. 22. Inflorescence (Howell No. 151C).

Fig. 23. Inflorescence (Howell No. 151C).

Fig. 24. Inflorescence (Howell No. 151C).

Fig. 25. Branchlet of younger, rarivesiculose plant (Howell No. 969).

Fig. 26. Fructiferous branchlet from same plant of same collection (Howell No. 969).

Fig. 27. Inflorescence (Howell No. 969).

All figures drawn by Roy W. Donley, under the direction of W. A. Setchell, and enlarged 2 diameters.

PLATE 30

Sargassum galapagense Grun.

Fig. 28. Fructiferous ramulus (Howell No. 151C).

Fig. 29. Inflorescence (Howell No. 151C).

Fig. 30. Leaf (Howell No. 151C).

Sargassum pacificum Bory

forma *subdelicatulum* (Grun.) comb. nov.

Fig. 31. Portion of a branch (Howell No. 160A).

Fig. 32. Fructiferous ramulus (Howell No. 138).

Fig. 33. Portion of a branch (Howell No. 120).

Sargassum pacificum Bory

forma *rigidiusculum* (Grun.) comb. nov.

Fig. 34. Tip of a primary branch (Howell No. 152B).

Sargassum pacificum Bory

forma *congestum* Setchell, forma nov.

Fig. 35. Tip of a primary branch of Type No. 249,324, Herb. Cal. Acad. Sci. (Howell No. 149), Narborough Island, Galapagos.

Fig. 36. Tip of a primary branch of type.

Fig. 37. Inflorescence of type.

Fig. 38. Inflorescence of type.

Fig. 39. Vesicle of type.

Fig. 40. Portion of a sterile primary branch showing curved fimbriae at bases of leaves and vesicles (Howell No. 992A).

Sargassum compactum Bory

Fig. 41. Fructiferous ramulus (type in Herb. Bory, Paris).

Fig. 42-47. Leaves from type specimen.

Fig. 48. Ramulus from type specimen.

All figures drawn by Roy W. Donley, under the direction of W. A. Setchell, and enlarged 2 diameters.

PLATE 31

Sargassum Howellii Setchell, sp. nov.

Fig. 49. Type of species. No. 249,325, Herb. Cal. Acad. Sci. (Howell No. 104), Clarion Island, Revillagigedo Group.

Sargassum zacaë Setchell, sp. nov.

Fig. 50. Portion of a plant of the type material (Howell No. 133).

Sargassum Templetonii Setchell, sp. nov.

Fig. 51-53. Portions of the type material (Howell No. 134).

Photo W. C. Matthews, reduced to approximately 0.5 diameter.

PLATE 32

Sargassum galapagense Grun.

Fig. 54. Portion of an ample plant with abundant vesicles (Howell No. 151C).

Fig. 55. Young complete, sterile plant (Howell No. 385).

Fig. 56. Older complete, fertile plant (Howell No. 385).

Fig. 57. Well elongated fertile plant, with a few small vesicles toward the apex (Howell No. 969 A).

Sargassum setifolium (Grun.) comb. nov.

Fig. 58. Young plant showing basal leaves (Howell No. 432).

Fig. 59. Upper portion of a luxuriant specimen (Howell No. 132).

Sargassum Skottsbergii Sjöstd.

Fig. 60. Fragment in Dudley Herbarium (No. 158,509) of Stanford University.

Photo. W. C. Matthews, reduced to approximately 0.5 diameter.

PLATE 33

Sargassum pacificum Bory

forma *subdelicatulum* (Grun.) comb. nov.

Fig. 61. Portion of a typical plant (Howell No. 138).

Sargassum pacificum Bory

forma *rigidiusculum* (Grun.) comb. nov.

Fig. 62. A small characteristic plant (Howell No. 373).

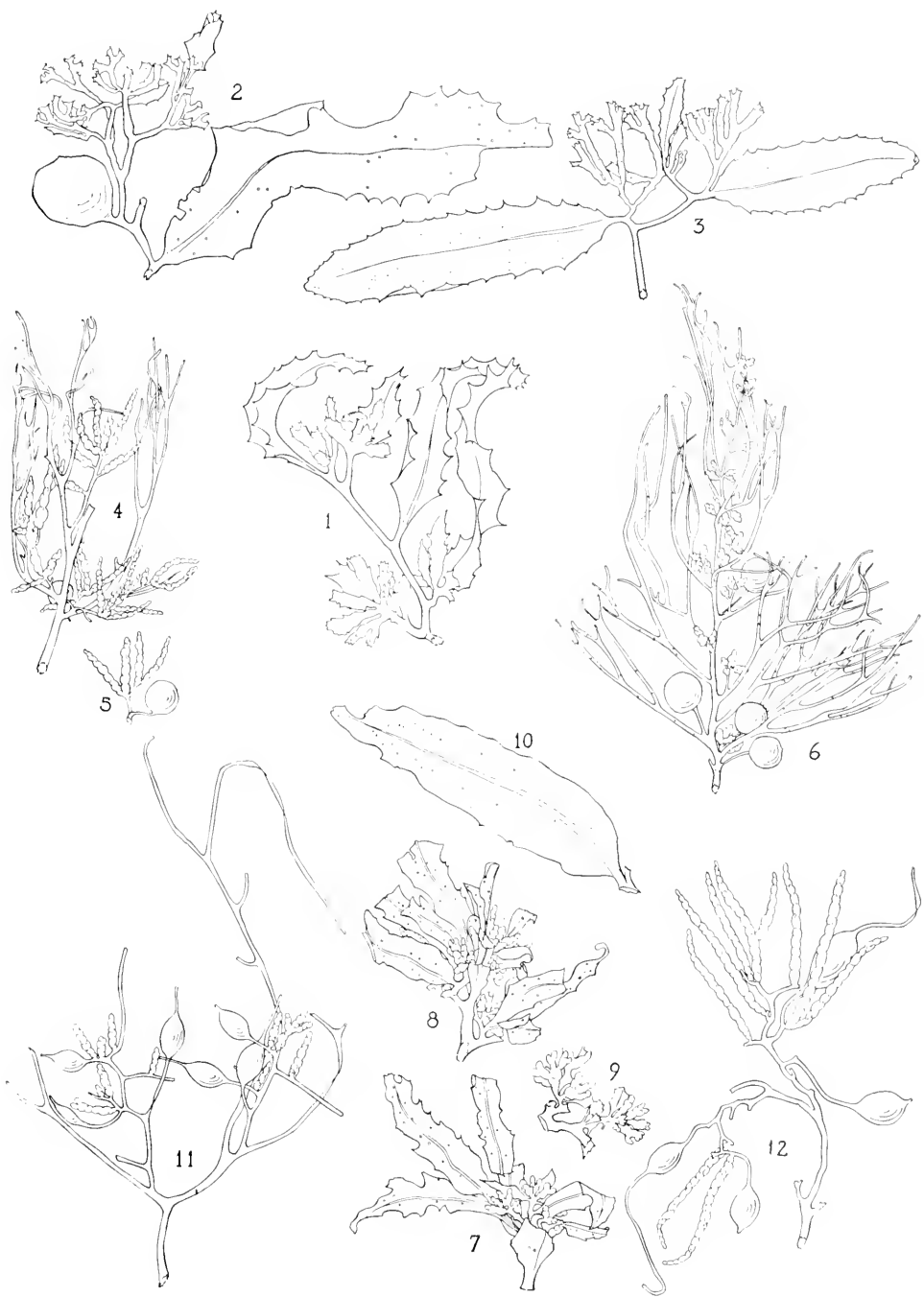
Sargassum pacificum Bory

forma *congestum* forma nov.

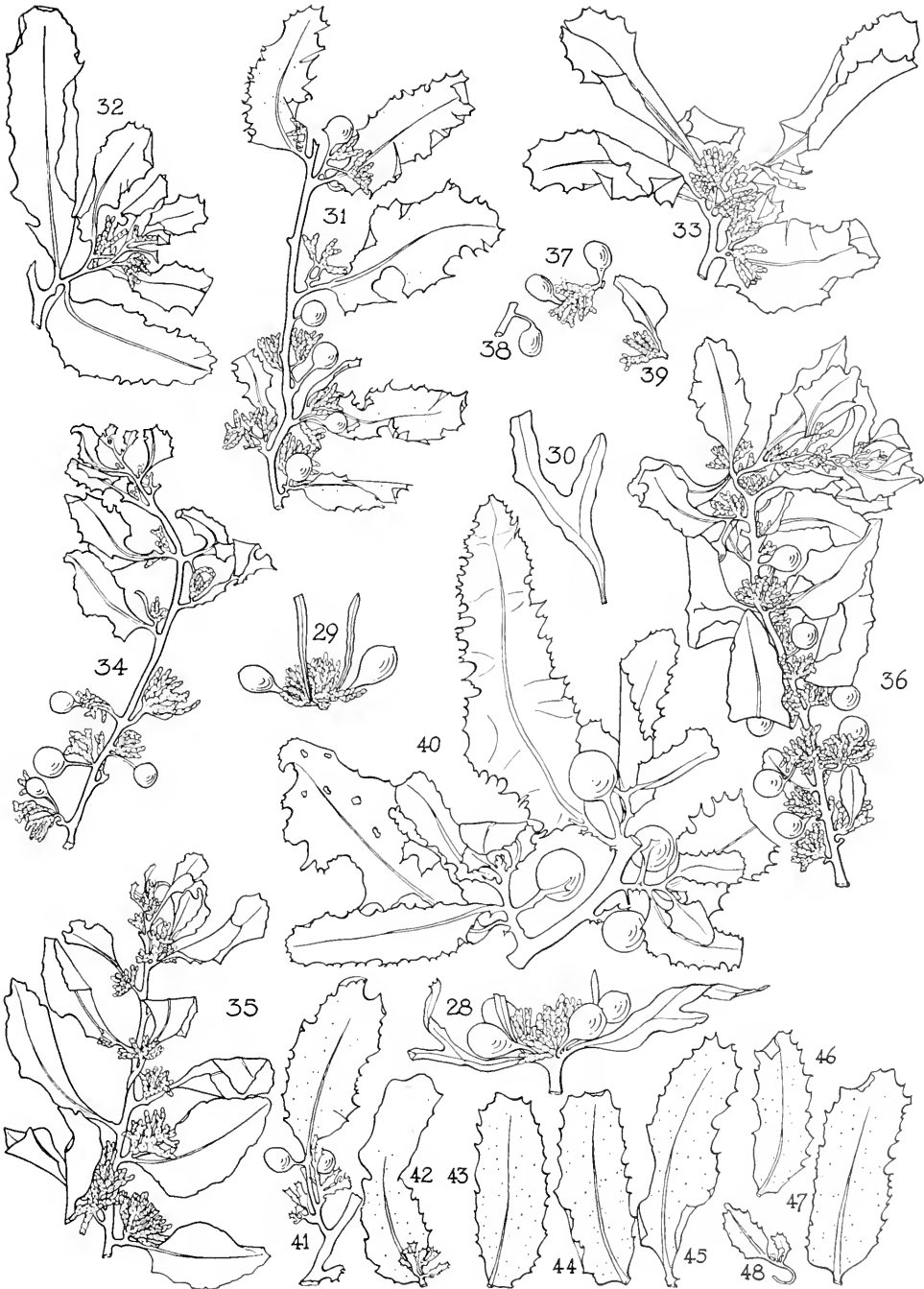
Fig. 63. A plant with unusually long branches (Howell No. 149).

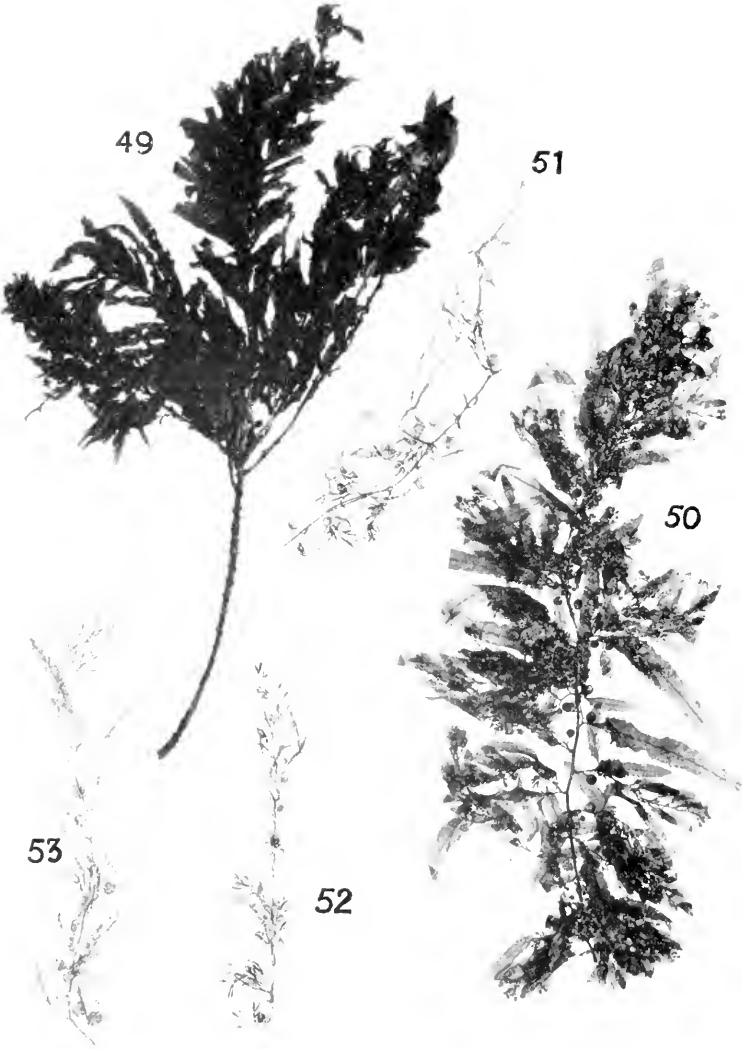
Fig. 64. A most congested primary (?) branch (Howell No. 149).

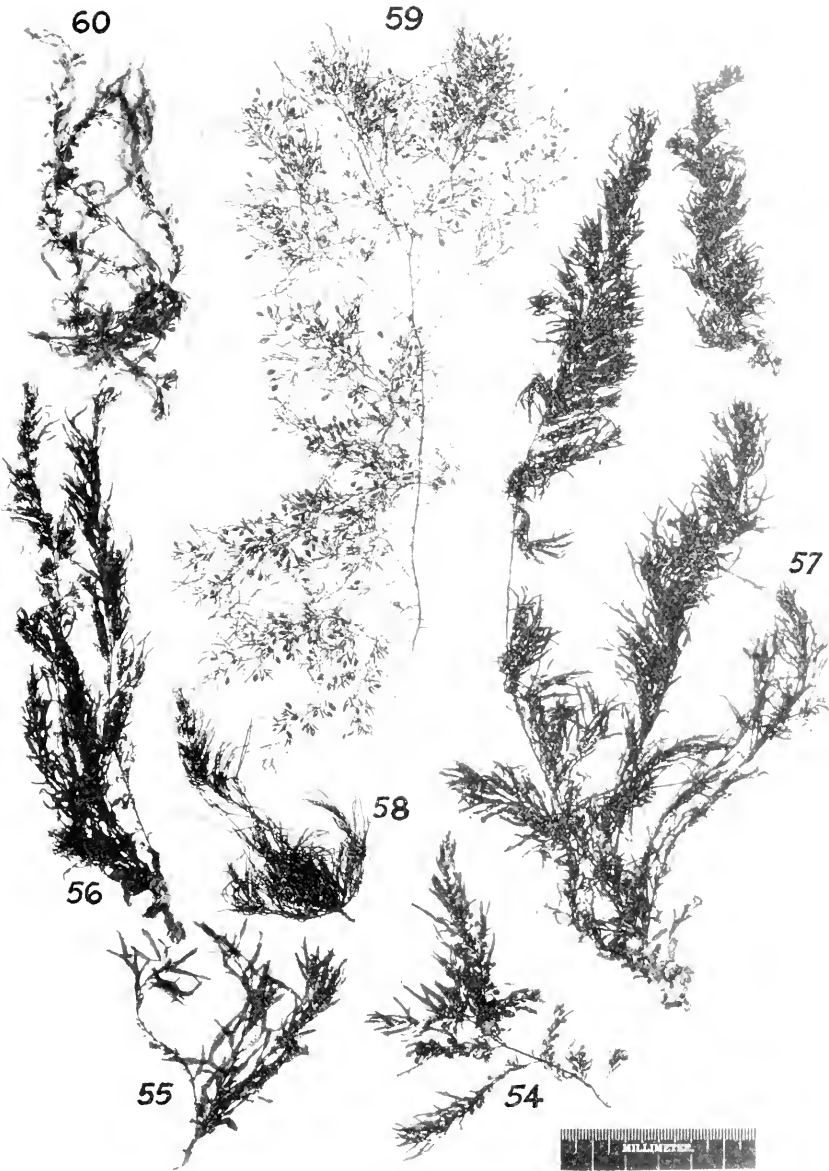
Photo. W. C. Matthews, reduced to approximately 0.5 diameter.













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**THE TEMPLETON CROCKER EXPEDITION OF THE
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No. 35**

**NEW SPECIES OF RECENT MOLLUSKS FROM THE
COAST OF WESTERN NORTH AMERICA**

BY
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AND
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The Templeton Crocker Expedition to the Galapagos Islands in 1932 secured a large collection of marine mollusks. Many of the species represented in that assemblage are comparatively rare in conchological collections. Two papers¹ dealing with portions of this valuable collection have already appeared and the present one contains descriptions of nineteen species which appear to be new to science.

The writers wish to express their thanks to Mr. Templeton Crocker whose generosity has made this paper possible. Gratitude is also due to Dr. G. D. Hanna, Curator of the Department of Paleontology of the California Academy of Sciences, for helpful suggestions and criticism of the manuscript, and for the drawings of the new species of *Pleurodon*. Acknowledgment is also made to Mr. Frank L. Rogers, who has prepared the photographs. These photographs are the result of work accomplished as a part of a Government Works Progress Administration project.

¹ A. M. Strong, G. D. Hanna, and L. G. Hertlein. Marine Mollusca from Acapulco, Mexico, with notes on other species. Proc. Calif. Acad. Sci., 4th ser., vol. 21, no. 10, Dec. 21, 1933, pp. 117-130, plates 5 and 6.
L. G. Hertlein. The Recent Pectinidae. Proc. Calif. Acad. Sci., 4th ser., vol. 21, no. 25, Sept. 26, 1935, pp. 301-328, plates 18 and 19.

Nuculana lucasana Strong and Hertlein, new species

Plate 34, figures 9, 12, 13

Shell small, olivaceous, swollen, fairly thick with the beaks a little nearer the anterior end; anterior end evenly rounded, with a shallow, radial depression extending from the beaks to the basal margin; posterior end narrowed by the broad, depressed dorsal area, the end rounded, without rostration; basal margin evenly rounded; posterior dorsal area concave near the beaks, the edge raised, giving the appearance of an escutcheon, but not bounded by either angle or rib; entire surface sculptured with close, uninterrupted, raised, concentric threads; inside white, polished; hinge with strong, projecting teeth, of which there are fourteen on the posterior and sixteen on the anterior side of the small ligamental pit. The type measures: length, 11.8 mm., height, 8.0 mm., diameter, 6.8 mm.

Holotype: No. 6966, and *paratype*: No. 6967, Calif. Acad. Sci., Paleo. Type Coll., from Loc. 27,584 (C.A.S.), Lat. 23° 03' to 23° 06' N., Long. 109° 36' to 109° 31' W., dredged about 10 miles due east of San Jose del Cabo, Lower California, Mexico, in 20 to 220 fathoms, Templeton Crocker Expedition, August 5, 1932. One hundred and seventy-five additional specimens were dredged at the same locality.

In many ways this shell conforms to the description of the unfigured *Leda* (*Jupiteria*) *lobula* Dall², dredged off Acapulco in 141 fathoms. Of this Dall states: "It is remarkable for its oval shape, which, if characteristic of the fully adult, would hardly allow it to be a member of this section of the genus." Dall's type measured: length 4.7 mm., alt., 3.2 mm., diam., 1.5 mm. Our shell is much larger, with the diameter nearly as great as the height. Also in Dall's description no mention is made of the anterior radial depression, which is present in many, although not in all species in the genus. Our shell is not typical of any subdivision of *Nuculana* recorded from the west coast of North America, the shape being more like that of some species of *Tindaria*. However the hinge seems to be that of *Nuculana*.

Modiolus eiseni Strong and Hertlein, new species

Plate 34, figures 11, 14, 15, 16

Shell thin, elongate, inflated, smooth; hinge line oblique, long, straight, with the beaks at about one third the distance from the anterior end; beaks hooked, rising above the hinge line; dorsal margin nearly straight, meeting the hinge line at a distinct angle and forming a wing-like projection; ventral margin slightly concave near the middle with a small byssal gape; extremities rounded; interior iridescent. The shell is covered with a thin, polished epidermis, colored in three zones radiating from the beaks; the dorsal half of the shell, extending to the bulging portion along a line from the beaks to the posterior end of the ventral margin, is claret brown of Ridgway; the anterior third extending to a line from the beaks to the middle of the

² Bull. Mus. Comp. Zool., vol. 43, no. 6, 1908, p. 375. U.S.S. *Albatross* station 3422, in 141 fathoms, mud, off Acapulco, Mexico, bottom temperature 53.5°.

ventral margin is raw umber; between these two zones is a narrow whitish band. The posterior portion of the shell is somewhat hirsute, holding a thin layer of sand grains. The type measures: length, 29 mm., height, 13 mm., maximum diameter of the two valves, 12 mm.

Holotype: No. 6968, Calif. Acad. Sci., Paleo. Type Coll., from Loc. 27,583 (C.A.S.), Lat. $22^{\circ} 44' N.$, Long. $105^{\circ} 59' W.$, about 38 miles southeast of Mazatlan, Sinaloa, Mexico, and about 8 miles offshore, in 10 to 17 fathoms, Templeton Crocker Expedition, July 29, 1932.

A second specimen was dredged at the same locality, and another at Loc. 27,584 (C.A.S.), Lat. $23^{\circ} 03'$ to $23^{\circ} 06' N.$, Long. $109^{\circ} 31'$ to $109^{\circ} 36' W.$, in 20 to 220 fathoms, about 10 miles due east of San Jose del Cabo, Lower California, Mexico.

The most striking characters of this species are the wing-like expansion of the dorsal margin and the brilliant color pattern, which easily distinguish it from such species as *Modiolus rectus* Conrad, or any other species described from western North America.

This species is named for Dr. Gustav Eisen, long a member of the California Academy of Sciences, in recognition of his pioneer zoological work in the southern part of Lower California.

***Cardium (Papyridea) crockeri* Strong and Hertlein, new species**

Plate 34, figures 1, 2, 7, 10

Shell ovate, a little longer than high, beaks nearly central; posterior gape distinct; anterior dorsal margin with a narrow depressed area; sculptured with forty-eight low, flattened, radiating ribs with much narrower interspaces, strongest at the posterior end, becoming narrower toward the anterior end; of these ribs twelve on the posterior end and eighteen on the anterior end are imbricated by small, pointed folds, more or less worn off toward the beaks, central ribs smooth; exterior yellowish white with short patches of red arranged in irregular concentric zones on the ribs; interior white, stained with reddish toward the beaks on the anterior side; margins crenulated; ligament external, strong, short; hinge with one cardinal and two laterals in each valve. The type measures: length, 46.8 mm., height, 41 mm., thickness of the two valves, 29 mm.

Holotype: No. 6969, Calif. Acad. Sci., Paleo. Type Coll., from Loc. 27,588 (C.A.S.), dredged in Lat. $24^{\circ} 14'$ to $24^{\circ} 18' N.$, Long. $111^{\circ} 28'$ to $111^{\circ} 29' W.$, about 13 miles southeast of Cabo Tosco, Santa Margarita Island, Lower California, Mexico, Templeton Crocker Expedition, August 8, 1932. A second but much smaller specimen was also dredged at the type locality.

The species differs from *Cardium (Papyridea) aspersum* Sowerby, in possessing a more convex shell, which has a more rounded outline and it is ornamented by brighter colors. The anterior plate on the hinge, which bears a groove and lateral tooth, is longer than the corresponding plate in *Cardium aspersum*.

This species is dedicated to Mr. Templeton Crocker, the enthusiastic leader of the expedition.

Pleurodon subdolus Strong and Hertlein, new species

Plate 35, figures 14, 18, 19

Shell minute, obliquely ovate, smooth, white, translucent; beaks prominent, hinge line short, straight, forming a small, flaring projection at each end; hinge plate broad, continued as a shelf along more than half of the posterior side of each valve, the inner margin turned up and, in the left valve, ending in a lateral tooth; cardinal teeth small, indistinct, divided into a posterior and anterior series, three or four in each, which meet at an angle, those in the posterior series being larger and wider spaced. The type measures: length, 1.85 mm., height, 2.5 mm.

Holotype: No. 6970, and *paratypes*: Nos. 6971 and 6972, Calif. Acad. Sci., Paleo. Type Coll., from Loc. 27,584A (C.A.S.), Lat. 23° 12' N., Long. 106° 29' W., dredged in 12 fathoms, about five miles west of Mazatlan, Sinaloa, Mexico, Templeton Crocker Expedition, August 2, 1932. Three additional valves were dredged at the same locality.

Pleurodon munitum Carpenter³, of which *Nucula petriola* Dall⁴ is a synonym, is the only West Coast species previously placed in this genus. It is a more regularly oval shell with a very persistent, dark epidermis, and the hinge plate is quite different. The hinge of the present species is very similar to that of *Pleurodon adamsi* Dall⁵, from the Straits of Florida, but the West American shell is considerably narrower in proportion to the length.

Cuspidaria lanieri Strong and Hertlein, new species

Plate 34, figure 8

Shell minute, plump, white, with a pale epidermis, the left valve a little the smaller, beaks a little nearer the anterior end; the anterior end rounded; the posterior end produced, compressed, strongly rostrate, truncate; sculptured with radiating ribs of which the one defining the beginning of the rostration and a second some distance anterior to it are strongly raised and project a short distance beyond the margin of the shell; these are followed anteriorly by ten smaller, closer spaced ribs with some indications of intercalary threads; on the rostrum there are four closely spaced radial threads near the dorsal margin; entire surface with microscopic lines of growth, most prominent near the end of the rostrum. The type measures: length, 4.5 mm., height, 2.9 mm., diameter, 1.2 mm.

³ *Cyrrilla munita* Carpenter, Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 4, 1898, p. 602. "from thirty fathoms off Catalina Island, California." — Dall, U. S. Nat. Mus., Bull. 112, 1921, p. 14. "Santa Barbara Islands, to Gulf of California." — I. S. Oldroyd, Stanford Univ. Publ. Univ. Ser., Geol. Sci., vol. 1, no. 1, 1924, p. 36 (as *Pleurodon munitum*), Dall's range cited.

⁴ *Nucula petriola* Dall, Proc. U. S. Nat. Mus., vol. 52, 1916, p. 395. "off Santa Rosa Island, California, in 53 fathoms, mud."

⁵ Trans. Wagner Free Inst. Sci., vol. 3, pt. 4, 1898, p. 601, pl. 24, fig. 9. "Dredged seven miles east of Povey Rocks, Straits of Florida."

Holotype: No. 6973, and *paratype*: No. 6974, Calif. Acad. Sci., Paleo. Type Coll., from Loc. 27,584 (C.A.S.), Lat. $23^{\circ} 03'$ to $23^{\circ} 06'$ N., Long. $109^{\circ} 31'$ to $109^{\circ} 36'$ W., dredged in 20 to 220 fathoms, about 10 miles due east of San Jose del Cabo, Lower California, Mexico, Templeton Crocker Expedition, August 5, 1932. Sixteen additional valves were dredged in the same locality.

The outline of this shell is quite similar to that of *Cuspidaria dulcis* Pilsbry & Lowe,⁶ represented in the Academy collection by specimens from the Tres Marias Islands. The present species is smaller, with more numerous ribs and lacks the twinning of the ribs on the left valve. Except for the *Albatross* dredging at great depths, records of species of this genus in west coast tropical waters are very few. Two species, *Cuspidaria costata* Sowerby⁷ and *Cuspidaria didyma* Hinds,⁸ have been described from Central America. Neither have been recognized in the Academy collection, nor in the extensive collection made by H. N. Lowe. The descriptions of both are so brief that positive identification of the species would be difficult. The sculpture of the present species is so striking that it would hardly seem possible to refer it to either of them.

This species is named for Mr. Robert J. Lanier, Assistant Superintendent of the Steinhart Aquarium of the California Academy of Sciences. He accompanied the Templeton Crocker Expedition to the Galapagos Islands and assisted in the collecting of many marine mollusks.

Poromya trosti Strong and Hertlein, new species

Plate 34, figures 3, 4, 5, 6

Shell small, rounded, thin, plump, smooth except for lines of growth; covered with a thin, yellowish brown epidermis, lighter toward the prominent umbones; both valves having a narrow, posterior area defined by a shallow, radial groove; interior pearly, hinge with a strong, rounded projecting cardinal tooth in one valve, fitting into a notch in the opposite valve; and a small, oblique, internal ligament and resilium set just behind the beaks. The type measures: length, 15.0 mm., height, 12.0 mm., thickness of the two valves, 8.7 mm.

Holotype: No. 6975, and *paratype*: No. 6976, Calif. Acad. Sci., Paleo. Type Coll., from Loc. 27,602 (C.A.S.), dredged in 40 to 60 fathoms, Cortes Bank, about 40 miles southwest of San Clemente Island, California, Templeton Crocker Expedition, August 24, 1932.

⁶ *Cuspidaria* (*Cardiomya*) *dulcis* Pilsbry and Lowe, Proc. Acad. Nat. Sci., Philadelphia, vol. 84, 1932, p. 104, pl. 17, figs. 20, 21, 22. "Acapulco, in about 20 fathoms." "Also San Juan del Sur, Nicaragua."

⁷ *Anatina costata* Sowerby, Proc. Zool. Soc. London, 1834, p. 87. "*Hab.* ad Sanctam Elenam." In sandy mud at a depth of six fathoms.

⁸ *Neaera didyma* Hinds, Zool. Voy. *Sulphur*, Moll., pt. 3, January, 1845, p. 70, pl. 20, fig. 19. "The West Coast of Veragua, in twenty-six fathoms, mud; in society with *N. costata*."

This species is easily separated from *Poromya tenuiconcha* Dall and other California species of the genus *Poromya* by the posterior radial groove.

This species is named for Mr. Henry Trost of the De Young Memorial Museum, San Francisco, California.

***Volvulella panamica* Dall**

Plate 35, figure 3

Volvulella panamica DALL, Proc. U. S. Nat. Mus., vol. 56, 1919, p. 298. "Panama Bay at station 2799, in 29½ fathoms, U. S. Fish Commission."

Fifteen specimens, dredged at Loc. 27,584A (C.A.S.), Lat. 23° 12' N., Long. 106° 29' W., Templeton Crocker Expedition, 1932, are referred to this species. The Academy also has specimens dredged in from 3 to 9 fathoms by L. G. Hertlein at Taboga Island, Panama, in 1932, which appear to be the same.

Dr. Dall states in his description "aperture very narrow with an apical sulcus." The specimens have the posterior end of the aperture somewhat flaring, not extending along the side of the spire as it does in other west coast species. This may be what Dall meant by an "apical sulcus." On this basis this identification is made, and the description of the new species, *Volvulella lowei* is published with some hesitation. For many years *Volvulella cylindrica* Carpenter, 1865,⁹ type locality Santa Barbara, California, was the only species in the genus recognized from the West Coast.

Dall in 1919¹⁰ added five new species, two from southern California, and three from the Bay of Panama, dredged in depths ranging up to 60 fathoms. The types of none of these have been figured, and there are but slight differences indicated by the descriptions. With the exception of the statement by Dall¹¹ that the range of *V. cylindrica* Carpenter is from Vancouver to the Gulf of California and a citation by Lowe¹² of *V. californica* Dall from Punta Penasco in the Gulf of California, there is no published record for any species in the genus between Scammon Lagoon, Lower California, and the Bay of Panama.

***Volvulella lowei* Strong and Hertlein, new species**

Plate 35, figure 2

Shell minute, pale brown, subcylindrical, involved, with a short apical point; smooth, except for twelve fine spiral grooves on the anterior and eight on the posterior end, showing as darker brown spiral lines on the fresh specimen; aperture the

⁹ Ann. Mag. Nat. Hist., ser. 3, vol. 15, 1865, p. 179. "Sta. Barbara (Jewett)."

¹⁰ Proc. U. S. Nat. Mus., vol. 56, 1919, pp. 297 to 299. The following are described as new by Dall in this publication: *Volvulella cooperi*, from Scammon Lagoon, Lower California; *V. californica*, off Santa Rosa Island, California; *V. panamica*, Panama Bay; *V. catharia*, Panama Bay; *V. callicera*, Galapagos Islands.

¹¹ U. S. Nat. Mus., Bull. 112, 1921, p. 62.

¹² Trans. San Diego Soc. Nat. Hist., vol. 8, no. 6, 1935, p. 29.

full length of the shell, very narrow, the posterior end forming a groove in the spine, the outer lip thin, parallel to the body of the shell, broadly rounding into the columella at the anterior end; columella oblique, nearly straight, slightly raised, leaving a shallow umbilical groove; body with a thin callus. The type measures: length, 4.2 mm., maximum diameter, 1.5 mm.

Holotype: No. 6978, Calif. Acad. Sci., Paleo. Type Coll., from Loc. 23,805 (C.A.S.), **Puerto Escondido, Gulf of California**. Fred Baker Collector, Expedition of the California Academy of Sciences to the Gulf of California, 1921. One additional specimen was collected at the same locality. Additional specimens were dredged in from three to nine fathoms at Bahia Honda, Veragua, Panama, by L. G. Hertlein in 1932. Also dredged at Loc. 27,584A (C.A.S.), Lat. 23° 12' N., Long. 106° 29' W., about five miles off Mazatlan, Sinaloa, Mexico, Templeton Crocker Expedition, 1932.

Except for the type these specimens are all bleached a dull white and show the spiral grooves without the color lines. In the type the apical spine is broken, while many of the other specimens have an elevated spine, in some cases distinctly curved. The species differs from southern California specimens of *Volvulella cylindrica* Carpenter in the more slender form, and in having the spiral grooves more distinctly grouped at the posterior and anterior ends. All other West Coast species are said to be smooth or with microscopic spiral striae only.

This species is named for the late Mr. Herbert N. Lowe, of Long Beach, California, in recognition of his contributions to the knowledge of the conchology of western North America.

***Fusinus zacae* Strong and Hertlein, new species**

Plate 35, figure 10

Shell slender, fusiform, with a long, slightly twisted canal, dark brown, lighter on the interspaces between the axial ribs of the lower whorls, base and canal reddish brown; nuclear whorls smooth, followed by eight strongly sculptured whorls, angulated in the middle; sutures strongly appressed; axial sculpture of eight, rounded ribs, strong over the middle of the whorls, fading out toward the summit of the whorls and on the base; entire surface with wavy lines of growth; spiral sculpture of six cords, faint in the interspaces, strong over the axial ribs where they form narrow, spirally elongated nodes; of these cords the one on the angle of the whorls is the strongest, while the two between the angle and the summit and the three between the angle and the suture become progressively weaker; base and canal with about fifteen, faint, spiral threads; outer lip thin; columella smooth. The type measures: length, 52 mm., length of aperture and canal, 25 mm., maximum diameter, 20 mm.

Holotype: No. 6979, Calif. Acad. Sci., Paleo. Type Coll., dredged in 20-220 fathoms at Loc. 27,584 (C.A.S.), Lat. 23° 03' to 23° 06' N., Long. 109° 31' to 109° 36' W., about 10 miles due east of **San Jose del Cabo, Lower California, Mexico**, Templeton Crocker Expedition, 1932.

In some ways this species agrees with the description of the unfigured *Fusinus centrifugus* Dall¹³ from the Galapagos, but the surface of our west Mexican species can hardly be said to be sculptured with "elevated lamellae," or the spiral cords to form "spade shaped spines" where they cross the axial ribs.

This species is named for Mr. Templeton Crocker's yacht *Zaca*.

***Nassarius gallegosi* Strong and Hertlein, new species**

Plate 35, figure 11

Shell short, conic, pale brown, darker on the back of the body whorl; nucleus of three, smooth, polished, rounded whorls; subsequent sculptured whorls seven, well rounded, sutures distinct; axial sculpture of seventeen, low, rounded ribs, strongest on the spire, fading out on the base; spiral sculpture of narrow cords which are somewhat swollen when they cross the axial ribs, of these, three at the summit are closely spaced, followed by three, somewhat stronger and wider spaces and two fine, closely spaced threads at the suture; base with eight, moderately strong, spiral cords; outer lip with a strong varix, inside with faint ridges corresponding to the external sculpture; body with a whitish callous, overriding but not obscuring the spiral sculpture, and a strong spiral ridge near the middle; columella broad, reflexed, terminating in a strong keel; canal short, strongly recurved, with a rather broad, spirally threaded, siphonal fasciole, separated from the base of the body whorl by a deep groove. The type measures: length, 21.5 mm., maximum diameter, 13.5 mm.

Holotype: No. 6980, Calif. Acad. Sci. Paleo. Type Coll., from Loc. 27,574 (C.A.S.), Lat. 18° 33' N., Long. 103° 45' W., dredged in 52 fathoms, near **Manzanillo, Colima, Mexico**, Templeton Crocker Expedition, 1932. One hundred and eighty-two additional specimens were dredged at the same locality.

Specimens were also secured by the Templeton Crocker Expedition at the following localities:

Loc. 27,557 (C.A.S.), between Punta Arenas and Bat Island, Costa Rica, Templeton Crocker Expedition, July 1, 1932.

Loc. 27,566 (C.A.S.), Lat. 14° 15' N., Long. 92° 28' W., dredged in 35 fathoms, about 28 miles west of Champerico, Guatemala, Templeton Crocker Expedition, July 11, 1932.

Loc. 27,569 (C.A.S.), Lat. 15° 40' N., Long. 93° 49' W., dredged in 28 fathoms, about 15 miles south of La Puerta Light, Gulf of Tehuantepec, Templeton Crocker Expedition, July 12, 1932. H. W. Clark Coll.

Loc. 27,568 (C.A.S.), Lat. 14° 52' N., Long. 93° 04' W., dredged in 35 fathoms, about 23 miles west of San Simon Bar, Chiapas, Mexico, Templeton Crocker Expedition, July 11, 1932. H. W. Clark Coll.

Loc. 27,571 (C.A.S.), Lat. 16° 38' N., Long. 99° 27' 30" W., to Lat. 16° 39' N., Long. 99° 24' 30" W., dredged in 20 to 45 fathoms,

¹³ Nautilus, vol. 29, no. 5, 1915, p. 56. "at the Galapagos Island in 33 fathoms, sandy bottom."

33 miles eastward of Acapulco, Guerrero, Mexico and about 32 miles west of Dulce Bay, Templeton Crocker Expedition, July 15, 1932.

