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RHYNCHOPHORINAE OF SOUTHEASTERN POLYNESIA[1, 2]

(Coleoptera : Curculionidae)

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Abstract: Ten species of Rhynchophorinae are recorded from southeastern Polynesia, including two new species of *Dryophthorus* from Rapa. Excepting the latter, all the species have been introduced into the area and most are of economic importance. Keys to adults and larvae, notes on biologies, new distributional data and illustrations are presented.

This is a combined Pacific Entomological Survey (1928–1933) and Mangarevan Expedition (1934) report. I had hoped to publish the account soon after my return from the 1934 expedition to southeastern Polynesia, but its preparation has been long delayed because of my pre-occupation with other duties.

With the exception of two new endemic species of *Dryophthorus*, described herein, all of the Rhynchophorinae found in southeastern Polynesia (Polynesia south of Hawaii and east of Samoa; see fig. 1) have been introduced through the agencies of man. The most easterly locality where endemic typical rhynchophorids are known to occur in the mid-Pacific is Samoa where there are endemic species of *Diathetes*. (I consider the Dryophthorini and certain other groups to be atypical Rhynchophorinae). West of Samoa the subfamily becomes increasingly rich and diversified. There are multitudes of genera and species from Papua to India, and it is in the Indo-Pacific where the subfamily is most abundant. Figure 2 demonstrates the comparative faunistic developments of the typical rhynchophorids.

I am indebted to the British Museum (Natural History) for allowing me extensive use of the unsurpassed facilities of the Entomology Department and libraries and to the Museum of Comparative Zoology, Harvard University, for use of the library. Photographs 22 and 26 are from the British Museum (Natural History), and all of the other photographs were generously prepared by my friend Dr David Kissinger.

LIST OF THE RHYNCHOPHORINAE OF SOUTHEASTERN POLYNESIA

DRYOPHTHORINI

1. *Dryophthorus rapaae* Zimmerman, n. sp. Rapa; endemic.

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1. Rhynchophora of Southeastern Polynesia, part 15.
2. This is part 16 of a series of reports resulting from the project "Pacific Island Weevil Studies" made possible by National Science Foundation Grant G-18933, which I gratefully acknowledge.

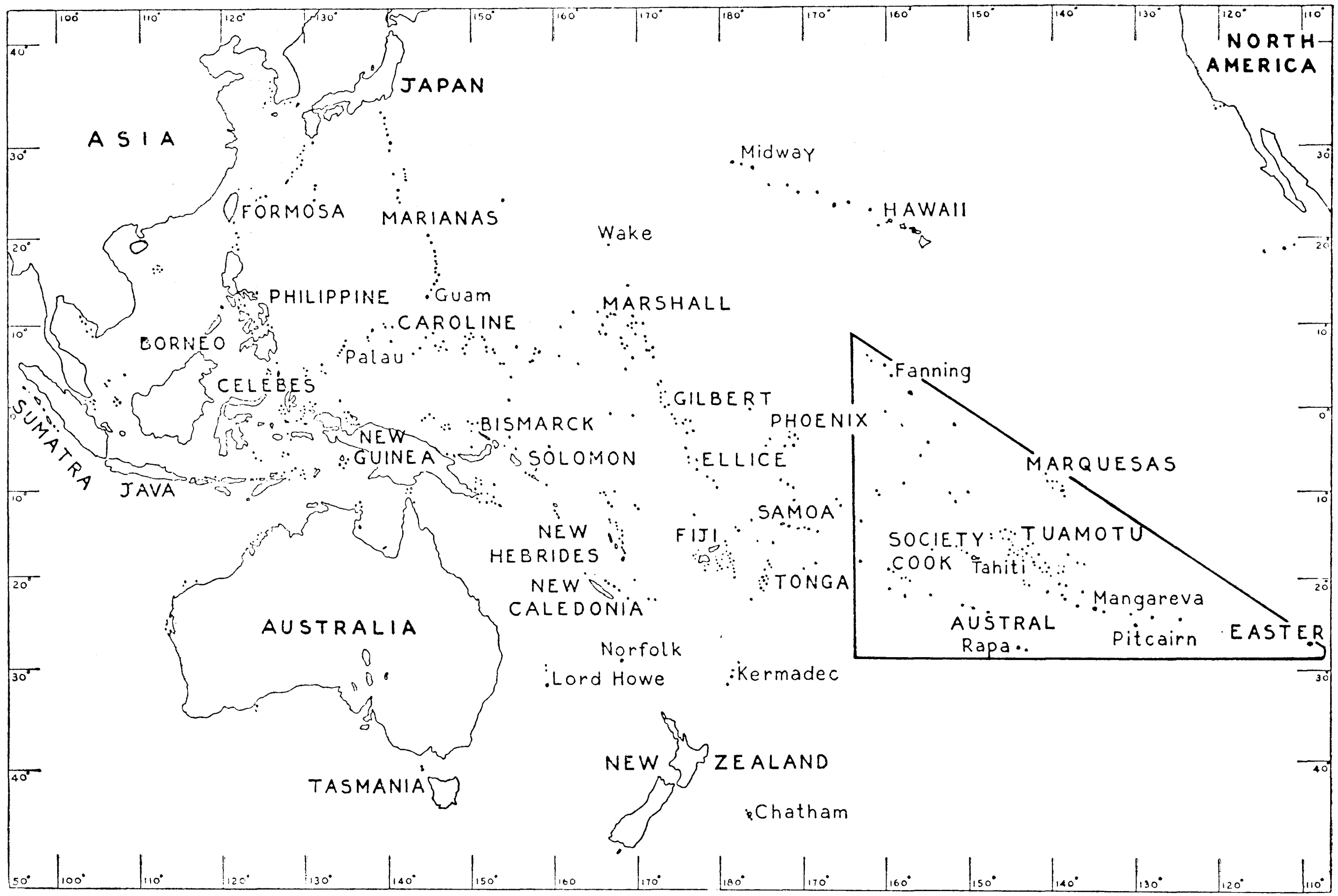

Fig. 1. Map of the Pacific showing the southeastern Polynesian triangle.

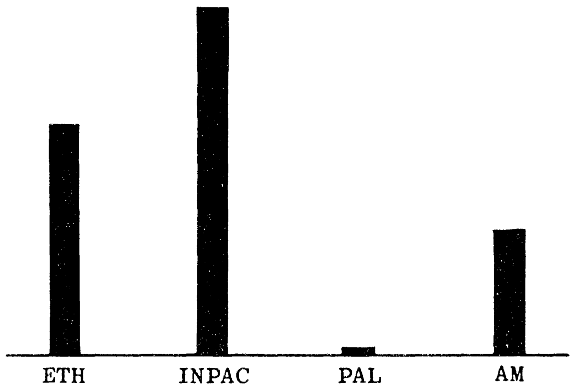

Fig. 2. A graph demonstrating the comparative generic representation of the typical Rhynchophorinae in the major faunistic regions. ETH=Ethiopian, 39 genera. INPAC=Indo-Pacific, 59 genera. PAL=Palearctic, 1 genus. AM=America, 21 genera. (Data modified from *Coleopterorum Catalogus.*)

2. *Dryophthorus perahuae* Zimmerman, n. sp. Rapa ; endemic.
3. *Stenommatus musae* Marshall. Society Islands; widespread in the Pacific.

Rhynchophorini

Sphenophorina

4. *Rhabdoscelus obscurus* (Boisduval). Society, Austral, Gambier and Marquesas Islands ; widespread in the Pacific.
5. *Cosmopolites sordidus* (Germar). Society and Marquesas Islands ; nearly tropicopolitan.
6. *Polytus mellerborgi* (Boheman). Society, Marquesas, Gambier and Pitcairn Islands ; nearly tropicopolitan.

Sitophilina

7. *Diocalandra taitense* (Guérin-Méneville). Line, Society, Tuamotu and Marquesas Islands ; widespread in the central Pacific.
8. *Sitophilus linearis* (Herbst). Society Islands ; nearly tropicopolitan.
9. *Sitophilus oryzae* (Linnaeus). Society Islands ; nearly cosmopolitan.
10. *Sitophilus zeamais* (Motschulsky). Society Islands ; nearly cosmopolitan.