Loc. 27,527 (C.A.S.), dredged in Acapulco Bay,¹⁴ Guerrero, Mexico, Templeton Crocker Expedition, April 4, 1932.

Loc. 27,573 (C.A.S.), Lat. 18° 14' N., Long. 103° 23' W., dredged in 60 fathoms, just off shore at Maruata, and about nine miles southeast of Pt. Telmo, and about 74 miles southeast of Manzanillo, Colima, Mexico, Templeton Crocker Expedition, July 17, 1932.

Loc. 27,580 (C.A.S.), dredged one half mile east of Isabel Island, Templeton Crocker Expedition.

Loc. 27,581 (C.A.S.), dredged between Isabel Island and Mazatlan, Sinaloa, Mexico, Templeton Crocker Expedition, July 28, 1932.

Loc. 27,594 (C.A.S.), Santa Maria Bay, Lower California, dredged in 10 to 16 fathoms, Templeton Crocker Expedition.

This species belongs to an off shore group of *Nassarius* containing *N. insculptus* (Carpenter)¹⁵ of southern California coast, *N. miser* Dall,¹⁶ stated to range from Acapulco to the Gulf of Panama in from 141 to 322 fathoms, and *N. catallus* Dall,¹⁷ reported only from the Gulf of Panama, in 182 fathoms. In the large series of specimens examined there is some difference in the relative strength of the axial and spiral sculpture, but the species seems to be entirely distinct from any described form. It is probably nearest to *N. catallus*, from which it differs principally in the larger size and finer sculpture.

This species is named for Professor José Maria Gallegos, formerly Explorer for the Departamento de Agricultura y Fomento, Mexico.

Mitrella harfordi Strong and Hertlein, new species

Plate 35, figure 15

Shell very small, solid, whitish, with a central band of large, irregular, brown blotches on the body whorl and distant, brown, axial markings on the upper whorls; whorls eight, including a small, undifferentiated nucleus; sutures distinct, narrowly channeled; surface smooth except for twelve strong, spiral grooves on the base and canal; aperture narrow, with a well defined hump just back of its thick outer lip, distinctly sinuated, the sinus bounded internally by a denticle, below which are five indistinct, spiral ridges; body with a thin callus; columella thickened; slightly grooved in accordance with the spiral sculpture; canal short. The type measures: length, 3.4 mm., maximum diameter, 1.8 mm.

Holotype: No. 6981, Calif. Acad. Sci. Paleo. Type Coll., from Loc. 27,571 (C.A.S.), Lat. 16° 38' N., Long. 99° 27' 30'' W., to Lat. 16° 39' N., Long. 99° 24' 30'' W., dredged in 20 to 45 fathoms, about 33 miles eastward of Acapulco, Guerrero, Mexico, and 32

¹⁴ This species was listed from this locality as *Nassarius miser* Dall, in Proc. Calif. Acad. Sci., ser. 4, vol. 21, no. 10, 1933, p. 119.

¹⁵ Proc. Calif. Acad. Sci., vol. 3, 1864, p. 223. "Catalina Island, 30-40 fm."

¹⁶ Bull. Mus. Comp. Zool., vol. 43, no. 6, 1908, p. 307, pl. 4, fig. 1. Gulf of Panama, in 182 fathoms.

¹⁷ Bull. Mus. Comp. Zool., vol. 43, no. 6, 1908, p. 307, pl. 11, fig. 11. Gulf of Panama, in 182 fathoms.

miles west of Dulce Bay, Templeton Crocker Expedition, July 15, 1932. Fifteen additional specimens were dredged at the same locality. Fourteen specimens of the species were dredged in from three to nine fathoms off Taboga Island, Panama by L. G. Hertlein in 1932.

In many ways this species resembles the northern shell commonly known as *Mitrella gausapata* Gould, but it is much smaller.

The swollen hump on the body whorl, similar to that on many species of *Strombina*, has not been noticed in any other species placed in the genus *Mitrella* from the West Coast, although in all other ways the species conforms to the definition of that genus.

This species is named for Mr. W. G. W. Harford, early Director of the Museum and Curator of Conchology of the California Academy of Sciences.

Anachis sinaloa Strong and Hertlein, new species

Plate 35, figure 6

Shell small, ovate, solid; nuclear whorls three, pale brown, smooth, glassy; subsequent sculptured whorls four, pale, slightly darker on the base and canal; sutures distinct; axial sculpture consisting of twelve strong ribs, extending from suture to suture, fading out on the base; spiral sculpture of incised grooves, strong in the interspaces, but not visible on the top of the axial ribs on the spire, of these grooves there are six on the spire and six on the base where they tend to cut across the feeble extensions of the axial ribs, canal with eight spiral threads; aperture narrow, outer lip thickened, slightly sinuated near the posterior angle, inside with six spirally elongated denticles; columella broad, obliquely truncated anteriorly; body with a distinct callus more or less ridged in accordance with the spiral sculpture; canal short, a little recurved. The type measures: length 4.2 mm., maximum diameter, 1.8 mm.

Holotype: No. 6982, Calif. Acad. Sci., Paleo. Type Coll., from Loc. 27,584A (C.A.S.), Lat. 23° 12' N., Long. 106° 29' W., dredged in 12 fathoms, **about 5 miles west of Mazatlan, Sinaloa, Mexico**, Templeton Crocker Expedition, August 2, 1932. Twenty-four additional specimens were dredged in the same locality.

The sculpture of this species is similar to that of *Anachis diminuta* (C. B. Adams),¹⁸ which is about the same length but much broader. While none of these specimens contained the animal, some of them look quite fresh. None of them show any indication of the very dark base and canal, which are characteristic of *A. diminuta*. *Anachis rufotincta* Carpenter¹⁹ is also described as having similar sculpture, but has "a deep orange-red stain at the base," and the measurements indicate a smaller and proportionally broader shell.

¹⁸ *Columbella diminuta* C. B. Adams, Ann. Lyceum Nat. Hist., New York, vol. 5, 1852, p. 309. "Panama."

¹⁹ *Anachis rufotincta* Carpenter, Cat. Mazatlan Shells [1855-]1857 p. 511. "Mazatlan," off Chama and Spondylus.

Anachis guerreroensis Strong and Hertlein, new species

Plate 35, figure 4

Shell small, ovate, solid, nuclear whorls four, smooth, shining, dark brown; subsequent sculptured whorls four, bright brown, with a narrow, paler band on the periphery of the body whorl; sutures distinct; axial sculpture of twelve rounded ribs, extending from suture to suture, fading out on the base; spiral sculpture of incised grooves in the interspaces between the ribs, of these grooves there are seven on the spire between the sutures and fifteen on the base and canal; aperture narrow, outer lip thickened, sinated near the posterior angle, inside with six spirally elongated denticles; columella broad, obliquely truncated anteriorly, bearing five rounded denticles; body with a strong callus; canal short, a little recurved. The type measures: length, 4.2 mm., diameter, 1.9 mm.

Holotype: No. 6983, Calif. Acad. Sci. Paleo. Type Coll., from Loc. 27,571 (C.A.S.), Lat. 16° 38' N., Long. 99° 27' 30" W., to Lat. 16° 39' N., Long. 99° 24' 30" W., dredged in 20 to 45 fathoms, about 33 miles eastward of Acapulco, Guerrero, Mexico, and about 32 miles west of Dulce Bay, Templeton Crocker Expedition, July 15, 1932. Nine additional specimens were dredged at the same locality.

Anachis guerreroensis belongs to the same group as *Anachis sinaloa* Strong & Hertlein, new species; it differs in the more numerous spiral grooves, and in the distinctly different color pattern.

Strombina bonita Strong and Hertlein, new species

Plate 35, figure 9

Shell slender, with a sharp, pointed spire; whitish, with a few, small, irregular, brown blotches; consisting of two, smooth nuclear and nine, flattish subsequent sculptured whorls; axial sculpture of eighteen, rounded, nearly vertical ribs, which are moderately shouldered at the suture and fade out as they pass over the slightly angulated periphery; spiral sculpture of about sixteen, slender threads on the base and canal, and a few microscopic striations on the spire; aperture oblong, outer lip thin at the edge, thickened a short distance back, with a slight hump on the outside and eleven spiral ridges on the inside; canal short, recurved. The type measures: length, 19 mm., diameter, 7.5 mm.

Holotype: No. 6984, Calif. Acad. Sci. Paleo. Type Coll., from Loc. 27,587 (C.A.S.), dredged in 20 to 25 fathoms off Cape San Lucas, Lower California, Mexico, Templeton Crocker Expedition, August 6, 1932. Two other specimens were dredged at the same locality. One immature specimen was taken at the nearby locality 27,585 (C.A.S.), Lat. 23° 02' N., Long. 109° 32' W., in 25 fathoms, a few miles offshore at Gorda Point, in San Jose del Cabo Bay, Lower California, Templeton Crocker Expedition, August 5, 1932.

This species can best be compared with *Strombina subangularis* Lowe,²¹ of which a number of specimens were dredged by the Tem-

²¹ Trans. San Diego Soc. Nat. Hist., vol. 8, no. 6, 1935, p. 21, pl. 3, fig. 2. "Carmen Island, Gulf of California, dredged in 20 fathoms."

pleton Crocker Expedition at Loc. 27,585 (C.A.S.). It is a smaller shell with more numerous axial ribs, stronger spiral sculpture, less angulated periphery and shorter canal. *Strombina angularis* (Reeve)²² from Panama is figured as a larger shell, with fewer axial ribs and a much more strongly angulated periphery.

Trophon keepi Strong and Hertlein, new species

Plate 35, figure 8

Shell thin, delicate, white; nuclear whorls two, smooth, rounded, tilted; subsequent sculptured whorls seven, with strongly tabulated shoulders; axial sculpture of twelve sharp varices, sharply angulated and more or less spinose at the shoulder, continuous over the entire whorl and extending to the canal, where they become lower and closely crowded; spiral sculpture of close, microscopic striations; outer lip thin, angulated at the shoulder of the whorl; body and columella with a coat of white enamel; canal long, slightly twisted and strongly recurved. The type measures: length, 26.9 mm., length of aperture and canal, 14.5 mm., maximum diameter, including varices, 10 mm.

Holotype: No. 6985, Calif. Acad. Sci. Paleo. Type Coll., from Loc. 27,603 (C.A.S.), dredged in 30 to 50 fathoms off the west end of San Nicolas Island, California, Templeton Crocker Expedition, August 27, 1932.

In outline the single type specimen resembles that of *Trophon triphorus* Dall,²³ said to range from the Straits of Juan de Fuca to off Piedras Blancas, Lower California. It differs in the much stronger development of the varices and the lack of the spiral cords.

This species is named for Prof. Josiah Keep, conchologist and early member of the California Academy of Sciences.

Eulimostraca bartschi Strong and Hertlein, new species

Plate 35, figure 7

Shell minute, elongate conic, translucent, the internal structure showing through and forming a distinct false suture, pale flesh color, with the base light brown, showing through as a darker line between the true and false sutures on the spire; whorls nine, the first three somewhat rounded, the latter whorls becoming flattened, sutures very indistinct; periphery subangulated, base short, rounded; aperture oval with the posterior angle acute; outer lip somewhat drawn forward in the middle; inner lip curved, raised, with behind it a shallow groove in the umbilical region; body with a thin, well defined callus. The type measures: length, 1.8 mm., maximum diameter, 0.5 mm.

Holotype: No. 6986, Calif. Acad. Sci. Paleo. Type Coll., from Loc. 27,584A (C.A.S.), Lat. 23° 12' N., Long. 106° 29' W., dredged in

²² Conch. Icon., vol. 11, 1859, pl. 1, fig. 1a, 1b.

²³ Proc. U. S. Nat. Mus., vol. 24, 1902, p. 545, dredged "off Destruction Island, State of Washington, in 516 fathoms." Also "off Tillamook Bay, Oregon, in 786 fathoms." — U. S. Nat. Mus., Bull. 112, 1921, pl. 15, figs. 8 and 9.

12 fathoms, **about five miles west of Mazatlan, Sinaloa, Mexico**, Templeton Crocker Expedition, August 2, 1932. Seven additional specimens were secured at the same locality.

This species is very similar to *Eulimostraca galapagensis* Bartsch,²⁴ dredged in 40 fathoms off the Galapagos Islands, the only species previously described in the genus from the West Coast. It differs principally in being much smaller with a less angulated periphery.

This species is named for Dr. Paul Bartsch, Curator of Mollusks in the U. S. National Museum in recognition of his contributions to conchology.

Epitonium (Nitidiscala) willetti Strong and Hertlein, new species

Plate 35, figure 5

Shell small, white, thin, turreted; nuclear whorls four, strongly rounded, elevated, smooth, changing abruptly to the sculpture of the succeeding whorls, of which there are five in the type; normal whorls well rounded, sutures deep; spiral sculpture absent; axial sculpture of eighteen, low, sharp, erect, strongly retractive varices, continuous over the sutures where they make a marked curve to the left as they ascend the spire; at the shoulder of the whorls there is sometimes a slight expansion of the varices but no indication of a spine or coronation; on the base the varices become lower and decidedly curved; aperture nearly circular; lip thin, continuous; shell not umbilicated. The type measures: length, 3.2 mm., maximum diameter, 1.6 mm.

Holotype: No. 6987, *paratypes*: Nos. 6988, 6989, 6990 Calif. Acad. Sci. Paleo. Type Coll., from Loc. 27,584A (C.A.S.), Lat. 23° 12' N., Long. 106° 29' W., **dredged in 12 fathoms, about five miles west of Mazatlan, Sinaloa, Mexico**, Templeton Crocker Expedition, August 2, 1932. Six additional specimens were dredged at the same locality.

The type has lost the first two nuclear whorls but they are intact in the paratypes, which have one or two less normal whorls and in some cases twenty or more varices. These specimens are probably young but are evidently quite distinct from the few west coast species with numerous, close spaced varices. The nearest species would seem to be *Epitonium sawinae* Dall,²⁵ which is more slender, with the varices almost always showing spines at the shoulder of at least some of the whorls.

This species is named for Mr. George Willett, Curator of Ornithology in the Los Angeles County Museum, Los Angeles, California.

²⁴ Proc. U. S. Nat. Mus., vol. 53, 1917, p. 333, pl. 43, fig. 1. "dredged off Galapagos Island, by the United States Bureau of Fisheries Steamer *Albatross*, at station 2813, in 40 fathoms, on coral sand bottom, bottom temperature 80°."

²⁵ *Scala sawinae* Dall, Proc. Biol. Soc. Washington, vol. 16, December 31, 1903, p. 193; "from 16 fathoms, off the isthmus harbor on the south side of Catalina Island, where it was dredged by W. H. Dall, in 1873." — Strong, Trans. San Diego Soc. Nat. Hist., vol. 4, no. 7, 1930, pp. 194, 195, pl. 20, figs. 9, 10.

Turbonilla (Pyrgiscus) wetmorei Strong and Hertlein, new species

Plate 35, figure 1

Shell minute, elongate conic, semi-translucent horn colored with two, narrow, indistinct, brown, spiral lines on the last two whorls; nuclear whorls large, helicoid, with the axis at right angles to that of the succeeding whorls, in the first of which they are about one third immersed; normal whorls seven, flattened in the middle, on the upper whorls strongly shouldered, less so on the later whorls; sutures distinct; axial sculpture of low, moderately strong, nearly vertical ribs; slightly swollen at the summit of the whorls; of these sixteen appear on the second whorl, increasing to twenty on the last whorl; spiral sculpture of from twelve to sixteen incised lines, varying in number, spacing and strength from whorl to whorl, crossing the rather broad intercostal spaces, but not visible on the tops of the axial ribs; periphery of the last whorl well rounded, base moderately long, rounded, marked by feeble extensions of the axial ribs and six very fine spiral lines; aperture elongate oval, outer lip thin, showing the external sculpture within, body with a thin callus; columella raised, curving into the aperture as an oblique fold. The type measures: length, 3.5 mm., diameter, 0.9 mm.

Holotype: No. 6991, *paratypes*: Nos. 6992, 6993, Calif. Acad. Sci. Paleo. Type Coll., from Loc. 27,584A (C.A.S.), Lat. 23° 12' N., Long. 106° 29' W., dredged in 12 fathoms, about five miles west of Mazatlan, Sinaloa, Mexico, Templeton Crocker Expedition, August 2, 1932. Forty-three additional specimens were secured at the same locality.

Many of the specimens are bleached a dull, chalky white. The species is similar in many ways to *Turbonilla indentata* Carpenter,²⁶ but is more slender and lacks the spiral threads and strong basal sculpture.

This species is named for Dr. Alexander Wetmore, Assistant Secretary, Smithsonian Institution, who on more than one occasion has furnished the writers with needed photographs of certain specimens in the U. S. National Museum.

Cymatium amictum Reeve 1844

Plate 34, figures 17, 18

Reeve stated in his description of the species²⁷ that it came from the Philippine Islands, and the name appears in the Catalogue of Marine Shells of the Philippine Islands by Faustino²⁸ as belonging in that fauna. Our specimens seem to agree with the description and figure in every way. We can find no previous record of this species from the west coast of North America, but several other species in this group have been generally recognized as occurring

²⁶ *Chrysallida indentata* Carpenter, Cat. Mazatlan Shells, [1855]-1857, p. 425. "Mazatlan, Mexico." "off Spondylus."

²⁷ L. Reeve, Conch. Icon., vol. 2, *Triton*, June, 1844, species 62, pl. 15, fig. 62. "Philippine Islands; Cum-ing."

²⁸ *Nyctilochus amictus* Reeve, Faustino, Philippine Bureau of Science, Monogr. 25, 1928, p. 227. "Philippines."

on both sides of the Pacific. The west coast specimens are characterized by the long, curved canal, closely reticulated sculpture on the upper whorls, lower whorls shouldered, sculptured with eight rounded axial ribs crossed by alternating major and minor, flattened, spiral cords below the shoulder and finer spiral threads above. The specimen figured measures: length, 48.8 mm., maximum diameter, 24 mm. It was dredged at Loc. 27,568 (C.A.S.), Lat. 14° 52' N., Long, 93° 04' W., in 35 fathoms, about 23 miles west of San Simon Bar, Chiapas, Mexico, Templeton Crocker Expedition, July 11, 1932.

Colubraria lucasensis Strong and Hertlein, new species

Plate 35, figure 17

Shell rather slender, with two and a half, smooth, glassy whorls and eight, subsequent sculptured whorls, each with strong varix; general color brownish, with a few irregular, indistinct, darker spots and streaks, varices showing a lighter central area, darker above and below; sculpture of fine axial riblets (about thirty-six on the last whorl) crossed by equally fine spiral threads, of which six appear on the spire; the intersections forming small rounded nodules; periphery rounded, base short, rounded, sculptured with about 16 spiral threads and fainter extensions of the axial riblets; aperture oval, outer lip thickened by a varix, inside with twelve, small denticles, each with a corresponding brown dot on the edge of the lip; body with a broad, thin wash of callus, and a faint, spiral rib a short distance below the posterior end of the aperture, the callus continuous with the slightly expanded columella; canal short, reflected. The type measures: length, 27 mm., maximum diameter, 10.5 mm.

Holotype: No. 6995, Calif. Acad. Sci. Paleo. Type Coll., from Loc. 27,587 (C.A.S.), dredged in 20 to 25 fathoms off Cape San Lucas, Lower California, Mexico, Templeton Crocker Expedition, August 6, 1932.

The single type specimen resembles the figure of *Triton soverbii* Reeve,²⁹ but is much smaller, with much less expansion of the columellar lip, and does not have "brown excavated lines ranged two and two." The specimen is probably not fully mature and might develop more similar characters with two or three more whorls. However, it is very doubtful whether the name *soverbii* can be used for a west coast shell. Reeve gave the locality as the Galapagos Islands, Cuming Collection, and stated that it is the shell described as *Triton lineatus* Sowerby, 1833³⁰ (not *Triton lineatus* Broderip, 1833³¹), also that the species is well figured by Chemnitz³².

²⁹ *Triton soverbii* Reeve, Conch. Icon., vol. 2, *Triton*, June, 1844, species 65, pl. 16, figs. 65, 65a. "Galapagos Islands, Pacific Ocean (found in sandy mud at a depth of six fathoms); Cuming."

³⁰ *Triton lineatus* Sowerby, Proc. Zool. Soc., London, 1833, p. 72 "Hab." [No locality cited. The species placed in the group of *T. maculosus* Lamarck.]

³¹ *Triton lineatus* Broderip, Proc. Zool. Soc., London, May, 1833, p. 6. "Hab. ad Insulas Galapagos." "Found in coral sand, in six fathoms."

³² Conchyl.—Cab., Bd. 10, 1788, p. 260, Tab. 162, figs. 1552, 1553. "Ostindischen Meeren und bei der Insel St. Maurice."

The localities recorded by Chemnitz were waters of the East Indies and the Island of St. Maurice. Tryon³³ cited the locality records for the species as Galapagos Islands by Cuming; Isle of France, Chemnitz; and the Red Sea by MacAndrew and Tapparone-Canefri. Carpenter³⁴ and Dall³⁵ listed the species from the Galapagos Islands, probably following Reeve as they cited no other localities. Zetek³⁶ cited the species as occurring in the Panamanian Zoogeographic Province. The only other reference to the species from the West Coast that we have noticed is by Stearns,³⁷ who discussed under the name *Tritonium (Colubraria) sowerbyi* Reeve, a fragment consisting of a basal whorl collected at Indefatigable Island, Galapagos Islands, which he compared with *Triton reticulatus* Blainville and *Triton testaceus* Mörch from the Antilles.

Natica colima Strong and Hertlein, new species

Plate 35, figures 12, 13, 16

Shell subglobose, rather thin, umbilicate, spire short, whorls rounded; covered with a very thin, semi-transparent epidermis; nucleus of three, small, smooth, polished whorls; normal whorls three, pale brownish, with two paler, narrow spiral bands, one just below the suture and the other just below the periphery of the body whorl, between these and on the upper portion of the base are faint indications of darker axial stripes, more distinct near the spiral bands, base whitish near the umbilicus; sculpture of fine, close, retractive axial grooves, most prominent just below the sutures on the upper whorls; aperture semi-circular, outer lip thin, showing the color markings within; columella thickened in the middle at the end of a blunt, spiral ridge within the umbilicus; body with a distinct callus ending abruptly at the umbilicus, notching the umbilical opening above the rib; operculum calcareous, white, slightly concave, the outer surface with eight, deep, square grooves. The type measures: height, 21 mm., maximum diameter, 18 mm.

Holotype: No. 6996, Calif. Acad. Sci., Paleo. Type Coll., from Loc. 27,574 (C.A.S.), Lat. 18° 33' N., Long. 103° 45' W., dredged in 52 fathoms, just offshore at Black Head (**Pta. San Juan de Lima**), about 20 miles northwest of Point Telmo, and about 47 miles south-east of Manzanillo, Colima, Mexico, Templeton Crocker Expedition, July 17, 1932.

The shell is quite similar to that of *Natica scethra* Dall,³⁸ dredged in 153 fathoms, in the Gulf of Panama, U.S.S. *Albatross* Sta. 3391, but the operculum is entirely distinct. In Dall's species the operculum has but two grooves in comparison to eight in the species here described.

³³ Man. Conch., vol. 3, (pt. 9), Dec. 31, 1880, p. 26.

³⁴ Rept. Brit. Assoc. Adv. Sci. for 1856 (issued 1857), pp. 188, 337, 360.

³⁵ Proc. U. S. Nat. Mus., vol. 37, 1909, p. 213.

³⁶ Rev. Nueva, nos. 1 & 2, 1918, p. 49. Panamanian Province.

³⁷ Proc. U. S. Nat. Mus., vol. 16, 1893, p. 393.

³⁸ *Natica (Cochlis) scethra* Dall, Bull. Mus. Comp. Zool., vol. 43, no. 6, 1908, p. 333, pl. 11, fig. 5.

PLATE 34

Fig. 1. *Cardium (Papyridea) crockeri* Strong and Hertlein, new species. Length, 46.8 mm., height, 41 mm., thickness of the two valves, 29 mm. Left valve of holotype, No. 6969, C.A.S. Paleo. type coll., from Loc. 27,588 (C.A.S.), dredged in Lat. 24° 14' to 24° 18' N., Long. 111° 28' to 111° 29' W., about 13 miles southeast of Cabo Tosco, Santa Margarita Island, Lower California, Mexico, Templeton Crocker Expedition. p. 161.

Fig. 2. *Cardium (Papyridea) crockeri* Strong and Hertlein, new species. Umbonal view of same specimen as illustrated in figure 1. p. 161.

Fig. 3. *Poromya trosti* Strong and Hertlein, new species. Length 12.5 mm., height 10.3 mm. Right valve of paratype, No. 6976, C.A.S. Paleo. type coll., from Loc. 27,602 (C.A.S.), dredged in 40 to 60 fathoms, Cortes Bank, about 40 miles southwest of San Clemente Island, California, Templeton Crocker Expedition. p. 163.

Fig. 4. *Poromya trosti* Strong and Hertlein, new species. Left valve of the specimen illustrated in figure 3. p. 163.

Fig. 5. *Poromya trosti* Strong and Hertlein, new species. Length, 15 mm., height 12 mm., thickness of the two valves, 8.7 mm. Holotype, No. 6975, C.A.S., Paleo. type coll., from the same locality as specimen shown in figure 3. p. 163.

Fig. 6. *Poromya trosti* Strong and Hertlein, new species. Umbonal view of the holotype shown in figure 5. p. 163.

Fig. 7. *Cardium (Papyridea) crockeri* Strong and Hertlein, new species. View of the interior of the right valve of the holotype. p. 161.

Fig. 8. *Cuspidaria lanieri* Strong and Hertlein, new species. Length, 4.5 mm., height, 2.9 mm., diameter of both valves, 1.2 mm. Holotype, No. 6973, C.A.S. Paleo. type coll., from Loc. 27,584 (C.A.S.), Lat. 23° 03' to 23° 06' N., Long. 109° 31' to 109° 36' W., dredged in 20 to 220 fathoms, about 10 miles due east of San Jose del Cabo, Lower California, Mexico, Templeton Crocker Expedition. p. 162.

Fig. 9. *Nuculana lucasana* Strong and Hertlein, new species. Umbonal view of holotype, No. 6966, C.A.S. Paleo. type coll., from the same locality as the specimen shown in figure 8. p. 160.

Fig. 10. *Cardium (Papyridea) crockeri* Strong and Hertlein, new species. View of the interior of the left valve of the holotype. p. 161.

Fig. 11. *Modiolus eiseni* Strong and Hertlein, new species. Length, 29 mm., height, 13 mm., maximum diameter of the two valves, 12 mm. Holotype, No. 6968, C.A.S. Paleo. type coll., from Loc. 27,583 (C.A.S.), Lat. 22° 44' N., Long. 105° 59' W., in 10 to 17 fathoms, about 38 miles southeast of Mazatlan, Sinaloa, Mexico, and about 8 miles offshore, Templeton Crocker Expedition. Umbonal view. p. 160.

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PLATE 34—Concluded

Fig. 12. *Nuculana lucasana* Strong and Hertlein, new species. Length, 11.8 mm., height, 8 mm., diameter of both valves, 6.8 mm. Holotype, No. 6966, C.A.S. Paleo. type coll., from the same locality as the specimen shown in figure 8. p. 160.

Fig. 13. *Nuculana lucasana* Strong and Hertlein, new species. Length, 11 mm., height, 7.3 mm. View of the interior of the right valve of paratype No. 6967, C.A.S. Paleo. type coll., from the same locality as the specimen shown in figure 8. p. 160.

Fig. 14. *Modiolus eiseni* Strong and Hertlein, new species. View of left valve of holotype. p. 160.

Fig. 15. *Modiolus eiseni* Strong and Hertlein, new species. View of the interior of the right valve of the holotype. p. 160.

Fig. 16. *Modiolus eiseni* Strong and Hertlein, new species. View of the interior of the left valve of the holotype. p. 160.

Fig. 17. *Cymatium amictum* Reeve. Length, 48.8 mm., maximum diameter 24 mm. Plesiotype, No. 6994, C.A.S. Paleo. type coll., from Loc. 27,568 (C.A.S.), Lat. 14° 52' N., Long. 93° 04' W., dredged in 35 fathoms, about 23 miles west of San Simon Bar, Chiapas, Mexico, Templeton Crocker Expedition. Apertural view. p. 172.

Fig. 18. *Cymatium amictum* Reeve. Another view of specimen illustrated in figure 17. p. 172.

PLATE 35

Fig. 1. *Turbonilla (Pyrgiscus) wetmorei* Strong and Hertlein, new species. Length, 3.5 mm., diameter, 0.9 mm. Holotype, No. 6991, C.A.S. Paleo. type coll., from Loc. 27,584A (C.A.S.), Lat. 23° 12' N., Long. 106° 29' W., dredged in 12 fathoms, about five miles west of Mazatlan, Sinaloa, Mexico, Templeton Crocker Expedition. p. 172.

Fig. 2. *Volvulella lowei* Strong and Hertlein, new species. Length, 4.2 mm., maximum diameter, 1.5 mm. Holotype, No. 6978, C.A.S. Paleo. type coll., from Loc. 23,805 (C.A.S.), Puerto Escondido, Gulf of California. Fred Baker collector, 1921. Also dredged at Loc. 27,584A (C.A.S.), Lat. 23° 12' N., Long. 106° 29' W., about five miles off Mazatlan, Sinaloa, Mexico, Templeton Crocker Expedition. p. 164.

Fig. 3. *Volvulella panamica* Dall. Length, 3.1 mm., maximum diameter, 1.1 mm. Plesiotype, No. 6977, C.A.S. Paleo. type coll., from the same locality as the specimen shown in figure 1. p. 164.

Fig. 4. *Anachis guerreroensis* Strong and Hertlein, new species. Length, 4.2 mm., maximum diameter, 1.9 mm. Holotype, No. 6983, C.A.S. Paleo. type coll., from Loc. 27,571 (C.A.S.), Lat. 16° 38' N., Long. 99° 27' 30" W., to Lat. 16° 39' N., Long. 99° 24' 30" W., dredged in 20 to 45 fathoms, about 33 miles slightly east of Acapulco, Guerrero, Mexico, and about 32 miles west of Dulce Bay, Templeton Crocker Expedition. p. 169.

Fig. 5. *Epitonium (Nitidiscala) willetti* Strong and Hertlein, new species. Length, 3.2 mm., maximum diameter, 1.6 mm. Holotype, No. 6987, C.A.S. Paleo. type coll., from the same locality as the specimen illustrated in figure 1. p. 171.

Fig. 6. *Anachis sinaloa* Strong and Hertlein, new species. Length, 4.2 mm., maximum diameter, 1.8 mm. Holotype, No. 6982, C.A.S. Paleo. type coll., from the same locality as the specimen illustrated in figure 1. p. 168.

Fig. 7. *Eulimostraca bartschi* Strong and Hertlein, new species. Length, 1.8 mm., maximum diameter, 0.5 mm. Holotype, No. 6986, C.A.S. Paleo. type coll., from the same locality as the specimen illustrated in figure 1. p. 170.

Fig. 8. *Trophon keepi* Strong and Hertlein, new species. Length, 26.9 mm., length of aperture and canal, 14.5 mm., maximum diameter including varices, 10 mm. Holotype, No. 6985, C.A.S. Paleo. type coll., from Loc. 27,603 (C.A.S.), dredged in 30 to 50 fathoms off the west end of San Nicolas Island, California, Templeton Crocker Expedition. p. 170.

Fig. 9. *Strombina bonita* Strong and Hertlein, new species. Length, 19 mm., maximum diameter, 7.5 mm. Holotype, No. 6984, C.A.S. type coll., from Loc. 27,587 (C.A.S.), dredged in 20 to 25 fathoms off Cape San Lucas, Lower California, Mexico, Templeton Crocker Expedition. p. 169.

Fig. 10. *Fusinus zaca* Strong and Hertlein, new species. Length, 52 mm., maximum diameter, 20 mm. Holotype, No. 6979, C.A.S. Paleo. type coll., from Loc. 27,584 (C.A.S.), dredged in 20 to 220 fathoms, about 10 miles due east of San Jose del Cabo, Lower California, Mexico, Lat. 23° 03' to 23° 06' N., Long. 109° 31' to 109° 36' W., Templeton Crocker Expedition. p. 165.

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PLATE 35—*Concluded*

Fig. 11. *Nassarius gallegosi* Strong and Hertlein, new species. Length, 21.5 mm., maximum diameter, 13.5 mm. Holotype, No. 6980, C.A.S. Paleo. type coll., from Loc. 27.574 (C.A.S.). Lat. 18° 33' N., Long. 103° 45' W., dredged in 52 fathoms, near Manzanillo, Colima, Mexico, Templeton Crocker Expedition. p. 166.

Fig. 12. *Natica colima* Strong and Hertlein, new species. Height, 21 mm., maximum diameter, 18 mm. Holotype, No. 6996, C.A.S. Paleo. type coll., from the same locality as the specimen illustrated in figure 11. p. 174.

Fig. 13. *Natica colima* Strong and Hertlein, new species. View of the exterior of the operculum of the holotype. p. 174.

Fig. 14. *Pleurodon subdolos* Strong and Hertlein, new species. Length, 1.85 mm., height (beak to base), 2.5 mm. Holotype, left valve No. 6970, C.A.S. Paleo. type coll., from the same locality as the specimen illustrated in figure 1. p. 162.

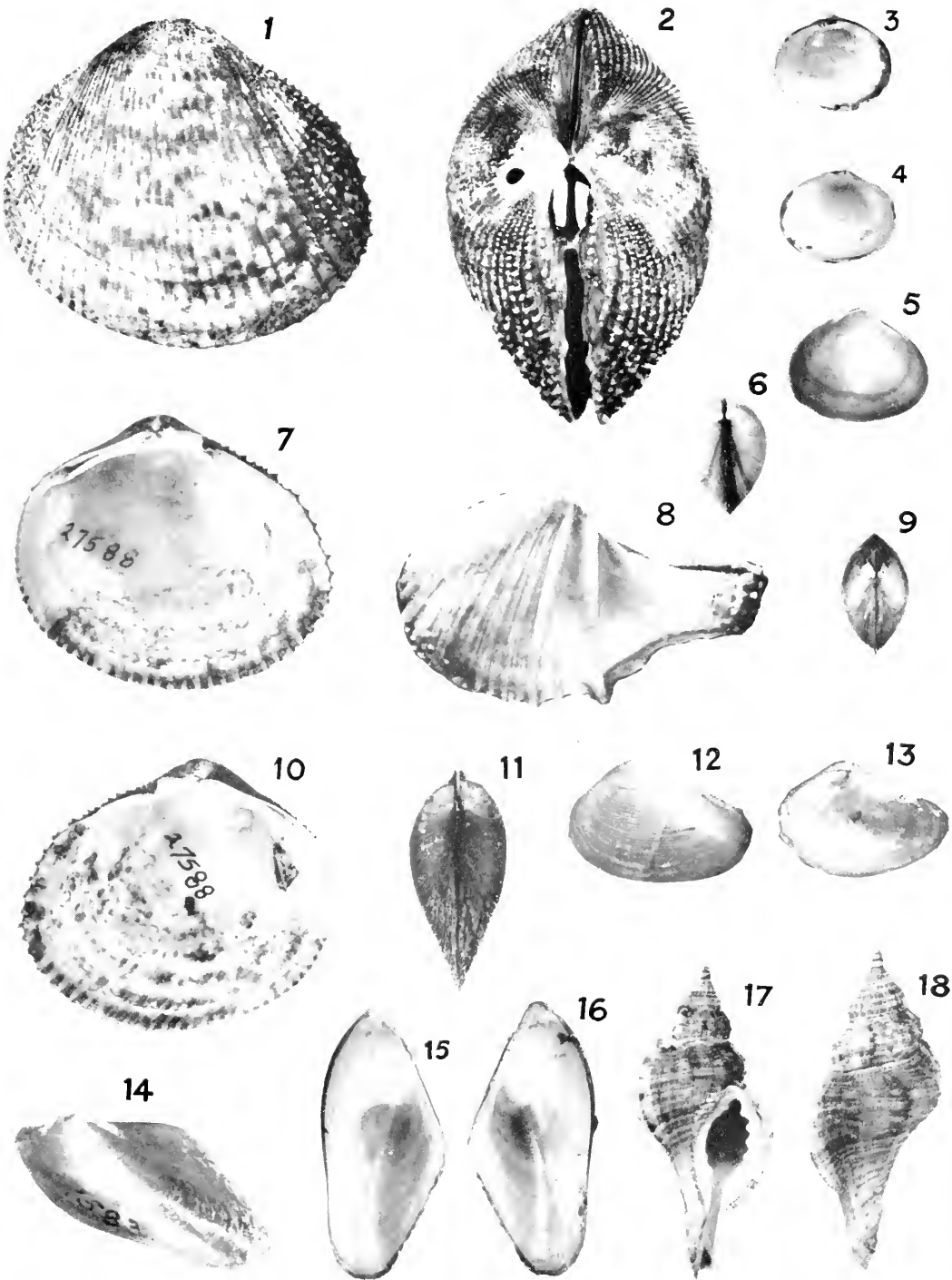
Fig. 15. *Mitrella harfordi* Strong and Hertlein, new species. Length, 3.4 mm., maximum diameter, 1.8 mm. Holotype No. 6981, C.A.S. Paleo. type coll., from the same locality as the specimen illustrated in figure 4. p. 167.

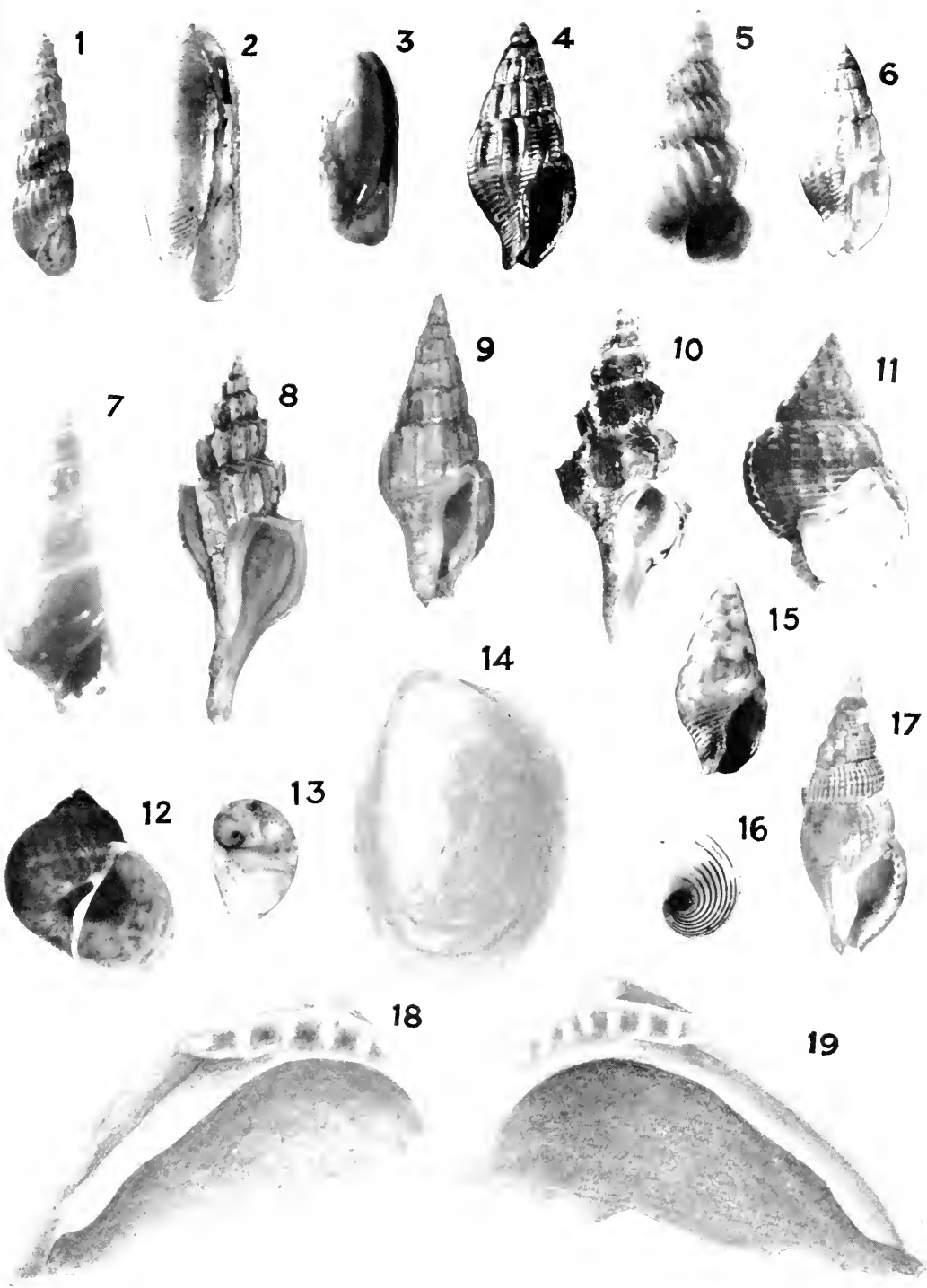
Fig. 16. *Natica colima* Strong and Hertlein, new species. View of the interior of the operculum of the holotype. p. 174.

Fig. 17. *Colubraria lucasensis* Strong and Hertlein, new species. Length, 27 mm., maximum diameter, 10.5 mm. Holotype, No. 6995, C.A.S. Paleo. type coll., from the same locality as the specimen illustrated in figure 9. p. 173.

Fig. 18. *Pleurodon subdolos* Strong and Hertlein, new species. Length, 1.55 mm., height, 2.05 mm. Paratype, left valve, No. 6971, C.A.S. Paleo. type coll., from the same locality as the specimen illustrated in figure 1. p. 162.

Fig. 19. *Pleurodon subdolos* Strong and Hertlein, new species. Length, 1.65 mm., height, 2.3 mm. Paratype, right valve, No. 6972, C.A.S. Paleo. type coll., from the same locality as the specimen illustrated in figure 1. p. 162.





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THE TEMPLETON CROCKER EXPEDITION OF 1934-35

No. 36

ADDITIONAL NEW FISHES

BY
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The Templeton Crocker Expedition of 1934-35 secured a number of new species of fishes which are described in the following pages. Two other species from the same voyage, *Notocheirus hubbsi*, representing a new genus and species, and *Normanichthys crockeri*, representing also a new genus and species, have been previously described by the writer in Copeia, 1937 (2): 88-91. (Cf. also Norman, Copeia, 1938 (1): 29-32.)

In the descriptions the actual measurements in millimeters are given in parentheses, followed by the proportions.

September 1, 1938

Family TRACHYPTERIDAE: The Deal Fishes

1. *Trachypterus deltoideus* Clark, new species

One specimen, 58 mm. long, Rurutu Island, Australs, Nov. 25, 1934. This species is unlike anything of which a description is available; some, but not all, the differences, may be due to stage of maturity. The silvery, finely wrinkled surface gives the general impression of a somewhat elongate triangle of tinfoil, and the body is proportionally much shorter than any species of which we can find a description. The dorsal fin is without any detached, anterior portion such as is usual in other members of the genus, and has relatively few rays or spines.

Total length 58 mm; body 45; head (11 mm.) 4.0 in body; depth (15) 3; eye (4) 2.75 in head; snout (3) 3.66; maxillary (4.5) 2.33, extending beyond middle of orbit; D. 95, beginning before middle of eye, low at its origin, but gradually rising toward its middle, from which point it remains nearly uniform in height until the end; no anal; pectoral short, of about 13 rays, apparently rising out of a pit; ventrals thoracic, exceedingly long, projecting beyond caudal, very thin and membranous, having a somewhat gauzy appearance; caudal peduncle long and slender, with a thin, rayless membrane on the ventral side, turning upward to the long, narrow, acute caudal of about 9 more or less forked rays, which point almost directly upward. Dorsal rays beset with minute tubercles which give the frail fin an appearance of roughness. Forehead markedly declivous; mouth somewhat oblique; two large nostrils in front of eye; lateral line represented by a depression along middle of side. Apparently most closely related to *T. trachypterus* Poey, of Cuba. Color uniform bright silvery.

Holotype and only specimen: No. 5532, Mus. Calif. Acad. Sci., Ichthyol., Rurutu Island, Australs, Nov. 25, 1934.

Family GIRELLIDAE

2. *Girella felicianae* Clark, new species

Two specimens from tide pools, San Felix Island, off Chile, Feb. 18, 1935, Templeton Crocker Expedition of 1934-35, one 82 mm., the other 115 mm., total length.

Compared with our specimens of *Girella nigricans* the range of which is given from Monterey, Calif., to Cape San Lucas, the San Felix specimens are deeper, and markedly different in color, being almost black with 7 or 8 rather narrow light bands separating the broad interspaces. Certain specimens of *Doydixodon freminvillei*, described as "dark uniform green, or banded with darker", may resemble them in color, but the anatomical characters are those of *Girella*. The following is a description of the larger specimen, chosen as the holotype:

Total length 115 mm.; body 88 mm., head (28 mm.) 3.14 in body; depth (38) 2.319; eye (7) 4.0 in head; snout (10) 2.8; maxillary (8) 3.5; interorbital (9) 3.11; D. XIV, 13; A. III, 11; V. (19 mm.) 1.47, reaching to vent; pectoral 18 rays (20 mm.) 1.4; scales 12–82–12, finely and sharply ctenoid, faint traces of scales on fin membranes; most of the head naked, except a little roughness on cheek; traces of scales on breast, belly naked, accessory scale at axil of ventral and of pectoral very small; the rather deep preorbital nearly sheathing the small maxillary. Upper lip rather thick, premaxillary slightly protractile. Teeth a row of trifid incisors in each jaw, followed by a band of smaller teeth. Opercle and preopercle entire; a small, flat spine back from margin of opercle; gill openings free from the isthmus, forming a shallow, thin fold across it; branchiostegals about 5; pseudobranchiae well developed; gillrakers about as long as pupil, fairly numerous.

The smaller paratype, 82 mm. in total length, was partly dissected with the following results; peritoneum jet black; stomach with numerous, very small caecae; intestine elongate and capacious, much convoluted. No airbladder noted, although in the description of the genus there is said to be an airbladder with posterior horns.

Holotype: No. 5567, and *paratype*: No. 5568, Mus. Calif. Acad. Sci., Ichthyol. **San Felix Island, off Chile**, from tidepool, Feb. 18, 1935.

Family POMACENTRIDAE: The Demoiselles

3. *Abudefduf tridentatus* Clark, new species

Among the small pomacentrids in the collection were two about 25 and 24 mm. long, which were sufficiently developed to be identifiable, but which were unlike anything of which an account could be found. The following is a description of the holotype:

Total length about 25 mm., end of caudal somewhat frayed; body 19 mm.; head (7 mm.) 2.62 in body; depth (12) 1.58; eye (2.1) 3.34; snout (1.9) 3.5; maxillary (2) 3.5, rather broad, reaching almost to a vertical of front edge of iris; interorbital (2.5) 2.8, arching high above eyes; D. XIII, 16, spines strong and heteracanth; A. II, 16; V. I, 5; the first ray attenuate, reaching almost to tip of first anal spine; P. about 17; caudal frayed, apparently somewhat emarginate; scales 4–28–12, 23 pores, the well arched lateral line ending under the soft dorsal; scales ctenoid with numerous fine, concentric growth lines, from 13 to 18 per scale; opercle covered by a few, very large scales. A low sheath consisting of a row of small scales at base of spinous dorsal, but all fin membranes naked. Opercle and preopercle entire; gill-membranes free from the isthmus; pseudobranchiae well developed; gill-rakers slender, about as long as eye. A striking character, unlike that of any pomacentrid in our collection, is shown by the teeth, which are in one row, incisor-like, unusually broad, and distinctly trifid. In the larger specimen the tips are black, contrasting with the rest of the tooth.

Color: Larger specimen (holotype) general uniform brownish, except snout, base of caudal, caudal, upper half of dorsal rays, tips of pectoral and anal rays, which are colorless; a blackish area from nape and along base of dorsal, and a spot about size of eye just behind dorsal. The smaller specimen shows 5 faint bars on sides.

Holotype: No. 5533, and *paratype*: No. 5534, Mus. Calif. Acad. Sci., Ichthyol., from **Taiohae Bay, Nukuhiva, Marquesas**, Oct. 6–15, 1934.

Family ELEOTRIDAE

4. *Ptereleotris letholepis* Clark, new species

Three specimens, one from Hao Island, Paumotos, Oct. 31, 1931, and the others probably from the same place, the specimens having been separated during sorting. They varied little in dimensions, and the specimen intermediate in size, which had its fins expanded so that counts could be made accurately, was chosen as the holotype, and is described as follows:

Total length 98 mm.; body 83 mm.; head (16 mm.) 5.19 in body; depth (13) 6.37; eye (4) in head, snout the same; maxillary (6) 2.66; interorbital (5) 3.2, flattish; D. VII, 27; A. 25 or I, 24; spine, if present, not distinguishable from ray, and both dorsal and anal rays unbranched; V, I, 5, the fins close together, narrow, and a little shorter than head; P. 23, broad, length about 1.33 in head; caudal longer than head, somewhat forked, its end ragged, the upper lobe acute, and projecting markedly beyond the lower. Mouth oblique, the lower jaw projecting, lips rather thin, upper protractile; stout, conical canines in both jaws, behind which are about 3 rows of smaller teeth, none on vomer; branchiostegals 4. Gill membranes joined to the isthmus well under throat. Partial dissection of a paratype showed pseudo-branchiae well developed well forward; gillrakers rather long and slender, about 7+20; no airbladder, silvery peritoneum and short simple intestine.

Color: In spirits uniform light brownish-olive, the fins faintly dusky, a black line at lower half of base of pectoral.

Holotype: No. 5529, and *paratypes*: Nos. 5530 and 5531, Mus. Calif. Acad. Sci., Ichthyol., from **Hao Island, Paumotos**.

These elongate, moderately compressed fishes bear a considerable resemblance to *P. dispersus* Herre of the Philippine Islands, but differ in contour, the dorsal outline being gently arched from tip of snout to caudal, the ventral outline being slightly concave. The parallel, wavy wrinkles between the muscular bands are similar. The minute, circular, apparently embedded scales can be made out only under magnification after the specimen has dried well, and even then only one is seen here and there, so that anything like an accurate count is impossible. There are a few, scattered ones on the membranes of the caudal.

Family CLINIDAE

5. *Salarias chilensis* Clark, new species

Six specimens, about 32 mm. long, from Valparaiso Harbor, Feb. 5-9, 1935, and one from Coquimbo Bay, Chile, Feb. 13, 1935.

The following is a description of the holotype, our largest specimen.

Total length 32 mm.; body 26 mm.; head (6.5 mm.) 4 in body; depth (6.0) 4.3; eye (2.5) 2.6 in head; snout (1.5) 4.3; maxillary (2) 6.5; interorbital (2) 6.5; D. XIII, 16; A. 19; V. 2; P. about 12; branchiostegals 4. Profile rounded, the jaws about

equal, gape short, not reaching to eye; body rather heavy forward, gradually tapering to tail. Teeth a palisade of narrow, compressed incisors, set rather firmly but movably in lips; no canines nor vomerine teeth; gill-membranes attached to isthmus near base of ventrals; lateral line barely perceptible, short, arched over pectoral; a short, simple filament above eye. The dorsal spines gradually shorten to the last, from which point the rays gradually lengthen, but there is hardly a distinct notch in the fin.

Color: Top of head blackish; five round blotches across dorsal line, narrowing at top of side, then widening to form a circular area at upper half of side. Narrow lines extend from middle of gape, below middle of eye, and another back and downward from eye, forming V-shaped marks with the apex posterior; lower half of pectoral black, ventrals plain; a narrow cross-line at base of caudal, which is a trifle emarginate.

On account of the small size of these fish certain details were difficult to make out satisfactorily. A dissected specimen showed the presence of small pseudo-branchiae, gillrakers rudimentary, but sharply conical, about 8 in number; the intestine short; no air bladder observed, peritoneum silvery, coarsely black-punctate; the vertebrae about $16 + 22 = 38$.

These fishes agreed with no available description, and differ clearly from *Salarias rubropunctatus*, the only known species of the genus from this region.

Holotype: No. 5535, Mus. Calif. Acad. Sci., Ichthyol., from **Valparaiso Harbor, Chile**, Feb. 5-9, 1935. *Paratypes*: six, Nos. 5536 to 5541 inclusive, from same place, and one, No. 5542, from Coquimbo Bay, Chile, Feb. 13, 1935.

6. *Ophioblennius xiphiodon* Clark, new species

Saber-tooth Snake Blenny

The collections contained a number of little blennies representing the genus *Ophioblennius*, of which few species have been described; one, *webbii*, from the Canary Islands, one, *steindachneri*, from the Tres Marias Islands and a third, *pinchoti*, from Black Beach Anchorage, Charles Island, Galapagos, in 1932. In the Templeton Crocker Expedition to the Galapagos of 1932 we obtained a considerable number of the last named species about the various islands.

The present species is strikingly different from *pinchoti* in both form and coloration, being much shorter and strikingly marked, instead of relatively plain. It differs also in details from the other species.

The following is a description of an average specimen, chosen as holotype:

Total length 44mm.; body 36 mm., head (10mm.) 3.6 in body; depth (8) 4.5; eye (3) 3.3 in head; snout (2.5) 4; maxillary (3) 3.3; interorbital width (2) 5 in head; D. XI, i, 16; A. 17; V. 2, no scales. Branchiostegals 6; upper lip finely crenate; a row of minute teeth attached loosely in bunches back of the lips and freely movable; four strong, curved canines near symphysis of lower jaw, and four smaller ones in upper jaw. A pinnately branched cirrus above eye, a short, palmately branched one at anterior nostril, and a pair of filaments each side of the nape.

A paratype was dissected with the following results. Pseudobranchiae small, well forward, the lining of the gill cavity silvery, coarsely punctate with black, as was the outside of the gill cover; gillrakers about $2+11$, minute, acute at tip; intestine short; vertebrae about $10+20=30$; no air bladder.

Color markings: Top of head dusky, spinous dorsal punctulate, a series of square, minutely punctate blotches, about ten in number and somewhat wider than the interspaces, each side of mid-dorsal line; a very narrow bar of minute dots across base of caudal; anal, soft part of dorsal and ventral, plain; pectorals black, tipped with coarse punctulations. All the specimens have the same general color pattern, but some are paler, some darker, and some have additional small, dusky blotches along the middle of the side.

Holotype: No. 5543, Mus. Calif. Acad. Sci., Ichthyol., Callao, Peru, Feb., 1935. *Paratypes*: seven, Nos. 5544 to 5550, from Callao; two, Nos. 5551 and 5552, from Valparaiso, Chile; and four, Nos. 5553 to 5556, from Chinchas, Peru, all taken during Feb., 1935.

7. *Ophioblennius fernandezensis* Clark, new species

Eight specimens, taken at San Juan Bautista (Cumberland) Bay, Juan Fernandez Islands, Jan. 31, 1935, were at first included with *O. xiphiodon*, of which they were regarded as simply pallid examples. In general shape, dentition, and other respects they are very similar to that species.

They differ in all having a comb of filaments on each side of the nape, and in their pallid coloration, there being a row of small, black blotches, about 10 in number, along the dorsal line, and a narrow, black bar at the base of the caudal, the rest of the body and all fins being plain. The differences between the species, though slight, are markedly constant.

Holotype: No. 5557; *paratypes*: seven, Nos. 5558 to 5564, Mus. Calif. Acad. Sci., Ichthyol., from San Juan Bautista (Cumberland) Bay, Juan Fernandez Islands, Jan. 31, 1935.

8. *Ophioblennius phalacrus* Clark, new species

One specimen, 32 mm. long, from Taiohae Bay, Nukuhiva, Oct. 2-15, 1934, is markedly different from the other species in our collection in several respects, being unusually short and deep, and of peculiar coloration. It fits the generic diagnosis given in Günther's Catalogue, but differs from all species of which we can find descriptions by lacking cirri at nostrils, above the eye, etc. The following is a short description of our specimen, only such features as could be observed without mutilation being noted.

Total length 32 mm.; body 26 mm.; head (9 mm.) 2.88 in body; depth the same; eye (3) 3 in head; snout (2) 4.5; maxillary (2.5) 3.6; gape hardly reaching to eye; interorbital (2) 4.5; D. X. 13; A. 14; V. 2; P. 19; no scales, but lateral line short, arched over pectoral, the pectoral rather short, but broad. Branchiostegals 5, gill-

membranes forming a shallow fold across the isthmus; caudal truncate or slightly emarginate. Teeth as usual in the genus, four stout, curved fangs about symphysis of upper and lower jaws, a palisade of small incisors in sides of jaws.

Color: Posterior part of body cream color; head coarsely punctate with black spots, the largest of which are larger than pupil, the spots extending backward along base of dorsal.

Holotype and only specimen: No. 5566, Mus. Calif. Acad. Sci., Ichthyol., **Taiohae Bay, Nukuhiva I., Marquesas**, Oct. 2-15, 1934.

Name from Greek *φάλακρος*, bald, from the absence of cirri on the positions where usually found in members of the genus, and included in some generic descriptions.

9. *Ophioblennius* sp. indet.

An additional specimen of *Ophioblennius*, sufficiently developed to reveal generic characters but too immature to justify its description as a definite species, was taken at Taiohae Bay, Nukuhiva Island, Marquesas, Oct. 6-15, 1934, and with it are a number of young fishes, similar in general appearance, but too young to even assign to any genus. In order that future investigators of that area may be on the lookout for more mature specimens, the following description is given:

Total length 32 mm.; body 26 mm.; head (9 mm.) 2.88 in head; depth (8) 3.25; eye (3) in head; snout (2) 4.5; maxillary (2.5) 3.6; interorbital (2) 4.5; D. XI-13, the spines long and slender, a short space between spinous and soft dorsal; A. I, 15; V. 2, the rays long and slender; P. 16, base broad; C. truncate; branchiostegals about 4, gill membranes forming a fold across the isthmus a little anterior to base of ventrals; jaws about even. Two strong and markedly curved canines at symphysis of upper jaw, followed by two smaller ones; a pair of similar, strongly curved canines at symphysis of lower jaw; no secondary canine immediately behind it, but there appears to be a small one back at the posterior part of the jaw. About 27 muscular bands; no scales, but an arched lateral line of about 27 pores over the pectoral and backward. No color except the usual black area over the occiput; a small silvery patch on belly. A branched cirrus at nostril, a slender single one above eye, and comb of filaments at nape.

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PROCEEDINGS
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THE TEMPLETON CROCKER EXPEDITION OF THE
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No. 37

THE CYPERACEÆ*

BY

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I. GALAPAGOS ISLANDS

With the exception of three peculiar endemic species of *Cyperus* (*C. galapagensis*, *C. Anderssonii* and *C. rubiginosus*), only wide-ranging tropical sedges are found on the Galapagos Islands. Six new records for these islands [see notes following list of species] were made by the Crocker Expedition—a remarkable number, considering the extent of previous exploration. From the point of view of phytogeography, the species collected on the isolated humid summit of Mt. Crocker are interesting. I have in mind such wide-spread tropical plants of moist forests as *Rynchospora corymbosa*, *Scleria hirtella* and *S. pterota*, because they occur in a region surrounded on all sides by coastal deserts, and are at an altitude precluding the possibility of human introduction. Between this humid area of Indefatigable Island and the vicinity of the sea-coast itself, the *Cyperaceæ* seem to be almost wholly lacking, the scrub-covered, dry terrain evidently being not conducive to growth. Along the coast the sedges fall into three ecological groups: (1) those with strong, drought-resisting root-

* Brooklyn Botanic Garden Contributions No. 88.

stocks, i.e., *C. ligularis* and *C. Anderssonii*; (2) annuals, i.e. *Fimbristylis annua* and *F. miliacea*, *Hemicarpha micrantha*, *Stenophyllus hirtellus*, *Eleocharis caribæa*, *Cyperus confertus*, *C. densicæspitosus*, *C. piceus*, *C. inflexus*, and probably *C. rubiginosus*; (3) species somewhat tolerant of salt water, i.e. *Cyperus lævigatus* and *Eleocharis fistulosa*. In the following list of *Cyperaceæ* known from the Galapagos Islands, it will be seen that *Cyperus* (15 species) and *Eleocharis* (6 species) are the largest genera:

<i>Cyperus Anderssonii</i> Boeck.	<i>Eleocharis caribæa</i> (Rottb.) Blake
<i>C. caracasanus</i> Kunth.	<i>E. fistulosa</i> (Poir.) Link
<i>C. compressus</i> L.	<i>E. maculosa</i> (Vahl) R. and S.
<i>C. confertus</i> Sw.	<i>E. mutata</i> (L.) R. Br.
<i>C. densicæspitosus</i> Mattf. et Kükenth.	<i>E. nodulosa</i> (Roth) Schultes
(<i>Kyllinga pumila</i> Michx.)	<i>E. Sellowiana</i> Kunth (<i>E. galapagensis</i> Svenson)
<i>C. distans</i> L. f.	<i>Fimbristylis annua</i> (All.) R. et S.
<i>C. esculentus</i> L.	(<i>F. laxa</i> Vahl)
<i>C. grandifolius</i> Anderss.	<i>F. miliacea</i> (Thunb.) Vahl
<i>C. inflexus</i> Muhl.	<i>Hemicarpha micrantha</i> (Vahl) Britton
<i>C. lævigatus</i> L.	<i>Rhynchospora corymbosa</i> (L.) Britton
<i>C. ligularis</i> L.	<i>R. tenuis</i> Link
<i>C. polystachyus</i> Rottb.	<i>Scleria hirtella</i> Sw.
<i>C. rubiginosus</i> Hook. f.	<i>S. pterota</i> Presl
<i>C. surinamensis</i> Rottb.	<i>Stenophyllus hirtellus</i> (Schrad.) Standl.
<i>C. piceus</i> Liebm. (<i>C. tristachyus</i> Boeck.)	
<i>Dichromena radicans</i> Cham. et Schlecht.	

***Cyperus Anderssonii* Boeckl.**

Cyperus Anderssonii Boeckl. Linnæa **36**: 334, 1869-70.

C. brachystachys (Hook. f.) Anderss., not Presl, 1820.

Unquestionably the most widespread sedge in the Galapagos Islands, often maintaining itself in dry rock crevices where there is practically no other vegetation. The numerous collections by the Crocker Expedition show admirably the great variation in length of rays.

***Cyperus caracasanus* Kunth**

Cyperus caracasanus Kunth, Enum. **2**: 86, 1837.

Wreck Bay, CHATHAM ISLAND, *Howell No. 8579* (in part), with *C. esculentus*. Widely distributed in the tropics of both hemispheres. Not previously reported from the Galapagos Islands.

***Cyperus compressus* Linné**

Cyperus compressus Linné, Sp. Pl. **46**, 1753.

Villamil, ALBEMARLE ISLAND, *Howell No. 8938*; Wreck Bay, Chatham Island, *Howell No. 8581*. A weedy, pan-tropical species, not before recorded from the Galapagos Islands.

Cyperus distans Linné

Cyperus distans Linné f., Suppl. Pl. 103, 1781.

Summit of Floreana Peak, CHARLES ISLAND, *Howell No. 9328*. Tropics of both hemispheres, not before recorded from the Galapagos Islands.

Cyperus grandifolius Andersson

Cyperus grandifolius Andersson, Kgl. Sv. Vet. Akad. Handl. 157, 1854.

Mt. Crocker, INDEFATIGABLE ISLAND, *Howell No. 9211*. The spikelets are compactly 10-20-flowered, whereas Andersson described them as remotely 6-10-flowered, but *No. 9211* agrees otherwise with Andersson's specimens at Stockholm and in the Gray Herbarium. The brown achenes are 2.0 mm. long, 0.6 mm. wide, with a lightly papillate surface. *Cyperus grandifolius* somewhat resembles a gigantic *C. strigosus*, but has a prominent horizontal woody rhizome 1 cm. thick, and except for *Lehmann No. 8431* from Colombia (possibly the same species) I have seen nothing approaching it. *C. galapagensis* Caruel, Rendic. Acad. Lincei, v: 621, 1889, is from description unquestionably *C. grandifolius*. Andersson's specimens of "*C. strigosus*" which I examined at Stockholm are *C. esculentus*, and so undoubtedly is Darwin's specimen from Charles Island.

Cyperus rubiginosus Hook. fil.

Cyperus rubiginosus Hook. f., Trans. Linn. Soc. 20: 178, 1847.

Probably nearest to the Hawaiian species, *C. trachysanthus* Hook. et Arnott, which likewise has prominent teeth just below the apex of the scale, and an arrangement of spikelets superficially like those of the Galapagos plants. The thick culms, drab (not red) scales, and large non-papillate, spongy-reticulated achenes of *C. trachysanthus* show, however, that the relationship is not very close.

Dichromena radicans Cham. et Schlecht.

Dichromena radicans Cham. et Schlecht., Linnæa 6: 38, 1831.

Villamil Mt. above Santo Tomas, ALBEMARLE ISLAND, *Howell No. 9000*. Reported by Stewart from CHATHAM ISLAND as *D. colorata* (Proc. Calif. Acad. Sci. ser. 4, 1: 43, 1911). The species is widespread in tropical America.

Fimbristylis annua (All.) R. et S.

Fimbristylis annua (All.) R. & S., Syst. 2: 95, 1817. *F. laxa* Vahl, Enum. 2: 292 1806.

The Crocker Expedition collections are undoubtedly the same as *F. diphylla* (Retz) Vahl, reported previously from HOOD ISLAND (Proc. Amer. Acad. 38: 129, 1902). According to Kükenthal's interpretation (cf. Fedde, Rep. Spec. Nov. 23: 195, 1926), which I am following, *F. diphylla* is the perennial form.

Fimbristylis miliacea (Thunb.) Vahl

Fimbristylis miliacea (Thunb.) Vahl, Enum. Pl. 2: 287, 1805.

Academy Bay, INDEFATIGABLE ISLAND, *Howell No. 9031*. A weedy tropical species of both hemispheres, not reported previously from the Galapagos Islands.

Rynchospora corymbosa (Linné) Britton

Rynchospora corymbosa (L.) Britton, Trans. N. Y. Acad. Sci. 2: 85, 1892.

Mt. Crocker, INDEFATIGABLE ISLAND, *Howell No. 9258*. Tropical regions of both hemispheres. Not recorded previously from the Galapagos Islands.

Rynchospora tenuis Link

Rynchospora tenuis Link, Jahrb. 3: 76, 1820.

Villamil Mt. above Santo Tomas, ALBEMARLE ISLAND, *Howell No. 9004*. Abundant in American tropics. Not recorded previously from the Galapagos Islands.

Scleria hirtella Sw.

Scleria hirtella Sw., Prodr. Veg. Ind. Occ. 19, 1788.

Mt. Crocker, INDEFATIGABLE ISLAND, *Howell No. 9220*. This widespread species was reported from INDEFATIGABLE ISLAND by Christophersen, Nyt Mag. for Naturvid. 70: 71, 1932.

Stenophyllus hirtellus (Schrad.) Standl.

Stenophyllus hirtellus (Schrad.) Standl., Field Mus. Pub. Bot. 8: 265, 1931.

All of the numerous specimens collected in the Galapagos Islands by the Crocker Expedition have pubescent culms, and therefore belong, at least provisionally, under *S. hirtellus*. The citations of *Fimbristylis capillaris* by Robinson (Proc. Amer. Acad. 38 (4): 129,

1902) and by Stewart should likewise be referred to *S. hirtellus*. Representative achenes (cf. Howell's No. 9519) are coal black when mature, averaging only 0.8 mm. in length, with an acute tubercle and a finely beaded-tuberculate surface, the prominences not arranged in obviously transverse lines; in *S. capillaris* the dull brown achenes average 0.9 mm., with flattened tubercles, and with a surface marked by shining transverse ridges and dull valliculæ.

II. COCOS ISLAND

The *Cyperaceæ* of this little island are extremely few, the only species of interest being a *Hypolytrum* which forms enormous clumps, resembling stands of *Iris*, along the watercourses. This species I now believe is the same as a previously described Brazilian plant.

Hypolytrum Schraderianum Nees

Hypolytrum Schraderianum Nees in Mart. Fl. Bras. 2: 65, t. 5, 1842. *H. nicaraguense* Liebm., Dansk Vet. Selsk. Skrivt. v. 2: 235, 1851.

Wafer Bay, COCOS ISLAND, Howell No. 10187. The illustration in Flora Brasiliensis might just as well have been made (even as to minute details of the spikelet) from Cocos Island material, which is without question *H. nicaraguense* of the adjacent mainland. The achenes of No. 10187 (averaging 2.5×1.4 mm.) are greenish with prominent raised nervation on the lower half; in age becoming opaque and brown, with corky tissue obscuring the nervation. Surface-markings and length of beak are extremely variable. The exact relationship to the Brazilian *H. amplum* has not yet been worked out.

III. MEXICO

It is especially interesting to see adequate collections, now made by the Crocker Expedition, of the rare species *Cyperus duripes* and *Stenophyllus nesioticus*, known only from the Revillagigedo Islands.

Cyperus aff. *brunneus* Sw.

Cyperus aff. *brunneus* Sw. Fl. Ind. Occ. 1: 116, 1797; I. M. Johnston, Proc. Cal. Acad. Sci. ser. 4, 20: 55, 1931.

ISABEL ISLAND, Mexico, Howell No. 10528; marine bluff, landing cove, Braithwaite Bay, SOCORRO ISLAND, Howell No. 8415; Mazatlan, Sinaloa, Mexico, Howell No. 10560; San Juanito, TRES MARIAS ISLANDS, Howell No. 10477. These collections from the REVILLAGIGEDO ISLANDS and the Mexican coast differ from *C. brun-*

neus as it occurs generally in Florida and the West Indies, in the more compact inflorescence (only in part of *No. 10528* is the inflorescence radiate), shorter and more closely flowered spikelets, shorter and smoother achenes, and somewhat narrower leaves with strongly rugose margins. These plants probably represent *C. glaucus* Steudel, a Guatemalan species described as having short rays densely and irregularly aggregated, recently treated under *C. planifolius* var. *brunneus* by Dr. Kükenthal (Pflanzenr. IV **120**: 448, 1935).

***Cyperus duripes* Johnston**

Cyperus duripes I. M. Johnston, Proc. Cal. Acad. ser. 4, **20**: 54, 1931.

Northern slope on summit of CLARION ISLAND above Sulphur Bay, *Howell No. 8369*; ocean bluffs, north anchorage, SOCORRO ISLAND, *Howell No. 8433*. Description of mature fruit (based on *Howell No. 8433*): achene oblong (1.7×0.7 mm.) trigonous with slightly concave faces, lustrous brown, the bead-like papillae more prominent than in *C. ligularis*, which has smaller achenes averaging only 1.5×0.6 mm.

Cyperus duripes appears to be closer to *C. Anderssonii* of the Galapagos Islands than to *C. ligularis*, in fact the resemblance between *Howell No. 8433* and his *No. 9040* (from Indefatigable Island) is striking. All the Galapagos material representing *C. Anderssonii* shows, on a smaller scale, the same smoothness of leaves and the same beaded type of achene-surface. Since the spikelets of *C. Anderssonii* are single-fruited (achenes averaging 1.6×0.7 mm.) (cf. Am. Journ. Bot. **22**: 269, pl.1, f.1, 1934), while those of *C. duripes* usually bear two achenes, I believe that *C. Anderssonii* is a reduced derivative of *C. duripes*. Thus we see another prominent link between the flora of the Galapagos and Revillagigedo islands.

***Stenophyllus nesioticus* Johnston**

Stenophyllus nesioticus Johnston, Univ. Calif. Pub. Bot. **7**: 438, 1922.

Northern slope on summit of CLARION ISLAND above Sulphur Bay, *Howell No. 8368*; dry rocky ridge west of landing cove, Braithwaite Bay, SOCORRO ISLAND, *Howell No. 8388*; dry rocky ridge west of landing cove, Braithwaite Bay, SOCORRO ISLAND, *Howell No. 8389*; dry slopes, north anchorage, SOCORRO ISLAND, *Howell No. 8454*. The mature achenes are broadly obovate (1.0×0.9 mm.), deep gray, rather sharply trigonous, and with a hemispheric style-base. Their small size removes *S. nesioticus* definitely from *S. junciformis* and *Bulbostylis alpestris* Kükenthal, species having achenes 1.4 mm. long, and I believe the relationship is exceedingly close to the widespread *Stenophyllus vestitus* (Kunth) Britton.

Probably because of the presence of leaf blades, which drop off in most mature material, Howell considers *No. 8389* to be a juvenile form, but it has perfectly mature achenes. Except for its glabrous culms this specimen is practically identical with *No. 10394* (*S. vestitus*) from the Mexican coast. Townsend's specimens (at the herbarium of the New York Botanical Garden) are also of the "juvenile" form.

***Stenophyllus vestitus* (Kunth) Britton**

Stenophyllus vestitus (Kunth) Britton, Bull. Torr. Club **43: 446, 1916.**

Punta Mita, Nayarit, *Howell No. 10394*. This collection is identical with *Hinton No. 4754* (herb. N. Y. Bot. Gard.) from Temascaltepec, State of Mexico, determined at Kew as *Bulbostylis vestita*. Both of these collections probably represent *Oncostylis hispida*, described by Liebmann from the middle part of Mexico and questionably differentiated by him from *O. vestita* because of capitate (i.e., non-umbellate) inflorescence. All later writers have treated the two names as synonyms.

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THE TEMPLETON CROCKER EXPEDITION OF THE
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FUNGI FROM THE GALAPAGOS AND
OTHER PACIFIC COASTAL ISLANDS

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Botanists and other members of expeditions from the California Academy of Sciences to the Galapagos Islands, Revillagigedos Islands, Guadalupe Island, Cocos Island, and some points on the west coast of Central America, have made certain collections of fungi. The greater number of collections were made by Mr. John Thomas Howell, botanist for the Templeton Crocker Expedition in 1932. Dr. Alban Stewart made a number of collections with the expedition to the Galapagos Islands, 1905-06, and Dr. H. L. Mason made a few collections on the Revillagigedos and Tres Marias Islands in 1925. These collections have been studied and such as could be determined are herewith reported.

Relatively few fungi have been collected from these Pacific coastal islands, since reports on the floras have dealt almost entirely with other groups of plants.

J. M. Berkeley, *Ann. Mag. Nat. Hist.*, **9**: 444, 1842, lists one fungus, *Polyporus igniarius* Fr. var. *scaber* Berk., collected by Charles Darwin, Galapagos Islands.

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J. D. Hooker, Trans. Linn. Soc., **20**: 164, 1847, also lists one species, *Schizophyllum commune* Fr., from Darwin's collections in the Galapagos.

W. F. Farlow, Proc. Amer. Acad. Arts & Sci., **38**: 82-83, 1902, recorded three fungi from the Galapagos, viz.:

Favolus cibaris Mont.

Fomes lucidus Fr.

Schizophyllum alneum Schroet.

Such other collections as may have been made I have not found reported, and it is of interest to record here the material that has been under study. Seventy-five species have been identified, and these are from collections distributed as follows:

Galapagos Islands.....	59
Revillagigedo Islands.....	18
Cocos Island.....	8
Tres Marias Islands.....	5
Guadalupe Island.....	3
Costa Rica.....	4
Nicaragua.....	5
Lower California.....	1

These records extend very considerably the known range of a number of species, and three species are reported as new.

The writer wishes to express his appreciation to the mycologists who have given aid and suggestions in this study, especially to Dr. G. B. Cummins, Dr. C. J. Humphrey, Dr. G. W. Martin, Dr. J. H. Miller, Dr. L. W. Miller, Dr. J. A. Stevenson, and Dr. E. M. Wakefield.

Specimens of the material here reported are deposited in the herbarium of the California Academy of Sciences, San Francisco, and with the exception of species for which material was very limited, a complete set is deposited in the herbarium of the University of California at Berkeley. Specimens determined, as noted in the text, by the above named mycologists were in almost all cases retained by them as a part of their collections. Duplicate material will be available for distribution to a limited number of interested students from a goodly number of the collections.

A small number of collections remain as yet undetermined, and may be reported at a later date by students to whom they have been submitted.

MYXOMYCETES

Craterium leucocephalum (Pers.) Ditm. var. *scyphoides* List., Mycetozoa, **96**, 1911. On living leaves, Abingdon Island, Galapagos, Sept. 21, 1906, *Stewart No. 8706*. (Det. G. W. Martin). Previously reported from the Galapagos Islands.

Diachæa leucopoda Rost., Sluzowce Monografia, 190, 1875. On living leaves, Abingdon Island, Galapagos, Sept. 4, 1906, *Stewart No. 8526*.

Physarum bogoriense Racib., Hedwigia, **37**: 52, 1898. On living leaves, Abingdon Island, Galapagos, Sept. 21, 1906, *Stewart No. 8707*. (Det. G. W. Martin).

Stemonitis fusca Roth. Roem. and Ust., Mag. Bot., **1**: 26, 1787. On dead bark, Post Office Bay, Charles Island, Galapagos, May 17, 1932, *Howell*.

Stemonitis splendens Rost., Sluzowce Monografia, 195, 1875. On dead wood, Academy Bay, Indefatigable Island, Galapagos, May 2, 1932, *Howell*.

ASCOMYCETES

DOTHIDIALES

Phyllachoraceæ

Ophiodothella Fici E. A. Bessey, Mycologia, **11**: 55, 1919. On *Ficus cotinifolia* Stokes, Braithwaite Bay, Socorro Island, March 26, 1932, *Howell*. Previously reported from Florida and Cuba.