Key to genera of Rhynchophorinae found in Southeastern Polynesia

A. Key to Adults

1. Antennal funicle 4-segmented ; pygidium normally almost concealed, but if exposed it displays a single, medial, conspicuous sulcus which extends from base to apex ; the true 4th tarsal segment ("cryptotarsite") more strongly developed than normal for Curculionidae and tarsi distinctly 5-segmented ; scutellum concealed ; metepisternum

concealed beneath elytra..(Dryophthorini)......2

Antennal funicle 6-segmented; pygidium always strongly exposed, never with a single medial sulcus that extends to apex but at most with a sulcus (appearing double) at extreme base only (as seen in normal position); the true 4th tarsal segment small and inconspicuous, enclosed within the 3rd segment (never projecting beyond 3rd segment) and tarsi thus appearing 4-segmented; scutellum and metepisternum conspicuously exposed..(Rhynchophorini)... 3

2 (1). Rostrum stout, much shorter than pronotum; lower edges of eyes distant from pronotum and widely separated beneath... **Dryophthorus**

Rostrum comparatively slender, about as long as pronotum; lower edges of eyes very close together or contiguous beneath and there normally hidden beneath edge of prosternum; minute species about 2 mm long... **Stenommatus**

3 (1). Antennal scrobe with a posterior vertical extension that extends ventrad in front of eyes ....(Sitophilina)... 4

Antennal scrobe entirely horizontal..(Sphenophorina)... 5

4 (3). Pygidium with a dorsal, basal, medial sulcus containing a narrow carina (usually easily seen extending a short distance caudad of apices of elytra when pygidium is in normal retracted position at rest and very prominent beneath elytra or when pygidium is extended, and because of the included carina it may appear as a double sulcus); setae scattered over surface of pygidium and not forming prominent lines; mesocoxae more narrowly separated than procoxae; ventrite 1 shorter at its narrowest point behind metacoxa than ventrite 2... **Sitophilus**

Pygidium without such a sulcus and with erect setae forming a median crest and a line at each side behind middle; mesocoxae more distantly separated than procoxae; ventrite 1, at its narrowest point behind metacoxa, distinctly longer than ventrite 2.. **Diocalandra**

5 (3). Tibiae uncinate and mucronate, the mucrones strong; claw segment of tarsus with articulating cavities opening mesally into one another and claws basally approximate; length, excluding head and rostrum, less than 5.0 mm............................. **Polytus**

Tibiae uncinate only, mucrones obsolete; tarsal claw segment with sclerotized extensions from dorsum and venter which curve around apex of segment thus enclosing it and distinctly separating the bases of the claws; length, excluding head and rostrum, over 7.0 mm 6

6 (5). Third tarsal segment hardly broader than 2nd, and 4th segment inserted in it *distad* of middle; scutellum expanding caudad; distal setose part of antennal club broadly cone-shaped; hind femora reaching behind elytra to apex of pygidium...**Cosmopolites**

Third tarsal segment much broader than 2nd, more than 2 or 3× as broad, and 4th segment inserted *basad* of its middle; scutellum narrowing caudad; distal setose part of antennal club V-shaped in cross section; hind femora not reaching apex of elytra.. **Rhabdoscelus**

B. Key to Larvae

1. Caudal (9th) abdominal segment with a pair of fleshy processes; posterior pair of setae on postmentum separated subequally to middle pair of setae; frons with only 4 pairs of setae; meso- and metathoracic postdorsa with only 2 setae; spiracles on middle abdominal segments minute, hardly discernible, non-functional.................
....(Dryophthorini)... 2

Caudal (9th) abdominal segment without fleshy processes; posterior pair of setae on postmentum separated by less than 1/2 the distance separating the middle pairs of setae; frons with 5 pairs of setae; meso- and metathoracic postdorsa with 3 or 4 setae; spiracles on middle abdominal segments all distinct and well developed .... (Rhynchophorini)... 3

2 (1). Head with frontal setae 4 and 5 long and subequal; inner surface of mandible with a granular area; abdomen with functional spiracle on segment 8 only; length of mature larva greater than 3.0 mm .... **Dryophthorus**

Head with frontal setae 4 and 5 unequal, 4 minute, 5 long; without a granular area on inner surface of mandible; abdomen with functional spiracles on segments 1 and 8; length of mature larva less than 2.75 mm..................................... **Stenommatus**

3 (1). Epipharynx with 2 simple anterolateral setae; sensilla on epipharynx very small, peg-like; postdorsum of meso- and metathorax with 3 setae; larvae small, subglobular, infesting seeds and cereals .... **Sitophilus**

Epipharynx with 3 or more anterolateral setae, some of these setae branched; sensilla on epipharynx developed as pores; postdorsum of meso- and metathorax with four setae; larvae infesting banana, palms, sugarcane and other grasses..................... 4

4 (3). Abdominal segments 1 to 7 without discernible spiracles (*Polytus*) or the spiracles very small, without discernible air tubes (*Cosmopolites*); seta on epipleurum of metathorax distinctly shorter than on epipleurum of mesothorax................................... 5

Abdominal segments with spiracles present, occasionally small, but air tubes are well developed; seta on epipleurum of metathorax subequal in length to that on epipleurum of mesothorax 6

5 (4). Abdominal segments 1 to 7 without discernible spiracles; thoracic spiracle not curved, the air tubes distinctly longer than subtriangular peritreme; typical abdominal segments with 4 postdorsal setae .... **Polytus**

Abdominal segments 1 to 7 with small spiracles but without air tubes; thoracic spiracles elongate, curved, the air tubes approximately 1/5 as long as peritreme; typical abdominal segments with 3 postdorsal setae...**Cosmopolites**

6 (4). Asperites absent laterad to rods on epipharynx; accessory sensory pores of epipharynx situated between the rods .... **Diocalandra**

Asperites present and distinct laterally on epipharynx; accessory sensory pores of epipharynx not situated between the labral rods, nearly always clearly outside the rods .... **Rhabdoscelus**

The foregoing key to the larvae was constructed largely by abstracting pertinent details from Anderson, 1948, with additions.

Tribe DRYOPHTHORINI (Schoenherr)

Mecorhynchi Divisio *Dryophthorides* Schoenherr, 1826: 24, 332; 1838: 1088 (Schoenherr gave the group a status equivalent to the Rhynchophorinae and Cossoninae).
Calandrides (including the *Dryophthorides*), Jekel, 1864: 540.
Cossonides group 1. *Dryophthorides*, Fairmaire, 1866: 321.
Cossonides subfamily *Dryophthorides*, Wollaston, 1873: 434, 441.
Cossoninae tribe *Dryophthorini* group *Dryophthori*, LeConte, 1876: 335.
Cossonini subtribe *Dryophthori*, Csiki, 1936: 110; world catalogue.
Dryophthorinae, of authors

The distinctive Dryophthorini have for long been associated with the Cossoninae, but they appear more nearly related to the Rhynchophorinae. The mouthparts are of the rhynchophorid type and are distinct from those of the Cossoninae. The structure of the legs is basically rhynchophorid, in spite of the fact that the fourth tarsal segment is clearly exposed and the tarsi are thus more obviously five-segmented than is usual in most

Curculionidae, but the narrow tarsi are distinct from most Rhynchophorinae. The hidden scutellum and metepisternum are highly unusual in winged Curculionidae. If the Dryophthorini are not considered a tribe of the Rhynchophorinae, then they probably should be given subfamily status between the Cossoninae and the Rhynchophorinae, but the relationships appear more accurately demonstrated by including the group as a tribe of the Rhynchophorinae. It is, however, an isolated assemblage and sharply distinct from the typical bulk of the Rhynchophorinae. As long as a century ago, Jekel (1864: 540) included the group in the "Calandrides." Some workers have considered the Dryophthorini and the Stromboscerini to be the same, but although they superficially resemble each other, I now consider them as separate tribes. The obliquely truncated antennal club of the Stromboscerini is a character that easily separates the groups (the apex of the antennal club in the Dryophthorini is rounded or conical). If it were demonstrated that only one tribe is involved, than the name Dryophthorini must be used, because it has priority. Any detailed study of these groups should include also the Sipalini.

Genus **Dryophthorus** Schoenherr

Dryophthorus Schoenherr, 1826: 332.—Fairmaire, 1866: 322. Type-species (*Lixus lymexylon* Fabricius)=*Curculio corticalis* Paykull, by original designation and monotypy.

Tetratemnus Wollaston, 1873: 9. Type-species: *Tetratemnus sculpturatus* Wollaston, by monotypy. Synonymy by Konishi, 1963: 124.

Tetraspartus Pascoe, 1885: 309. Type-species: *Tetraspartus bagoides* Pascoe, by monotypy. Synonymy by Voss, 1963: 219.

More than 40 species have been assigned to *Dryophthorus* from Europe, North and Central America, Madagascar, Seychelles, Ceylon, Java, Japan, New Zealand, New Guinea, New Caledonia and Hawaii. Some of the species may not belong to this genus. The greatest known center of development is in Hawaii where 17 species have been described, and they are a common element of the endemic Hawaiian fauna. Only one species is recorded from Europe, only one from North America and there is a scattering of species elsewhere. There are probably numerous species awaiting discovery in the Indo-Malayan provinces, and there are several new species before me from various Pacific islands. I was surprised not to have discovered more species of this interesting group on the more than 50 islands of southeastern Polynesia where I collected intensively in 1934, but, in spite of careful search, I found the genus only on the wonderful southern island of Rapa. I should expect, however, that species may yet be discovered in the Society Islands. None were found by any of the several workers who spent much time and careful work in the extensive surveys of the Marquesas. The weevils are winged; they inhabit dead wood and appear very tolerant of wet conditions. It would appear that the genus would be widely spread in the high Pacific islands. It is difficult to explain why the group has flourished in Hawaii but is so scarce elsewhere in Polynesia.