Phyllachora Acalyphæ Bonar, new species

Figure 1

Maculæ amphigenæ, superne atrobrunnæ, inferne olivaceæ, marginibus angustis viridibus, orbiculares, 1-2 mm. diam., dein confluentes; stromata minuta, in maculis mediis, subepidermalia, punctiformia, atra, plerumque hypophylla; loculi 4-12 in quoque stromate, sæpe lateraliter applanati, membrana stromatica ad epidermidem lateraque crassa, atra, intus obsolescente, 80-125 μ lati, 125-150 μ longi, poro aperti; asci fusoides-clavati, octospori, 70-80 x 10-12 μ , sporidiis oblique uniseriatis vel biseriatis; sporidia navicularia, hyalina, continua, 19-22 x 5-6 μ ; paraphyses filiformes, simplices vel ramosæ.

Spots amphigenous, blackish brown above, olivaceous below, with a narrow green border, circular, 1-2 mm. diameter, or becoming confluent; stromata minute, central in spots, subepidermal, punctiform, black, mostly hypophyllous; locules 4-12 in a stroma, often laterally flattened, with heavy black tissue toward leaf surface and on sides, scarcely developed on inner side, 80-125 μ wide x 125-150 μ high, opening by a pore; asci fusoid-clavate, 8-spored, 70-80 x 10-12 μ , spores obliquely uniseriate to biseriate; spores navicular, hyaline, 1-celled, 19-22 x 5-6 μ ; paraphyses filiform, simple or branched.

Type: C. A. S. Herb. No. 261370. On leaves of *Acalypha umbrosa* Brandg., Socorro Island, March 29, 1932, Howell.

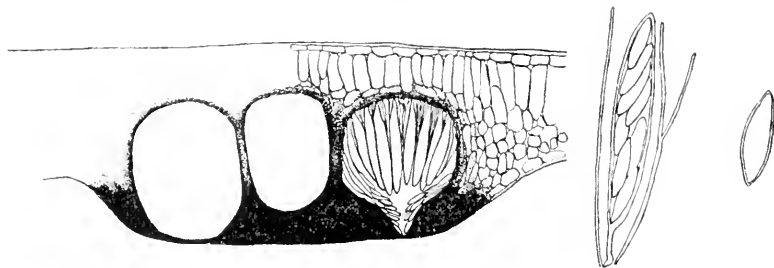


Fig. 1. *Phyllachora Acalyphæ* Bonar, new species. Left, section through leaf showing stroma and locules; middle, ascus and paraphyses; right, ascospore.

Phyllachora Scleriæ Rehm, Hedwigia, **39**: 232, 1900. On *Cyperus duripes* Johnston, Clarion Island, March 23, 1932, Howell.

Spots somewhat larger than those reported on *Scleria* from Brazil. The spores are slightly wider than stated in the original record, but the occasional obpyriform spores reported by Rehm are regularly found with the obtuse end occupying the distal end of the ascus.

SPHÆRIALES

Sphæriaceæ

Zignoëlla truncata Rehm, Hedwigia, **40**: 106, 1901. On dead bark of *Zanthoxylum Limoncello* Planch. and Oerst., near Academy Bay, Indefatigable Island, Galapagos, May 4, 1932, Howell.

Our material varies slightly from Rehm's characterization of the species in that the ostiole is of a distinctly lighter shade than the perithecial wall. However, this character does not seem sufficient to warrant a different name.

Pleosporaceæ

Leptosphæria Phoradendri Bonar, new species

Figure 2

Perithecia amphigena, in foliis dense disposita in zonulis remotis vel confluentibus, maculis manifestis nullis, subepidermalia, cuticula tecta, punctulata, atra, late pyriformia, circum ostiolum pariete crasse carbonaceo, alibi membranaceo et paulum carbonaceo, 250-300 μ diam.; asci basiales, octospori, ampullacei, stipite brevo angustoque, parietibus ad apicem incrassatis, 150 x 30 μ ; ascosporidia crebra, 3-4-seriata, inasco basilaria, ellipsoideo-cylindracea, 3-septata, ad septum medium paulo constricta, castanea, 37-50 x 10-12 μ ; paraphyses multæ, copiose ramosæ, irregulares, anastomosantes, hyalinæ.

Status conidicus pycnidia exhibens specie similia peritheciis in foliis; pycnidia amphigena, dispersa, subepidermalia, globosa, ostiolo poroideo erumpentia, 150–225 μ diam., pariete carbonaceo, superne incrassato, inferne membranaceo; conidia copiosa, bacilliformia, hyalina, continua, 6–9 x 0.75–1 μ ; conidiophora simplicia vel ramosa, quam conidia longiora.

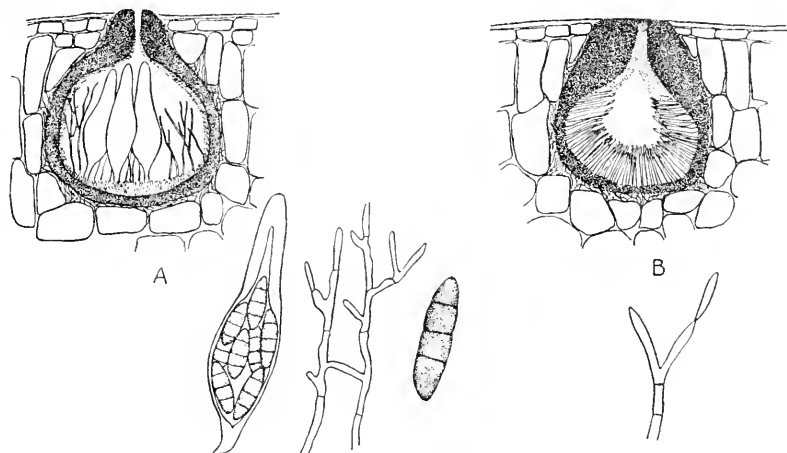


Fig. 2. *Leptosphaeria Phoradendri* Bonar, new species.

A. Section showing structure and position of perithecium in leaf; below, detail of ascus, paraphyses, and ascospore.

B. Section showing structure and position of pycnidium in leaf; below, conidiospores and conidia.

Perithecia amphigenous, thickly scattered over leaves in small isolated or confluent areas, not forming evident spots; subepidermal, remaining covered by cuticle, punctate, black, broadly pyriform, wall heavy carbonaceous around ostiole, membranaceous and slightly carbonized below, 250–300 μ diameter; asci basal, flask-shaped, with short narrowed stipe, walls thickened toward apex, 150 x 30 μ ; ascospores crowded, 3–4 seriate, basal in ascus, ellipsoid-cylindric, 3-septate, slightly constricted at median septum, chestnut brown, 37–50 x 10–12 μ ; paraphyses numerous, much branched, irregular and anastomosed, hyaline.

Conidial stage forming pycnidia similar to perithecia in appearance on leaves; pycnidia amphigenous, scattered, subepidermal, globoid, erumpent by poroid ostiole, 150–225 μ diameter; wall carbonized, thickened above, membranaceous below; conidia abundant, bacilliform, hyaline, 1-celled, 6–9 x .75–1 μ ; conidiophores simple or branched, longer than conidia.

Type: C. A. S. Herb. No. 261369. On living leaves of *Phorodendron Townsendii* Trel., Socorro Island, March 27, 1932, Howell.

Clypeosphaeriaceæ

Peltosphaeria vitrispora (Cke. and Hk.) Berl., Icones Fungorum, 2: 109. On decorticated wood, Socorro Island, March 26, 1932, Howell.

This organism was originally named *Pleospora vitrispora* Cke. and Hk. from dead twigs from California. Many of the perithecia are located in elliptic elevations on the surface of the wood, the surrounding tissue being eroded away. This corresponds to the illustrations given by Berlese of the original material. The ascospores are variable in size and septation with age.

Diatrypaceæ

Diatrype microstega Ell. and Ev., N. Amer. Pyren., 574, 1892. On dead wood, Socorro Island, March 26, 1932, *Howell*. Formerly reported from a collection by Harkness from San Francisco Bay Region, California.

Xylariaceæ

Camillea sagræana (Mont.) B. and C., Exot. Fungi, Jour. Acad. Nat. Sci. Phila., 2nd. ser. 2: 285, 1853. On dead wood, Post Office Bay, Charles Island, Galapagos, May 17, 1932, *Howell*. (Det. W. W. Diehl.)

Daldinia concentrica (Bolt.) Ces. and DeNot. var. *microspora* (Starb.) Theiss., Ann. Myc., 7: 3, 1909. Near Fortuna, Indefatigable Island, Galapagos, May 11, 1932, *Howell*.

Xylaria arbuscula Sacc., Mich., 1: 249, 1878. Academy Bay, Indefatigable Island, Galapagos, May 6, 1932, *Howell*. (Det. J. H. Miller). Duncan Island, Galapagos, June 7, 1932, *Howell*. (Det. J. H. Miller).

Xylaria bulbosa (P. ex Fr.) B. and Br., Berk., Outlines Brit. Fungology, 385, 1860. Academy Bay, Indefatigable Island, Galapagos, May 4, 1932, *Howell*. (Det. J. H. Miller).

Xylaria hypoxylon (L. ex Fr.) Grev., Flor. Edin., 355, 1824. Near Academy Bay, Indefatigable Island, Galapagos, May 8, 1932, *Howell*. (Det. J. H. Miller).

Xylaria sp. Five collections of *Xylaria* by Mr. Howell, from Indefatigable Island, Galapagos, were found to be sterile and not determinable as to species.

BASIDIOMYCETES

USTILAGINALES

Mykosyrinx Cissi (DC.) G. Beck, Ann. Nat. Hofmus. Wien, **9**: 123, 1894. On *Cissus sicyoides* L., Galapagos Islands, 1905–1906, Alban Stewart No. 7170, 7171; Fortuna, Indefatigable Island, Galapagos Islands, May 8, 1932, *Howell*.

UREDINALES

Bubakia Crotonis (Cke.) Arth., Rés. Sci. Cong. Bot. Vienna, 339, 1906. On *Croton Masonii* Johnston, Braithwaite Bay, Socorro Island, March 27, 1932, *Howell*.

Puccinia globosipes Peck, Bull. Torr. Bot. Club, **12**: 34, 1885. On *Lycium minimum* L. C. Hitchcock, South Seymour Island, Galapagos, June 10, 1932, *Howell*.

Puccinia heterospora B. & C., Jour. Linn. Soc., **10**: 356, 1868. On *Abutilon californicum* Benth. (*A. avicennæ* Gaertn.) Braithwaite Bay, Socorro Island, March 26, 1932, *Howell*. On *Sida spinifera* L., Post Office Bay, Charles Island, Galapagos, May 17, 1932, *Howell*.

Puccinia Lantanæ Farl., Proc. Amer. Acad. Sci., **18**: 83, 1883. On *Lantana* sp., Academy Bay, Indefatigable Island, Galapagos, May 2, 1932, *Howell*.

Puccinia Lithospermi Ell. & Kell., Jour. Mycol., **1**: 2, 1885. On *Evolvulus hirsutus* Lam. (*E. alsinoides* L.), Tagus Cove, Albemarle Island, Galapagos, May 26, 1932, *Howell*.

Puccinia notha Jack. and Holw., Bot. Gaz., **65**: 305, 1918. On *Vernonia littoralis* Brandegee, Socorro Island, March 26, 1932, *Howell*.

Puccinia striolata Arthur, Mem. Torr. Bot. Club, **17**: 142, 1918. On *Irisene celosia* L., Clarion Island, March 23, 1932, *Howell* No. 8366.

Uredo Scalesiæ Bonar, new species

Uredia amphigena, dispersa, minuta, disciformia, pulverulenta, fusca, epidermide folii rupta inconspicua; sporidia subglobosa, sæpe lateraliter applanata, 18–24 x 20–26 μ , pariete cinnamomeo, 1–2.5 μ crasso, subtilissime verruculoso, poris 2, subæquatorialibus, in lateribus applanatis dispositis; paraphyses plurimæ, cum sporidiis intermixtæ, elongato-clavatæ, 80–100 μ longæ, apicibus usque ad 5 μ diam. tumefactis.

Uredia minute, scattered, amphigenous, discoid, pulverulent, chocolate brown, ruptured epidermis inconspicuous; urediospores asymetric globoid, often flattened laterally, 18–24 x 20–26 μ , wall cinnamon brown, 1–2.5 μ thick, very finely ver-

rucose, pores 2, subequatorial, borne on the flattened sides; paraphyses very numerous, intermixed with the urediospores, elongate clavate, 80-100 μ long, the tips swollen to 5 μ diameter.

Type: No. 261371, C. A. S. Herb. On leaves of *Scalesia gummifera* Hooker f., west side of Albemarle Island, 20 miles north of Iguana Cove, Galapagos, May 22, 1932, *Howell*. This species seems close to *Puccinia æmulans* Syd., but the abundant paraphyses are distinctive in this species on *Scalesia*.

Uromyces Blainvilleæ Berk., Jour. Linn. Soc. Bot., **14**: 92, 1875. On *Blainvillea dichotoma* (Murr.) Cass., James Bay, James Island, Galapagos, June 4, 1932, *Howell*.

Uromyces proeminens (DC.) Pass., Rab. Fungi Eur., 1795, 1873. On *Euphorbia thymifolia* L., Punta Arenas, Costa Rica, June 26, 1932, *Howell*.

Uromyces proeminens-euphorbiicola (Tranz.) Arthur, Man. Rust. U. S., 309, 1934. On *Euphorbia pilifera* L., near Villamil, Albemarle Island, Galapagos, April 27, 1932, *Howell*. On *Euphorbia pilifera* L. Wreck Bay, Chatham Island, Galapagos, April 15, 1932, *Howell*.

AURICULARIALES

Auriculariaceæ

Auricularia polytricha (Mont.) Pat., Sacc. Syll., **6**: 766, 1888. On dead wood, Braithwaite Bay, Socorro Island, March 27, 1932, *Howell*.

Auricularia rosea Burt, Ann. Mo. Bot. Gard., **8**: 391, 1921. Socorro Island, March 27, 1932, *Howell*. Slope of Coseguina Volcano, Gulf of Fonseca, Nicaragua, July 6, 1932, *Templeton Crocker*.

DACROMYCETALES

Dacromycetaceæ

Guepinia fissa Berk., Ann. Mag. Nat. Hist., **10**: 383, 1842. On dead wood, east side of Albemarle Island, Galapagos, May 30, 1932, *Templeton Crocker*.

AGARICALES

Thelephoraceæ

Hymenochæte luteo-badia (Fr.) Wakef., Kew Bull., No. 1, 13, 1917. Fortuna, Indefatigable Island, Galapagos, May 11, 1932, *Howell*. (Det. E. M. Wakefield).

Stereum affine Lev., Ann. Sci. Nat., (III) **2**: 210, 1844. Cocos Island, Sept. 7, 1905, *Stewart No. 1439*. (Det. E. M. Wakefield).

Stereum duriusculum B. and Br., Jour. Linn. Soc., **14**: 66, 1875. Charles Island, Galapagos, Oct. 10, 1905, *Stewart Nos. 966, 967, 975, 976*. (Det. E. M. Wakefield).

Stereum lobatum (Knze.) Fr., Epicr., **547**, 1838. Wafer Bay, Cocos Island, June 28, 1932, *Templeton Crocker*. (Det. C. J. Humphrey).

Stereum rimosum (Berk.) Hook., Kew Jour., **169**, 1851. Cocos Island, Sept. 12, 1905, *Stewart No. 1529*. (Det. E. M. Wakefield).

Clavariaceæ

Pterula capillaris Lev., Ann. Sci. Nat., (III) **2**: 208, 1844. On wood, Fortuna, Indefatigable Island, Galapagos, May 13, 1932, *Howell*.

Hydnaceæ

Hydnodon thelephorum (Lev.) Banker, Mycologia, **5**: 297, 1913. Charles Island, Galapagos, Feb. 28, 1906, *Stewart No. 4190*. (Det. L. W. Miller).

Odontia uda (Fr.) Bres. ? Atti Accad. Rovereto, **3**: 97, 1897. Cocos Island, Sept. 12, 1905, *Stewart Nos. 1520, 1536*. (Det. L. W. Miller.)

Polyporaceæ

Fomes rimosus Berk., Fr. Nov. Symb. Myc., **66**: 1851. On stump, Maria Magdalena Island, May, 1925, *Mason*. Maria Madre Island, May, 1925, *Mason*. Tagus Cove, Albemarle Island, Galapagos, May 25, 1932, *H. W. Clark*.

Fulvofomes melleicinctus Murr., Murrill, Tropical Polypores, **85**, 1915. James Bay, James Island, Galapagos, Aug. 8, 1906, *Stewart No. 6078*.

Ganoderma Curtisii (Berk.) Murr., N. Amer. Fl., **9**: 120, 1908. Jervis Island, Galapagos, Dec. 10, 1905, *Stewart No. 3813*.

Ganoderma flaviporum Murr., N. Amer. Fl., **9**: 116, 1908. Port Parker, Costa Rica, July 3, 1932, *H. W. Clark*.

Ganoderma pulverulatum Murr., N. Amer. Fl., **9**: 121, 1908. James Bay, James Island, Galapagos, June 12, 1932, *Howell*.

Ganoderma subincrustatum Murr. N. Amer. Fl., **9**: 122, 1908. Charles Island, Galapagos, Oct. 5, 1905, *Stewart No. 778*.

Polyporus abietinus (Dicks.) Fr., Syst. Mycol., **1**: 370, 1821. On dead pine, N. end Guadalupe Island, Nov. 15, 1931, *Howell*.

Polyporus Cowellii Murr., Bull. Torr. Bot. Club, **31**: 39, 1904. Cocos Island, Sept. 4, 1905, *Stewart No. 1447*.

Polyporus licnoides Mont., Pl. Cell. Cuba, 243, 1845. Slope of Coseguina Volcano, Gulf of Fonseca, Nicaragua, July 6, 1932, *Templeton Crocker*.

Polyporus membranaceus (Sw.) Fr., Syst. Mycol., **1**: 370, 1821. Slope of Coseguina Volcano, Gulf of Fonseca, Nicaragua, July 6, 1932, *Templeton Crocker*.

Polyporus pavonius (Hook.) Fr., Epicr. Syst. Mycol., 477, 1838. Slope of Coseguina Volcano, Gulf of Fonseca, Nicaragua, July 6, 1932, *Templeton Crocker*.

Polyporus porrectus (Murr.) Sacc. and Trott., Syll. Fung., **23**: 374, 1925. Slope of Coseguina Volcano, Gulf of Fonseca, Nicaragua, July 6, 1932, *Templeton Crocker*.

Polyporus sanguineus (L.) Fr., Nov. Symbol. Myc., 75, 1851. On dead logs, Maria Madre Island, May 1925, *H. L. Mason*. On dead wood, Braxillito Bay, Costa Rica, July 1, 1932, *Howell*.

Polyporus spathulatus (Hook.) Mont., Ann. Sci. Nat., IV, **1**: 125, 1854. Near Academy Bay, Indefatigable Island, Galapagos, May 4, 1932, *Howell*. On ground, near summit of Tagus Cove Mountain, elev., 3900 ft., Albemarle Island, Galapagos, May 26, 1932, *Howell*.

Polyporus tabacinus Mont., Ann. Sci. Nat., (II), **3**: 349, 1835. Cocos Island, Sept. 12, 1905, *Stewart No. 1537*. (Det. C. J. Humphrey).

Polyporus tricholoma Mont., Ann. Sci. Nat., (II), **8**: 365, 1837. South Albemarle Island, Galapagos, Aug. 23, 1906, *Stewart No. 6701*. Cocos Island, Sept. 12, 1906, *Stewart No. 1556*. Near Academy Bay, Indefatigable Island, Galapagos, May 8, 1932, *Howell*. James Bay, James Island, Galapagos, June 4, 1932, *Howell*.

Trametes hispida Pass., Nouv. Giorn. Bot. Ital., **4**: 155, 1872. Tres Marias Islands, May, 1925, *Mason*.

Trametes rigida Berk. and Mont., Ann. Sci. Nat. (III), **11**: 240, 1849. On dead wood, Socorro Island, March 27, 1932, *Howell*. (Det. C. J. Humphrey).

Agaricaceæ

Lentinus orinocensis Pat., Bull. Soc. Myc., **4**: 21, 1888. Tagus Cove, Albemarle Island, Galapagos, May 24, 1932, *Howell*.

Lentinus villosus Klotzsch, Linnæa, **8**: 479, 1833. Socorro Island, March 27, 1932, *Howell*. Maria Magdalena Island, May, 1925, *Mason*. (Det. C. H. Kauffman).

Marasmius siccus (Schw.) Fr., Epicr. Myc., 382, 1838. Near Academy Bay, Indefatigable Island, Galapagos, May 4, 1932, *Howell*.

Montagnites argentina Speg., Fg. Arg. novi r crit., 160, 1899. Lower California, Mexico, Cape San Lucas, Aug. 7, 1932, *Howell*.

Montagnites tenuis Pat., Jour. de Bot., **8**: 219, 1894. On beach sand, Gardner Bay, Hood Island, Galapagos, April 20, 1932, *H. W. Clark*. On sand, South Seymour Island, Galapagos, June 10, 1932, *Howell*.

Schizophyllum commune Fr., Syst. Myc., **1**: 330, 1821. On wood, near Academy Bay, Indefatigable Island, Galapagos, May 8, 1932, *Howell*. On wood, James Island, Galapagos, June 4, 1932, *Howell*. Abingdon Island, Galapagos, Sept. 21, 1906, *Stewart No. 8779*. Basso Point, Chatham Island, Galapagos, Feb. 8, 1906, *Stewart Nos. 2119, 2120*.

Tubaria sp. Near Fortuna, Indefatigable Island, Galapagos, May 12, 1932, *Howell*.

GASTEROMYCETES

Bovista plumbea Pers., Syn. Fung., 137, 1801. Guadalupe Island, March 17, 1932, *Howell*.

Bovistella sp. Near Academy Bay, Indefatigable Island, Galapagos, May 4, 1932, *Howell*.

Calvatia cyathiformis (Bosc) Morgan, Jour. Cin. Soc. Nat. Hist., **12**: 168, 1890. Near Fortuna, Indefatigable Island, Galapagos, May 12, 1932, *Howell*. Near James Bay, James Island, Galapagos, Aug. 8, 1906, *Stewart Nos. 6190-6197*. South Albemarle Island, Galapagos, Aug. 23, 1906, *Stewart Nos. 6758, 6759*.

Cyathus rugispermus (Schw.) DeToni, Sacc. Syll., **7**: 42, 1888. On rotting wood, Braxillito Bay, Costa Rica, July 1, 1932, *Howell*.

Geaster triplex Jungh., Tidskr. Natur. Geschiedenis, **7**: 287, 1840. Charles Island, Galapagos, April 25, 1932, *Howell*. Near Academy Bay, Indefatigable Island, Galapagos, May 4, 1932, *Howell*.

Mycenastrum corium Desv., Ann. Sci. Nat., (II) **17**: 147, 1842. James Bay, James Island, Galapagos, Jan. 3, 1906, *Stewart No. 3721*.

Myriostoma coliforme (Pers.) Corda, Anleit., Tab. D., fig. 16-17, 1842. Near Academy Bay, Indefatigable Island, Galapagos, May 8, 1932, *Howell*.

Phellorinia inquinans Berk., Lond. Jour. Bot., **2**: 421, 1843. South Seymour Island, Galapagos, June 10, 1932, *H. W. Clark*.

Podaxis pistillaris (L. ex Pers.) Fr., Syst. Myc., **3**: 63, 1829. Near Gardner Bay, Hood Island, Galapagos, June 26, 1906, *Stewart No. 7532*.

Tulostoma granulosum Lev., Demidoff. Voy., 120, 1842. Guadalupe Island, March 16, 1932, *Howell*.

Tulostoma occidentale Lloyd, Mycol. Writings, **2**: Tyl. 13, 1906. South Seymour Island, Galapagos, June 10, 1932, *Howell*.

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THE TEMPLETON CROCKER EXPEDITION OF THE
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No. 39

TWO NEW FLAGELLATES FROM TERMITES
IN THE
GENERA CORONYMPHA KIRBY, AND METACORONYMPHA
KIRBY, NEW GENUS.

BY
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University of California

During the cruise of the *Zaca* to Central America, Mexico, and the Galapagos Archipelago, termites were collected by Dr. A. E. Larsen, who also prepared smears of their intestinal Protozoa. A report on these termites, by S. F. Light, has been published in this series. The smears of Protozoa were submitted to the writer for study and report. Among them are preparations from *Kalotermes pacificus* Banks, which contains some unusually interesting multinucleate flagellates. These were collected on James Island and Albemarle Island of the Galapagos Archipelago.

The flagellates of *K. pacificus* are the same as those collected by the writer in 1925 from termites on Taboga Island, Panama, determined by T. E. Snyder as *Kalotermes tabogae*. Light (1935) concluded that *K. tabogae* is synonymous with *K. pacificus*, an opinion which is not opposed by a study of the protozoan faunas.

July 20, 1939

The same flagellates have been found in *Kaloterme emersoni* Light and *K. platycephalus* Light, collected by Light in the State of Colima, Mexico, in 1930 and sent to the writer for preparation of smears; and in *K. lighti* Snyder collected by Light at Ray, Arizona, in 1929.

The only other species of the subgenus *Kaloterme sensu stricto*, to which all the above termites belong, that has been found on the Galapagos Islands is *K. immigrans* Snyder; excepting *K. galapagoensis* Banks which, according to Light (1935), is a *species inquirenda*. Protozoa of *Kaloterme immigrans* were obtained by the writer at Fanning Island in 1924, and by Dr. Larsen at Chatham, Narborough, Jervis, South Seymour, James, and Tower Islands of the Galapagos Archipelago. The genus *Coronympha* was established by the writer (1929) for the species *clevelandi* in this termite of Fanning Island, as well as in *Kaloterme clevelandi* Snyder of Panama and in *Kaloterme* sp. of the Galapagos Archipelago. The last host was doubtless also *K. immigrans*.

The flagellates found in these termites belong to a peculiar group of the Calonymphidae. They differ from *Stephanonympha* and *Calonympha*, the common genera of the family, in having conspicuous crests and axostyles that are not gathered into a bundle. Each mastigont has essentially the structure of the mastigont of a devescovid flagellate; they may, in fact, be regarded as polymastigont devescovidids, in the same way that *Microrhopalodina* is a polymastigont oxymonad.¹

Each of the species *K. pacificus*, *K. tabogae*, *K. lighti*, *K. emersoni*, and *K. platycephalus* contains two species of these flagellates, one a species of *Coronympha*, and the other of the new genus *Metacoronympha*. In addition, *Tricercomitus* and *Oxymonas* are present in all; *Trichonympha* was found in all except *K. lighti*. The absence of *Trichonympha* from the one colony examined does not, of course, indicate that it is absent from the species. The six or seven species of termites containing *Coronympha* and *Metacoronympha* are the only ones of about a hundred members of the genus *Kaloterme sensu lato* examined by the writer that were found to lack a representative of the subfamily Devescovidinae.

Reference was made to these Protozoa by Light (1933) in his account of *Kaloterme emersoni* and *K. platycephalus*, using data supplied by the writer. *Metacoronympha* was incorrectly listed there as *Stephanonympha*. The genus name *Metacoronympha* was given in a list of genera prepared by the writer (1937) in a survey of host parasite relations in the distribution of Protozoa in termites.

Financial assistance in preparation of the drawings illustrating this paper has been given by the Research Board of the University of California and the National Research Council.

¹ Duboseq and Grassé (1933, p. 448) state that *Coronympha* is a "*Eutrichomastix* polyénergide." The more immediate relationship is probably to Devescovidinae, and through that group to *Monocercomonas* (= *Eutrichomastix*).

***Coronympha octonaria* Kirby, new species**

Plate 36, figures 1-8

Coronympha clevelandi (pl. 36, fig. 9) contains sixteen karyomastigonts arranged in a circle. *C. octonaria* agrees with *C. clevelandi* in every way except that there are only eight karyomastigonts. A few specimens have been found with ten or twelve, but this is unusual. None has been seen with sixteen, unless in a division stage.

The species is somewhat smaller, and especially more slender, than *C. clevelandi*. Whereas that species has a range from 25 to 53 μ in length, and 18 to 46 μ in width, averaging 30 by 23 μ , fifty specimens of *C. octonaria* from *K. emersoni* ranged from 19 to 40 μ in length, and 14 to 26 μ in width, averaging 28 by 18.6 μ ; and fifty from *K. lighti* were 20 to 35 μ in length, 12 to 22 μ in width, averaging 27 by 16.4 μ .

Each karyomastigont consists of a nucleus, blepharoplast, cresta, three slender flagella and one stout flagellum, parabasal body and axostyle.

The eight pyriform nuclei are arranged in a circle (pl. 36, fig. 2), the longitudinal axis of each at an angle to the longitudinal axis of the body, so that the circle formed by their anterior ends is smaller than that formed by their posterior ends. A nucleolus can be distinguished in each nucleus in sufficiently destained material.

The blepharoplasts are arranged in a circle whose diameter is considerably smaller than that formed by the inner ends of the nuclei. The crestas (pl. 37, fig. 4A) are like those of many devescoviniid flagellates, subtriangular in form, the broader proximal end flattened, the distal end slender. The cresta (chromatic rod) of *C. clevelandi* (pl. 37, fig. 4B) is not rounded proximally, as stated in the original description (Kirby, 1929). Reexamination of the material has shown that the crestas are shaped like those of *C. octonaria*, though somewhat smaller in size.

The trailing flagellum is a moderately stout cord except in its anterior and posterior portions, where it is slender. The anterior portion lies close against the outer edge of the cresta, which is at the surface of the body. Usually it cannot be distinguished from it, so that flagellum and cresta seem to be continuous, and the form and length of the latter cannot be ascertained. Specimens can be found, however, in which the two are at least partially separated. The three long, fine, anterior flagella are ordinarily adherent, at least in their proximal portion.

The bacilliform parabasal bodies (pl. 36, figs. 3, 4) are each situated against the peripheral side of a nucleus, and, when long, are curved so that the concave side is outward. There is much variation in size. Ordinarily the parabasals generally are almost or quite as long as the nuclei; sometimes they exceed that length. They are larger than those of *Coronympha clevelandi*. Material of *C. clevelandi* was studied again to check the accuracy of the description published

in 1929. In some the parabasals are more bacilliform than was indicated then, but none was observed to equal or exceed the nucleus in length.

The axostyles are like those of *C. clevelandi*, being broad enough to permit the sheath and a clear interior to be distinguished. They run through the endoplasm, but are not gathered into a compact bundle, and often project posteriorly for a short distance. There is no terminal enlargement.

A number of division stages were found in material from *Kaloterms emersoni* (pl. 36, figs. 5-7). At the onset of division the nuclei leave their position in the anterior circle, and become distributed in the peripheral cytoplasm. In all cases observed but one eight nuclei were so distributed. This one had seven. In all division figures observed a stout flagellum was attached at one end of the paradesmose. Evidently as in *Devescovina* the trailing flagellum is not discarded; the old flagella are distributed, and new ones grow out to complete the supply.

When nuclear division has been completed the sixteen nuclei are distributed in two groups of eight to opposite ends of the body, and form into circles from which the now full-grown new crestas radiate and the groups of new axostyles extend posteriorly (pl. 36, fig. 8). Plasmotomy then occurs.

Abnormal numbers of nuclei would result if this distribution were not equal. When there are ten, at the previous division six may have gone to one end and ten to the other, assuming that the parent had sixteen. Division and equal distribution of all the nuclei in a flagellate with ten or twelve would perpetuate the number. The very small number of instances of such numbers of nuclei indicate that unequal distribution seldom occurs.

There is no evidence that the nuclei divide in a flagellate that is not as a whole undergoing binary fission. But since little division material has been found, such a possibility cannot be denied.

It is probable that a species of *Coronympha* with four karyomastigonts exists or has existed in *Kaloterms*. That is one thing to search for in unexplored termites. The series would be completed by the discovery of a flagellate with two karyomastigonts of this type.

Metacoronympha senta Kirby, new genus, new species

Plate 37, figures 1-6; Plate 38, figures 1-5; Plate 39, figures 1-10

Those hosts here studied which contain *Coronympha octonaria* also have this larger flagellate. There is, however, no question of the two being developmental stages of the same species. In *Kaloterms immigrans* and *K. clevelandi*, *Coronympha clevelandi* is the only multinucleate flagellate.

Metacoronympha senta has a stout body that is more broadly rounded anteriorly than posteriorly. The posterior end is often

more or less bluntly pointed. Fifty specimens from *Kaloterme emersoni* ranged in length from 32 to 77 μ , in width from 20 to 66 μ , averaging 51 by 38 μ . Fifty from *K. tabogae* (= *K. pacificus*?) ranged from 22 to 92 μ by 15 to 67 μ , averaging 40.5 by 30 μ . There were many more small forms, as well as some larger forms, in the material from *K. tabogae*.

The anterior end of the body is occupied by the numerous karyomastigonts in regular arrangement, located in the peripheral cytoplasm (pl. 38, fig. 1; pl. 39, fig. 1). There are always a great many more than eight, and they are never arranged in a circle, nor in concentric circles. The number varies greatly. One of the largest specimens from *Kaloterme tabogae* contained 345 karyomastigonts (pl. 37, fig. 6), and one of the smallest (pl. 37, fig. 2) had 66. Four specimens from *Kaloterme emersoni* had 134, 127, 100, and 95 (pl. 38, fig. 4). The one drawn from *K. platycephalus* (pl. 38, fig. 3) had 144. The average number is under a hundred and fifty.

The karyomastigonts are arranged in dextrotropic spiral rows, turning over to the right as observed from the anterior end. The nuclei in the rows are usually evenly and regularly spaced. Of fifty specimens, seven had five rows (pl. 37, fig. 2), thirty-four had six (pl. 38, fig. 4), seven had seven (pl. 38, fig. 3), and one each had eight and nine (pl. 37, fig. 6). The last had only six rows at the center of the spiral. Six, then, is the usual number.

In suitably stained material it can be observed that the chromatin masses of the nuclei are situated within contiguous polygonal compartments (pl. 38, fig. 2) in an arrangement that calls to mind the structure of the surface layer of a *Volvox* colony. That is, however, merely an analogy. The polygonal boundaries are formed by the nuclear membranes, which have expanded, leaving a considerable area around the central chromatin masses, and have become angular as a result of being pressed together. That this is really the case has been proved by observation of stages just after division (pl. 39, fig. 10), in which the nuclei have not yet become organized into position. The membranes are then spherical, or nearly so, and surround the chromatin more closely, but in the specimen drawn some have begun to expand. Certain of the drawings (pl. 38, fig. 4; pl. 39, fig. 1) are not accurate in respect to the nuclear membranes, which should be contiguous as described above.

In flagellates with a small or average number of karyomastigonts the nuclei are usually all of approximately the same size (pl. 37, figs. 1, 2, 5; pl. 38, fig. 4); but in those with an exceptionally large number the nuclei decrease in size toward the anterior end of the spiral rows (pl. 37, fig. 6; pl. 38, fig. 3).

The crestas are the most conspicuous structures in a flagellate stained in iron haematoxylin and destained to the point where they alone remain black. They stain more intensely than the chromatin of the resting nucleus. Their shape suggests that of thorns, so that in such preparations the anterior portion has a thorny appearance.

Of course, the crestas are imbedded in the peripheral cytoplasm, and do not project. The specific name has been selected because of this appearance in certain Heidenhain's iron haematoxylin material.

In shape the crestas have a general resemblance to those of *Coronympha*. They are variable in size (pl. 37, fig. 4, C), and in some the antero-medial edge is longer than in other crestas of the same total length. In flagellates with a large number of karyomastigonts the crestas of the anterior ones may be very small, the size increasing in the more posterior ones. Figure 4, C, 5, 6, and 7 shows the crestas in three karyomastigonts of a single specimen from *Kaloterme tabogae*.

As in *Coronympha*, the more slender proximal part of the trailing flagellum is usually indistinguishable from the cresta. The trailing flagellum is not so stout as those of *C. clevelandi* and *C. octonaria* (pl. 37, fig. 4). The three anterior flagella of each karyomastigont arise in one group, and are united proximally. In the fixed material observed they were always separated in the distal portion, the separation sometimes beginning not far from the point of origin.

The axostyles show no tendency, as in *Stephanonympha* and *Calonympha*, to collect in a bundle as they run through the body. Each trunk runs separately from the others, and they are more peripherally located than in *Coronympha*. Generally they are in the outer endoplasm. They project when they reach the boundary of the body. This may be at the posterior end of the flagellate, as is usual, but only occasionally are they gathered close together here. Certain axostyles may fall short of the length of some of the others, and project before they reach the posterior end. It is seldom that they do not project at all.

At the posterior end the trunk of the axostyle is enlarged in a spearhead-formed cusp (pl. 39, fig. 2). Usually enlargement begins before it reaches the boundary of the cytoplasm; the edge of the cytoplasm is at the broadest point. Beyond is a comparatively long tapering projection. The anterior portions of the axostyles, alongside the nucleus, could not be studied satisfactorily. The slender trunk runs to the posterior end of the nucleus without any noticeable change in diameter.

The presence of this enlarged cusp at the posterior end of the axostyle is a frequent characteristic in flagellates of termites. It does not exist in certain genera of the subfamily Devescovinae, namely, *Devescovina*, *Macrotrichomonas*, *Caduceia*, and *Pseudodevescovina*, but it does occur in many undescribed species of *Foaina* and in *Metadevescovina*. Outside of the Devescovinae it has been noted in a number of other polymastigotes, and in some hypermastigotes.

No such cusps are present in *Coronympha octonaria*. A reexamination of *Coronympha clevelandi* was made, and the original description corroborated in respect to their absence in that species also. In *Coronympha* the axostyles taper gradually to the projecting tips,

which usually extend beyond the cytoplasm for a short distance, but may be completely enclosed.

The cytoplasm of both *Coronympha* and *Metacoronympha* usually contains an abundance of fragments of wood. Many particles are relatively large, and these grade down to very small ones. All of these seem to be imbedded directly in the cytoplasm. There are no large food vacuoles. A narrow clear space surrounds each one, as is true of other cytoplasmic inclusions. Among them, or instead of them, there may be smoothly or unevenly rounded spherules of variable size (pl. 38, fig. 5). These are of heterogeneous constitution. In iron haematoxylin stained material granules, or less often bacilliform bodies, for the most part peripherally located, stain deeply, the remainder lightly or not at all. The deeply stainable components are relatively more abundant in some spherules, less abundant in others. Some smaller bodies stain deeply and uniformly. Such spherules, which probably represent phases of wood digestion, were particularly abundant in some material from *Kalotermes tabogae*, where there were comparatively few particles of wood among them.

The outer surface of the body in *Metacoronympha*, as in *Coronympha*, is not marked by any type of regularly adherent micro-organism. Spirochaetes are usually present against the body as well as in the vicinity, but they do not adhere in a definite tuft or coat as in many other flagellates of termites.

DIVISION

Among the Calonymphidae, nuclear division was observed by Janicki (1915) in *Stephanonympha silvestrii* and *Calonympha grassii*. He reported that division occurs simultaneously in all nuclei, and the dividing nuclei are distributed irregularly throughout the peripheral cytoplasm. The anterior parts of the axostyles are resorbed, while the compact bundle composed of the posterior parts persists for a while. An extranuclear spindle develops with granules at its ends, to which flagella are attached. Chromosomes appear, which are granular in form and of unknown number in *S. silvestrii*, band-formed and four or five in number in *C. grassii*. The old parabasal body persists at one pole, while a new one develops at the other. Janicki believed that the new axostyles originate by direct transformation of the extranuclear spindle.