Dryophthorus rapaae Zimmerman, new species Fig. 3, 4, 10, 11, 14–17.

Derm mostly piceous black with apex of rostrum, antennae and legs dark castaneous; incrustation variable, quite thick on parts of some examples, white to pale yellowish; dorsum without tufts or patches of pubescence.

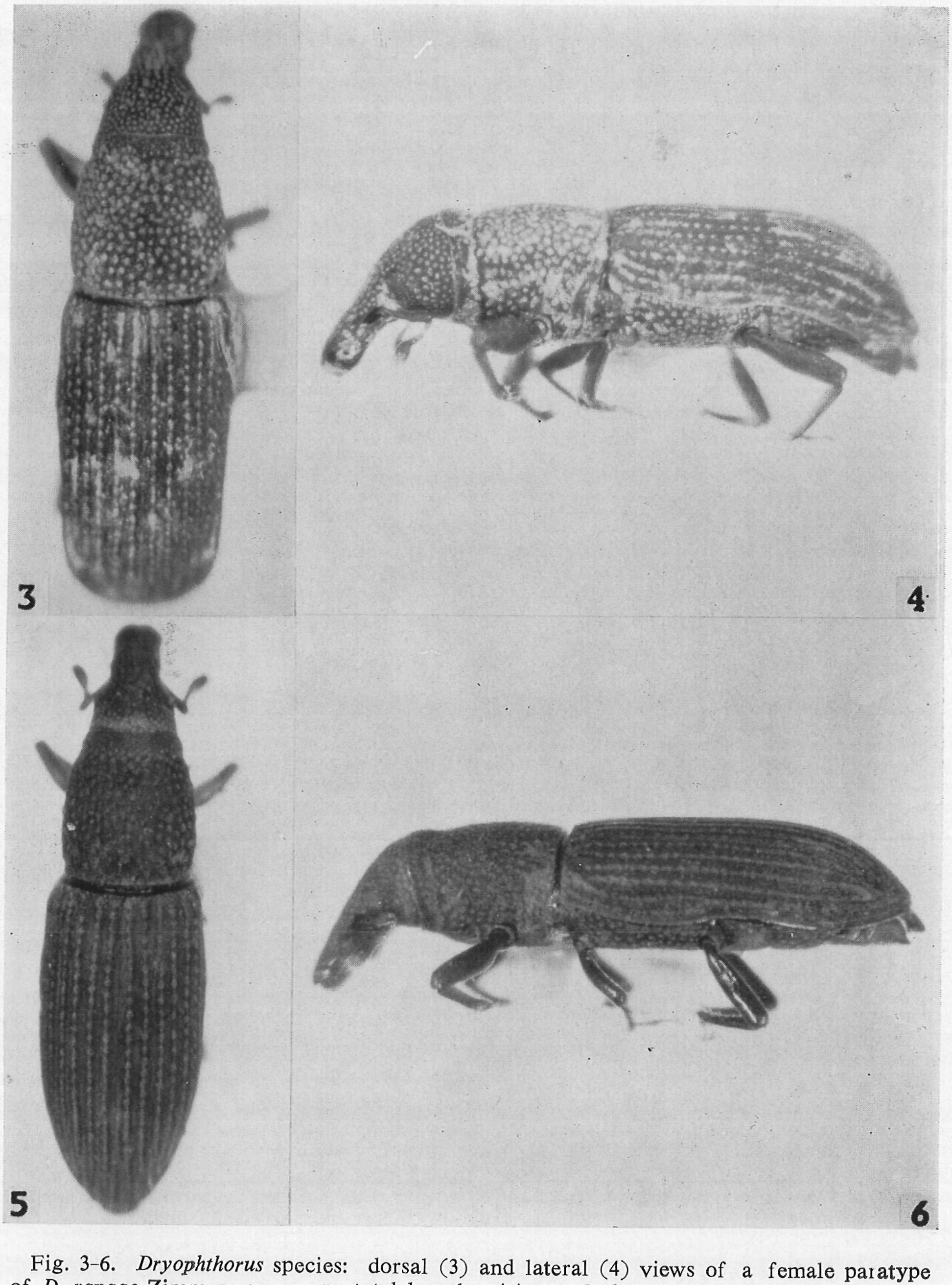

Fig. 3–6. *Dryophthorus* species: dorsal (3) and lateral (4) views of a female paratype of *D. rapaae* Zimmerman, n. sp., total length: 4.4 mm. 5, dorsal and 6, lateral views of a female paratype of *D. perahuae* Zimmerman, n. sp., total length: 4.0 mm.

Head with punctuation moderately coarse on crown, coarse between eyes, punctures mostly separated by intervals about equal to their diameters, closer between eyes, and there some punctures may anastomose; a variable, usually quite conspicuous, depressed area between eyes extending on to base of rostrum; base of crown with some inconspicuous microscopic granules on intervals between some punctures; setae in punctures very fine and inconspicuous; eyes continuous with contour of head, 6 facets broad at widest part and subequal in height to distance from front margin of eye and shiny apical area of rostrum, as seen from side. *Rostrum*, viewed from front or above, with sides moderately concave from scrobes to apex; distal margin distinctly emarginate at middle and shallowly concave laterad of emargination; shiny apical area with minute punctures; remainder of dorsum of rostrum coarsely and in part confluently punctured and in part more coarsely punctured than front of head. *Antennae* with scape somewhat longer than funicle plus club, microsculpture making most of scape mat; funicle with segment 1 ovate, about 2/3 as long as broad, about as long as segment 2 + 1/2 of 4; segment 3 subquadrate; segment 4 moderately transverse; segments 1+2 fully 2× as long as 3+4; club about 2/3 as broad as long, as long as the 4 funicular segments combined and the apical setose section about 1/4 as long as basal shiny section which is as long as funicular segments 4 to 2 + about 1/3 of 1.

Prothorax without obvious pubescence; length and breadth subequal; subapical; constriction moderate, expanding into a conspicuous, shallowly impressed, median area centered at about apical 3/4, and dorsum also with a shallow impression at middle of each side of disc (variably impressed and indistinct on some specimens, rather strong on others), longitudinal dorsal contour, as seen from side, evenly, gently arcuate from base to subapical constriction; without any indication of a median line; punctures on dorsum individually discrete, moderately coarse, mostly separated by distances subequal to their diameters on disc; setae borne by punctures inconspicuous; microsculpture of intervals very fine and similar to that of elytra. *Elytra* subparallel-sided, shaped as illustrated, somewhat less than 2× as long as broad, broadest near basal 1/3; base subtruncate; striae well impressed, their punctures mostly somewhat smaller than those on pronotum and separated by distance 1.5 to 2× their diameters, their setae small, very fine and inconspicuous; stria 10 obsolete between a point above metacoxa to apex of ventrite 2; stria 7 and 8 apically joined and terminating at a point above ventrites 3 and 4; intervals moderately convex, including those on disc, but with interval 7 strongly elevated and explanate on declivity from above apex of ventrite 1 to suture and the explanate area conspicuously visible from above; interval 11 very narrow at suture behind the raised interval 7; intervals without pubsecence or elevations, their setae minute and fleck-like and microsculpture very fine and similar to that on pronotum. *Sternum* with prosternum obviously convex or tumescent, punctures rather similar in middle to those on pronotum, the posterior intercoxal process impressed but without punctures; intercoxal process of mesosternum apically distinctly arcuate; metasternum with punctures on disc smaller and more widely separated than those of prosternum, but those on sides similar to those of prosternum; setae minute and inconspicuous; procoxae separated by 1/2 transverse diameter of a procoxa; mesocoxae slightly more widely separated than procoxae; metacoxae separated by 2× the distance between procoxae and about 2/3 transverse diameter of a metacoxa. *Legs* moderate, rather slender, fore femora length/width index 2.68, hind femora 3.43; microsculpture, although very fine, conspicuous; punctures sparse and shallow, setae sparse and fine. *Venter* with microsculpture as on dorsum, with punctures on ventrites 1 and 2 rather similar to those on metasternum; punctures on ventrites 3 and 4 mostly inconspicuous; punctures on basal half of ventrite 5 larger and coarser than those on 1 and 2 and with a distinct, broad impression on either side.

Length (excluding head and rostrum): 3.2–3.8 mm; breadth: 1.0–1.3 mm.

RAPA ISLAND. Holotype ♀ (BISHOP 7558), 15 paratypes and 1 damaged specimen collected from a rotten stump of an unidentified tree at Maitua, about 200 m elevation, 10.VII.1934; 1 paratype taken from a dead branch of *Homolanthus* at Maitua, about 230 m elevation, 2.VII.1934; 1 paratype taken from beneath a dead limb on the northeast ridge of Mangaoa Peak, 325 m elevation, 6.VII.1934; 1 paratype collected from a rotten stump of *Meryta choristantha* ("Puru") on the south slope of Mt Tepiahu, about 150 m elevation, 20.VII.1934; 4 paratypes taken from dead "Puru" wood on the northwest slopes of

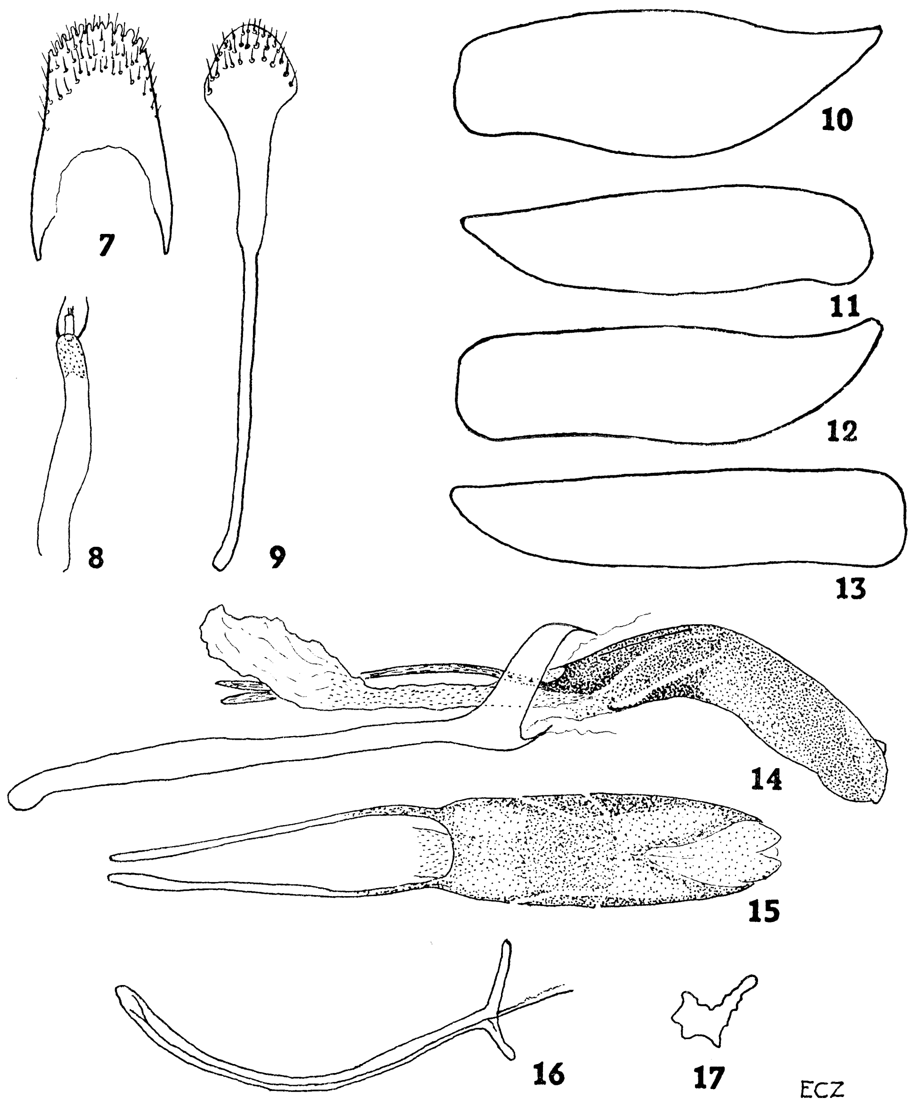

Fig. 7–17. Details of *Dryophthorus*. 7, 8 and 9 are from a female paratype of *D. perahuae*: 7, tergite 8; 8, one lobe of ovipositor; 9, 8th sternite. 10–11, pro- and metafemora of *D. rapaae*. 12–13, pro- and metafemora of *D. perahuae*. 14–17, details from a male *D. rapaae*: 14, lateral and 15, dorsal views of aedeagus and associated structures (only part of the internal sac is shown on 15); 16, ninth sternite ("spiculum ventrale" or "urosternite"); 17, a direct caudal view of the sclerotized "rectal ring" drawn from a specimen broken away from the caudal part of the rectum at the "ring".

Mt Tautautu, at about 230 m elevation, 9.VII.1934; 3 paratypes collected from a rotten stump of "Puru" on the south slope of Mt Tepiahu at about 150 m elevation, 20.VII.1934. All of the specimens were collected by me.

This species is closely similar and closely allied to its Rapan associate *perahuae* described here. It has the appearance of being a somewhat proportionately broader species, but this is largely because of the conspicuously explanate posterior part of the seventh elytral interval on this species and its comparatively feeble development on *perahuae*. The species are easily distinguished by this character.

The 2 Rapa species bear some resemblance to some of the Hawaiian species, such as *distinguendus* which also has the 7th elytral interval elevated.

The female 8th tergite, urosternite (sternite 8) and lobes of the ovipositor ("coxites") appear so closely similar to those of *perahuae* that I have illustrated those parts of *perahuae* only.

Dryophthorus perahuae Zimmerman, new species Fig. 5, 6, 7–9, 12, 13.

Derm mostly black with apex of rostrum, antennae and legs castaneus; incrustation on head, thorax and elytra thin, yellowish-brown to reddish-brown; dorsum without any tufts or patches of pubescence.

Head with puncturation moderate, punctures individually discrete, mostly separated by distances about equal to the diameters of the punctures; with a variable depressed area between eyes extending on to base of rostrum (feebly developed in some specimens); base of crown (when not concealed beneath pronotum) with minute, shiny granules between the punctures; setae in punctures very fine and inconspicuous; eyes continuous with contours of head, 6 facets broad at widest part, height somewhat more than 2.5× as great as greatest breadth and subequal to distance between front of eye and shiny apical area of rostrum as seen from side. *Rostrum*, viewed from front or above, with outline of sides moderately strongly concave from scrobes to apex; distal margin conspicuously emarginate at middle and shallowly concave laterad of emargination; shiny apical area with minute punctures and remainder of dorsum of rostrum sculptured as on front of head. *Antenna* with scape a little longer than funicle plus club; funicle with segment 1 elongate ovate, about 1/3 longer than broad, subequal in length to segments 2+3; segment 2 sub-V-shaped, about as broad as long; segment 3 subquadrate; segment 4 moderately transverse; segments 1+2 longer than 3+4 (as about 10 : 7); club about 2× as long as broad, equal in length to entire funicle, the basal shiny section about 4× as long as apical setose section, and the shiny section subequal in length to funicular segments 4 to 2 + about 1/3 of 1.

Prothorax without obvious pubescence; only slightly longer than broad; subapical constriction moderate; dorsum with a variable, broad, shallow, median depression in anterior 1/2 or less; disc otherwise gently convex (1 specimen has a shallow impression in front of each posterolateral corner of pronotum); without any indication of a median line; punctures on disc mostly separated by intervals subequal to or a little larger than those of elytral striae; intervals between punctures with very fine microsculpture similar to that on elytra; punctures shiny when incrustation is removed; setae borne by punctures fine and inconspicuous. *Elytra* subparallel-sided, shaped as illustrated, about 2× as long as broad, broadest somewhat cephalad of middle; base subtruncate; striae mostly rather shallowly impressed, their punctures mostly rather similar to or somewhat smaller than those on disc of pronotum, mostly separated on disc by distances about 2× their diameters; stria 10 obsolete between metacoxa and caudal margin of ventrite 2; striae 7 and 8 terminating and joined at a point above ventrite 4; intervals without protuberances, without pubescence, gently convex, those on disc nearly flat but with interval 7 more strongly elevated and moderately cariniform from a point above apex of ventrite 2 and curved around elytral apex to join interval 1 (the cariniform part of interval 7 is not conspicuous from above); interval 11 continues around extreme apex to suture; setae of strial punctures very fine and difficult to see; setae on intervals minute, fleck-like; microsculpture microscopic as on pronotum. *Sternum* with prosternum coarsely and closely punctured on disc cephalad of coxae and there gently convex, impunctate on posterior intercoxal process; intercoxal process of mesosternum hardly arcuate on caudal margin, subtruncate; metasternum with punctures on disc smaller and more widely separated than those on prosternum; setae minute and inconspicuous; procoxae separated by very little more than 1/2 breadth of a procoxa; distance between mesocoxae a little greater than that between procoxae; metacoxae separated by twice the distance between procoxae, or a little more, and about 2/3 of a transverse diameter of a metacoxa. *Legs* comparatively slender for the genus, front femur length/breadth index 3.28, hind femur 4.16; although with microsculpture, the derm is shiny; punctures on femora and tibiae mostly rather sparse and shallow; setae fine, sparse. *Venter* with microsculpture as on dorsum, with punctures on ventrites 1 and 2 similar to those on metasternum; punctures on ventrites 3 and 4 shallow and mostly inconspicuous; ventrite 5 with much coarser and denser punctures on basal 1/2 than on ventrites 1 and 2, and with a large, broad, conspicuous, shallow impression on each side.