Considerably more division material of *Metacoronympha senta* has been found than of *Coronympha octonaria*. It likewise occurred on several slides from *Kalotermes emersoni*. No attempt has been made to obtain conclusive evidence on all points. The writer expects to make a complete study of division of the Calonymphidae, based on an abundance of material from many termites.

In *Metacoronympha senta*, as in other Calonymphidae, the nuclei depart from their regular arrangement at the onset of division, and

are distributed irregularly in the peripheral cytoplasm. They were never observed deep in the endoplasm during nuclear division, though after it is completed (pl. 39, fig. 10) some often do occur in that position. Along with each nucleus go all other components of the karyomastigont. The axostyles were not visible in any of the stages of nuclear division.

Figure 3, pl. 39, shows nuclei in a very early prophase, the earliest one seen. The paradesmoses are comparatively very short. The nuclei have undergone no alteration in shape, but a granular structure in the central chromatin mass is more distinct than formerly. The central chromatin mass consists of a matrix substance and relatively large, peripherally located, deeply staining granules. In many of the nuclei five granules are present, as is true in almost all cases where the separate granules can be seen readily. In some of the karyomastigonts the old cresta is attached to one pole; in others it has been detached. The flagellate is evidently in a stage just at the time of degeneration of the old crestas. Some of those still present have a degenerate appearance, being somewhat misshapen, and in some they are not attached at the usual point.

A granule is situated close to each end of the paradesmose, connected by a filament, and to these granules flagella are attached in pairs (pl. 39, fig. 3, c). The old flagella have been distributed. New flagella and new crestas have not yet appeared.

Prophases with paradesmoses a little longer, and no trace of old or new crestas, are more frequent (pl. 39, figs. 4, 5). Probably, as is true in *devescovicinid* flagellates, the old flagella persist at the two poles. At what stage new ones grow out to complete the number could not be determined because of the small size of the division figures, and the usual presence of foreign organisms on the surface of the body. During the anaphase and telophase additional flagella are present.

New crestas, small in size and equal at the two poles, have appeared by the anaphase (pl. 39, fig. 6). In certain prophases possible new crestas, very small still, were seen, but it was difficult to be certain of the observation. Since they are present in the anaphase, however, there is no doubt that they develop during the prophase, after the old one has been discarded.

The crestas increase in size, and after the nuclei have divided reach the maximum length (pl. 39, fig. 8). The nuclei are still connected by the elongated paradesmose, which may have a length of four or five times the nuclear diameter. In late telophase nuclei, and sometimes in nuclei organized into spiral rows (pl. 39, fig. 9) the chromatin mass is composed of a matrix and usually five large, deeply staining granules, as in the prophase. The

usual presence of five granules in these stages may indicate the existence of five chromosomes, but no chromosomes have been seen in the anaphase.

The paradesmose eventually disappears. It does not give rise to new axostyles, as Janicki supposed, in *Devescovininae*. Although it has not been possible to determine this point conclusively in *Metacoronympha*, there is no doubt that the situation is the same as in *Devescovininae*.

The nuclei become grouped at opposite ends, though not in such regular arrangement as in *Coronympha*. No stages of division of the body were seen. In many specimens, however, on the slides on which division stages were numerous, the nuclei were distributed irregularly, not being arranged in spiral rows. It may reasonably be supposed that some of these are stages after plasmotomy. In that stage one would expect to find nuclei grouped without regular arrangement toward one end. In a prophase, when nuclei are also irregularly distributed, the paradesmose would be present. On this basis it may be assumed that pl. 39, fig. 10, represents such a post-division stage. The nuclear membranes are expanding in some mastigonts, and lie more or less adjacent to one another. As remarked above, this stage shows clearly the origin of the polygonal areas noted in vegetative individuals.

There are interesting problems in reorganization that have not been solved for lack of adequate material. The origin of the new parabasal apparatus is one. Janicki's account of this probably is correct. What factors determine that the nuclei shall usually be arranged in six spiral rows, and, conversely, what behavior results in a different number of rows? How does it happen that nuclei, crestas, and parabasal bodies are often smaller in the anterior karyomastigonts? In *Metacoronympha senta*, as in *Coronympha octonaria*, no evidence was found for division of non-dispersed nuclei. In division figures all dividing nuclei were of the same size in any one flagellate. How do differences in size arise, and how does it happen that nuclei arrange themselves so that there is a gradation in size along the spiral rows? What is the origin of the great diversity in number of nuclei? In all cases observed all the nuclei were dividing. May there be two or more successive divisions of nuclei, to increase the number in a small individual? May nuclear division take place, and rearrangement of nuclei occur, without being immediately followed by division of the body? May fission occur without being immediately preceded by nuclear division?

It is hoped that these questions can be answered after study of other Calonymphidae.

DIAGNOSES

It is necessary to revise the diagnosis of the genus *Coronympha*, given by the writer (1929), in order to permit the inclusion of the species described in this paper.

Coronympha Kirby, 1929

Multinucleate flagellates, with karyomastigonts arranged in a single circle in the anterior portion of the body; each karyomastigont consisting of a nucleus, blepharoplast, cresta, three anterior flagella, a trailing flagellum, a parabasal body and an axostyle; blepharoplasts in a small circle at the anterior end of the body; axostyles double-contoured, not gathered into a bundle, often project slightly from the posterior end; dividing nuclei become distributed generally in peripheral cytoplasm, mitotic figure with paradesmose and other features like those of devescovid flagellates.

Genotype.—*C. clevelandi* Kirby, 1929.

Coronympha clevelandi Kirby, 1929

Dimensions of body: length 25–53 μ , averaging 30 μ , width 18–46 μ , averaging 23 μ ; sixteen karyomastigonts; nuclei clavate, containing one or more nucleoli and finely distributed chromatin; crestas subtriangular, broader and flat in anterior portion; trailing flagellum a moderately stout cord; parabasal body rounded or bacilliform, situated peripheral and adjacent to nucleus, not exceeding its length; axostyles without enlarged cusps posteriorly, projecting from body; xylophagous.

Type host.—*Kalotermes clevelandi* Snyder, **Panama**.

Additional host.—*K. immigrans* Snyder, **Fanning Island, Galapagos Islands**.

Coronympha octonaria Kirby, new species

Dimensions of body²: length 19–40 μ , averaging 28 μ , width 12–26 μ , averaging 18 μ ; eight karyomastigonts usual, exceptionally ten or twelve; nuclei clavate; crestas somewhat larger, and broader anteriorly, than those of *C. clevelandi*; trailing flagellum like that of *C. clevelandi*; parabasal body bacilliform, ordinarily almost or quite as long as nucleus, sometimes exceeding length of nucleus, and incurved toward periphery of body; axostyles without enlarged cusps posteriorly, projecting from body; xylophagous.

Type host.—*Kalotermes emersoni* Light, **Mexico**.

Additional hosts.—*K. pacificus* Banks, **Galapagos**. *K. tabogac* Snyder, **Panama**. *K. platycephalus* Light, **Mexico**. *K. lighti* Snyder, **Arizona**.

² The dimensions here are for collective material from different host species; dimensions from individual species are given elsewhere.

Metacoronympha Kirby, new genus

Multinucleate flagellates with numerous karyomastigonts arranged in spiral rows meeting at the anterior end, averaging more than a hundred in the type species; each karyomastigont with nucleus, blepharoplast, cresta, three anterior flagella, a trailing flagellum and an axostyle; axostyles double-contoured as in *Coronympha*, distributed usually in outer endoplasm, not gathered into bundle, usually projecting a distance from the posterior end; nuclear division as in *Coronympha*.

Genotype.—*M. senta* Kirby, new species.

Metacoronympha senta Kirby, new species

Dimensions of body: length 22 to 92 μ , averaging 45 μ , width 15 to 67 μ , averaging 34 μ ; karyomastigonts 66 (or less) to 345 (or more), averaging about 150, arranged usually in 6 spiral rows, sometimes in 5, 7, 8, or 9 rows; nuclei ellipsoidal, membranes in vegetative individuals at anterior end often expanded and pressed together in polygonal form; crestas variable in size, some equal to those of *Coronympha octonaria*, broadened and flattened anteriorly in subtriangular form; trailing flagellum stouter than anterior flagella, but more slender than in *Coronympha clevelandi* and *C. octonaria*; parabasal body rounded or bacilliform, varying in size according to position of karyomastigonts; axostyles with enlarged cusps posteriorly, the tapering portion usually projecting beyond cytoplasm; xylophagous.

Type host.—*Kalotermes emersoni* Light, **Mexico**.

Additional hosts.—*K. pacificus* Banks, **Galapagos**. *K. tabogae* Snyder, **Panama**. *K. platycephalus* Light, **Mexico**. *K. lighti* Snyder, **Arizona**.

SUMMARY

1. Two new calonymphid flagellates, *Coronympha octonaria* Kirby, n. sp. and *Metacoronympha senta* Kirby, n. g., n. sp., are described from five termites of the genus *Kalotermes*, *K. emersoni* and *K. platycephalus* of Mexico, *K. pacificus* of the Galapagos Islands, *K. tabogae* of Panama (probably a synonym of *K. pacificus*), and *K. lighti* of Arizona.

2. *Coronympha octonaria* has eight karyomastigonts arranged in a circle. *Metacoronympha senta* has a large, variable number, averaging about 150, arranged generally in six spiral rows meeting at the anterior end.

3. Each karyomastigont has the structures of a devescovinid flagellate: three slender anterior and one stouter trailing flagellum, a sub-triangular, flattened cresta, a parabasal body, axostyle, blepharoplast and nucleus.

4. The axostyles run separately through the endoplasm, not being gathered into a bundle, and they project from the cytoplasm for a short distance. In *Metacoronympha* there is an enlarged posterior cusp, as in certain devescovinids and other flagellates of termites.

5. In division the nuclei lose their regular arrangement, to be distributed irregularly in the peripheral cytoplasm. The mitotic figure is like that in *devescovid* and *trichomonad* flagellates. The old cresta is resorbed and new ones form *de novo*. After the telophase, nuclei group at opposite ends and fission occurs.

6. *Coronympha* and *Metacoronympha* possibly have evolved from *devescovid* flagellates. They may be regarded as polymastigont *devescovid*ids, in the same way that *Microrhopalodina* is a polymastigont oxymonad.

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EXPLANATION OF PLATES

Abbreviations for methods of preparation: A.F., acid fuchsin; B., Bouin's fluid; D., Delafield's haematoxylin; F. G., Gatenby's modification of Flemming's fluid; H., Heidenhain's iron haematoxylin; S., Schaudinn's fluid.

PLATE 36

Figs. 1-8. *Coronympha octonaria* n.sp. Figs. 1, 2, and 5-8 from *Kalotermes emersoni*; fig. 3 from *K. platycephalus*; fig. 4 from *K. pacificus*. $\times 1830$.

Fig. 1. Entire, lateral view; crestas, axostyles, nuclei, and flagella. S.H.

Fig. 2. View from anterior end; blepharoplasts, nuclei, four flagella to each karyomastigont. S.H.

Fig. 3. Nucleus and long parabasal body. S.D.

Fig. 4. Nucleus and shorter parabasal body. B.D.

Fig. 5. Prophase, showing distribution of nuclei. S.H.

Fig. 6. Anaphase or early telophase. Old stout trailing flagellum attached at one pole. S.H.

Fig. 7. Late telophase; elongated paradesmose, new flagella. S.H.

Fig. 8. Just prior to cleavage; nuclei have completed division, are in circles at opposite ends. S.H.

Fig. 9. *Coronympha clevelandi* from *K. clevelandi*. S.H. $\times 1830$.

PLATE 37

Figs. 1-3, 5-6. *Metacoronympha senta* n.g., n. sp.

Fig. 1. From *K. emersoni*. Entire, of average size. S.H. $\times 970$.

Fig. 2. From *K. tabogae*. End view of a small individual, showing 66 nuclei in 5 rows. S.H. $\times 1335$.

Fig. 3. From *K. platycephalus*. Bacilliform parabasal bodies alongside nuclei. S.D. $\times 1830$.

Fig. 4. A, Three crestas of *Coronympha octonaria*; B, three of *C. clevelandi*; C, crestas of *Metacoronympha senta*, showing size variations. S.H. $\times 1830$.

Fig. 5. From *K. tabogae*. A small individual. F.G.H. $\times 1335$.

Fig. 6. From *K. tabogae*. A very large flagellate, with 345 nuclei, showing size variation in nuclei and parabasal bodies. S. D. $\times 880$.

PLATE 38

Metacoronympha senta n.g., n.sp.

Fig. 1. From *K. platycephalus*. B.H. $\times 1335$.

Fig. 2. From *K. emersoni*. Anterior end, showing beginning of the six spiral rows of nuclei, with polygonal compartments, formed by contiguous nuclear membranes, around the nuclear chromatin. S.H.A.F. $\times 1830$.

Fig. 3. From *K. platycephalus*. Anterior end, 144 nuclei in 7 rows; faintly stained parabasal bodies alongside many of the nuclei, a blepharoplast beside each. B.H. $\times 1335$.

Fig. 4. From *K. emersoni*. Nuclei all of same size, 95 in 6 rows. The nuclear membranes should, toward the center, be contiguous and somewhat polygonal, as in fig. 2. S.H. $\times 1830$.

Fig. 5. From *K. tabogae*. Endoplasmic inclusions of a crushed flagellate; fragments of wood, and residues of wood digestion. F.G.H. $\times 1830$.

PLATE 39

Metacoronympha senta n. g., n. sp.

Fig. 1. From *K. tabogae*. An individual with an unusually large number of karyomastigonts. Note variation in size of crestas. S.H. $\times 1335$.

Fig. 2. From *K. tabogae*. Spearhead-shaped cusps at posterior ends of axostyles. All axostyles of this flagellate are formed in this manner, with ends projecting from the cytoplasm. F.G.H. $\times 1830$.

Figs. 3-10. Division stages from *K. emersoni*. S.H. 23-29, $\times 1830$; 30, $\times 1335$.

Fig. 3. Early prophase; nuclei are distributed; all nuclei drawn are from one flagellate; old crestas attached to *b*, *c*, and *d*, absent from others; *e* showing granules separate from, but connected by fibrils to the ends of the paradesmose; five granules in each central chromatin mass.

Fig. 4. Prophase; paradesmose, granules and distributed flagella; no crestas.

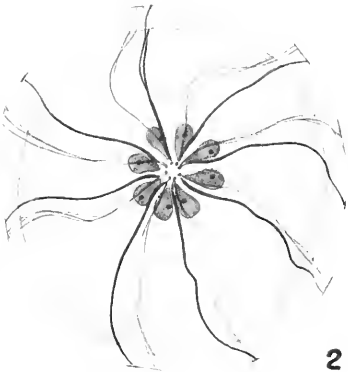
Fig. 5. A little later prophase; no crestas.

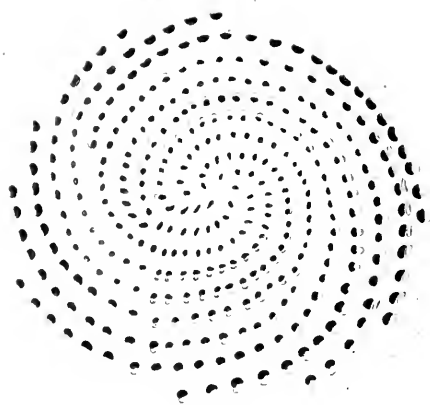
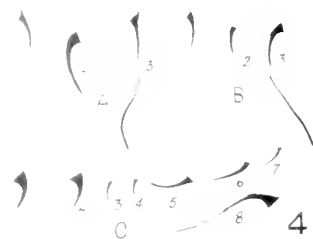
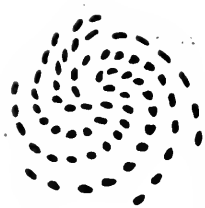
Fig. 6. Anaphase; new crestas have developed.

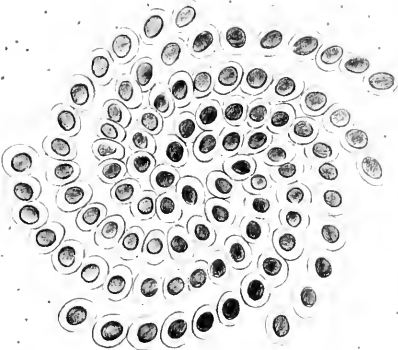
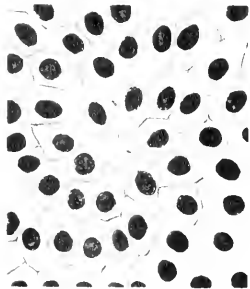
Figs. 7, 8. Telophases; new crestas full grown.

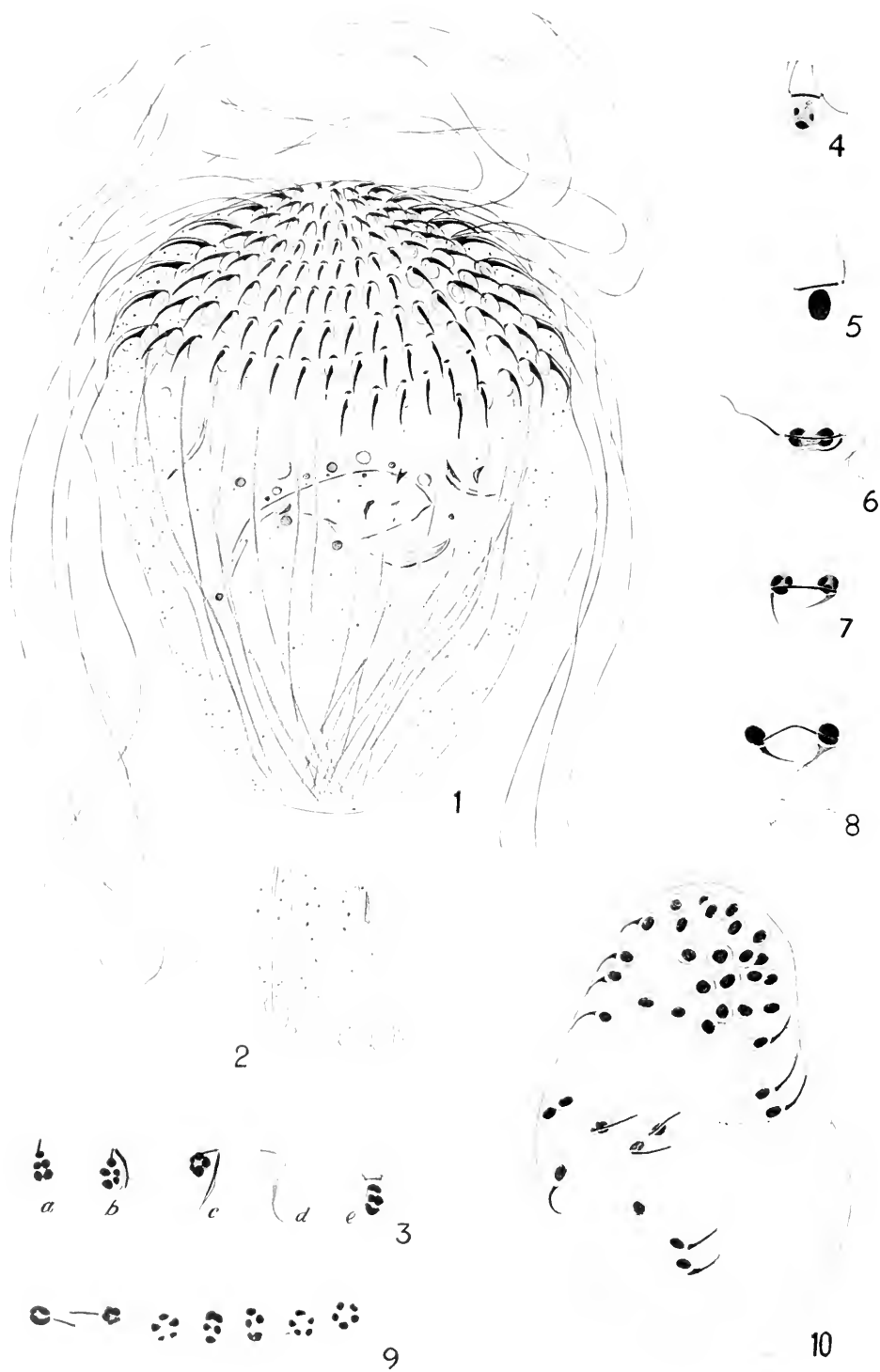
Fig. 9. Two nuclei of late telophase, showing granules; five nuclei after arrangement in spiral rows, with five granules each.

Fig. 10. Probably after division of the body; karyomastigonts not yet organized into spiral rows; a few of the posterior karyomastigonts lie deep in the endoplasm.









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THE GENUS SCALEZIA*

BY

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INTRODUCTION

HISTORY AND MATERIALS

The genus *Scalesia* of the helianthoid *Compositæ* is the largest genus of vascular plants in the Galapagos Islands, and is one of the two genera of vascular plants which have been generally recognized as endemic, the other being the helianthoid genus *Lecocarpus* Descaïne. *Scalesia* was described by Arnott from a specimen collected by Hugh Cuming in 1829,¹ and the description of the genus with its single species, *S. atractyloides*, was published by Lindley in 1836 (p. 443). The genus was referred to the *Heliantheæ Heliopsidææ*, that group in the classification of Lessing (1832, p. 223) containing a number of genera later referred by Bentham and Hooker f. to their subtribe *Verbesinææ*; but no definite statement of the relationship of *Scalesia* was made, although it might have been differentiated from other genera in that group by such characters as the homogamous heads and the compressed achenes without pappus. By De Candolle (1839, vol. 7, p. 308) the genus was placed among *genera incertæ sedis* and his description is derived entirely from that of Arnott. Two years later, Hooker and Arnott (1841, vol. 3, p. 312) published a description of the genus and remarked: "A very distinct genus unlike any with which we are acquainted." The position of *Scalesia* is fixed by Bentham and Hooker f. in the *Genera Plantarum* (1873, vol. 2, pp. 195, 367) in the subtribe *Verbesinææ* of the *Helianthoideæ* where *Scalesia* is placed between *Wulffia* Neck. and *Mirasolia* (Schultz Bip.) Benth. and Hook. f. From the latter, *Scalesia* is separated by the heads discoid or less amply radiate, by the involucre narrower, and by the achenes thinner (op. cit., p. 368), and from the former it is distinguished chiefly by the thinner achenes without frequently fleshy pericarp (op. cit., p. 195). Hoffmann (1894, p. 232) refers *Scalesia* to his *Heliantheæ-Verbesinææ*, but places it in a seemingly anomalous position between *Temnolepis* Baker, a monotypic genus of Madagascar, and the very natural North American genus *Rudbeckia* L., which, in turn, is followed by *Wulffia* and *Gymnolomia* HBK. The most recent generic description of *Scalesia* is that of Lemée (1934, p. 996), in which the older generic diagnoses are modified in the light of more recently described species; but no suggestion of relationship is given.

Most of the references to *Scalesia* in the literature of the past half century have related to reports on collections made in the Galapagos Islands. Of these collections, the two most important are those of Snodgrass and Heller, obtained on the Hopkins-Stanford Expedition

¹ This is the date generally accepted for Cuming's visit to the Galapagos Islands. The specimen of *Scalesia atractyloides* Arn. in Herb. Kew., however, bears a printed label with the date 1831, but undoubtedly this was not the year in which the specimen was collected but rather the year in which Cuming gave his collections to Sir William Jackson Hooker. (Cf. Howell, *Hugh Cuming's Visit to the Galapagos Islands*. In press.)

of 1898 and 1899, and of Stewart, obtained on the California Academy of Sciences Expedition of 1905 and 1906; and both were unusually rich in material of *Scalesia*. No fewer than five new species were described by Robinson from the former collection, and in the latter collection all the species then known from the islands were represented except two (and they are still known only from the type collections).

The present paper has grown out of an attempt to identify the specimens collected by the author as botanist on the Templeton Crocker Expedition of the California Academy of Sciences in 1932. Although the collections obtained in *Scalesia* are not comparable in number and diversity with those obtained by Snodgrass and Heller, or by Stewart, enough difficulty was encountered in attempting determinations to indicate the need of a revision of the genus with keys and diagnoses to the species. While in Europe in 1935, the author gave special attention to the genus, and the types of all the earlier species were examined at the Royal Herbarium, Kew, at the Herbarium of the University of Cambridge, and at the Herbarium of the Museum of Natural History in Stockholm. In the more immediate preparation of this paper, the collections of *Scalesia* in the Gray Herbarium of Harvard University, the Dudley Herbarium of Stanford University, and the Herbarium of the Brooklyn Botanic Garden have been borrowed; and these, together with the collections in the Herbarium of the California Academy of Sciences, have constituted as important and as adequate a working collection as may be had at the present time. From the treatment that has been prepared, it is hoped that not only will there result a better understanding of this remarkable genus taxonomically, but that also there will be suggested a solution of certain phyto-geographic problems to which it bears a definite relation.

Acknowledgments. For the assistance and many kindnesses given in the preparation of this revision, the writer wishes to express his appreciation and gratitude to his friends who have been helpful and to the officers and assistants of herbaria from which specimens have been borrowed, or at which they have been examined, particularly to Dr. T. A. Sprague at Kew, and to Dr. Eric Asplund at Stockholm. Dr. S. F. Blake, Washington, D. C., has answered questions of the writer, and, from his critical and extensive knowledge of the *Compositæ*, has offered helpful suggestions on several points. Miss Veronica Sexton, Assistant Librarian of the California Academy of Sciences, has given help in the bibliography, and Miss Ruth D. Sanderson, Librarian at the Gray Herbarium, copied and sent the original description of the genus. Library facilities at the University of California, generously extended to the author at all times, have been used for some works not in the Library of the Academy. The writer is grateful to Mr. Templeton Crocker for the opportunities offered on his expedition in 1932; and especially is he indebted to Miss Alice Eastwood, Curator of the Department of Botany of the

California Academy of Sciences, not only for the opportunity to study in Europe in 1935, but also for her help and sustained interest in the preparation of this work.

GENERAL MORPHOLOGY

Habit. The species of *Scalesia* are all woody and erect, but in habit represent two distinct types, shrubs and trees. Although the shrubs are usually 1 to 2 m. tall, occasionally they are as low as 0.3 m., and, under favorable conditions, they may become arborescent and 3 or 4 m. tall. Usually the shrubs are rather openly few-branched from near the ground and do not present a "twiggy" appearance. The arboreous species may attain a height of 20 m. and are characterized by a single, well-developed trunk that is exceptionally clear of lower branches. At the upper and lower limits of the forest belt where the *Scalesia* trees are found, they may be considerably reduced in height and only 5 m. tall. Nothing is known of the roots of *Scalesia* aside from their perennial character.

Although the arboreous *S. pedunculata* Hook. f. is reminiscent of *Helianthus annuus* L. grown to fantastic proportions, the scalesias seem to represent growth forms that have lost all direct connection with herbaceous antecedents. In this particular, there is a distinct difference between the frutescent and arboreous members of *Scalesia* and the rosette-trees or megaphytes, as they have been called, which are found occasionally in other divisions of the *Compositæ*, in the *Lobeliaceæ*, and in other families of flowering plants. These remarkable plants, strikingly exemplified by the arborescent senecios and lobeliads of East Africa, and by the Silver Swords and lobeliads of Hawaii, appear to represent the exaggerated gigantism of herbaceous rosette forms, and not, as in *Scalesia*, an essentially frutescent and arboreous habit.

Stems. The stems are round and not striate, although the branchlets may be roughened by prominent scars left after the leaves fall. The trunk of *S. pedunculata* may become 2 to 3 dm. in diameter. The bark of shrubs and trees is smooth or wrinkled and not corky, and is brown or gray. The wood is soft, and even in the trees a pithy center is evident (Svenson, 1935, p. 215). A gummy or resinous sap seems to be common to all species in the genus, and is evident in specimens especially about flowering branchlets where a clear, amber-like bead will frequently form at broken places. Branching is subdichotomous or rarely truly dichotomous.

Trichomes. The vesture of the stems and leaves in *Scalesia* is varied in character, and has been described as sericeous, villous, hirsute, scabrous, subvelutinous, and glandular. The trichomes are essentially of two sorts, glandular and nonglandular. The glandular hairs may be capitate-glandular, or they may be slender, shorter or longer, viscidulous hairs. The nonglandular hairs may be stiff or

soft, appressed or spreading, dense or very sparse, short and conical or very elongate. In several of the species that are so markedly scabrous, the roughness is imparted chiefly by the hard, enlarged, conical bases of the nonglandular hairs, which persist after the slender elongate tips have broken off. No species of *Scalesia* is known to be entirely glabrous, and although most species are noticeably and distinctly pubescent, *S. Snodgrassii* Rob. is more nearly glabrous than any other. No species is known with only glandular hairs, but in some species glandular hairs are very few, if not entirely lacking. However, in some of those species which are without glandular hairs, the branchlets and leaves may appear to be glandular-viscid because of the resinous sap in them. The character of the trichomes, which in several entities impart a distinctive aspect that is reflected in the specific names (cf. *S. aspera* Ands. and *S. villosa* Stew.), is generally a reliable taxonomic character, and, together with other characters, may be used to advantage in separating species and varieties.

Leaves. When one considers the relative compactness of the genus *Scalesia* from the point of view of inflorescence and flowers, the diversity of leaf-form is exceptional, and exceeds even the great variability that is characteristic of some of the largest helianthoid genera on the mainland. Although the variation is so very great when the genus is taken as a whole, several distinct leaf-types are discernible, and in this work they have been used as the chief criteria to limit four series of species. In general shape the leaves vary from nearly linear to suborbicular, and from entire to deeply bi- or tri-pinnatifid. In general the leaves are distinctly petiolate, occasionally sessile. Usually the blades are rather prominently 3-nerved from the base, but in those species with lobed leaves, the blades are pinnately veined. In the triplinerved leaves, the lowest pair of veins may be more or less confluent with the upper, lateral veins or they may form a pair of definite, submarginal nerves that extend to the apex. The former is more characteristic of wider leaves, the latter of narrower leaves. The apex of the blade is usually acute, though sometimes it may be obtuse or acuminate; the base of the blade is cordate, truncate or cuneate. Sometimes the base is decurrent and the petiole is bordered for a longer or shorter distance or even to the base.

The bordered or "winged" petiole should here receive some special attention. Heretofore the presence or absence of a border has been used as a taxonomic character to which some importance has been attached; and, in recognition of it, Andersson even adopted the epithet *decurrens* for one of his species. In this work the development of a wing on the petiole, striking as it generally is, has not been regarded as a reliable taxonomic character, and has not been given even varietal value. In *S. gummifera* Hook. f., leaves on vigorous shoots have been seen with petioles narrowly bordered to the base, while on less vigorous branchlets the petioles were entirely un-

winged; in *S. Crockeri* Howell, the leaves produced during the exceptionally favorable season of 1932, when they were collected, had broad wings which at the base were auriculate-enlarged, but on the same shoot were withered leaves of an earlier season with petioles unwinged. In the narrower leaves, the base of the blade is so gradually attenuate into the wing that it is scarcely possible to determine where the blade ends and the petiole begins, and those leaves termed "subsessile" in diagnoses belong to this type (cf. *S. villosa* Stew.); but in leaves with broader blades the petiole is usually very definite, no matter how broad the wing. This sort of variation occurs in many helianthoid genera, but it is doubtful if elsewhere the wings can be so conspicuous a feature and so untrustworthy taxonomically as they are in *Scalesia*. Blake (1918, p. 23) has already discussed the morphology and venation of this type of leaf in his monograph of *Viguiera*, and what he writes there is equally applicable to *Scalesia*.

In texture there is some variation in the leaves of *Scalesia*, but not as much as might be expected in a genus whose species range from extreme desert conditions of a practically unweathered lava-flow to the heart of a dense, tropical rain-forest. In all species the leaves are well-developed. In vesture, however, there is great variation, and, while generally its character is relatively constant for a species, there are several exceptions which will be discussed in the taxonomic section later.

In *Scalesia*, variation in phyllotaxy is also anomalous. By both Bentham and Hooker f. (1873, p. 367) and by Hoffmann (1894, p. 232), the alternate arrangement of the leaves was emphasized as a character of generic importance; but with increased collections, what was once considered so important a character is now not regarded of even varietal value, unless supported by other differences. While generally arranged alternately, one or two species, as they are now known, have leaves opposite (cf. *S. Helleri* Rob.). In many species with leaves usually alternate, an occasional pair of leaves may occur which appear to be opposite, but are not truly so. Sometimes such pairs seem to develop after the close of the rainy season when the growth of the plant is retarded, and a fore-shortening of internodes results in a falsely opposite relation; but occasionally on shoots with all or most other leaves alternately arranged, pairs have been seen that are indubitably opposite.

Inflorescence. The heads are usually 1 or 2, or rarely 3 or 4, at the ends of the branchlets, and, although they arise from the axils of the uppermost leaves, the shoot which bears them usually terminates with them, and one or more branches arise from axils immediately below them. The peduncles are usually naked, rarely with one or two leafy bracts, and vary from very short or almost none in *S. Darwinii* Hook. f., to as much as 15 cm. long in *S. pedunculata* Hook. f. The relative length of leaves and peduncles has been emphasized in the past, and is still a character that is useful

in certain instances when correlated with other characters. In *S. microcephala* Rob., and probably also in the closely related *S. cordata* Stew., the heads are several, and are arranged in a short, corymbose, leafy cluster, the only approach to an aggregate arrangement of heads known in the genus. The heads are usually medium-sized and 1 to 3 cm. broad, but in *S. microcephala* they are sometimes only 0.5 cm. broad.

Involucre. Except for those species in the series *Foliaceæ*, the character of the involucre and phyllaries has not exhibited distinctive variations which could be used to much advantage taxonomically, except in certain species when correlated with other characters. This relative uniformity in the essential character of the involucre, and a corresponding uniformity in flowers and fruits has led to the conclusion that *Scalesia* is a genus in which fundamentally divergent tendencies are lacking. In general shape, the involucre varies from tubular-campanulate to broadly hemispheric-campanulate. The sides are straight or in some species are constricted, especially in fruit, above a somewhat swollen base. The phyllaries are usually loosely to closely imbricate in 2 to 4 series, and vary from narrowly oblong to nearly orbicular in shape. In most species the phyllaries equal or are a little shorter than the disk, but in the series *Foliaceæ* the outer phyllaries are foliaceous and longer than the disk. In age the phyllaries are usually indurate, at least at the base, and somewhat veined. The vesture of the phyllaries does not differ essentially in character from that of the leaves and stems.

Receptacle and Pales. The receptacle is flat or low-convex, and nearly smooth. The pales are sharply folded or carinate, and closely envelop the flowers before anthesis, and the fruit at maturity. At the top, the pales are trifid or shallowly 3-lobed, and the variation in the shape and size of the lobes has proved a useful character in the separation of closely related varieties or species. Sometimes the lobes are about equal in length and width, sometimes the lateral lobes are shorter and narrower than the middle lobe; generally the lobes are triangular-deltoid, and acute or acuminate, but in some species they are more or less widened upward, and are obtuse or emarginate. The margin of the pales varies from entire and glabrous to ciliate or irregularly laciniate-cleft. The lobes of the outermost pales frequently differ more or less in shape from those in the inner part of the head, which are the ones described in the diagnoses. Whether the pales are persistent or deciduous is not known for many species because of the paucity of material, but it is probable that they are persistent, and fall only as the heads disintegrate.

Corollas. In *Scalesia* the flowers are either neutral, ligulate ray-flowers or fertile, tubular disk-flowers. The corollas of both kinds are white. The rays are few in a single series, and occur in two, closely related species, *S. gummifera* Hook. f. and *S. affinis* Hook. f.

The ligules are several-nerved and rather irregularly 2- or 3-dentate at the apex. The disk-corollas are tubular with a 5-toothed limb. The throat is somewhat ampliate, and is generally longer than, and well-differentiated from, the more slender tube. The disk-corollas are straight and erect in the head, or frequently they are outwardly curving. In four species of the series *Lobatæ*, an interesting modification of the corollas of some of the marginal flowers is an enlargement and ligule-like development of the limb. Although such flowers seem to be sterile with styles and stamens abortive or lacking, the various shapes assumed by the corolla-limb has led me to interpret these flowers as modifications of disk-flowers. Sometimes the limb is more or less oblique, with the limb palmately expanded on the outer side, at other times the enlarged corolla is somewhat bilabiate, and yet again it may be lobed with a separate distinct lobe opposite the expanded, ligule-like part. This structure is not conspicuous, which may account for the fact that it has not been noted heretofore. These corollas are only 5 to 7 mm. long, and are strongly recurved.

There is a little variation in the character and distribution of pubescence on the outside of the corollas, but the differences are slight and not of taxonomic importance. Usually the lower sides of the lobes bear a few, stoutish trichomes and the tube is more or less hairy. Occasionally the nerves of the throat are pubescent, and rarely the tube is glabrous.

Andræcium and Gynæcium. The characters of the stamens and pistils do not differ from those in related genera: the appendage of the anthers is broadly lanceolate to ovate, and the bases are cordate or sagittate; the style-branches vary in length in different species, but, in all, the triangular-acute or more elongate appendage is papillose. The anthers are purple.

Achenes and Pappus. The strongly flattened achenes of the genus *Scalesia* appear to represent the chief character to which generic importance can be attached and by which *Scalesia* may be most definitely separated from its relatives. The pericarp is not thickened, the sides are smooth or occasionally bear a low longitudinal rib, and the edges are not at all winged. The achenes are oblongish, slightly widened upward, rounded at base and sub-truncate above, and glabrous. Usually there is no pappus, but in some species two, short, slender, smooth bristles are borne at either end of the truncate top. Sometimes when no bristles are present, pappus is represented by two callous spots or stubby processes of horny texture.

GENERIC STATUS AND RELATIONSHIP

Although Hooker and Arnott wrote of *Scalesia* as a very distinct genus (1841, p. 312), no such opinion has been expressed since Bentham and Hooker f. in the *Genera Plantarum* aligned the nearly related genera of the *Verbesinæ* so that their close interrelation is readily apparent. Of these numerous genera, "the great majority of them American", Bentham in his masterly paper on the *Compositæ* has written as follows: ". . . many of them natural enough, but distinguished by characters of comparatively small importance, sometimes passing into each other, and often very technical and very difficult to group together except into very artificial series. . ." (1873, p. 439). At several places in the same paper Bentham remarks on the interrelation of *Scalesia* and other Galapagian *Compositæ* with the *Compositæ* of the Mexican and Central American region of North America. "In the insular genus *Scalesia*, eighteen or ten Galapagian species, may be traced a connexion with . . . *Mirasolia*, which belongs to the southern or Central American portion of the Mexican region" (p. 444); and, again: the "affinity" of the Galapagian *Compositæ* "seems to be rather with those of Central America than of the more immediately opposite coast of Ecuador" (p. 556). In "Table 14. *Compositæ* of the Galapagos Islands", Bentham writes opposite *Scalesia* under the heading "Connexions", "*Mirasolia* and other Central American Wedelioid *Helianthoideæ*" (p. 556); and on the following page (p. 557) goes so far as to say of the two endemic Galapagian genera he recognizes: "*Lecocarpus* and *Scalesia* might without difficulty have been referred to *Melampodium* and *Mirasolia* respectively as sections. . . ."