Length (excluding head and rostrum): 3.2–3.4 mm; breadth: 1.1–1.2 mm.

RAPA ISLAND. Holotype ♀ (BISHOP 7559) and 3♀ paratypes collected on the east ridge of Mt Perahu, about 500 m elevation, 28.VII.1934, in the tissues of dead *Cyathea* tree fern fronds, and 1♀ paratype collected on 13.VII.1934, at about 400 m elevation at the same locality and from the same host. All of the specimens were collected by me.

This species is closely similar to *rapaae*, and in addition to the less strongly elevated elytral interval 7, as noted under *rapaae* above, ventrite 2 is less tumid and its caudal margin is less produced and less precipitous, and there are other minor differences as noted in the description.

Genus **Stenommatus** Wollaston

Stenommatus Wollaston, 1873: 442, 506. Type-species: *Stenommatus fryi* Wollaston, by monotypy.

This group of small weevils contains four described species. The type-species and one other are recorded from Mexico and Central America, a third was described from India and the fourth is known only from the Pacific.

Stenommatus musae Marshall Fig. 18, 19.

Stenommatus musae Marshall, 1920: 277, pl. 7, fig. 7.—Anderson, 1948: 437, description of larva.

DISTRIBUTION: Java, Fiji, Hawaii (type locality: Honolulu), Society Islands; more widely spread in the Pacific but not yet recorded. First reported from southeastern Polynesia by Zimmerman, 1940: 288.

Host plant: *Musa* (banana). The larvae and adults are often numerous in the decaying corns.

New data: Society Is. — 1 specimen collected from *Musa* on Tahiti (without more precise locality data), 13.IX.1928 (A. M. Adamson), and 1 from dead banana leaves on Moorea at about 300 m elevation, 5 km from the sea in Faaroa Valley, 4.XII.1928 (A. M. Adamson).

This minute species is the smallest of the southeastern Polynesian Rhynchophorinae (the specimens I have seen are 2.0 mm or less in length).

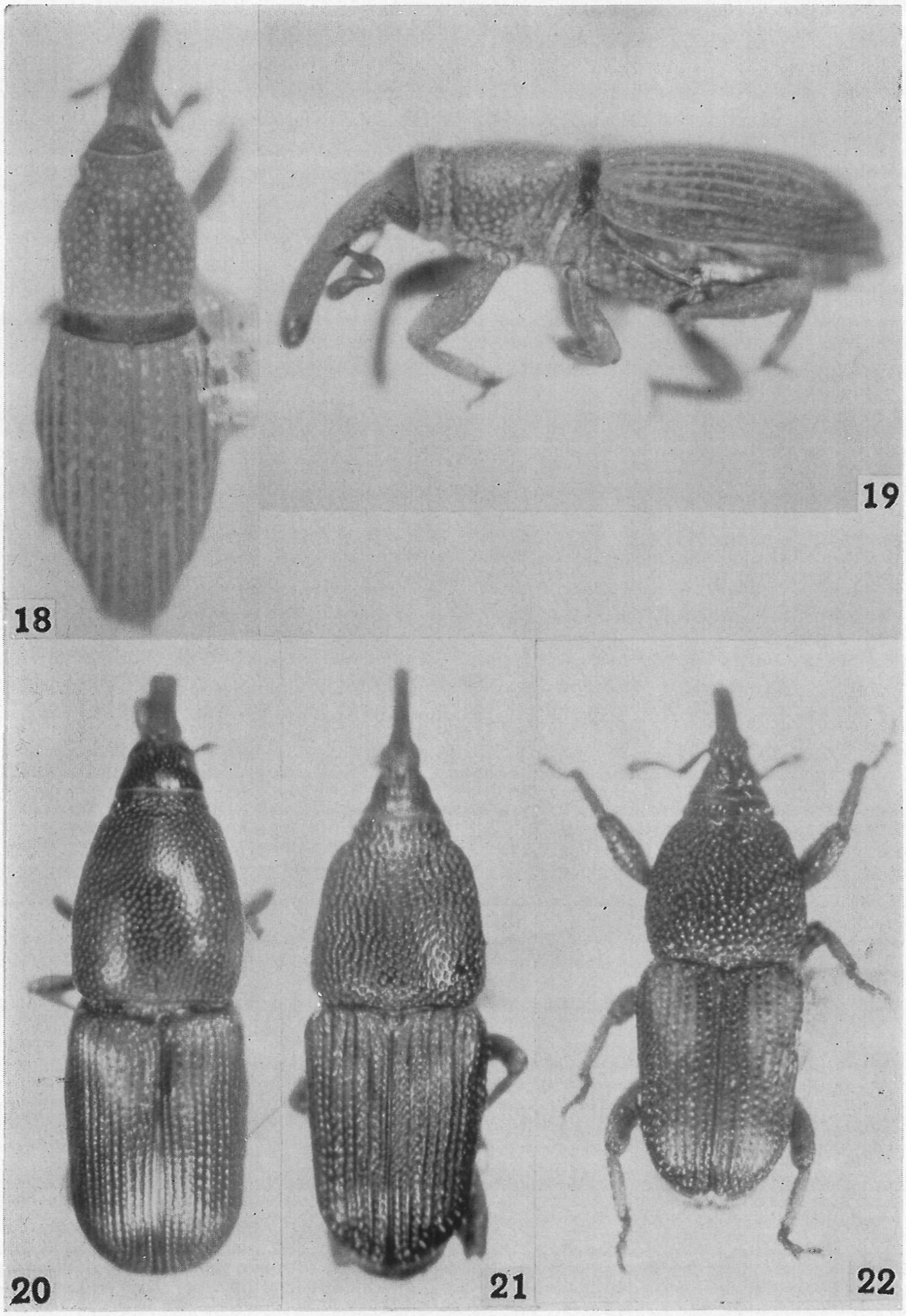

Fig. 18-22. 18, 19, Dorsal and lateral views of a female *Stenommatus musae* Marshall from Tahiti, total length: 2.1 mm. 20, *Sitophilus linearis* (Herbst), a male from Tahiti, total length 4.5 mm. 21, *Sitophilus zeamais* (Motschulsky), a female from Tahiti, total length: 4.5 mm. 22, *Sitophilus oryzae* (Linnaeus), a male from North Borneo, total length, excluding legs: 3.5 mm.

Tribe RHYNCHOPHORINI

Calandraeides Subivisio *Gymnopygi* Schoenherr, 1826: 23, 326.
Rhynchophorides Subdivisio *Gymnopygi* Schoenherr, 1838: 816.
Tribu *Calandrides* Fairmaire, 1866: 267.
Subfamily *"Calandridae"* Le Conte, 1876: 330.
Tribe *Rhynchophorini* Csiki, 1936: 8.

Subtribe SPHENOPHORINA

Sphenophorides Lacordaire, 1866: 270, 286.
Sphenophorinae Kolbe, 1899: 5.
Sphenophorini Leng, 1920: 335,
Calandri Csiki, 1936: 28.

Genus **Rhabdoscelus** Marshall

Rhabdoscelus Marshall, 1943: 119.
Rhabdocnemis Faust, 1894: 348 (mentioned but not described in 1893: 150): preoccupied by *Rhabdocnemis* Pomel, 1872, for a genus of sponge. Type-species: *Sphenophorus maculatus* Gyllenhall, by original designation.

Rhabdoscelus is a Malayan-Papuan genus of 10 or more species, of which the following has become a widely spread pest species in the Pacific.

Rhabdoscelus obscurus (Boisduval) Fig. 25, 27–30.

Calandra obscura Boisduval, 1835: 448 (type locality: New Ireland).
Sphenophorus obscurus (Boisduval): Fairmaire, 1883: 41.
Rhabdocnemis obscurus (Boisduval): Gahan, 1900: 114.
Sphenophorus insularis Boheman, 1859: 148 (type locality: Tahiti). Synonymy by Fairmaire, 1883: 41.
Sphenophorus nudicollis Kirsch, 1877: 156 (type locality: Mysore).—Faust, 1894: 200, *Rhabdoscelis*, 348, *Rhabdocnemis*.
Sphenophorus sulcipes Karsch, 1881: 11, pl. 1, fig. 16 (type locality: Marshall Islands). **New synonymy.**
Sphenophorus promissus Pascoe, 1885: 300 (type locality: New Guinea).—Faust, 1893: 150, *Rhabdocnemis*.
Sphenophorus tincturatus Pascoe, 1885: 301 (type locality: Ternate).
Sphenophorus Beccarii Pascoe, 1885: 301 (type locality: Buru).—Faust, 1893: 150, *Rhabdocnemis*; 1899: 121, as a synonym of *nudicollis*.
Sphenophorus interruptecostatus Schaufuss, 1885: 204 (type locality: Sunda Islands).—Faust, 1893: 150, 1894: 200, *Rhabdocnemis*; 1899: 121.—Heller, 1898: 34, as synonym of *tincturatus*.
Rhabdocnemis fausti Gahan, 1900: 113.—Muir and Swezey, 1916: 13, 15, as a variety of *obscurus*.
See Terry, 1907, Muir and Swezey, 1916 and Williams, 1931: 209–218, pl. 33 (col.) and 34, for a detailed account of the biology, immature stages, economic importance and control in Hawaii. Veitch, 1919, has reported on the species in Fiji. Csiki, 1936: 66–67, catalog. Anderson, 1948: 430, has described the larva.

The New Guinea Sugarcane Weevil

DISTRIBUTION: Widely spread in the Pacific from the Celebes to southeastern Polynesia, Queensland north through Micronesia to the Bonins and Hawaii, and also on Christmas Island in the Indian Ocean. Probably a native of the Papuan area and widely dispersed by man.

Host plants: Sugarcane, coconut, sago, *Areca* and other palms, occasional in other plants such as banana, papaya, maize and other grasses. It is a pest species of major importance.

New data: Society Islands—Tahiti: 1 specimen, Papeete, XI.1926. (G. P. Wilder); 1 from Papara, III.1927, from decaying coconut tree (Wilder); 1 from Lake Vaihiria, 5.V. 1927 (Wilder); 1 taken from sugarcane at Atimaono, 22.XII.1928 (Mumford and Adamson); 1 from Vaitaare, Afaahiti, 20.III.1934 (Zimmerman); 2 from a banana stump, Arue District, about 150 m elevation, (Zimmerman); 4 from a rotten papaya stump, 6.III.1934 (Zimmerman). Moorea: 3 taken from coconut, 11.I.1928 (Wilder); 11 from coconut, 20. I.1928 (Wilder); 3 taken, XII.1928 (Wilder). Raiatea: 1 taken in 1926-27 (J. W. Moore); 4 taken at Fetuna, III.1955 (N. L. H. Krauss). Austral Islands—Rurutu: 3 taken from coconut leaf stalk, elevation about 120 m, 19.I.1921 (A. M. Stokes). Raivavae: 1 found in a house, IV.1922 (Stokes); 1 from the dead fruit of *Inocarpus edulis*, near Unurau, elevation about 30 m, 3.VIII.1934 (Zimmerman). Rapa: 1 from the stem of *Erianthus* in Hiri Valley, elevation about 10 m, 28.VII.1934 (F. R. Fosberg). Gambier Islands—Mangareva: 2 from dead banana stalk, northeast slope of Mt Duff, between about 35 and 150 m elevation, 23.V.1934 (Zimmerman); 2 from dead banana, near the convent, about 100 m elevation, 24.V.1934 (Zimmerman); 3 from Rikitea, about 30 m elevation, 4.VI.1934 (Zimmerman). Akamaru: 2 from the north side, 29.V.1934 (Zimmerman). Marquesas Islands —Nukuhiva: 3 specimens from coconut, Taipivi, 20.XI.1929 (LeBronnec).

The *Erianthus* and *Inocarpus edulis* are new host plant records for this weevil. It is possible, however, that the *Inocarpus* record does not constitute a true host of the species.

This is the largest species of Rhynchophorinae known to occur in Polynesia east of Samoa. It is an extremely variable species in size, color, color pattern and facies. The size range in the 59 specimens recorded here (excluding head and rostrum) is 7.5-13.5 mm. The variability is the cause of frequent confusion in identification, and it is possible that several synonyms exist in literature in addition to those listed above. Karsch introduced a synonymous name when he re-described the species as *Sphenophorus sulcipes* from the Marshall Islands in 1881. Most unfortunately, most all of the new names created by Karsch in his 1881 paper are synonyms.

The weevil is well known as a pest of sugarcane, and its attacks are particularly serious in the softer canes. As many as 30% or more of the canes in a plantation may be attacked and the sugar crop may be reduced perhaps as much as 10% or more. It is possibly the most serious insect pest of sugarcane in the central and eastern Pacific. Details of its ravages in Hawaii have been set forth clearly in Williams' account in his 1931 handbook and by Muir and Swezey, 1916. The paper on the species in Fiji by Veitch, 1919, contains interesting details. It also frequently attacks coconut and other palms. It may become numerous in injured or sick palms, and it is frequently found in stumps of palm trunks or fronds and in areas surrounding wounds.

The mature larva is usually about 15 mm in length when it has a favorable food supply, and the fifth and sixth abdominal segments are markedly expanded ventrad. When mature, it forms a large, conspicuous cocoon from coarse fibers of the host plant. This is the only known weevil in southeastern Polynesia that makes such cocoons, and its work is thus easily determined even after the weevils have left the host plants.

The larval parasite *Microceromasia sphenophori* (Villeneuve) (Diptera: Tachinidae) has been spread widely to assist in the control of this weevil (see Muir and Swezey 1916, and Williams 1931, for an account of the fly). The larvae of some predaceous elaterid beetles, such as *Conoderus exul* (Sharp) (=*Monocrepedius*), the larvae and adults of the histerid beetle *Plaesius javanus* Erichson, and others, prey upon the larvae, as do various ants, mites, fungi and some other predators and parasites. Much searching has been done, especially by Muir and Pemberton, of the Hawaiian Sugar Planters' Experiment Station, in an effort to discover effective parasites and predators for use in the control of the weevil in sugarcane. Further studies may produce worthwhile results, especially now that air transport makes possible the swift transfer of insects from endemic areas to the laboratory and experimental locations, but satisfactory biological control of this weevil may prove exceedingly difficult.

Genus **Cosmopolites** Chevrolat

Cosmopolites Chevrolat, 1885: 289. Type-species: *Calandra sordida* Germar, by original designation and monotypy.

Only two species are listed in this genus, *pruinosus* Heller, from Borneo and the Philippines, and the following:

Cosmopolites sordidus (Germar) Fig. 23, 24.

Calandra sordida Germar, 1824: 299 (type locality: "in India orientali").

Sphenophorus striatus Fahreus, *In* Schoenherr, 1845: 251 (type locality: Brazil).—Wollaston, 1877: 336, in Madeira.

Sphenophorus cribricollis Walker, 1859: 218 (type locality: Ceylon).

Cosmopolites sordidus (Germar): Chevrolat, 1885: 289.—Zimmerman, 1942: 144, pl. 6, G.—Costa Lima, 1956: 248, fig. 205-8.

Csiki, in *Coleopterorum Catalogus*, lists *Curculio mendicus* Olivier (Madagascar) as a synonym, but this surely seems to be an error, and it would appear from Olivier's figure that the species does not even belong to this subfamily.

See Csiki, 1936: 67, for partial bibliography. For a detailed, annotated bibliography of 215 titles, see Leonard, 1931. For an account of the biology and details of the immature stages, see Moznette, 1920. Cotton, 1924: 7, and Anderson, 1948: 421, have described the larva.

The Banana Root Borer or Banana Root Weevil

DISTRIBUTION: This weevil, which evidently is of Indo-Malayan origin, has become widely spread by man to most regions of the world where bananas are grown, including North, Central and South America, Madeira, Africa and southern Asia, and it is widely dispersed through the islands of the tropical Pacific.

Host plants: *Musa* species. The records of attacks on sugarcane appear to be in error.