Hoffmann and Robinson have also expressed opinions relative to *Scalesia* and related genera, but only reiterate what Bentham wrote. Hoffmann, after describing the subtribe *Heliantheæ-Verbesininae*, echoes Bentham's remarks of two decades earlier when he says, ". . . deren Gattungen zum Teil schwierig und nur durch künstliche Merkmale zu unterscheiden sind" (1894, p. 226). Robinson, in his analysis of the Galapagian flora, writes that "even *Scalesia* is not a strong genus, as it is not easy to show very sharp, generic distinctions between it and some allied *Helianthoideæ* in Mexico and Central America" (1902, p. 242); and later he writes of the "Mexican allies" of *Scalesia* (p. 255). James Small (1919) in his studies on the *Compositæ* says nothing pertinent to this aspect of our problem.

From this historical review, two questions emerge requiring at least consideration, if not tentative answers: (1), should *Scalesia* be maintained as a genus; and, (2), if it is so recognized, what appears to be its probable relationship to other helianthoid *Compositæ*.

Because of Bentham's repeated references to *Mirasolia* as a near relative of *Scalesia*, a brief history of that genus is appropriate in a consideration of both these questions. *Mirasolia* was first described as a subgenus of *Tithonia* by Schultz Bipontinus in Seemann's

Botany of the Voyage of the Herald (305,—1856-7), where it was distinguished by its glabrous, epappose achenes; and was later raised to generic rank by Bentham and Hooker f. in *Genera Plantarum* (1873, pp. 367, 368), where it was related not only to *Scalesia* but to *Tithonia*, *Wulffia*, and *Balsamorhiza*. Hoffmann (1894, p. 235) returns *Mirasolia* to *Tithonia*, and Blake (1921, p. 424), in his revision of the genus *Tithonia*, treats it likewise. While there is no apparent similarity in habital appearance between the usual, cultivated *Tithonia*, *T. rotundifolia* (Mill.) Blake, and *Scalesia*, the dissimilarity between our genus and those species of *Tithonia* formerly referred to *Mirasolia*, especially *T. scaberrima* Benth., is reduced to a more technical consideration. However, *Tithonia*, as now accepted and including *Mirasolia*, with its convex receptacle, usually aristate-acuminate pales, and strongly thickened or subquadrangular achenes, does not seem to represent a generic concept so near to that of *Scalesia* as to those of *Helianthus* and *Viguiera* (cf. Blake, 1918, p. 21), and to the same immediate relationship *Balsamorhiza* should also be referred (cf. Sharp, 1935, p. 57). *Gymnolomia*, which is grouped with *Scalesia* by Hoffmann (1894, pp. 228, 233), has now been reduced to a few Andean species related to *Aspilia* (cf. Blake, 1918, p. 13), and the North American elements, some of which were treated at one time under the generic designation *Heliomeris* Nutt., have been referred to *Viguiera* or related genera by Blake (1918, pp. 13-21).

So disposing of these genera as more particularly a part of the *Helianthus* group of genera, only the genus *Wulffia* remains of those mentioned by Bentham in connection with *Scalesia*. Here, it would seem, the relationship to *Scalesia* is much more definite. In Bentham and Hooker f., *Wulffia* immediately precedes *Scalesia*, and by Hoffmann it is only once removed from *Scalesia* in the generic sequence. It is a genus with only two species, one of which, *W. baccata* (L. f.) O. Ktze., is widely distributed from the West Indies to subtropical South America. Following O. E. Schulz (1911, p. 91), *Wulffia* may be characterized by its woody, scandent habit, convex receptacle, yellow-flowered heads with sterile rays, acute or acuminate pales, and more or less quadrangular achenes, which become tumid and succulent ("*denique tumida et succulenta*"). From this it is apparent that for *Scalesia* such important characters as the trifid pales and the strongly flattened, thinly coated achenes remain for differences of a generic order, differences that are supported by such valuable secondary characters as frutescent and arboreous habit, usually alternate leaves, white flowers, and plane or low-convex receptacle. So it would appear that *Scalesia* is sufficiently removed from *Wulffia* and its cotribuals to be maintained as an insular genus and as such it is here accepted. In theoretical support of our acceptance of *Scalesia*, these lines from Robinson's address on the generic concept in the classification of the flowering plants are apropos: "... few, if any, genera carry conviction as natural groups, or, to be more

precise, naturally delimitable groups, unless they can be separated by more than one feature. The ideal genus is certainly one in which several distinguishing traits are constantly associated. When limits are properly drawn it is certainly true that a very large number of such ideal genera exist. Unfortunately for the peace of mind of the systematist, however, there are considerable series of species in certain families, which quite defy classification into genera of this sort. They are groups in which we are forced into accepting a far less satisfactory type of generic division, and in some cases it is necessary to make the most of a single character . . . " (1906, p. 87).

While it does seem likely that *Scalesia* finds in *Wulffia* a closely related genus, it is highly improbable that the relatively unvarying climber *Wulffia* gave rise to the highly diverse and variable series of shrubby and arborescent species in *Scalesia*, or *vice versa*. Rather it would seem that these two genera, and probably others about as nearly related, have had a common antecedent, and that subsequent generic differentiation has developed along lines more or less collateral and parallel. The ancient type might well have resembled the present-day group of genera which center in *Wedelia* and *Aspilia*, a group marked by characters which are variable in themselves and from which might easily have been derived such technical differences in heads, flowers, and fruits as are used to distinguish *Scalesia*, *Wulffia*, and related genera. This group is both herbaceous and woody, leaves are both alternate and opposite, pales are entire, ray-flowers are both fertile and sterile, and the thickened achenes usually have well-developed pappus. Moreover, it is wide-spread and occurs both in South America and Africa (which fact will help explain the immediate proximity of the Madagascarene *Temnolepis* to the Galapagian *Scalesia* in the generic sequence of Hoffmann).

The probability of *Scalesia* and *Wulffia* belonging to the *Wedelia-Aspilia* group of genera had made a strong appeal to me even before I knew that Bentham had expressed similar ideas. At several points in his treatise on the *Compositæ*, Bentham refers to this wedelioid complex and the relation of *Wulffia* and of *Scalesia* to it. Thus, as has already been quoted, in his table on the *Compositæ* of the Galapagos Islands, he gives the relations of *Scalesia* as "*Mirassolia* and other Central American wedelioid *Helianthoideæ*" (1873, p. 556), and before that, "the tropical *Wulffia* . . . and the tropical and Mexican *Perymenium* . . . have their nearest connections probably with *Wedelia* and with *Melanthera*" (p. 445). So it would seem that *Scalesia*, *Wulffia*, and a half dozen or more genera that are about equally interrelated may be definitely related to *Wedelia* and *Aspilia*, and that all together they may have been derived from an ancient African or South American wedelioid prototype. And, if it is too much to imagine that close connection between South America and Africa which present-day distribution suggests, a connection broken eons ago either by the sinking of a long-lost Atlantis or by the rifting and drifting of continents, a convenient center of

dispersal may, with much reason, be located on a warm Antarctica of the preglacial Tertiary (cf. Scharff, 1912; Wegener, 1915; Skottsberg, 1925; Chubb, 1933).

Whether these wedelioid genera should be combined into a large, all-inclusive genus as sections or subgenera is not a question to consider here. Such a course has been pursued in certain asteroid groups, and most floristic botanists are now following where the synantherologists have led; but even there, as here, it seems as if the nicer and finer generic distinctions are more useful in discussions of relationships and matters of geographic distribution. As Blake (1918, p. 14) has written in his monograph of *Viguiera*: "The aim of generic limitations however is not merely to provide an easy index to our real units the species, but to indicate their true genetic relationships so far as this can be done without too great a sacrifice of clearness and precision." And finally, as Bentham has so ably and concisely put it in discussing the smaller helianthoid genera of the Mexican region (*Rumfordia*, *Selloa*, *Axiniphyllum*, *Varilla*, etc.): "Small as they are, I do not think that any of these genera are sufficiently connected with any of their large cotribuals to be incorporated with them, unless these again be much more consolidated; nor do they form of themselves a separate group in the subtribe. Like so many others of the same region, they may be considered as the scattered remnants of various ancient races . . ." (1873, p. 444).

GENERIC SUBDIVISIONS

It was early apparent in my study that the species in *Scalesia* align themselves in four groups, and almost from the beginning I have found it convenient to treat these groups as taxonomic subdivisions of the genus. It has been decided to designate them as series, for, although they are usually quite distinct from one another, they are not based on characters to which subgeneric importance can be properly attached. The great differences in the shapes of the leaves, which is one of the remarkable features of the genus, afford the chief basis for the classification, and with the variation of leaf-shape can be correlated distinctive venation patterns. In one series the foliaceous enlargement and elongation of the outer phyllaries offer an additional criterion, which has proved a very natural and convenient distinction.

The series have been designated as *Lobatae* (with seven species), *Dentatae* (five species), *Pedunculatae* (three species), and *Foliaceae* (three species). In the *Lobatae* the leaves are shallowly to deeply lobed, or even bi- or tri-pinnatifid, and the lateral veins end in a lobe on the margin. In all the other series the lowest pair of lateral veins extend strongly forward toward the end of the leaf where they are either confluent with other lateral veins, as in the *Dentatae* and the *Pedunculatae*, or form a pair of distinct marginal nerves as in the

Foliaceæ. In the *Dentatæ* the leaves usually have a conspicuously toothed margin, and, in the *Foliaceæ* and *Pedunculatæ*, in which the leaf-margins are entire or nearly so, elongate, foliaceous phyllaries distinguish the *Foliaceæ* from the *Pedunculatæ*.

Two further matters relating to the series should be briefly discussed, the distribution of these species-groups in the archipelago, and their relative age. The series *Lobatæ* with the largest number of species is also represented on the greatest number of islands, seven species on six islands, Chatham, Barrington, Indefatigable, Duncan, Abingdon, and Wenman islands. These islands, except Duncan, are roughly aligned southeast to northwest along the northeastern side of the archipelago, and it would appear probable that the dispersal of the species in the series has taken place along the line of the Southeast Trade Winds. Support to this theory of dispersal comes from the fact that *S. divisa* Ands. on Chatham Island, the southeasternmost island in this alignment, is the least differentiated species in the series, and resembles more closely certain species in the *Dentatæ* and *Pedunculatæ*, the series which are regarded as primitive, as will be pointed out later. Aside from *S. divisa* and *S. Helleri* Rob., the latter a very distinct species on Barrington Island and adjacent Indefatigable, the other species of the series are very closely related, and seem to represent variants isolated on different islands.

In the *Dentatæ*, with five species on five islands, Charles, Albermarle, Narborough, Indefatigable, and North Seymour islands, a similar tendency towards a southeast-northwest alignment is to be noted extending from Charles Island to Albermarle and Narborough islands, while Indefatigable and adjacent Seymour lie a little outside the alignment to the north. In the Galapagian species of the genus *Mollugo* a comparable evolutionary trend has been noted (Howell, 1934a). The *Pedunculatæ*, represented by three species on the five, large south-central islands (Chatham, Charles, Indefatigable, James, and Albermarle islands), do not seem to be aligned as do the *Lobatæ* and the *Dentatæ*, but rather to be encompassed by an arc whose center is Chatham Island. However, a possible evolutionary sequence may be correlated with a southeast-northwest geographic distribution in the *Pedunculatæ* if a plant resembling *S. pedunculata* var. *parviflora* Howell on Charles Island were the progenitor of *S. cordata* Stew. in southern Albermarle Island; and if *S. microcephala* Rob. of central and northern Albermarle were derived from *S. cordata*. The *Foliaceæ* is not only the most compact of the series, but is known only from James Island.

The selection of the primitive form in the series *Lobatæ* from Chatham Island, and the suggestion of evolutionary alignments in the *Dentatæ* and *Pedunculatæ* centering in Charles Island, may be interestingly correlated with the theory that, geologically considered, the islands of Chatham, Hood, and Charles are the oldest (Chubb, 1933, p. 21).

Bindloe and Hood islands are the only two of the larger islands on which no *Scalesia* has been found; and, although Hood Island has been rather well explored and probably has no *Scalesia* on it, we may expect the discovery of a species of the *Lobatae* on the relatively little-visited Bindloe if my theory of dispersal in that series is correct.

As to the relative age of the series in *Scalesia*, not much is to be said. In a group as generically compact as *Scalesia*, it is not easy to indicate primitive and advanced species, and especially is this so in a genus in which so many species are highly specialized for a particular environment. Of only one series, the *Foliaceae*, can it be said that it probably is of relatively recent origin, both because of its narrow distribution, and because of the derived relation it seems to bear to *S. affinis* Hook. f. In each of the other series are species which may seem to be advanced in certain characters, but primitive in others. Thus, if radiate heads are primitive, *S. gummifera* Hook. f. and *S. affinis* of the *Dentatae* would form the base of an evolutionary tree, but in their adaptation to a most rigorous environment, they are among the most highly specialized. The arboreous habit in the *Pedunculatae* may be counted as primitive, but the heads are discoid; and a pair of similar species in the *Lobatae* and *Dentatae*, *S. aspera* Ands. and *S. divisa* Ands., perhaps indicates a close, primitive relation between those series. However, along with the *Foliaceae*, the *Lobatae* (except for *S. divisa*) can probably be regarded as a derived group of relatively recent origin, chiefly because of the venation of the much-cut leaves, which is a distinct departure from the usual helianthoid, triplinerved type. But whether one of the several groups in the discoid and radiate *Dentatae*, or in the *Pedunculatae* can be chosen as primitive is doubtful. Rather it would seem that these groups are closely interrelated, and that the truly primitive type from which they have been derived has been obliterated in the process of adaptation or selection of variants for specialized surroundings.

Relative to the development of a shrubby or arboreous habit in the *Compositae* as an indication of age, it is of interest, but perhaps not of much moment, to quote James Small: "The shrubs peculiar to so many oceanic islands are probably . . . the result of the direct action of aridity, wet and cold, or hot and dry conditions. . . . The large shrubs and trees are obviously the extreme development of the shrubby condition. These trees usually occur as more or less isolated specimens high up on the mountain sides where there are open associations and consequently very little competition, and where all the ecological conditions tend to slow growth and lignification. The trees of the oceanic islands have long been objects of interest, usually regarded as relics of an ancient flora, but in the light of the new views on the origin and dispersal of species they are to be considered as more or less recent species which have become arborescent under the influence of external conditions. . . ." (1919, p. 22).

In *Scalesia*, the three-nerved leaves, the radiate heads of species in the *Dentatæ*, and the arboreous habit in the *Pedunculatæ* should undoubtedly be regarded as primitive characters.

SPECIES CONCEPT

In this revision some species have been given a more conservative treatment than others, and to me the inconsistency seems especially apparent; but in those cases where a less conservative treatment has been followed, material is so scanty that it has seemed insufficient on which to propose fewer and more conservative entities. Sometimes, as in the cases of *S. incisa* Hook. f. and *S. retroflexa* Hemsl., the species are known only from a single collection. In other cases, as in *S. Hopkinsii* Rob., where two or three collections have been made, just enough material has been obtained to indicate certain tendencies in variation, which, with the collection of more material, may appreciably alter specific limits as I have accepted them. Though not entirely satisfied with such species, I believe there is not the least justification for attempting to change the specific limits at present.

In contrast to these species are several which are more conservatively treated, and, because there is now available a number of collections of each, I have felt it proper to realign specific limits in the light of variations and inter-gradations disclosed. These species are *S. pedunculata* Hook. f., *S. gummifera* Hook. f., and *S. affinis* Hook. f., and to each has been reduced a variant which heretofore has received specific recognition.

Besides these larger and more variable species, there are a few which seem remarkable for their distinctness and consistency, and, although they are known mostly from only a few collections each, they are believed to represent fixed types which will not merge with related species. The closely related but distinct species in the series *Foliaceæ* belong to this group, and *S. Helleri* Rob. of the *Lobatæ*, and *S. villosa* Stew. of the *Dentatæ* are others. With the collection of further material, it seems likely that named varieties of several species will be recognized; and, since *Scalesia* is part of an insular flora in which many species are highly localized, and is itself remarkable for distinct local species, the discovery of new species in the genus is to be expected as the islands are intensively explored.

ECOLOGICAL DISTRIBUTION

Species of *Scalesia* are found from the hottest and driest lava deserts of the lowlands to the cooler and damper forest belt in middle altitudes of the higher islands, or to brushy slopes above the forests. Such species as *S. gummifera* Hook. f., *S. affinis* Hook. f., and *S. Stewartii* Riley growing on lava flows which still look as

fresh and unaltered as the day when they cooled, are especially remarkable. On Albermarle Island at Tagus Cove *S. gummifera* and *Cereus Thouarsii* Weber are pioneers on the barren wastes. Such species remain even after other hardy species have become established and form a sparse scattered growth on the lava, but the *Scalesia* is not known to persist in any brush formations which develop as the lava disintegrates. Other species of *Scalesia*, such as *S. villosa* Stew., and *S. Crockeri* Howell near sea level, and, at higher elevations *S. microcephala* Rob., are found in this later succession of plants. Unfortunately no collections in the series *Lobatae* were made by the author, but from field notes on Stewart's collections it is believed that most of the species of that series belong to this group of species that grow with other shrubby plants on partly disintegrated lava. The arboreous species of the series *Pedunculatae* are the only ones known to grow in deep soil, such as is found in the rain-forest belt.

In his account of "botanical conditions on the Galapagos Islands," Stewart (1915) describes the field occurrence of many of the species of *Scalesia* on the different islands, and references to his account are given under the different species in the taxonomic section of this work.

The distribution of the species of *Scalesia* among the different islands is highly characteristic of the distribution of other variable groups on the Galapagos Islands. In this group, as in others, the geographic isolation afforded by the different islands has not only allowed the segregation of ecologic and morphologic variants, but has also been effective in perpetuating them. In *Scalesia* these segregates are sometimes regarded as specifically distinct, as in the series *Lobatae*, or at other times they are interpreted as varieties of a variable species, as in *S. pedunculata* Hook. f.

Because of the diverse edaphic and climatic conditions on the Galapagos Islands, which vary from barren lava-deserts to rain-forests of almost tropical luxuriance, an ecological segregation has also taken place in *Scalesia* and other variable phanerogams of the islands, a type of segregation that affords an isolation no less real than the truly insular type. By this type of segregation, which has been recently discussed in detail by Turrill (1938), a species of *Scalesia* which has become adapted to a highly specialized environment on unaltered lava is confined as definitely to fresh flows as if it were on an island surrounded by water, and to such a species, a forest belt or a patch of brush on disintegrated lava may be as impassable a barrier as a mountain range. Undoubtedly this sort of segregation has been an important factor in the development of the three species in the series *Foliaceae* that are found on James Island; first of all in the original divergence of the prototype of the series from *S. affinis* Hook. f., and later in the segregation of the three species within a few miles of each other.

Not uncommonly the same ecologic factors effecting segregation

are locally active in several, unrelated groups of plants, and, because of the peculiar geologic history or critical geographic position of the particular district where they grow, an endemic area may emerge in which unrelated entities exhibit parallel responses to some specialized, ecologic condition. Such an area seems to occur in the vicinity of Sullivan Bay on James Island, where several remarkable and distinct species are found, such as *Philoxerus rigidus* (Rob. & Greenm.) Howell, *Mollugo Crockeri* Howell, *Coldenia nesiotica* Howell,² and *Scalesia Stewartii* Riley; and another is that region including the Seymour islands and adjacent Indefatigable, where such local species as *Paspalum redundans* Chase, *Alternanthera Snodgrassii* (Rob.) Howell, *Bursera malacophylla* Rob., *Euphorbia bisulcata* Howell, *Opuntia Zacana* Howell, and *Scalesia Crockeri* Howell are found.

It has seemed worthwhile to call attention to these aspects of our study, although such ecologic studies as these properly require a great amount of detailed information which is practically lacking for the Galapagos Islands. This branch of botanical research, however, is most important, and valuable data are likely to be obtained in the Galapagos Islands, which have been called "Evolution's workshop and showcase" (Howell, 1934b, p. 515), and which embrace so large an area but little affected by man. For as Turrill (1938, p. 390) remarks at the close of his paper on "Ecological Isolation", "... it is highly desirable that it (*i. e.*, ecological isolation) should be intensively studied in wild floras (and faunas) before man's interference is carried so far that natural vegetation becomes only a paleobotanical phenomenon."

SCALESIA AND THE ORIGIN OF THE GALAPAGOS ISLANDS

The origin of the Galapagos Islands, whether they are oceanic or continental, has been considered in relation to these distributional matters in the genus *Scalesia*. Georg Baur (1891) used the term "harmonic" to designate the relation he found between varieties and species in certain groups of plants and animals on the different islands, a condition which to him indicated a former continental connection followed by gradual subsidence. Baur, however, applied the term in a strictly internal sense from the harmonic biologic relations among the several islands, and drew his conclusions only from this *internal* consideration. What he should have endeavored to show also was whether the fauna and flora of the islands were "harmonic" or "disharmonic" with the fauna and flora of the continental mainland, a much more difficult problem requiring extended knowledge of the continental biota. Certainly *Scalesia*, with the distribution of nearly related species on the different islands, is

² *Coldenia nesiotica* Howell, nom. nov. *Coldenia conspicua* Howell, Proc. Calif. Acad. Sci., (4), 22: 105 (1937), not *C. conspicua* Johnston, Journ. Arn. Arbor. 16: 183 (1935).

to be regarded as harmonic from a strictly insular or internal point of view, as the term has been used by Baur. From a broader or external point of view, the relation between *Scalesia* and the helianthoid *Compositæ* of both North and South America can also be regarded as harmonic; for, although the genus is strictly insular and therefore may be interpreted by some as a distinct break with mainland relatives, in reality it bears the same relation to genera on the mainland as they bear to one another. With time, however, the disharmonic character of the faunas and floras of oceanic islands becomes concealed or blurred as new insular forms evolve, and, on the other hand, the fauna and flora of a continental island might become disharmonic due to the extinction of numerous species, genera, and even families (Gulick, 1932, pp. 418, 423).

In the present study of the genus *Scalesia* no new data have been disclosed on the origin of the Galapagos Islands, but there is nothing that has been learned which would conflict with a theory that formerly there was a connection between an emerged region, where the islands now are, and a continental mass to the northward or eastward. On the other hand, there is perhaps nothing to conflict with the theory that in the beginning the genus was accidentally introduced by wind, birds, or float from the mainland on a Galapagian island of oceanic origin. But to me it seems that the *probability* of the arrival of the genus by a land connection is greater than the *probability* of successful transportation across a broad expanse of ocean. The fruits are not susceptible of wind transportation, and the thinness of their pericarp would not preserve them from ocean water on a long journey on driftwood, nor from digestive juices during the flight of a bird. The physiological difficulties attendant on the establishment of a fruit, even if it were to arrive, also seem insurmountable when the peculiarities of growth requirements are considered. That the progenitor of our present species may not have been so highly specialized is, of course, a fact to be reckoned with; but a presumption of this sort is perhaps more highly theoretical than the presumption that there was once a large land mass with continental connections where now the Galapagos Islands lie. My experience with the distribution of plants in continental areas, such as California and the Great Basin, where endemism of a marked insular character is very common, is perhaps a chief reason why I place so low value on the probability of "accidental" transportation. So, although I cannot positively say that data from my study of *Scalesia* point to a former continental connection, the indication from both morphological and physiological considerations seems to be definitely in that direction.³

* The alignment of evolutionary trends in several of the series within the archipelago along lines parallel with the direction of the Southeast Trade Winds, a phenomenon that has been briefly described in the discussion of the series, does not offer the same degree of difficulty in matters of dispersal that is presented by an expanse of ocean hundreds of miles in extent. Moreover, the distribution of *Scalesia* through the Galapagian area may have been accomplished at a time when the islands were even less distantly separated than now, or when only a single, inclusive Galapagian land existed.

This theory which I favor finds further support, albeit weaker than I would like, in maps like those of Scharff (1912, figs. 14-17), which indicate the hypothetical distribution of land and water during the Tertiary, and which show the Galapagian area connected either with Mexican, Central American, or South American regions. Much more plausible and definite evidence for a former land connection with the Central American region comes from the study of sub-oceanic topography and the existence of the so-called Galapagos Plateau, which, when it is bounded by the 1500 fathom line, is shown as a circular, equatorial area with a broad, northeastern extension that encompasses Cocos Island and approaches very closely the coast of Panama southwest of Mariato Point. (See charts in *Mem. Mus. Comp. Zool. Harv. College*, vol. 24, pl. 85, and *Bull. Mus. Comp. Zool. Harv. College* vol. 23, no. 1, pl. 3). While an orogenic disturbance of much less magnitude than that which resulted in the Andean cordilleras would make dry land of this submarine plateau, there is no lack of evidence, biological, geological, and geographical, that the Panamanian region and adjacent seas have had a varied history in the Tertiary (cf. Dickerson, 1917, p. 205; Dacqué, 1915, map). And perhaps to be correlated with these continental disturbances is the evidence to be found in different parts of the Galapagos Islands that they have been subjected to elevations and depressions, and that at least local, diastrophic movements have taken place (Dall and Ochsner, 1928; Howell, 1932; Chubb, 1933; Hertlein and Strong, 1939). This probable paleo-geographical relation between the Galapagos Islands and Central America finds still further support in the fact that the lava of the islands is predominantly basaltic, which is the North American lava-type, and not andesitic, the South American type (Pilsbry, 1930, p. 121; Richardson, 1933, p. 64; Hertlein and Strong, 1939, p. 368).

Present geological evidence is perhaps still insufficient for a definite authoritative statement regarding the origin of the Galapagos Islands, but it would appear that from insular studies in the several branches of geology will eventually come the answer that can only be theoretically approached in botany and zoology.

SYSTEMATIC TREATMENT

Scalesia Arnott

Heads homogamous and discoid, or rarely heterogamous with few neutral ray-flowers. Involucre narrowly to broadly campanulate, the phyllaries closely or loosely imbricated in 2 to 4 series, narrowly oblong to round-ovate, the innermost plane, the outer coriaceous-thickened, becoming more or less indurate in age, occasionally with herbaceous foliaceous tips. Receptacle plane or low-convex, the pales trifid at apex and folded or carinate along the middle, enclosing the disk-flowers, probably persistent. Corollas of the ray-flowers rather short, several-nerved and irregularly 2- or 3-toothed at apex; corollas of the disk-flowers tubular-funnelform with a 5-toothed limb, or occasionally the outermost oblique and radiate-enlarged. Anthers cordate at base, not caudate, the apical appendage lanceolate to ovate. Style-branches straight or coiled, the papillose appendage triangular and acute or more elongate. Achenes of ray-flowers sterile, achenes of disk-flowers fertile, glabrous, obovoid-oblong, truncate, very strongly compressed, not winged, scarcely nerved. Pappus usually none, occasionally represented by two short, slender bristles or by a pair of callous thickenings.—Erect shrubs or trees commonly with resinous or gummy sap, and with sericeous, villous, scabrous, or glandular foliage and branchlets or rarely subglabrous. Leaves well-developed and more or less clustered at the ends of branchlets, alternate or rarely opposite, sometimes both alternate and opposite leaves on the same branch, varying from nearly linear to suborbicular, and from entire to bi- or tri-pinnatifid, petiolate to subsessile, the blade acute, obtuse, or acuminate at apex, cordate, truncate, or cuneate at base, sometimes decurrent as a broad or narrow wing to the base of the petiole, the lateral veins widely divaricate and ending in a marginal tooth or lobe, or the lowest pair upwardly curved towards the apex of the leaf and either confluent with the other lateral veins or forming a distinct, submarginal vein. Heads small or medium-sized (0.5–3 cm. broad), pedunculate or rarely almost sessile, mostly solitary or few at the ends of branchlets, or rarely several corymbosely arranged in a short leafy cluster, the corollas white.

Scalesia Arn. in Lindl., Nat. Syst. Bot., 443 (1836); DC. Prod., 7: 308 (1839); Hook. and Arn., in Hook., Jour. Bot. 3: 312 (1841); Benth. and Hook. f., Gen. Pl. 2: 195, 367 (1873); O. Hoffm. in Engl. and Prantl, Nat. Pflanzenfam., IV, 5: 228, 232 (1894); Lemée, Dict. Gen. Pl. Phanérog., 5: 996 (1934).

No satisfactory derivation of the name *Scalesia* has been found. Translating Hooker and Arnott's description of the style-appendage, Wittstein (Etymologisch-botanisches Handwörterbuch, ed. 2, 1856) gives the following, far-fetched derivation: "Von *scala* (Treppe), über den Griffel hinaus befindet sich ein spitzer Kegel, dessen Behaarung von der Basis an auf und ab steigt."

The following abbreviations indicate the herbaria in which specimens have been studied: CAS, Herbarium of the California Academy of Sciences; B, Herbarium of the Brooklyn Botanic Garden; DS, Dudley Herbarium, Stanford University; G, Gray Herbarium, Harvard University; K, Royal Herbarium, Kew; Cantab., Herbarium of the University of Cambridge; Holm., Herbarium of the Museum of Natural History, Stockholm.

KEY TO THE SERIES

- a. Leaves mostly regularly serrate to entire, the lowest pair of lateral veins curved strongly upward, either confluent with the upper lateral veins or extending to the apex of the leaf as a submarginal vein. (In *S. aspera* in the *Dentatæ* the lateral veins sometimes end in a marginal tooth.)
 - b. Outer phyllaries equalling or shorter than the disk, if slightly exceeding the disk, then the leaves serrate and the heads radiate.
 - c. Pubescence on branchlets villous or glandular and spreading, or scabrous and subappressed; leaves serrate (sometimes subentire in *S. villosa*, *S. aspera*, and *S. Crockeri*), petioles winged or unwinged. Series 1. *DENTATÆ* (p. 241)
 - cc. Pubescence on branchlets sericeous or, if tomentulous or villous, the plants arboreous; leaves entire, undulate or occasionally obscurely crenulate; petioles unwinged. Series 2. *PEDUNCULATÆ* (p. 250)
 - bb. Outer phyllaries foliaceous and exceeding the disk; leaves entire. Series 3. *FOLIACEÆ* (p. 258)
- aa. Leaves deeply and irregularly serrate to twice or thrice pinnatifid, the lateral veins widely divaricate and ending in a tooth or lobe on the margin. (In *S. divisa* the lowest pair of lateral veins extend upward, and either end in a lobe or are confluent with the other lateral veins.) Series 4. *LOBATÆ* (p. 261)

Series 1. *Dentatæ*, ser. nov.

Frutices, ramulis pilis villosis glandulosive patentibus vel scabris subappressis vestitis; foliis anguste lanceolatis ad late ovatis vel rotundatis, trinervatis ex basi, plerumque regulariter serratis, petiolis alatis vel exalatis; capitulis homogamis discoideisque vel heterogamis radiatisque; phyllariis exterioribus disco brevioribus vel paullum longioribus.—Species typica, *S. affinis* Hook. f.

Shrubs, the branchlets with villous or glandular spreading pubescence, or scabrous subappressed pubescence; leaves narrowly lanceolate to broadly ovate or roundish, 3-nerved from base, usually regularly serrate, petioles winged or unwinged; heads homogamous and discoid, or heterogamous and radiate; outer phyllaries shorter than, or a little longer than, the disk.—The type species, *S. affinis* Hook. f.

KEY TO THE SPECIES

- a. Heads radiate.
 - b. Inner pales with triangular-deltoid lobes, the middle lobe not more than twice as long as broad. 1. *S. affinis*
 - bb. Inner pales with lanceolate to linear-lanceolate lobes, the middle lobe usually more than twice as long as broad. 2. *S. gummifera*
- aa. Heads discoid.
 - c. Leaves lanceolate, sparsely to conspicuously villous, margin more or less revolute; lobes of pales triangular-deltoid. 3. *S. villosa*
 - cc. Leaves narrowly to broadly ovate, scabrous to subsericeous, margin not revolute; lobes of pales elongate, oblong or linear.
 - d. Petioles not at all winged; phyllaries broadly ovate, imbricated in 3 or 4 series. 4. *S. aspera*
 - dd. Petioles generally winged; phyllaries oblong, loosely imbricated in 2 or 3 series. 5. *S. Crockeri*

1. *Scalesia affinis* Hook. f.

Trans. Linn. Soc. 20: 212 (1847)

Shrub 0.3–3.5 m. tall with a main trunk and generally few branches with leaves clustered near the ends, stems with brownish bark, the ends of the branchlets subvelutinous to villous, the pubescence sometimes sparse; leaves usually alternate or sometimes opposite or nearly opposite, light to dark olive-green, ovate, or if wings on the petiole are especially broad, rhomboidal, 7–18 cm. long, 3–12 cm. wide, serrate, acute, decurrent in broad or narrow wings along the petiole, more or less semi-amplexicaul at the very base, pubescent above and below, the pubescence subsericeous or villous, sometimes scant, not becoming harsh in age, somewhat glandular, the lowest pair of veins prominent and projected strongly forward; heads 1 to 3 at the ends of branchlets, radiate, broadly campanulate, 1.5–2 cm. broad, 1–1.5 cm. long, exceeded by the leaves, peduncles 3–6.5 cm. long, hirsutulous and glandular, apparently not leafy-bracted; phyllaries in about 3 series, the outer and middle ovate to almost orbicular, or sometimes narrower and ovate-oblong, 5–9 mm. long, 2–8 mm. wide, equalling or much shorter than the disk, acute, thinly pubescent or subvillous, indurate at base in age; pales 7–9 mm. long, 3-lobed at the apex, the lobes broadly lanceolate to triangular-deltoid and bearing short stiff trichomes, the middle lobe of the central pales not more than twice as long as wide; rays several, about 8 mm. long, toothed at the apex; disk-flowers numerous, corolla 6 mm. long, the lobes spreading, papillose-ciliate, the outside glabrous, except for a few hairs near the tips of the lobes and near the base of the corolla-tube; anthers exserted, the appendages about 0.5 mm. long; style-branches about 1 mm. long; achenes 2.5–4 mm. long, without pappus, rarely with callous rudiments.

References. Walp., Ann. Bot., 1: 414 (1848–9); Ands., Kgl. Vet. Akad. Handl., 1853: 89, 182 (1855); Ands., Bot. Eugenies Resa, 17 (1857), 71 (1861); Hemsl., in Hook. Icon., pl. 2718 (1901); Rob., Proc. Amer. Acad., 38: 216, 219 (1902); Stew., Proc. Calif. Acad. Sci., (4), 1: 156 (1911), Trans. Wisc. Acad., 18: 301 (1915); Riley, Kew Bull., 1925: 223.

S. decurrens Ands., Kgl. Vet. Akad. Handl., 1853: 182 (1855); Ands., *op. cit.*, 77, 89; Walp., Ann. Bot. 5: 220 (1858); Ands., Bot. Eugenies Resa, 10, 17 (1857), 71 (1861); Rob., Proc. Amer. Acad., 38: 216 (1902); Stew., Proc. Calif. Acad. Sci., (4), 1: 157 (1911), Trans. Wisc. Acad., 18: 297 (1915); Christoph., Nyt Mag. for Naturvid., 70: 95 (1932); Svenson, Amer. Jour. Bot., 22: 218, 259 (1935).

S. decurrens f. *denudata* Ands., Kgl. Vet. Akad. Handl., 1853: 182 (1855); Ands., Bot. Eugenies Resa, 71 (1861).

Collections studied. Charles Island: *Darwin* (Cantab., type; drawings, K); *Andersson* (Holm., type of *S. decurrens*; G); *Andersson* No. 94 (K; drawing, G); *Snodgrass and Heller* No. 410 (DS, G); *Stewart* No. 671 (CAS, G); *Stewart* No. 661 in part (G); *Hicks on St. George Expedition* No. 422 (K); Black Beach, *Crocker in 1932* (CAS), *Howell* No. 8906 (CAS). Indefatigable Island: *Academy Bay, Svenson* No. 239 (B), *Schimpff* No. 66 (CAS, Holm.); Conway Bay, *Chapin* No. 1140 (B).

Scalesia affinis is very near *S. gummicera* Hook. f., under which the relationship is discussed.

Until now, *S. affinis* and *S. decurrens* Ands. have been maintained as distinct species, but I have not found enough difference between specimens referred to them even to recognize *S. decurrens* as a variety. When studying in Europe in 1935 I thought that "*S. affinis* and *S. decurrens* are probably separable as species on the characters of

leaf-bases (those of *S. decurrens* being so much broader and less attenuate), the more ovate-oblong phyllaries in *S. decurrens* which in that species equal the pales, and the differently shaped tips of the pales" (notes made in Stockholm, July 31, 1935). But after studying the considerable number of specimens cited above, these characters are not now regarded as decisive or critical. In a single collection (*Howell No. 8906*) which was taken to Europe as a basis for comparison with authentic specimens, the leaf-bases of one part matched the leaf-bases of the type of *S. affinis* while the leaf-bases of another part matched those of the type of *S. decurrens*. Taxonomic value has not been attached to the relative lengths of phyllaries and pales, since these differences do not seem to be correlated with any other variations, or with geographic distribution. And the point noted in Stockholm about the differences in the lobes of the pales has not been regarded as critical, since the different shapes observed may be found between pales in the outer and inner parts of the same head. In this work the shape of the pales in the inner part of the head is taken as typical of a species.

No specimen has been seen which carries Andersson's designation *S. decurrens* f. *denudata*, and the plant so-named probably represents only a trivial variant. Neither the leaves of the type in Stockholm nor the leaves of the other Andersson collections examined can be described as "dense incano-tomentosa" as was done by Andersson in the original description of the species.

While I was working at Kew, Dr. T. A. Sprague borrowed from the Herbarium of the University of Cambridge the types of those species of *Scalesia* not represented at Kew, and so it was possible to compare the type of *S. affinis* with the drawings in Herb. Kew., and with the plate in Hooker's *Icones*, No. 2718. Unfortunately certain details of foliage depicted in the plate are neither like the corresponding parts in the plant specimen nor in the original sketches, and these details were the very ones mentioned by Robinson (1902, p. 219) when he discusses the relationship of his newly described *S. narbonensis* to *S. affinis*. In the plate the openly spaced leaves are shown to be distinctly opposite and petiolate, and the lateral veins of the blade are nearly or quite simple. In the type the leaves are crowded, the arrangement is mostly alternate (although a pair may seem to be opposite, due perhaps to the foreshortening of the upper internodes), the base of the leaves is more definitely cuneate, the wings on the petioles are even broader than the wings in the type of *S. gummifera* Hook. f., and the lateral veins of the blade are branched in the manner typical of this series of the genus. The original sketches depict the plant as it appears in the type, the printed plate is a composite of details which give an inaccurate idea of the type.