New data: Marquesas Islands—2 specimens from Atuona Valley, Hiva Oa, about 30 m elevation, from banana, 25.II.1929 (Mumford and Adamson); 3 specimens from Hiva Oa, from "fei" banana (*Musa paradisiaca*), 8.V.1929 (Mumford and Adamson); 27 from Hiva Oa, on banana, 13.VII.1929 (no collector mentioned, but from the Pacific Entomological Survey); 5 from Tahuata, from dead banana leaves, 28.V.1930 (LeBronnec and Tauraa). Society Islands—Tahiti: 1 without specific locality, 2.VIII.1926 (G. P. Wilder); 1 from banana corm, Papara District, XII.1926 (Wilder); 1 from the same place, 10.II.1927 (Wilder); 16 from rotten banana stalk Fautaua Valley, 7.III.1934 (Zimmerman); 5 from banana stalk, Arue District, about 500-600 m elevation, 9.IV.1934 (Zimmerman), 2 from a dead stalk of a " fei " banana, Apirimaue Valley, Tiupi Bay, Papeari, 4.V.1934 (Zimmerman). Moorea: 3 specimens without specific locality 20.I.1925 (Wilder). Raitatea: 1 without additional locality, 1926-27 (J. W, Moore).

Predators: The large histerid beetle, *Plaesius javanus* Erichson, is a predator on the larvae of this weevil, and it has been introduced to many areas inhabited by the weevil. I do not have a detailed listing of the localities to which the predator has been introduced in Polynesia. The larvae of certain hydrophilid beetles also prey upon the weevil larvae.

Control: Whalley (1957) has reported upon his studies of the weevil in Uganda, East Africa, and he stated that "Almost 100 per cent clearance of plantations has been obtained over a two/three-month period with one application of dieldrin 0.5 dust." Whalley recommends shaking the dust into the banana stools about the bases of the pseudostems and dusting the split surfaces of discarded rhizomes and pseudostems and placing these, dusted side down, as traps scattered about the banana plantation. He suggested that two or three applications of dust per year will control the weevil, and he reports that reinfestation of treated plots is slow with the highest rate of reinfestation occurring in the rainy season. The weevils appear to be normally unusually sedentary. Whalley found that "Of 400 marked weevils released at one point in the plantation, 35 per cent were recovered over an eight-month period within a radius of ten yards of the original release point." See also Harris, 1947.

Moznette, 1920, published a valuable account of the species as he studied it in Florida, USA and the following details are abstracted from his report:

"The young suckers attacked by the borers wither and die in a very short space of time. This is due to the feeding and tunneling of the grubs or larvae between the lateral roots and the bulb ... An indication that a young plant is infested is the withering and drying of the curled roll of unopened leaves or growing part of the plant. The root, upon examination, is found to be riddled with the larvae of this insect and when cut open discloses the borer *in situ*. The adult weevils are abundant in soil about the root and also are found under loose fiber surrounding the base of the stem, at the crown. They also congregate in the cavities caused by the larvae at the base of the bulb of the banana plant. In the planting at Larkins, Fla., where the infestation was first found, the writer collected 55 adults at the base of one plant and as many as 50 larvae and pupae in the bulb. The older plants infested appeared tall and spindling and no doubt succeeded in growing as much as they did by the presence of numerous lateral roots surrounding the bulbs of the plants and because the attacks of the insects had been gradual. Most of the bananas in the planting were old and so riddled by the larvae as to be readily felled. After feeding thoroughly on the plant the weevils will abandon it for another ...

"The female beetle having been fertilized enters between a leaf sheath and the stem and selects a spot for the deposition of an egg. The beetle than prepares a small cavity by means of the powerful mandibles...After having completed the cavity the beetle reverses its position and with the aid of the ovipositor deposits a single egg in the prepared place (fig. 1). On February 9, 1918, many eggs were observed which were laid

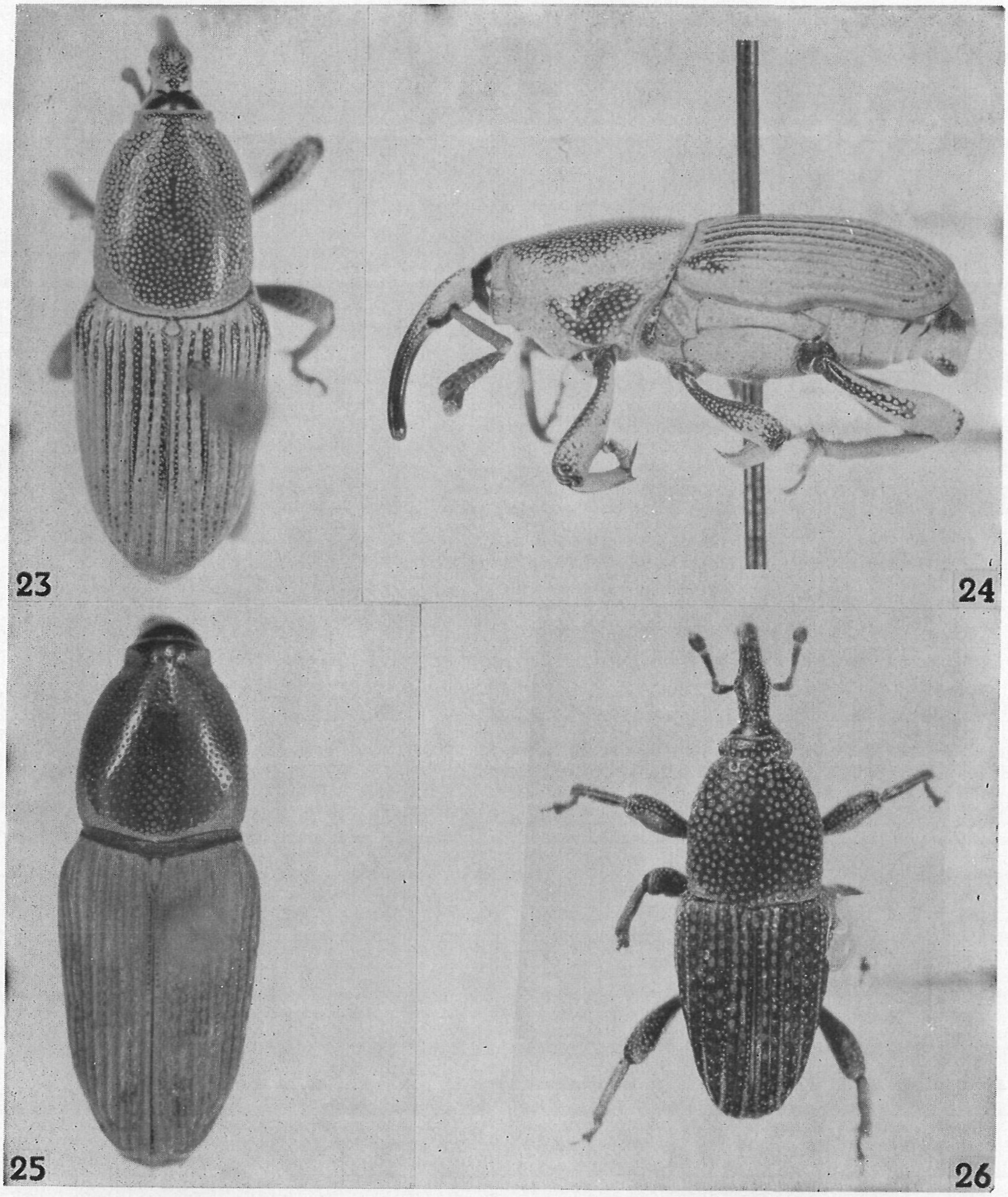

Fig. 23–26. 23, 24, Dorsal and lateral views of *Cosmopolites sordidus* (Germar), Hiva Oa, Marquesas Islands, total length: 12.5 mm; this specimen has the pale "varnish" intact. 25, *Rhabdoscelus obscurus* (Boisduval), Nukuhiva, Marquesas Islands, length: 11.5 mm. 26, *Polytus mellerborgi* (Boheman), one of the original specimens collected near Honolulu, Hawaii, by Thomas Blackburn and described by Sharp in 1885 as *Calandra remota*; length 5.1 mm.

apparently a short time previously in the tissues, usually in the small compartments in the sheaths or stem. A few eggs were even found laid loosely in the slightly decayed leaf sheaths close to the healthy fleshy banana bulb, from which place they entered the bulb. The eggs, for the most part, are deposited singly in the sheaths near the crown at the surface of the soil. In hatching, the egg does not completely collapse. The larvae eat their way in all directions in the bulb, and one can easily trace a channel as it gradually grows wider, terminating in a pouch near the outer surface in which the larva pupates on reaching maturity...

"From a few experiments the egg period was found to last from 5 to 7 days. From the character of the channels of the grubs it is the opinion of the writer that the eggs are deposited in the outer sheaths or between the outer sheath and the stem, the grubs working their way into the body of the bulb or trunk. The work of the larvae is particularly destructive, since they girdle the plant in the immediate vicinity of the lateral roots put out from the bulb of the plant (Pl. 11, A), thus cutting off the passage of the sap. The larvae not only work frequently in this region just described but may be found tunneling into the main trunk as far as the heartwood. The larvae usually work below ground, but in a number of instances the writer has found them in the trunk as high as 2 feet above ground. The larval stage was found to last over a period of from 15 to 20 days...