Two specimens in Herb. Calif. Acad. Sci. collected by Stewart, are here referred to *S. affinis*, but they are not typical and may represent varieties worthy of recognition when they are understood

more fully. *Stewart No. 661* (in part) has the broad, dentate leaves and radiate heads of *S. affinis*, but the pubescence of the upper stems and the phyllaries is more like that of *S. villosa* Stew. Since this plant was collected with a typical aspect of *S. affinis* (*Stewart No. 661* in Herb. Gray.) in a region noted by Stewart for the occurrence of *S. villosa*, we suspect that this plant, which is intermediate in aspect between the two species, may be a segregate of a cross between the two species.

The other atypical collection of *S. affinis* is *Stewart No. 663* (CAS) from the southeastern side of Indefatigable Island. Though the heads are radiate, and the petioles more or less bordered to the base as in *S. affinis*, the harshly pubescent and coarsely serrate leaves and the small, ovate-lanceolate phyllaries are much more like the corresponding parts in *S. aspera* Ands., to which Stewart referred the collection (1911, p. 156). The material is entirely inadequate for a proper estimate at this time, but the collection of further material may disclose an entity worthy of taxonomic recognition. (See further discussion of this collection under *S. aspera*).

Scalesia affinis is one of the early colonizers on new lava flows, and has usually been found at low elevations not far distant from the sea. Low leafy plants of *S. affinis* are clearly depicted with *Cereus Thouarsii* Weber in the picture of vegetation at Black Beach, Charles Island, in Bull. Mus. Comp. Zool., Harv. College, vol. 23, no. 1, pl. 20.

2. *Scalesia gummifera* Hook. f.

Trans. Linn. Soc. 20: 212 (1847)

Compactly or loosely few-branched shrubs 0.3–2 m. tall with brown branches and villous or subhirsutulous branchlets; leaves more or less clustered at the ends of branchlets, usually alternate, rarely opposite or even whorled by the foreshortening of the upper internodes, light to dark olive-green, ovate to ovate-lanceolate or rhomboidal, 3.5–15 cm. long, 1–8 cm. wide, serrate, acute, cuneate-attenuate at base, pubescent above and below and somewhat glandular, pubescence subsericeous at first, becoming sparse and harsh in age, the lowest pair of veins prominent, projected strongly forward toward the apex of the leaf where they are confluent with other lateral veins, petiole either unwinged or narrowly to rather widely winged below the cuneate base of the blade; heads one or two at the ends of branchlets, radiate, cylindric to campanulate, 1–1.3 cm. long, 0.7–1.5 cm. wide, usually exceeded by the uppermost leaves, peduncles 1–6 cm. long, frequently bearing a single reduced leaf about the middle and occasionally a bract-like leaf just below the head; phyllaries in 2 or 3 series, the outermost narrowly oblong to oblong-ovate, 8–12 mm. long, 2–5 mm. wide, equalling or a little shorter than the disk, subacute, indurate at base in age, pubescence similar to that of the leaves; pales trifid, the middle division longer than the lateral, the divisions narrow and acuminate, pilose and frequently appearing like subplumose tails; rays about 10, 7–9 mm. long, somewhat irregularly 2- or 3-lobed at apex; disk-flowers numerous, corolla 5–7 mm. long, the lobes spreading, papillose-ciliate, the outside glabrous except for a few hairs near the tip of the lobes and near the base of the corolla-tube; anthers conspicuously exerted, the appendage 0.75–1 mm. long; style-branches 1.2–1.6 mm. long; achenes without pappus, 2.5–3.5 mm. long.

References. Walp., Ann. Bot., **1**: 414 (1848-9); Ands., Kgl. Vet. Akad. Handl., 1853: 83, 90, 182 (1855); Ands., Bot. Eugenies Resa, **13**, 17, tafl. 7, fig. 2 (1857), 71 (1861); Rob., Proc. Amer. Acad., **38**: 217, 244 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 157 (1911), Trans. Wisc. Acad., **18**: 282, 289 (1915); Riley, Kew Bull., 1925: 223.

S. narbonensis Rob., Proc. Amer. Acad., **38**: 218, pl. 3, fig. 4-7 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 158 (1911), Trans. Wisc. Acad., **18**: 335 (1915).

Collections studied. Albemarle Island: *Macrae* (K: Herb. Hook., type; Herb. Benth.); *Andersson* (Holm.); *Cheesman on St. George Expedition No. 453* (K); Tagus Cove, *Snodgrass and Heller No. 150* (G), *Howell No. 9520* (CAS); Elizabeth Bay, *Snodgrass and Heller No. 266* (DS, G); Cowley Bay, *Stewart No. 673* (CAS, G); Black Bight, *Blair on St. George Expedition No. 447* (K); eastern side, 3 miles south of Equator, *Howell No. 9627* (CAS); 5 miles northeast of Webb Cove, *Howell No. 9445* (CAS); Villamil, *Stewart No. 674* (CAS, G), *Howell No. 8943* (CAS). Narborough Island: northern part, *Snodgrass and Heller No. 297* (G, type of *S. narbonensis*, the first-cited specimen), *Stewart No. 680* (CAS, G); southern side, *Snodgrass and Heller No. 341* (DS, G).

Scalesia gummifera is very closely related to *S. affinis* Hook. f., and together they present one of the most puzzling aggregates of variations in the Galapagos Islands. Very easily the aggregate might be treated as a single species with one or more named varieties. It has seemed better, however, to recognize two species, which may be separated in a decided manner by the excellent character of the pales, a character which is well correlated with the insular distribution of the entities. Besides this character, there are several differences in foliage and flowers, which, while they do not hold in every instance, add weight to the opinion that the entities should be accepted as species.

As indicated above, there are two specimens in Herb. Kew. collected by *Macrae*, one in Herb. Hook., the other in Herb. Benth. The former should be taken as the type. In it the leaf-blade is decurrent along the petiole even to its base, although the foliar border becomes very narrow and attenuate. In the other specimen, which bears a printed label, "Herb. Soc. Hort. Lond. *Macrae*. 1925", the base of the blade is attenuate-cuneate, but below this is a definite unwinged petiole. In Herb. Gray. there is a tracing of this type of leaf which compared favorably with the leaves of *Howell No. 9520*.

In *S. gummifera*, the character of the unbordered petiole has not been found definite enough for the segregation of a taxonomic entity. For example, in *Howell No. 9627* from eastern Albemarle, which is represented by several branches from the same bush or adjacent bushes, petioles both winged and unwinged are to be found, the leaves on a vigorous, actively growing shoot having winged petioles while those on smaller, less vigorous branchlets having mostly unwinged petioles. In most collections only one type of leaf

is shown (perhaps because most earlier collections are represented by only a single branch), although successive collections from the same locality may exhibit winged and unwinged petioles (cf. *Stewart No. 614* and *Howell No. 8443* from Villamil).

The decision to treat as representative of a single entity specimens with petioles narrowly winged or unwinged leads inevitably to the reduction of *S. narbonensis* Rob. When Robinson originally described *S. narbonensis* from Narborough Island, he did not relate it to *S. gummifera*, which grew on the closely adjacent island of Albemarle, but rather to *S. affinis*, which grew on the much more distant islands of Indefatigable and Charles. The reason for this was undoubtedly because of the broader campanulate heads of the Narborough plant. More numerous recent collections from Albemarle Island have shown that the shape of the heads in *S. gummifera* varies from cylindric-campanulate to hemispheric-campanulate; and, although the two extremes probably represent different genetic strains, it would seem that no taxonomic line should be drawn between them at present. The emphasis placed on other characters by Robinson when he compared *S. affinis* and *S. narbonensis* is not of importance, when one appreciates the inaccuracies depicted in the plate of *S. affinis* (Hook. Icon. pl. 2718) which Robinson used as a basis for his comparison and discussion. The plate is discussed under *S. affinis*.

Probably the most significant variant to be noted in *S. gummifera*, however, comes from Villamil on the southern shore of Albemarle Island. The campanulate heads and the broad oblong-ovate or ovate phyllaries are very similar to those of *S. affinis*, but the pales are distinctly those of *S. gummifera*. Nevertheless this plant from southern Albemarle is undoubtedly intermediate between the two species. It may well be that the Villamil plant is the descendent of that form of *S. affinis* which first reached Albemarle Island from Charles Island, borne thither in a direct line on the Southeast Trade Winds and the Humboldt Current. Except for the plant from Cowley Bay, on the eastern side of Albemarle Island, all the forms of *S. gummifera* that have been seen differ from the Villamil plant, a divergence in character one might expect if the dispersal of *S. gummifera* took place from the south to the north. The plant from Cowley Bay (*Stewart No. 673*) is more or less intermediate between the Villamil plant and the typical form in the western and northern parts of Albemarle. Variations in plants from different parts of Albemarle and Narborough islands are such that these southern plants are scarcely susceptible of taxonomic segregation.

As in the case of the closely related *S. affinis*, *S. gummifera* grows on relatively fresh lava, generally near the coast. The collection made by Snodgrass and Heller (*No. 341*) on the southern side of Narborough Island is the most marked departure from the usual lowland habitat, it having been collected at an elevation of 2000 ft.

The less xerophytic character of this specimen is probably due to the elevation at which it was collected.

At the locality on the west side of Albenmarle Island 5 miles north-east of Webb Cove, a fungus was collected on the leaves of *S. gummifera*. This has recently been described as *Uredo Scalesiæ* Bonar (1939, p. 201).

3. *Scalesia villosa* Stewart

Proc. Calif. Acad. Sci., (4), 1: 158, pl. 4, fig. 1-3 (1911)

Shrubs 2-3 m. tall, the stems with brownish-gray bark, the branchlets villous with long, silky hairs; leaves grayish-green, clustered at the ends of the branchlets, alternate, lanceolate, 3-10 cm. long, 0.5-2 cm. wide, attenuate at apex, at base gradually narrowed to the short bordered or scarcely bordered petiole, the margin narrowly revolute, entire or undulate, occasionally obscurely serrulate especially on the larger leaves, sericeous-villous above and below and with short, glandular hairs intermixed among the long, slender, silky ones, sometimes becoming more or less scabrous, the hairs rather sparse except along the veins and margins, the apices almost penicillate, the lowest pair of lateral veins prominent, extending nearly to the end of the leaf very near the margin; heads one to several at the ends of branchlets, broadly campanulate, 12-13 mm. long, becoming subglobose in age and 1.5-2 cm. in diameter, peduncles villous-tomentose, 2.5-6 cm. long, usually surpassed by the leaves; phyllaries loosely imbricated in 2 or 3 series, lanceolate-oblong, 8 mm. long, 2-3 mm. wide, subacute, sericeous-villous; pales 8 mm. long, the lobes triangular-deltoid and not more than twice as long as broad; rays none; disk-flowers numerous, corolla 5-6 mm. long, the tube and lower part of the throat villous-hairy, the upper part subglabrous or glabrous; anther-appendage lanceolate, acute, 1 mm. long; style-branches about 1.5 mm. long; achene oblong-obovate, 2.5-3 mm. long; pappus none.

References. Stew., Trans. Wisc. Acad., 18: 300, 301 (1915); Riley, Kew Bull., 1925: 224; Christoph., Nyt Mag. for Naturvid., 70: 95 (1932).

S. villosa var. *championensis* Stew., Proc. Calif. Acad. Sci., (4), 1: 159 (1911).

S. Darwinii Rob. and Greenm., Amer. Jour. Sci., (3), 50: 146 (1895), not Hook. f.; Rob., Proc. Amer. Acad., 38: 216 (1902), in part.

Collections studied, all from Charles Island: Cormorant Bay, Baur No. 107 (type, G), Stewart No. 692 (CAS); Hornell on St. George Expedition No. 411 (K); 2 or 3 miles south of Post Office Bay, Howell No. 9371 (CAS).

Scalesia villosa is a very distinct species most closely related to *S. affinis* Hook. f. but differing from it in excellent characters of foliage and flowers. In appearance it looks more like the narrow-leaved species endemic on James Island, but the venation and serration of the leaves, the character of the heads and the phyllaries, and the lobing of the pales are very distinctive and different. The flowers of this species have not been described heretofore.

From a specimen collected by Mr. J. R. Slevin on Champion Island, an islet northeast of Charles Island near Cormorant Bay, Stewart described *S. villosa* var. *championensis* (type, CAS). The material is scarcely adequate for determining the value of this

entity, which is distinguished from the species on Charles Island by the somewhat broader, more sparsely villous leaves with more prominently revolute margins.

4. *Scalesia aspera* Ands.

Kgl. Vet. Akad. Handl. 1853: 180 (1855)

Shrubs 1-3.3 m. tall, the stems dark brownish, the branchlets scabrous with short scattered upwardly appressed hairs; leaves dark olive-green, not densely clustered at the ends of the branchlets, alternate or occasionally opposite, ovate, 3.5-10 cm. long, 1.5-6 cm. wide, scabrous above and below with short, stiff, subappressed trichomes, serrate, crenulate-serrate, undulate or subentire, acute, at base broadly to narrowly cuneate, or attenuate and decurrent along half the length of the petiole or less, petiole 0.5-2 cm. long, scabrous with outwardly curved hairs, the lowest pair of lateral veins not very prominent, extending forward, but frequently ending in a tooth about the middle of the leaf; heads solitary at the ends of branchlets, broadly campanulate, 1-1.5 cm. long, 1.5-2 cm. broad, peduncles scabrous, 2.5-10 cm. long; phyllaries in 2 to 4 series, oblong, ovate-oblong or suborbicular-ovate, acute or subobtusate, sparsely to densely scabrous-pubescent or merely hairy; pales 8-11 mm. long, strongly compressed-carinate, the lateral lobes of the trifid apex oblong-lanceolate, irregularly toothed or lacerate, a little wider than the middle triangular-lanceolate lobe; rays none; disk-flowers numerous, 6-7 mm. long, the lobes papillose-ciliate and bearing a few trichomes on the lower side, the tube and lower part of the throat with short, upwardly appressed hairs; anther-appendage about 0.6 mm. long, narrowly ovate; style-branches short, 0.8 mm. long, triangular, penicillate; achenes 4-5 mm. long; pappus reduced to two callous spots.

References. Ands., Kgl. Vet. Akad. Handl., 1853: 81, 89 (1855); Walp., Ann. Bot. 5: 219 (1858); Ands., Bot. Eugenies Resa, 12, 17, tabl. 7, fig. 3 (1857), 70 (1861); Rob., Proc. Amer. Acad., 38: 216 (1902); Stew., Proc. Calif. Acad. Sci., (4), 1: 156 (1911); Svenson, Amer. Jour. Bot., 22: 216 (1935).

Only two collections typical of *S. aspera* have been studied, both from Indefatigable Island: *Andersson* (Holm., type; G); north-western side, *Stewart No. 664* (CAS, G).

Although in this work *S. aspera* is placed in the series *Dentata*, it appears to be more nearly related to *S. divisa* Ands. of the series *Lobata* than to any other species. In both of these species the venation of the leaves is sometimes irregular: in *S. divisa* the veins do not always branch widely and end in a marginal lobe, and in *S. aspera* the lowest veins do not always extend up towards the end of the leaf. Although each of these species is somewhat anomalous in its respective series, *S. divisa* with its leaves deeply and frequently doubly serrate seems best referred to the series *Lobata* nearest *S. incisa* Hook. f.; and *S. aspera* with its leaves serrate or subentire seems best referred to the series *Dentata* as a remote, irradiate relative of *S. affinis* Hook. f. Lack of sufficient collections makes it difficult to appraise these entities properly from the point of view of possible relations and phylogeny.

A third collection is tentatively referred to this species, *Stewart No. 662* (CAS, G), from the southeastern side of Indefatigable Island at 600 ft. This plant differs most markedly from typical

S. aspera in the vesture, there being none of that harshness on branchlets and leaves that is so characteristic of the species. The collection was originally reported by Stewart (1911, p. 156) as *S. affinis* and this is not surprising since it is more like the plate of *S. affinis* in Hooker's *Icones* (No. 2718) than is the type itself. This plant from Indefatigable Island differs from real *S. affinis*, however, in the entirely unbordered petioles, the eradiate heads, the somewhat narrower phyllaries, and the more slender lobes of the pales. Between the specimens in Herb. Calif. Acad. Sci. and Herb. Gray. there is some difference in appearance since in the latter specimen the pubescence on the branchlets is more villous-tomentose and the pubescence on the young leaves is sericeous and denser. There is no doubt that the specimens are immediately related but they probably came from different bushes.

This collection, with the homogamous heads of *S. aspera* and the villous or sericeous vesture of *S. affinis*, is as anomalous in *S. aspera* as Stewart's No. 663, with the heterogamous heads of *S. affinis* and the harsh pubescence of *S. aspera*, is in *S. affinis*. Each is probably worthy of nominal recognition, but since they grow near each other on the southeastern side of Indefatigable Island, the possibility that they are segregates from a hybrid complex derived from a cross between *S. affinis* and *S. aspera* seems very probable. This relation between these two forms is not one to be solved in the herbarium with the examination of three specimens, but, as has been pointed out in our discussion of Stewart No. 663 under *S. affinis*, must await detailed field work and the collection of adequate material.

5. *Scalesia Crockeri* Howell, spec. nov.

Frutex humilis rotundatus 0.6–1 m. altus, caulibus fuscis, ramulis pilis paucis multisve stipitato-glandulosis intermixtis trichomis patentibus elongatis albis vestitis; foliis atrovirentibus, resinoso-fragrantibus, trinervatis, dense aggregatis apicibus ramulorum, oppositis, ovatis ad suborbicularibus, 3–7 cm. longis, 1–6.5 cm. latis, glandulosis et scabris, serratis ad tenuiter crenulato-serrulatis vel subintegris, apice rotundatis mucronatisque vel acutis, basi abrupte vel gradatim attenuatis in conspicue alatum vel exalatum petiolum; capitulis solitariis apice ramulorum, cylindraceo-campanulatis, 1.5 cm. longis, circa 1 cm. latis, pedunculis 2.5–4 cm. longis, scabris glandulosisque, foliis equalibus vel brevioribus; phyllariis 2- vel 3-seriatis, vix imbricatis, sæpe oblongis, subacutis, glandulosis et scabris; paleis circa 8 mm. longis, fere profunde trifidis, lobis acuminatis, in latitudine subæqualibus, in longitudine lobo medio lateralibus paullum longiore, lacerato-scariosis vel serrulatis infra, ciliatis pubescentibusve supra; radiis nullis; floribus disci circa 20, corollis 6–8 mm. longis, tuba glabra, $\frac{1}{3}$ – $\frac{1}{2}$ longitudine faucis, lobis recurvatis; acheniis oblongo-oblanceolatis, 4.5–5 mm. longis; pappo nullo.

Low, rounded, leafy shrubs 0.6–1 m. tall, the stems brown, the branchlets sparsely to densely stipitate-glandular with scattered elongate, spreading, white trichomes interspersed among the glandular hairs; leaves dark green, resinous-fragrant, densely clustered at ends of branchlets, opposite, ovate to suborbicular-ovate, 3–7 cm. long, 1–6.5 cm. wide, serrate to shallowly crenulate-serrulate or subentire, rounded and mucronate at apex or acute, at base abruptly or gradually narrowed to conspicuously

winged petiole, the wing as much as 2.5 cm. wide, the base of the wings sometimes auriculate-expanded or adjacent edges of the wings of opposite leaves shortly connate, rarely petioles unwinged, vestiture of leaves glandular and scabrous, the scattered harsh trichomes interspersed among numerous stipitate glands, the lowest pair of lateral veins prominent, directed forward towards the upper part of the blade; heads solitary at the ends of branchlets, cylindric-campanulate, 1.5 cm. long, about 1 cm. wide, peduncles 2.5-4 cm. long, scabrous with rough spreading trichomes and shorter glandular hairs, equalling or shorter than the leaves; phyllaries scarcely or loosely imbricated in 2 or 3 series, mostly oblong, subacute, glandular and scabrous; pales about 8 mm. long, rounded but not carinate, rather deeply trifid, the lobes acuminate, about equally wide, the middle a little longer than the lateral, lacerate-scarious or serrulate below, ciliate and pubescent above; rays none; disk-flowers about 20, corolla 6-8 mm. long, the tube $\frac{1}{3}$ - $\frac{1}{2}$ as long as the throat and glabrous, the throat hairy below and on the veins above, the lobes recurved, hairy on the outside at the tips; anther-appendage ovate, about 1 mm. long; style-branches about 1.5 mm. long, the tip curved and hairy; achenes oblong-oblanceolate, 4.5-5 mm. long; pappus none.

Type: No. 272130, Herb. Calif. Acad. Sci., on marine bluffs on the south side of **North Seymour Island**, *Howell No. 9992*, Templeton Crocker Expedition, June 11, 1932, a single collection only.

So far as we know, this is the first *Scalesia* to be collected on either of the Seymour islands, and it represents another of the distinctive elements in the floral district comprising those islands and adjacent northern Indefatigable Island. It combines in a most puzzling way characters of *S. aspera* Ands. and *S. affinis* Hook. f., but from one or the other of those species it may be separated by characters of foliage and vestiture, and from both it is different in the more slender heads, the narrower more loosely imbricated phyllaries, and the more acuminate lobes of the pales.

Stewart's collection from the northern side of Indefatigable Island, *No. 665* (CAS), is inadequate for proper study, but may be either *S. Crockeri*, or a form intermediate between *S. Crockeri* and *S. aspera*. In this specimen, the leaves are either alternate or opposite and lack the broadly winged petioles so conspicuous in the type from North Seymour Island.

Series 2. *Pedunculatæ*, ser. nov.

Arbores vel frutices, ramulis pilis sæpe sericeis interdum scabris villosive vestitis; foliis lanceolatis ad late ovatis, trinervatis ex basi, plerumque integris, petiolis exalatis; capitulis homogamis et discoideis; phyllariis exterioribus et disco subæqualibus.—Species typica, *S. pedunculata* Hook. f.

Trees or shrubs, the branchlets usually sericeous, sometimes villous or scabrous; leaves lanceolate to broadly ovate, 3-nerved from base, usually entire, petioles unwinged; heads homogamous and discoid; outer phyllaries about equalling the disk.—The type species, *S. pedunculata* Hook. f.

KEY TO THE SPECIES

- a. Leaves broadly to narrowly lanceolate, cuneate at base; peduncles 5–15 cm. long (or occasionally shorter in var. *parviflora*); heads 1–3 cm. broad. 6. *S. pedunculata*
- aa. Leaves ovate-lanceolate to ovate, at base subtruncate to cordate or sometimes very shortly cuneate; peduncles 0.5–2.5 cm. long; heads 0.5–0.7 cm. broad.
 - b. Arborescent shrub 2–4 m. tall; leaves rounded, subtruncate or very shortly cuneate at base. 7. *S. microcephala*
 - bb. Tree about 9 m. tall; leaves broadly cordate at base. 8. *S. cordata*

6. *Scalesia pedunculata* Hook. f.

Trans. Linn. Soc. 20: 211 (1847)

Low to tall trees 5–20 m. tall with long straight trunks 2–3 dm. in diameter; branchlets not glandular, appressed-pubescent and more or less sericeous, becoming glabrate, or in var. *pilosa*, the hairs spreading, denser, and more persistent; leaves alternate or sometimes nearly or quite opposite, lanceolate to ovate-lanceolate and ovate, 4–20 cm. long, 1–10 cm. wide, appressed-pubescent, dark or light green to somewhat cinereous, nonglandular, the tip attenuate-acute, the base abruptly or more gradually cuneate, margin entire or rarely minutely crenate-serrulate, petiole 0.5–5 cm. long; heads 1 to 3 near the ends of the branchlets, 1–3 cm. broad, usually long-pedunculate, peduncles 5–15 cm. long, rarely a little shorter, thinly appressed-pubescent and glabrate, or rarely persistently and rather densely villous; involucre campanulate, about 1 cm. long, the phyllaries rather thin, or becoming more or less thickened and indurate in age, oblong-lanceolate to ovate-lanceolate, acute; pales 6–12 mm. long, the lobes truncate or obtuse to subacuminate; rays none; disk-flowers more than 20, corolla 5–6 mm. long, hairy on the tube and glabrous above, or hairy on the veins of the upper part of the tube and throat; anthers exserted, the appendage about 0.5 mm. long; achenes 3.5–7 mm. long, with or without rudimentary pappus.

Scalesia pedunculata has the widest distribution of any species in the genus and on account of its arboreous habit is one of the most remarkable. It occurs on the four larger and higher central and southeastern islands of the archipelago, and on each it is one of the most numerous and important elements in the forest of the moist zone. Darwin was the first who called attention to the forests of *S. pedunculata* when he wrote: "Characteristic of the vegetation of James Island, forming woods of straight trees in the alpine or damp region" (Trans. Linn. Soc. 20: 211); and Stewart has described briefly the vegetation of what he aptly calls the "*Scalesia* forests" (1911, pp. 208, 209).

It was my privilege to visit the *Scalesia* forests on two of the islands, Charles and Indefatigable. To collect in the luxuriant "sunflower forest" on Indefatigable Island above Academy Bay was a botanical experience as unique in its way as to explore the impressive cactus groves of the arid lowlands. In the vicinity of Fortuna on Indefatigable Island, *Scalesia* was the most abundant tree in the rain-forest, and a distinctive note was imparted to the vegetation by the rounded bunchy crowns, supported by the tall

slender trunks covered with buff-brown shallowly broken bark, and clear of branches nearly to the top. The resemblance of the leaves to the leaves of *Helianthus* has already been noted by Svenson (1935, p. 215), and at the time of my visit I likened the entire tree to a gigantic sunflower, 10 to 20 m. tall. On Charles Island, not only did I collect in the *Scalesia* forest in the interior of the island between Floreana Peak and the spring, but I also viewed the top of the forest from the grass-covered summit of Floreana Peak. From this summit one looks down nearly a thousand feet into the crater, the lower inner slopes and floor of which are covered with a rain-forest of tropical luxuriance. In this forest the rounded, bright green crowns of the *Scalesia* are conspicuous, and, from the vantage point of the crater-rim, appear to be more abundant than any other tree.

A review of the material of this remarkable species has shown that it is not uniform in character, and, as in other variable species in the flora of the Galapagos Islands, the variations have become more or less segregated among the several islands where the species occurs. As a result of this study, five variants have been recognized and named according to the key and diagnoses that follow.

KEY TO THE VARIETIES OF *Scalesia pedunculata*

- a. Heads large, 2-3 cm. broad, 1.5 cm. long; phyllaries oblong-lanceolate; achene 5.5-7 mm. long.....6a. var. *typica*
- aa. Heads smaller, 1-2 cm. broad, 1-1.5 cm. long; achene 3.5-5 mm. long.
 - b. Pubescence appressed or subappressed, sericeous on young parts, the peduncles early glabrescent.
 - c. Phyllaries relatively thin and flat, not becoming conspicuously indurate or thickened; achenes without rudiments of pappus.
 - d. Heads 1.5-2 cm. broad; phyllaries ovate or oblong-ovate; lobes of pales oblongish, subobtusely truncate.....6b. var. *Svensoni*
 - dd. Heads 1-1.5 cm. broad; phyllaries oblong or oblong-lanceolate; lobes of pales triangular-lanceolate, acute.....6c. var. *parviflora*
 - cc. Phyllaries conspicuously thickened, indurate, and bowed; achenes with 2 rudimentary pappus callosities.....6d. var. *indurata*
 - bb. Pubescence of stems, petioles, and peduncles conspicuously and densely pilose-hirsutulous or villous, more or less persistent.....6e. var. *pilosa*

6a. *Scalesia pedunculata* var. *typica* Howell, nom. nov.

Pubescence appressed, the stems and peduncles early glabrate; peduncles 1-1.5 dm. long, rather stout; heads 2-3 cm. broad, 1.5 cm. long; phyllaries oblong-lanceolate, the outer obtuse or all acute, not becoming noticeably thickened; pales 10-12 mm. long, the lobes acute, the middle longer and wider than the lateral; flowers very numerous; achenes 5.5-7 mm. long; pappus none or represented by two small callosities.

References. *S. pedunculata* Hook. f., Trans. Linn. Soc. **20**: 211 (1847), in part; Walp., Ann. Bot., **1**: 414 (1848-9); Ands., Kgl. Vet. Akad. Handl., 1853: 90, 181 (1855); Ands., Bot. Eugenies Resa, **17** (1857), **71** (1861); Hemsl., in Hook. Icon., pl. 2717 (1901), in part; Rob., Proc. Amer. Acad., **38**: 219 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 158 in part, 208, 209 (1911), Trans. Wisc. Acad., **18**: 332 (1915).

Scalesia pedunculata in its typical form is known only from James Island where it was first collected by Darwin (Cantab., type; drawings, K), and later by Stewart (No. 688, CAS, G), who found "trees 25-40 ft. high" above 950 ft. at James Bay (1911, p. 158).

The only collection of *S. pedunculata* made by Darwin is in the Herbarium of the University of Cambridge, and consists of two specimens mounted on the same sheet that carries a single label. Although the two specimens obviously belong to the same species, they are quite unlike in details of aspect and parts, and in this treatment they are interpreted as two distinct varieties. The upper specimen on the sheet has three heads and in it the pubescence of the stems, petioles, and peduncles is rather densely hirsutulous-pilose. The heads in this specimen are less than 1.5 cm. in diameter. The lower specimen carries a single fruiting head, but near it in a pocket are fragments from a head removed from a second headless peduncle. In the lower plant the stems, petioles, and peduncles are appressed-pubescent, the stems and peduncles becoming glabrate. The head in the lower specimen is 2.5 cm. in diameter.

In his original description, Hooker covers about equally the characters of both specimens, so that it is difficult to say that one more than the other was in his mind as he wrote his description. But of the two it has seemed that the lower specimen has critical points in its favor and it has been chosen as the type of the species. In the preliminary diagnostic description, the leaves are described as "integerrimis." This applies to the leaves of the lower specimen but not to the leaves of the upper, in which the margin is very slightly undulate-crenate or serrulate, a serrulation now and again being rather prominent. Also in the preliminary description, the head on the lower specimen is better described by "late breviter campanulatis" than are those of the upper, in which the heads are not so noticeably low and broad. In the longer description that follows, first a character of one specimen and then of the other is described, though again the size of the heads, "circa $\frac{3}{4}$ unc. diametro," more nearly fits the lower specimen than the upper. So in this work the lower specimen is chosen as the type of *S. pedunculata* Hook. f. and the upper is named and described as var. *pilosa*.

The plate in Hooker's *Icones Plantarum*, No. 2717, is apparently drawn from both specimens. The habit drawing is that of the upper specimen and the enlarged details are undoubtedly taken from the lower plant. The fragments of the dissected head from the lower plant are in the pocket on the sheet.

6b. *Scalesia pedunculata* var. *Svensoni* Howell, var. nov.

Adpresso-pubescenti, pedunculis brevi glabrescentibus, 6–14 cm. longis, crassiusculis; capitulis 1.5–2 cm. latis, 1.5 cm. longis; phyllariis ovato-oblongis ad ovatis, acutis vel abrupte et breviter acuminatis, nec conspicue crassiusculis nec induratis; paleis 7 mm. longis, lobis in longitudine æqualibus et in latitudine subæqualibus, medio subobtusis, lateralibus truncatis vel irregulariter emarginatis; acheniis 4.5–5 mm. longis; pappo nullo.

Pubescence subappressed, the peduncles becoming glabrate early; peduncles 6–14 cm. long, rather stout; heads 1.5–2 cm. broad, 1.5 cm. long; phyllaries ovate to ovate-oblong, acute or abruptly short-acuminate, not conspicuously thickened or indurate; pales 7 mm. long, the lobes short and broad, equal in length and about equal in width, the middle lobe subotuse, the lateral truncate or irregularly emarginate; achene 4.5–5 mm. long; pappus rudiments none.

References. *S. pedunculata* Hook. f., in part, Stew., Proc. Calif. Acad. Sci., (4), 1: 158 (1911), Trans. Wisc. Acad., 18: 316, 326 (1915); Svenson, Amer. Jour. Bot., 22: 215, 259 (1935).

Type: Herb. Brooklyn Botanic Garden, collected by H. K. Svenson, No. 118, in the vicinity of the plantation, **6 miles north of Academy Bay at 750 ft., Indefatigable Island.** Duplicates in Herb. Gray. and Herb. Holm. Other collections studied, all from Indefatigable Island: northwest side above 700 ft., *Stewart No. 687* (CAS, G); Conway Bay, *Chapin No. 1139* (B); Academy Bay, “400 to probably 1500 ft.,” *Stewart No. 685* and *No. 686* (leaves only, CAS); Fortuna (*i. e.*, “the plantation” of Svenson), *Howell No. 9172* (leaves only, CAS); forest region at 300 m., *Schimpff No. 83* (leaves only, CAS).

6c. *Scalesia pedunculata* var. *parviflora* Howell, var. nov.

Subappresso-pubescenti; pedunculis tenuiter pubescentibus demum glabratibus, 4–10 cm. longis, gracilibus; capitulis 1–1.2 cm. longis, 1–1.5 cm. latis; phyllariis oblongis ad oblongo-lanceolatis, acutis, nec crassiusculis nec induratis; paleis 6–7 mm. longis, lobis acutis, in longitudine æqualibus, in latitudine interdum inæqualibus; acheniis 4–4.5 mm. longis; pappo nullo.

Pubescence subappressed, the peduncles thinly pubescent and at length glabrate; peduncles 4–10 cm. long, slender; heads 1–1.2 cm. long, 1–1.5 cm. broad; phyllaries oblong to oblong-lanceolate, acute, not becoming indurate or thickened; pales 6–7 mm. long, the lobes equal in length, sometimes unequal in width, acute; achene 4–4.5 mm. long, without pappus.

References. *S. pedunculata* Hook. f., in part, Stew., Proc. Calif. Acad. Sci., (4), 1: 158 (1911), Trans. Wisc. Acad. 18: 299, 321 (1915).

S. ovata Ands., Kgl. Vet. Akad. Handl., 1853: 181 (1855); Ands., *op. cit.*, 79, 89; Walp., Ann. Bot. 5: 219 (1858); Ands., Bot. Eugenies Resa, 11, 17 (1857), 70 (1861); Rob., Proc. Amer. Acad., 38: 219 (1902); Stew., Proc. Calif. Acad. Sci., (4), 1: 158 (1911); Svenson, Amer. Jour. Bot., 22: 219 (1935).

Type: Herb. Calif. Acad. Sci. No. 12201, collected by Alban Stewart, No. 683, on exposures of basaltic lava, **1000 to 1200 ft., Charles Island**, Mar. 1, 1906. Duplicate in Herb. Gray.

Other collections studied. Charles: upper wooded region, *Anderson in 1852* (Holm., type of *S. ovata* Ands.); exposures of basaltic lava, *Stewart No. 681* and *682* (CAS, G). Indefatigable: southeastern side above 450 ft., *Stewart No. 689* and *690* (CAS, G); vicinity of the plantation, 6 miles north of Academy Bay, 550 ft., *Svenson No. 71* (B, G). As deduced from geographic distribution, Lee's collection (G) made in 1888 on Charles Island probably belongs here. It consists of a leafy twig without flowers. A fragmentary specimen in Herb. Kew., collected by Capt. Wood in the "Galapagos", would appear to belong to var. *parviflora*. In it the leaves are lanceolate, small, 3 cm. long; the peduncle is 3 cm. long; and the head is a little over 1 cm. broad.

An examination of the type of *S. ovata* Ands. showed it to belong to the small-headed variant of *S. pedunculata* on Charles Island. The type is very fragmentary with only a single head, so in proposing a new name for the arboreous *Scalesia* of Charles Island, it has seemed best to take for the type of the entity a more adequate specimen which would allow dissection and a more detailed study.

6d. *Scalesia pedunculata* var. *indurata* Howell, var. nov.

Adpresso-pubescenti, caulibus tarde pedunculis brevi glabrescentibus; pedunculis 8–12 cm. longis, crassiusculis; capitulis 1–1.5 cm. latis, circa 1 cm. longis; phyllariis oblongo-lanceolatis, acutis obtusisve, conspicue crassiusculis, costatis et induratis; paleis 8 mm. longis, lobis æqualibus, acutis vel subacutis; acheniis 4 mm. longis, 2 rudimenta pappi ferentibus.

Pubescence appressed, the stems tardily and the peduncles more promptly glabrescent; peduncles 8–12 cm. long, rather stout; heads 1–1.5 cm. broad, about 1 cm. long; phyllaries oblong-lanceolate, acute or obtuse, somewhat bowed, becoming conspicuously thickened, ribbed and indurate; pales 8 mm. long, the lobes equal, acute or subacute; achene 4 mm. long, with 2 rudimentary pappus-callosities.

References. *S. pedunculata* Hook. f., in part, Stew., Proc. Calif. Acad. Sci., (4), 1: 158 (1911), Trans. Wisc. Acad., 18: 306 (1915).

Type: Herb. Calif. Acad. Sci. No. 12200, collected by Alban Stewart, *No. 684*, on **Chatham Island above 600 ft. at Wreck Bay**, Jan. 27, 1906. Duplicate in Herb. Gray.

This plant, known only from the single collection cited above, is very near the arboreous *Scalesia* on Charles Island, and may be only a trivial form of it. However, in older heads the involucre are quite remarkable and it seems adequately distinct.

6e. *Scalesia pedunculata* var. *pilosa* Howell, var. nov.

Foliis, ramulis et pedunculis piloso-hirsutulis vel villosis, pubescentia subadpressa vel patente, haud glabrescentibus; pedunculis 10 cm. longis; capitulis circa 1–1.2 cm. latis; phyllariis griseo-pubescentibus, ovato-lanceolatis, acutis; acheniis 3.5 mm. longis; setis pappi circa 1 mm. longis.

Pubescence subappressed to spreading, pilose-hirsutulous or villous, the parts not glabrescent; peduncles 10 cm. long; heads about 1–1.2 cm. broad; phyllaries

griseous-pubescent, ovate-lanceolate, acute; achene 3.5 mm. long; pappus-bristles about 1 mm. long.

References. *S. pedunculata* Hook. f., Trans. Linn. Soc., **20**: 211 (1847), in part; Hemsl., in Hook. Icon., pl. 2717 (1901), in part.

Type: Herb. Cantab., collected by Darwin in 1835 on **James Island**.

As noted in the discussion under var. *typica*, the type of var. *pilosa* is mounted with the specimen selected in this work as the type of *S. pedunculata* Hook. f., and is the plant figured in the habit drawing in Hooker's Icones, pl. 2717. A comparison of the specimen in Herb. Cantab. with the figure disclosed that the peduncles in the specimen are much more densely pubescent with somewhat ascending hairs; and, whereas the leaves in the drawing are shown to be entire, those of the specimen are more or less crenulate or serrulate. With further botanical collecting on James Island, it is hoped that the distributional relation between var. *pilosa* and var. *typica* will be learned.

7. *Scalesia microcephala* Rob.

Proc. Amer. Acad. **38**: 218, pl. 3, fig. 2, 3 (1902)

Arborescent shrubs or low trees with a single trunk and rounded crown, 2-4 m. tall; branchlets pubescent or tomentulous, generally glabrescent, more or less resinous-glandular; leaves broadly lanceolate to ovate-lanceolate, 3-12 cm. long, 1-5 cm. wide, appressed-tomentose and pale below, thinly pubescent and yellowish-green to olive-green above, entire, sinuate, or crenulate-serrulate, acute to acuminate, rounded, subtruncate, or very shortly cuneate at the base, petioles 0.5-5 cm. long, puberulent and gummy; heads 7-9 mm. long, 5-7 mm. broad, on shortly villous pedicel-like peduncles 0.5-2.5 cm. long, arranged in leafy corymbose inflorescences 2-5 cm. long, at the ends of the branchlets and exceeded by the leaves, the short rhachis simple or sometimes forked near the base; involucre campanulate, 0.5-0.6 cm. high, phyllaries lanceolate or oblong-lanceolate, acute, pubescent; pales 4-5 mm. long, trifold, the lobes triangular, acute; rays none; disk-flowers 9 to 15, corolla 5 mm. long, the outside puberulent; anthers nearly entirely exserted, the appendage rather narrow, 0.5 mm. long; achene oblong, 3-4 mm. long; pappus-bristles 1 mm. long or pappus and pappus-rudiments obsolete.

References. Stew., Proc. Calif. Acad. Sci., (4), **1**: 158 (1911), Trans. Wisc. Acad., **18**: 283 (1915).

Collections studied, all from Albemarle Island: Tagus Cove, Snodgrass and Heller No. 910 (type, G); Tagus Cove Mt., 2500 ft., Snodgrass and Heller No. 254 (DS, G); Tagus Cove Mt., 4000 ft., Snodgrass and Heller No. 875 (DS, G); Tagus Cove Mt. above 1200 ft., Stewart No. 678 (CAS, G, K); summit of Tagus Cove Mt., 4000 ft., Howell No. 9562 (CAS); Cowley Bay Mt., Stewart No. 679 (CAS, G).

The last collection cited above may prove to be a distinct variety when adequate material is obtained. In Stewart's specimens, the leaves are more resinous-glandular, the pubescence is thinner and

harsher, and the leaf-margins are more prominently serrulate than in the specimens from Tagus Cove. The achenes are devoid of pappus but since some achenes in specimens from above Tagus Cove have been seen which have no pappus, this is scarcely to be counted a diagnostic difference. It is of interest to note that in character of pubescence the Cowley Bay plants are about intermediate between the plants of Tagus Cove and *S. cordata* Stew., which comes from still further south on Albemarle Island, a character difference which seems to be correlated with distribution, and which indicates yet again how closely *S. cordata* is related to *S. microcephala*.

On the south side of Narborough Island at 2000 ft., Snodgrass and Heller (No. 343, DS, G) collected sterile specimens of a *Scalesia* of this relationship and they are tentatively referred here until flowering or fruiting specimens are obtained.

8. *Scalesia cordata* Stewart

Proc. Calif. Acad. Sci., (4), 1: 156, pl. 4, fig. 4, 5, 6 (1911)

Trees up to about "9 m." tall; branches tomentulous-puberulent and resinous-glandular at first, early becoming glabrate; leaves ovate, broadly cordate at base, the basal lobes rounded, acute to subacuminate at the apex, 8-17 cm. long, 5-11 cm. wide, paler and finely puberulent to thinly tomentulous below, olivescent and sparsely scabrid-pubescent above, margin more or less crenulate-undulate, petioles 3.5-7 cm. long, thinly puberulent; inflorescence and heads similar to those of *S. microcephala* Rob.; flowers unknown; achene oblong, 3-3.5 mm. long, with two well-developed pappus-bristles 1-2 mm. long.

References. Stew., Proc. Calif. Acad. Sci., (4), 1: 209 (1911), Trans. Wisc. Acad., 18: 285, 290 (1915).

Scalesia n. sp. ?, Rob., Proc. Amer. Acad., 38: 220 (1902).

Collections studied, all from Albemarle Island: above Villamil, Stewart No. 669 (CAS, type; G, K); Iguana Cove at 1000 ft. or less, Snodgrass and Heller No. 856 (G); Iguana Cove, 1000 to 2000 ft., Snodgrass and Heller No. 869 (DS, G).

Adequate flowering and fruiting specimens of *S. cordata* have not yet been collected. The fragmentary and partially broken heads of Stewart's collection show that it is very near *S. microcephala* Rob., and when it is better understood it will probably be interpreted as a variety of that species. The distinctive leaf-base appears to be the only real difference between the two entities, although from Stewart's account *S. cordata* would appear to be definitely more arboreous than *S. microcephala*. In citing his specimen, Stewart writes, "Villamil, occasional trees at 175 ft., abundant at 250-600 ft., smaller and less abundant at 1300 ft." (1911, p. 157). On the Templeton Crocker Expedition of the California Academy of Sciences I collected on Villamil Mt. on an overnight excursion to Santo Tomás, but this remarkable tree was not seen; and at Iguana Cove

where a brief stop was also made, time ashore was not sufficient to get much beyond the flat where I landed.

Series 3. **Foliaceæ**, ser. nov.

Frutices, ramulis foliisque pilis sericeis pilosis glanduloso-scabrisve vestitis; foliis anguste ad late lanceolatis, trinervatis ex basi, integris, petiolis exalatis; capitulis homogamis et discoideis; phyllariis exterioribus foliaceis et disco conspicue longioribus.—Species typica, *S. atractylodes* Arn.

Shrubs, the branchlets and leaves sericeous, pilose, or glandular-scabrous; leaves narrowly to broadly lanceolate, 3-nerved from base, entire, petioles unwinged; heads homogamous and discoid; outer phyllaries foliaceous and conspicuously exceeding the disk.—The type species, *S. atractylodes* Arn.

KEY TO THE SPECIES

- a. Leaves linear-lanceolate, cinereous, not scabrous except on margins, not noticeably glandular; involucre becoming strongly constricted above the swollen indurate base; lobes and sides of the pales not lacerate.
 - b. Pubescence sericeous and appressed; heads about 1 cm. high, on slender peduncles up to 1.5 cm. long; corollas 6.5 mm. long; achenes without pappus-bristles or rudiments... 9. *S. atractylodes*
 - bb. Pubescence pilose, the outer parts of the leaf-blades with shorter subappressed hairs; heads about 1.5 cm. high, nearly sessile; corollas 8–9 mm. long; achenes with short pappus-bristles or with variously shortened or obsolescent rudiments... 10. *S. Darwinii*
- aa. Leaves lanceolate to ovate-lanceolate, olivaceous, very scabrous, conspicuously glandular; involucre not constricted, the base not so indurate; lobes and sides of the pales lacerate-serrulate... 11. *S. Stewartii*

9. **Scalesia atractylodes** Arnott

Lindley, Nat. Syst. Bot., 443 (1836)

Shrub 1.5–2.3 m. high, the foliage and young stems cinereous with a short, appressed, nonglandular pubescence, sericeous on the young parts, somewhat harsher on old leaves; leaves loosely clustered at the ends of elongate, naked branches, linear-lanceolate, to 10 cm. long, 6–8 mm. wide, caudate-attenuate, narrowing at base into a petiole 0.5–1 cm. long, margin entire or somewhat undulate, in age scabrous and more or less revolute, the lateral veins and midrib evident below, the lateral veins confluent with submarginal veins; heads one or several at the ends of branches, almost hidden among the leaves, rather loosely flowered, about 1 cm. long, the peduncles slender, to 1.5 cm. long; phyllaries lanceolate, at base becoming indurate-thickened and the involucre more or less constricted near the middle in age, one or more of the outer phyllaries exceeding the head, elongate, foliaceous and up to 2 cm. long; pales 8 mm. long, strongly carinate along the prominent midrib, the lobes subulate-triangular, equal in width, 2–2.5 mm. long; rays none; flowers about 20, the corolla 6.5 mm. long, gradually widening upward, the lower part hairy, the upper part subglabrous or hairy on veins below sinuses and on lower sides of lobes, lobes spreading-recurved; anthers nearly entirely exerted, the appen-

dage about 0.6 mm. long, triangular-lanceolate; style-branches coiled, a little more than 1 mm. long, the tip thickened, hairy, triangular-pointed; achenes a little more than 3 mm. long, mottled, without pappus-bristles or rudiments.

References. DC., *Prod.*, **7**: 308 (1839); Hook. and Arn., in Hook., *Jour. Bot.*, **3**: 312 (1841); Walp., *Repert.* **2**: 611 (1843); Hook. f., *Trans. Linn. Soc.*, **20**: 210 (1847); Ands., *Kgl. Vet. Akad. Handl.*, 1853: 90, 179 (1855); Ands., *Bot. Eugenie Resa*, 17 (1857), 69 (1861); Rob., *Proc. Amer. Acad.*, **38**: 216 (1902); Stew., *Proc. Calif. Acad. Sci.*, (4), **1**: 156, 207 (1911), *Trans. Wisc. Acad.*, **18**: 331 (1915); Riley, *Kew Bull.*, 1925: 223.

Collections studied. Galapagos Islands, *Cuming No. 106 in 1831*⁴ (type, K); James Bay, 3 miles inland, *Cheesman on St. George Expedition No. 387* (K); James Bay, *Stewart No. 666* (CAS, G, K).

Although *S. atractyloides* was the first species of *Scalesia* to be known, it is one of the rarest and is one of the most local in distribution. It is found "among lava rocks" (Riley), and "on borders of recent lava flows where it grows to the exclusion of all other large vegetation" (Stewart) at lower elevations on James Island in the vicinity of James Bay. *Scalesia Darwinii* Hook. f., *S. Stewartii* Riley, and *S. atractyloides*, all of which are endemic on James Island, form a remarkably compact series in *Scalesia* characterized by the foliaceous outer phyllaries and the entire, lanceolate or linear-lanceolate leaves.

10. *Scalesia Darwinii* Hook. f.

Trans. Linn. Soc. **20**: 211 (1847)

Arborescent shrub 2.6–3.3 m. tall, pale and cinereous, the upper stems, bases of leaves, petioles, and involucre with long, soft, pilose hairs, the outer part of the leaf-blade with shorter, subappressed hairs; leaves clustered at the ends of branches, narrowly lanceolate to linear-lanceolate, to 10 cm. long, 0.6–1.3 cm. wide, gradually narrowing from below the middle into a long attenuate tip, gradually or more abruptly cuneate at the base, margin entire or broadly undulate, venation evident below, the lateral veins confluent in a submarginal vein, petiole 1–1.5 cm. long; heads solitary at the ends of branches, almost sessile among the leaves and nearly concealed, constricted near the middle, the base becoming swollen and indurate in age, 1.5 cm. long without the foliaceous elongate phyllaries which are up to 2.5 cm. long and linear-lanceolate or lanceolate-attenuate; pales 8 mm. long, the lobes triangular and about equal in width, ciliate, the lateral lobes 1 mm. long, middle lobe 2 mm. long; rays none; flowers crowded, more than 20, corolla 8–9 mm. long, the tube hairy from near the base to above the middle, subglabrous above or sparsely hairy on veins or on the lower sides of the spreading-recurved lobes; anthers almost entirely exserted, the appendage triangular-lanceolate, 0.6–0.7 mm. long; style-branches about 1.5 mm. long; achene 4 mm. long, mottled light and dark brown; rudimentary pappus present or obsolete, or pappus of 1 or 2 bristles 1 mm. long.

References. Walp., *Ann. Bot.* **1**: 414 (1848-9); Ands., *Kgl. Vet. Akad. Handl.*, 1853: 90, 179 (1855); Ands., *Bot. Eugenie Resa*, 17 (1857), 70 (1861); Rob. and Greenm., *Amer. Jour. Sci.*, (3), **50**: 146 (1895), in part; Hemsl., in Hook. *Icon.*, pl. 2719 (1901); Rob., *Proc. Amer. Acad.*, **38**: 216 (1902), in part; Stew., *Proc. Calif. Acad. Sci.*, (4), **1**: 157 (1911).

⁴It seems likely that the date of Cuming's visit to the Galapagos Islands was in 1829. James Island was one of the islands visited by Cuming.

Collections studied, both from James Island: James Island, *Darwin* (type, Cantab.); James Bay, around 1000 ft., *Stewart No. 670* (CAS, G, K).

Scalesia Darwinii, another rarely collected species, is closely related to *S. atractyloides* Arn., but the differences between the two do not seem to be the kind that will disappear or intergrade when more extensive collections are obtained. Both species are found on James Island adjacent to James Bay, but from Stewart's notes there would appear to be a distinct break in the distribution of the two, *S. atractyloides* being found at lower elevations, *S. Darwinii* being found "around 1000 ft." As Stewart has pointed out (1911, p. 157), Darwin probably confused *S. pedunculata* Hook. f. and *S. Darwinii* when he described the latter as "forming woods of straight trees in the alpine or damp region" (Trans. Linn. Soc. 20: 211).

The soft, pilose hairs of *S. Darwinii* are denser and much longer on the petioles, the upper branches, and about the heads than are indicated in the drawing in Hooker's *Icones*, pl. 2719; and the pubescence on the leaf-blades is not uniformly distributed from base to tip as is shown there, but rather the numerous long hairs near the base of the blade pass into the shorter and more appressed hairs, especially on the upper side.

11. *Scalesia Stewartii* Riley

Kew Bull. 1925: 223

Arborescent shrub with single trunk and generally with branches and leaves forming a narrow crown, 0.7–3 m. tall, the young stems with stipitate glands and long slender pilose hairs; leaves dark green or olivaceous, lanceolate to ovate-lanceolate, 5–11 cm. long, 0.7–2 cm. wide, acuminate, broadly or narrowly cuneate at base, entire, very scabrous and stipitate-glandular on both sides, the base of the leaves and the petioles sparsely set with long, slender, brittle white trichomes, the petioles 0.3–1.5 cm. long, the venation evident below, the lateral veins confluent with a submarginal vein; heads solitary among the leaves at the ends of branches on short peduncles up to 1.5 cm. long, the head tubular-campanulate, not constricted above the base, the outer phyllaries up to 3.5 cm. long, broad and spreading with an expanded foliaceous limb, texture and pubescence as in the leaves; pales 9 mm. long, the lobes triangular-acuminate, serrulate-lacerate, equal in width, the lateral lobes 2 mm. long, the middle lobe 3 mm. long; rays none; corollas 40 or more, 7–8 mm. long, glabrous below, hairy about the middle, above subglabrous or hairy on nerves and on the lower sides of the spreading lobes; anthers completely exerted, the appendage lanceolate-ovate, 0.5–1 mm. long; style-branches 2 mm. long, short-hairy at the thickened, triangular cuspidate tips; achenes 3–4 mm. long, compressed, light brown with darker mottling; pappus none.

References. *S. atractyloides* Stew., not Arn., in part, Proc. Calif. Acad. Sci., (4), 1: 156 (1911), Trans. Wisc. Acad., 18: 328 (1915).

Collections studied, both from James Island: northwestern side on lava beds near the coast and above 700 ft., *Stewart No. 667* (K, type; CAS, G); Sullivan Bay, on lava-flow where little else grows, *Howell No. 10020* (CAS).

Stewart's *Scalesia* is very distinct from its immediate relatives, *S. atractyloides* Arn. and *S. Darwinii* Hook. f., notably in the scabrous and glandular trichomes on the broader leaves, the unconstricted involucre, and the conspicuously expanded, foliaceous tips of the outer phyllaries. It seems eminently fitting that this remarkable species is dedicated to Dr. Alban Stewart to whom goes the distinction of obtaining the most adequate and complete collection of specimens in this genus yet to be prepared.

Series 4. *Lobataë*, ser. nov.

Frutices, ramulis foliisque plus minusve villosis glandulosisque scabris vel raro subglabris; foliis variabilibus, profunde et irregulariter serratis ad bi- vel tri-pinnatifidis, venis lateralibus divaricatis et terminantibus in dente vel lobo marginali, petiolis exalatis; capitulis discoideis, floribus similibus fertilibusque vel interdum extremis sterilibus corollis radiato-dilatatis et plus minusve obliquis; phyllariis exterioribus et disco subæqualibus vel phyllariis paulum brevioribus.—Species typica, *S. incisa* Hook. f.

Shrubs, the leaves and branchlets more or less villous and glandular, scabrous or rarely subglabrous; leaves variable in shape, deeply and irregularly serrate to bi- or tri-pinnatifid, the lateral veins divaricate and ending in a marginal tooth or lobe, petioles unwinged; heads discoid, the flowers all alike and fertile, or sometimes the outermost sterile and with corollas radiate-enlarged and more or less oblique; outer phyllaries about equalling the disk or a little shorter.—The type species, *S. incisa* Hook. f.

KEY TO THE SPECIES

- a. Leaves alternate or occasionally the upper nodes approximate and the leaves opposite or subopposite, the blades grossly serrate to prominently lobed, the primary sinuses rarely extending more than $\frac{2}{3}$ of the way to the midrib.
- b. Vesture of upper stems, leaves, and peduncles scabrous, scarcely villous or glandular, the trichomes not drawn out in an elongate hair-like process; lobes and sides of pales entire.
- c. Leaves grossly serrate, the serratures entire or serrate; peduncles equalling or longer than the leaves, 6–8 cm. long; phyllaries oblong to ovate, 4–5 mm. broad 12. *S. divisa*
- cc. Leaves lobed, the lobes irregularly few-toothed; peduncles equalling the petioles, 2–3 cm. long; phyllaries linear-oblong, 1.5–2 mm. broad. 13. *S. incisa*
- bb. Vesture of upper stems, leaves, and peduncles slightly to markedly viscidulous or glandular, villous or pilose, the base of the trichomes sometimes scabrous-hardened, the pubescence sometimes scant; lobes and sides of pales finely serrulate to laciniate.
- d. Pales with lobes similar, triangular and sharply acute to acuminate; heads 1.5–2 cm. across, the corollas straight and bearing coarse trichomes on the lower side of the lobes. 14. *S. retroflexa*

- dd.* Pales with lobes unequal in width, or, if nearly equal, then the lobes obtuse or oblanceolate; heads about 1 cm. across, the corollas strongly outwardly curving, devoid of coarse trichomes on the lobes (the lobes ciliate in *S. Hopkinsii*).
- e.* Pales with lobes oblong to triangular-oblong, widest at or below the middle; peduncles 1.5–3.5 cm. long. 15. *S. Baurii*
- ee.* Pales with lobes oblanceolate to oblong-obovate, widest above the middle; peduncles 2–8 cm. long.
- f.* Shrub 2–3 m. tall, the herbage pilose, the young parts subsericeous, or the pubescence inconspicuous with hairs fewer and shorter; lobes and teeth of the leaves mostly sharply acute. . . . 16. *S. Hopkinsii*
- ff.* Low shrub to 1 m. tall, the herbage subglabrous; lobes and teeth of leaves mostly rounded and obtuse 17. *S. Snodgrassii*
- aa.* Leaves opposite, the blades finely dissected and twice or thrice pinnatifid, the primary sinuses extending nearly to the midrib. 18. *S. Helleri*

12. *Scalesia divisa* Ands.

Kgl. Vet. Akad. Handl. 1853: 179 (1855)

Shrub 1–2 m. tall, the upper part of the stems somewhat glandular and scabrous; leaves alternate, pubescent when young, becoming scabrous, scarcely glandular, ovate, 4–8 cm. long, 2–4 cm. wide, rounded or broadly cuneate at base, the margin irregularly and coarsely serrate-lobed or serrate, the serratures entire or irregularly serrate, the petiole slender, 1–4 cm. long; heads discoid, many-flowered, 1.5–2 cm. broad, peduncles glandular and scabrous under the head, 6–8 cm. long, equalling or exceeding the leaves; phyllaries in 2 or 3 series, oblong-lanceolate to oblong-oblanceolate or narrowly ovate, about 1 cm. long, mostly 4–5 mm. wide, scabrous outside; pales 7 mm. long, the lobes about a third as long, triangular, acute, ciliate; corollas about 4 mm. long, those on the periphery curved outward in mature heads, the lobes ciliate, the upper part of the tube glabrous, the lower part hairy; anthers becoming entirely exerted, the apical appendage about 0.5 mm. long, oblong-ovate; achene 4 mm. long, with or without rudiments of 2 pappus-paleæ.

References. Ands., Kgl. Vet. Akad. Handl., 1853: 69, 72, 89 (1855); Walp., Ann. Bot., 5: 219 (1858); Ands., Bot. Eugenies Resa, 7, 8, 16, tafl. 7, fig. 1 (1857), 70 (1861); Rob., Proc. Amer. Acad., 38: 217 (1902); Stew., Proc. Calif. Acad. Sci., (4), 1: 157 (1911), Trans. Wisc. Acad. 18: 305 (1915).

Scalesia divisa is known from only two collections, the original made by Andersson in 1852 on Chatham Island, and reported as frequent in rocky places in the lower parts (Holm., type; CAS, G, K), and the second by Stewart, No. 672 (CAS, G), collected on Chatham Island at Sapho Cove from lava beds near the coast. The species is closely related to *S. incisa* Hook. f., also from Chatham Island, but Hooker's species differs in its lobed leaves, shorter peduncles, smaller heads with fewer flowers, and linear-oblong phyllaries. The corollas in the only known specimen of *S. incisa* are straight, but in *S. divisa* the corollas are outward-curving in mature heads. *Scalesia divisa* perhaps finds even a closer relation in *S. aspera* Ands., as

has been indicated in the discussion under *S. aspera*. A primitive antecedent of these species might have been the first form to diverge from that complex of which the radiate species in the series *Dentatæ* are believed to be modern representatives; and from such a form not only have *S. aspera* and *S. divisa* probably been derived, but also the series *Lobatæ*.

13. *Scalesia incisa* Hook. f.

Trans. Linn. Soc. 20: 210 (1847)

Shrub (?) with stems and leaves more or less scabrous, almost devoid of pilose hairs and rarely glandular; leaves alternate, plane, narrowly ovate, about 5 cm. long and 2.5 cm. wide, scabrous and with very few glandular hairs, irregularly pinnately lobed, the sinuses extending about half way to the midrib, the lobes approximate and irregularly few-toothed, the petiole slender, 2-3 cm. long; head discoid, many-flowered, about 1 cm. broad, peduncle about equalling the petioles; phyllaries in 2 series, linear-oblong, acute or subobtusate, 1.5-2 mm. broad, 8 mm. long, equalling the pales; lobes of the pales triangular, shortly acute and beset with peculiar thickish, conical trichomes; corollas straight, pubescent below the middle and very slightly upward along the veins, the outside of the lobes with a few conical trichomes; achenes 4 mm. long, oblong, with minute rudiments of 2 pappus-paleæ.

References. Walp., Ann. Bot., 1: 414 (1848-9); Ands., Kgl. Vet. Akad. Handl., 1853: 72, 89, 179 (1855); Ands., Bot. Eugenies Resa, 16 (1857), 70 (1861); Hemsl., in Hook. Icon., pl. 2716 (1901); Rob., Proc. Amer. Acad., 38: 217, 219 (1902); Stew., Proc. Calif. Acad. Sci., (4), 1: 158 (1911).

Scalesia incisa is known only from a single collection, that of Darwin on Chatham Island in 1835 (Cantab.). The leaves are more like those of *S. Baurii* Rob. and Greenm. in shape, but the pubescence is entirely different, and the two species can be readily separated by the shape of the phyllaries. According to Hemsley, *S. retroflexa* Hemsl. is most closely related to *S. incisa*, but the two species can be separated by vestiture, leaves, and phyllaries, and may not be so nearly related as stated. It would appear that *S. incisa* has its closest affinity in *S. divisa* Ands., which also grows on Chatham Island. For a time it was thought that *S. incisa* and *S. divisa* might be varieties of a single species, but *S. divisa* is adequately distinct in its serrate leaves, larger heads, broader phyllaries, and different pales.

A comparison of the plate of *S. incisa* (Hook. Icon. pl. 2716) with the type of the species discloses several details in the plate which are not as accurate as might be desired for critical study. In the type the leaves are more irregularly lobed and toothed, the phyllaries are linear-oblong and acute or subobtusate, and, perhaps most critical of all, the lobes of the pales are triangular and shortly but definitely acute. The examination of the type and discovery of the acute lobes of the pales brought *S. incisa* into even closer relationship with *S. divisa* than with *S. Baurii*, where its affinity would be sought if emphasis were placed on the character of the

pales as illustrated. In the detail of the flower and achene in the plate, there is no indication of the stubby rudiments of pappus which were discovered in examining the type; but the neglect of this minute detail in the drawing is rather to be expected, since, before this, attention has not been directed to this character in any species in this section of the genus.

14. *Scalesia retroflexa* Hemsl.

Hook. Icon. pl. 2715 (1901)

Shrub about 2 m. tall with villous hairs on stems, leaves, and peduncle, these parts also with numerous glandular hairs; leaves alternate, noticeably retroflexed, ovate to oblong, cordate at base, 6–10 cm. long including the slender petiole, pinnately lobed, the lobes finely and regularly toothed or cleft, margins crisped; heads discoid, solitary on short peduncles in the axils of the upper leaves, many-flowered, about 1.5–2 cm. broad; phyllaries ovate to ovate-lanceolate, acute or obtuse, equaling the pales; lobes of the pales triangular, acute or acuminate, the margins of the lobes serrate-ciliate with stout, spreading trichomes; corolla puberulent outside; achene without even rudimentary pappus.

References. Rob., Proc. Amer. Acad., **38**: 217, 219 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 158 (1911).

Scalesia retroflexa is known only from the type specimen which was collected on Indefatigable Island by Habel in 1868 (K). It consists of a single branch, which is beautifully delineated in the plate accompanying the original description.

15. *Scalesia Baurii* Rob. and Greenm.

Amer. Jour. Sci., (3), **50**: 141 (1895)

Shrub, stems and petioles with villous hairs from more or less thickened conical bases, which on the older parts becomes hardened and scabrous, the branchlets and petioles also glandular; leaves alternate, or approximate below the heads, ovate, 3–10 cm. long, 2.5–7 cm. wide, cuneate at base, acute at apex, pinnately parted, the primary sinuses extending half way to the midrib or a little beyond, the lobes irregularly lobed and sharply serrate, the lobes and lobules generally acute, the blade finely scabrous above with a few elongate hairs, below pilose-scabrous with elongate tips on the trichomes, villous-hairy along the nerves, petiole about 3 cm. long; head discoid, 1 cm. long and about as broad, peduncles 1.5 to more than 3.5 cm. long, shorter than or equalling the leaves, scabrous under the head and subglabrous below or glandular and villous; involucre 5–6 mm. high, the phyllaries in 3 series, cinereous with short, scabrous trichomes, broadly elliptic-ovate to obovate, acute and tipped with a short mucro; pales 5–6 mm. long, the outer variously cleft and irregularly lobed, the inner trifid, lobes about 2 mm. long, acute, oblong-triangular, somewhat lacinate, the two outer lobes nearly twice as broad as the middle lobe; the corollas of the outer flowers enlarged, obliquely and palmately expanded, the tube outwardly curved, the whole simulating a ray and 6–7 mm. long, these flowers with abortive

stamens and pistil, the other corollas 5 mm. long, more or less outwardly curved, the tube hairy, the upper half and lobes glabrous; anther-appendage about 0.75 mm. long; style-branches 1.5 mm. long, the tips acuminate-acute, the branches spreading from about the middle; achene with 2 callosities indicating pappus-rudiments.

References. Rob. and Greenm., Amer. Jour. Sci., (3), **50**: 146 (1895); Rob., Proc. Amer. Acad., **38**: 216, 219, 247 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 156 (1911), Trans. Wisc. Acad. **18**: 311 (1915).

The above diagnosis has been drawn chiefly from the type specimen, which was collected by Baur on Duncan Island, *No. 129* (G). The only other collection which has been seen which may be referred to this species is a collection also from Duncan Island, *Stewart No. 668* (CAS, G, K). From the type it differs in the following critical and important details: heads discoid, the outer corollas curving outward, the limb oblique, but not at all enlarged; the pales oblongish and about equally wide, the lateral lobes somewhat asymmetric and denticulate-fimbriate at the obliquely subtruncate tip, the middle lobe symmetrical and abruptly acutish. This collection seems to approach *S. retroflexa* Hemsl. but differs in the smaller leaves, less glandular pubescence, shorter involucre, the blunter lobes of the pales, and the more curving corollas.

The specimen called by Robinson *S. Baurii* var. *glabrata* (Duncan Island, *Snodgrass and Heller No. 706*, G) would seem to be nearer *S. Snodgrassii* Rob., and it is referred to that species in this work. This opinion can scarcely be regarded as decisive, since paucity of material and lack of sufficient collections preclude a really adequate treatment.

16. *Scalesia Hopkinsii* Rob.

Proc. Amer. Acad. **38**: 217, pl. 3, fig. 1 (1902)

Shrub 2–3 m. tall, the stems, leaves, and peduncles pilose, the young parts subsericeous, some of the hairs viscidulous, or the pubescence scant; leaves alternate or subopposite, ovate, acute, shortly cuneate or truncate to broadly cordate, 6–10 cm. long, 4.5–8.5 cm. wide, irregularly pinnately lobed and serrate, the lobes and serrations usually sharp, occasionally obtuse, the primary sinuses shallow, or extending a little more than halfway to midrib, paler and more pubescent beneath, slightly scabrous in age, petiole 1–3 cm. long, pilose; heads 1–1.3 cm. long, about 1 cm. broad, flowers numerous; peduncles 2–6.5 cm. long, shorter than the leaves; involucre 5–7 mm. high, the phyllaries in about 3 series, oblong to obovate or suborbicular, obtuse or subacute, sometimes mucronulate, densely pilose on the outside and ciliate; pales 6–8 mm. long, the lobes oblong to broadly oblanceolate, generally obtusish or obcordate, the margin serrulate-ciliate; outermost corollas about 5.5 mm. long, the limb strongly recurved and folded, 3-toothed at tip or 4- or 5-lobed and obliquely bilabiate, inner corollas about 5 mm. long, the tube thick and hairy, the throat glabrous, the lobes ciliate and hairy on the lower side, or glabrous, the outer corollas spreading; style-branches 1–2 mm. long, divergent or recurved-coiling, the

tip somewhat enlarged, acute, hairy on lower side; achenes 3–4 mm. long, flattened or trigonous, callous with pappus-rudiments which sometimes carry a bristle 1 mm. long.

References. Rob., Proc. Amer. Acad., **38**: 219, 243 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 157 (1911), Trans. Wisc. Acad. **18**: 275 (1915).

As is the case in all species of the series *Lobatae*, *S. Hopkinsii* is inadequately known from insufficient material. Only three collections, all from Abingdon Island, can be definitely placed: the type collection made by Snodgrass and Heller (*No.* 851, G, type, DS), and two collections made by Stewart (*No.* 676 and *No.* 677, CAS, G, K). From Stewart's report on his collections, it can be inferred with reasonable certainty that *No.* 677, with smaller pinnatisect leaves, came from near the shore and that *No.* 676, with broader thinner leaves, came from above 330 m. (Proc. Calif. Acad. Sci., (4), **1**: 158). The variability shown by these two collections would indicate that variations in the species may prove to be of such a nature that lines between it and related species will disappear when further collections are made.

In Herb. Kew. there is a fragmentary collection made by Habel in 1868 on Indefatigable Island. When this was examined by the writer at Kew in 1935, it was noted as "seemingly near *S. Hopkinsii*. The leaves match Stewart's Abingdon plant in which the leaves are less cleft (*No.* 676) and the pubescence is similar." The place of collection of Habel's specimen may not be right. He collected on Abingdon Island as well as on Indefatigable Island and it may be suspected that the fragment in question originated, not on Indefatigable Island where *S. Hopkinsii* has not otherwise been collected, but rather on Abingdon Island, where Stewart reports it as "common bushes 6–8 ft. high from the vicinity of the shore to 1500 ft." (*op. cit.*, 157). There is a tracing of the Habel collection in Herb. Gray.

In the original description, *S. Hopkinsii* is described as "*capitulis eradiatis*." A careful examination of specimens of the type collection from both the Gray Herbarium and the Dudley Herbarium has disclosed no enlarged marginal corollas, which in Stewart's specimens are not conspicuous but which are evident and unmistakable on inspection.

17. *Scalesia Snodgrassii* Rob.

Proc. Amer. Acad. **38**: 219, pl. 3, fig. 8 (1902)

Shrub 0.6–1 m. tall, the stems subglabrous with very few scattered pilose and viscidulous hairs; leaves alternate, ovate, narrowly ovate or oblong-ovate, acute or obtuse, somewhat asymmetric and very shortly cuneate below the basal lobes, 5–10 cm. long, 3–6 cm. broad, irregularly pinnately lobed, the lobes again shallowly

lobed or grossly dentate, the lobes and teeth obtuse or subacute, the primary sinuses usually extending more than half way to the midrib, sparsely pilose-scabrous on both sides, the petiole 1.5–4.5 cm. long, sparsely pilose and viscidulous; heads 0.8–1 cm. long and about as broad, peduncles 5–8 cm. long, somewhat puberulent with long pilose and short glandular hairs, sometimes foliaceous-bracteate; involucre 5–6 mm. long, the phyllaries obovate-oblong, acute, pubescent and shortly ciliate; pales 5–7 mm. long, the outer asymmetrically lobed, the inner regularly lobed, the lobes tending to be oblong-obovate, acute to obtusish, serrulate-ciliate; outermost corollas strongly recurved, the limb 2–3 mm. long, shallowly or deeply 3-lobed, a small fourth lobe present on the inner side of the mouth of the throat; inner corollas 5 mm. long, the tube heavy and hairy, the throat light and glabrous, except along the nerves, the lobes glabrous, the corollas of the outer flowers strongly recurved; style-branches slender, acute, 2 mm. long, coiling; achene of outermost flowers trigonous, 3 mm. long, achene of inner flowers compressed, 3 mm. long, with 1 or 2 rudimentary pappus-bristles or the pappus reduced to obsolescent callosities.

References. Rob., Proc. Amer. Acad., **38**: 216, 251 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 158, 159 (1911), Trans. Wisc. Acad., **18**: 308, 338 (1915).
S. Baurii var. *glabrata* Rob., Proc. Amer. Acad., **38**: 216, 247 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 156 (1911).

Scalesia Snodgrassii was originally collected on Wenman Island by Snodgrass and Heller (*No. 10*, type, G; DS), and it was re-collected there by Stewart (*No. 691*; CAS, G, K). *Scalesia Baurii* var. *glabrata* Rob., which is here referred to *S. Snodgrassii*, is known only from the type collection which was made on Duncan Island, *Snodgrass and Heller No. 706* (G, type; DS).

Scalesia Snodgrassii is very closely related to *S. Hopkinsii* Rob. and *S. Baurii* Rob. and Greenm., and with fuller knowledge derived from further collections it may be found necessary to treat them as subspecific entities of a single, polymorphic species. Because of the variability in characters of foliage and vesture by which the entities have been separated, there is at present insufficient material on which to base a proper specific concept, either for each one separately, or for a collective species. As pointed out by Robinson (*op. cit.*, 216), *S. Baurii* var. *glabrata* is "very near *S. Snodgrassii*," and we believe that it should be considered a part of the latter. The following notes taken from the type specimen of *S. Baurii* var. *glabrata* will serve to indicate the close resemblances and minor differences between *S. Snodgrassii* and it:

Uppermost stems thinly villous with long silky hairs, and with a few, short glandular hairs; leaves alternate, or appearing opposite below the peduncles, triangular-ovate, obtuse or subacute, truncate or subcordate, 3.5–4.5 cm. long, 3 mm. wide, pinnately lobed, the sinuses extending less than half the distance to the midrib, the lobes broad and rounded, shallowly lobed or toothed, subglabrous above and below, a few hairs and rigid trichomes on the midrib below, petiole 1 cm. long, with ascending, villous hairs and short, capitate glands; peduncle glandular-hairy, 4.5–7 cm. long, the heads exceeding the leaves; heads 1 cm. long and about as broad; involucre 6–8 mm. high, the phyllaries in about 3 series, broadly elliptic-ovate to obovate,

acute or the inner truncate or even subobcordate and abruptly acute, sparsely pubescent on the backs, finely and closely ciliate; outermost enlarged flowers 5 mm. long, 3-cleft at apex, the lateral lobes longer and broader than the middle, pubescent on the veins from end to end; inner corollas 4-4.5 mm. long, the tube hairy to about the middle, glabrous above, corollas mostly straight or the outermost slightly curved.

18. *Scalesia Helleri* Rob.

Proc. Amer. Acad. **38**: 217, pl. 1, fig. 9, 10 (1902)

Shrub, 2-2.7 m. tall, the upper stems, leaves, and peduncles conspicuously villous and more or less glandular-viscidulous, or the villous hairs inconspicuous and nearly lacking; leaves opposite, twice or thrice pinnatifid-dissected into linear or narrowly oblong segments, the sinuses between the primary divisions extending nearly to the midrib, glandular-scabrous, elliptical to ovate, 2-8 cm. long, 1.5-5 cm. broad, petioles 1-2 cm. long; heads 1-1.2 cm. long, 1-1.5 cm. broad, discoid, many-flowered, peduncles slender, about 2 cm. long, equalling or shorter than the leaves; involucre about 7 mm. long, phyllaries oblong, rounded above but usually shortly and very abruptly acute; pales about 6 mm. long, lobes 2 mm. long, triangular, acute or subacuminate, serrate-ciliate; corollas straight, about 5 mm. long, the lobes spreading slightly from their middle, the tube slender and narrow at base, glandular-encrusted and hairy below the lobes; anthers slightly exerted, the appendage 0.5-0.6 mm. long, triangular-ovate; style-branches divaricate, thick and clavellate, acute, 1 mm. long; achene oblong, 2-2.5 mm. long, without even rudimentary pappus.

References. Rob., Proc. Amer. Acad., **38**: 245 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 157 (1911), Trans. Wisc. Acad., **18**: 293 (1915); Christoph., *Nyt Mag. for Naturvid.*, **70**: 95 (1932); Lemée, *Dict. Gen. Pl. Phanérog.*, **5**: 997 (1934); Svenson, *Amer. Jour. Bot.*, **22**: 213 (1935).

This very distinct species is known from only three collections, the first two from Barrington Island (*Snodgrass and Heller No. 466*, G, type, DS, and *Stewart No. 675*, CAS, G, K), and the third and most recent from Turtle Bay on the southern side of Indefatigable Island (*Rorud No. 155*). The last has not been examined by the writer, but in the other two collections there appears to be diversity in the vesture of the plants, the type collection being much more conspicuously pilose, the Stewart collection being more noticeably glandular.

The detailed drawing of a pale accompanying the original description (*op. cit.*, pl. 1, fig. 10) does not show the usual sort of lobing found in the pales. Usually the lobes are longer in proportion to the full length of the pale, and characteristically the lobes are sharply acute or even subacuminate. The drawing of the pale referred to is probably taken from one in the outermost series of the head, where occasionally they are not so deeply cleft or so acutely tipped.

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ERRATA

- Page 1. Line 5 from top: for pp. 1-66 read pp. 1-63.
 Page 34. Line 4 from bottom: for **Minettia Desvoidy** read **Minettia** Desvoidy.
 Page 187. Line 15 from bottom: for (*C. galapagensis*) read (*C. grandifolius*).
 Page 201. Line 12 from bottom: for *Irisene celosia* L. read *Iresine celosia* L.
 Page 202. Line 16 from top: for *Eurphorbia* read *Euphorbia*.

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