"The larvae upon attaining maturity construct an oval space at the end of the burrows, usually well toward the outer layers, where the larval [skin] is cast, and where the larva pupates. The pupae are naked. Jepson found in Fiji that a period of from 5 to 8 days from the time of pupation elapses before the emergence of the adult. The adults bear wings and are very sluggish. When disturbed they will "play" 'possum" for a considerable length of time. The adults are gregarious and were found in clusters in cavities and depressions in the outer sheaths of the banana close to the surface of the ground and also below the surface. The length of life of the adult is not known. The writer has kept them in captivity without food for two months. Jepson in Fiji has kept the beetles in captivity about 14 weeks without food, and in the state of nature they undoubtedly will live longer. In all probability the banana root-borer continues to breed all the year round, provided that the food supply is plentiful. The beetles are nocturnal, only coming up from the soil at night for their activities above ground."

For more information on this pest of bananas, one may consult the publications listed in the Leonard bibliography cited above.

Genus **Polytus** Faust

Polytus Faust, 1894: 353. Type-species: *Sitophilus mellerborgii* Boheman, by monotypy.

This genus has long been associated in literature with the Sitophilina, but its placement in that group may have resulted from the use of convergent characters. It appears that it might better be placed with the Sphenophorina. The suprageneric classification of the Rhynchophorinae is in a state of uncertainty and is in need of prolonged and detailed study. It is significant that Anderson separated the genera widely in his 1948 study of the larvae, and the biologies of *Polytus* and *Sitophilus* differ greatly.

As now constituted, *Polytus* contains only the following widespread species:

Polytus mellerborgii (Boheman) Fig. 26.

Sitophilus Mellerborgii Boheman, in Schoenherr, 1838: 976 (type locality: Java).
Calandra Mellenborgi (misspelling): Gemminger and Harold, 1871: 2653.
Polytus Mellenborgi (misspelling): Faust, 1894: 353.—Hustache, 1924: 503.
Calandra remota Sharp, 1885: 183, 254 (type locality: near Honolulu, Hawaii).—Perkins, 1900: 139.
Sphenophorus musaecola Fairmaire, 1898: 489 (type locality: "Ile Maurice", Madagascar).
Polytus mellerborgi (Boheman): Champion, 1914: 493.—Illingworth, 1924: 375.—Csiki, 1936: 71.
Anderson, 1948: 422, description of larva.

DISTRIBUTION: This species, a native of Indo-Malaya, has become widely spread by commerce and is now present over much of the tropical world where bananas are grown from southeastern Polynesia through Melanesia, Micronesia, Indo-Malaya, south China, Burma, India, Ceylon, islands of the Indian Ocean to Madagascar. It is also established in Mexico and Central America.

Host plant: It bores in the decaying corms and stalks of banana.

New data: Marquesas Islands—Ua Pou: 15 specimens taken from banana, 10.XII.1929 (R. Whitten) and 10 specimens with the same data (Mumford and Adamson). Gambier Islands—Mangareva: 3 specimens from dead banana near convent, elevation about 100 m, 24.V.1934 (Zimmerman), and 1 from Rikitea, elevation about 15 m, 26.VI.1934 (Zimmerman). Pitcairn Island: 1 specimen from the north side, 13.VI.1934 (Zimmerman). Society Islands—Tahiti: 13 specimens from a banana stump, Arue District, about 120 m elevation, 6.III.1934 (Zimmerman); 35 from a rotten banana stalk, Fautaua Valley, 7.III. 1934 (Zimmerman); 8 from a rotten banana stalk, Fautaua Gorge, elevation about 500-600 m, 13.III.1934 (Zimmerman); 1 from Arihiri, Pare, 15.III.1934 (Zimmerman); 1 from Afaahiti, near Vaitaare, 24.III.1934 (Zimmerman); 1 taken on *Inocarpus edulis* ("Mape") (an accidental capture, not a host plant) at Tiupi Bay, Papeari, 31.III.1934(Zimmerman); 7 from a dead stalk of "fei" banana (*Musa paradisiaca*, "plantain"), Apirimaue Valley, Tiupi Bay, Papeari, 5.V.1934 (Zimmerman).

Because of its solid black color and general facies, this species resembles a diminutive *Cosmopolites sordidus*, and it is taken often in the same plant tissue invaded by that species. It is found frequently in very wet parts of its host plant.

Calandra mexicana Champion, 1910: 170, pl. 8. figs. 11, 11a-b, is listed in *Coleopterorum Catalogus* as a synonym of this species, but Marshall, 1940: 125, has explained that this is an error and that *mexicana* is a good species of *Sitophilus* (=*Calandra*).

Kalshoven, 1961: 65, said: "It has been described originally from Java, but, curiously enough, only few specimens are to be found in the collections of Indonesian Coleoptera in the Netherlands museums; nor is it mentioned in the local literature on economic entomology, although the fauna of healthy and diseased *Musa* spp. has had much attention, particularly in Java and Sumatra."

Subtribe Sitophilina

Calandrides groupe *Calandrides vrais* Lacordaire, 1866: 298.—Faust, 1899: 23, key.—Heller, 1926: 180, revised key and notes.
Calandrina, Calandrides, Calandrinae, Calandrini, of authors, rejected names; see Hemming, 1957.
Subtribe *Sitophili* Csiki, 1936: 68.

For details of larvae, see Cotton, 1921 and 1924, and Anderson, 1948.

As now constituted in literature, it would appear that this subtribe may be a compound assemblage, and *Sitophilus* and *Diocalandra* may eventually be placed in separate groups.

Genus **Diocalandra** Faust

Diocalandra Faust, 1894: 353. Type-species: *Calandra frumenti* Fabricius, by monotypy.

This genus contains about seven described species found in Africa and the Indo Pacific. One species has been found in southeastern Polynesia.

Diocalandra taitense (Guérin-Méneville) Fig. 31-34.

Calandra Taitense Guérin-Méneville, 1834?, pl. 39 bis, fig. 4, 4a, b, 1844: 171. For notes on date of publication, see list of literature consulted.
Sitophilus Taitensis (Guérin-Méneville): Gyllenhal, In Schoenherr, 1838: 982.—Fairmaire, 1849: 69.
Diocalandra taitensis (Guérin-Méneville), of authors.
For a study of biology on Tahiti, see Doane, 1909, and on Fanning Island, see Herms, 1926. Swezey, 1920, gave an account of its discovery in Hawaii, and in 1924 he published a short note of his observations on the species in Samoa. Risbec, 1935: 169, pl. 2, discussed the damage done to coconuts in the New Hebrides. Lespesme, 1947: 627, fig. 526 (contains some errors regarding characters of the species). Anderson, 1948: 431, has described the larva.

DISTRIBUTION: This weevil was originally described from Tahiti, and for a long time it was not known elsewhere. It has, however, been widely distributed to various parts of the Pacific. The larvae bore in the husk and petiole of the fruit of coconut, and this habit has facilitated its dissemination, because the nuts have been carried far and wide for food and drink by generations of men. It has been reported from the Marquesas, Society Islands, Christmas, Washington and Fanning Islands, Hawaii, Gilbert and Ellice Islands, Fiji, Rotuma, New Hebrides, Solomons, Rennell, Bismarcks ? and New Guinea ?

Considerable confusion exists in the identification of specimens from localities outside of eastern Polynesia, and many specimens of *Diocalandra frumenti* (Fabricius) have been misdetermined as this species. This confusion began very early, because in 1881 Fairmaire said that the range of the species extended from Fiji to Madagascar. He obviously had confused *frumenti* with this species. The weevil did not appear in Hawaii until about 1918, and evidence indicates that its spread to other areas north of the equator is also recent. With the inadequate assemblage of data now available, we are not in a position to state what area is the original home of the species, but it may be Melanesian or Papuan.

Host plant: coconut.

New data: Marquesas Islands—Nukuhiva: 14 specimens from Taipivai, 20.XI.1929, from coconut (LeBronnec). Tuamotu Archipelago—Hao Island: 1 specimen from Boring Bay, 18.V.1934, at base of coconut frond (Zimmerman) and 1 specimen from Takotika, 19.V.1934 (Zimmerman). South Marutea: 1 specimen from NW islet, 22.V.1934 (Zimmerman). Gambier Islands—Tarauruoa Islet: 1 specimen from coconut frond, 26.V.1934 (Zimmerman). Aukena Island: 1 taken from a coconut frond on NW side, 28.V.1934 (Zimmerman). Society Islands—Tahiti: 1 specimen from Sand Island, Mataia, 8.VII.1932 (G. P. Wilder) and 1 from an unspecified locality on Tahiti, from coconut, 22.XII.1929 (Mumford and

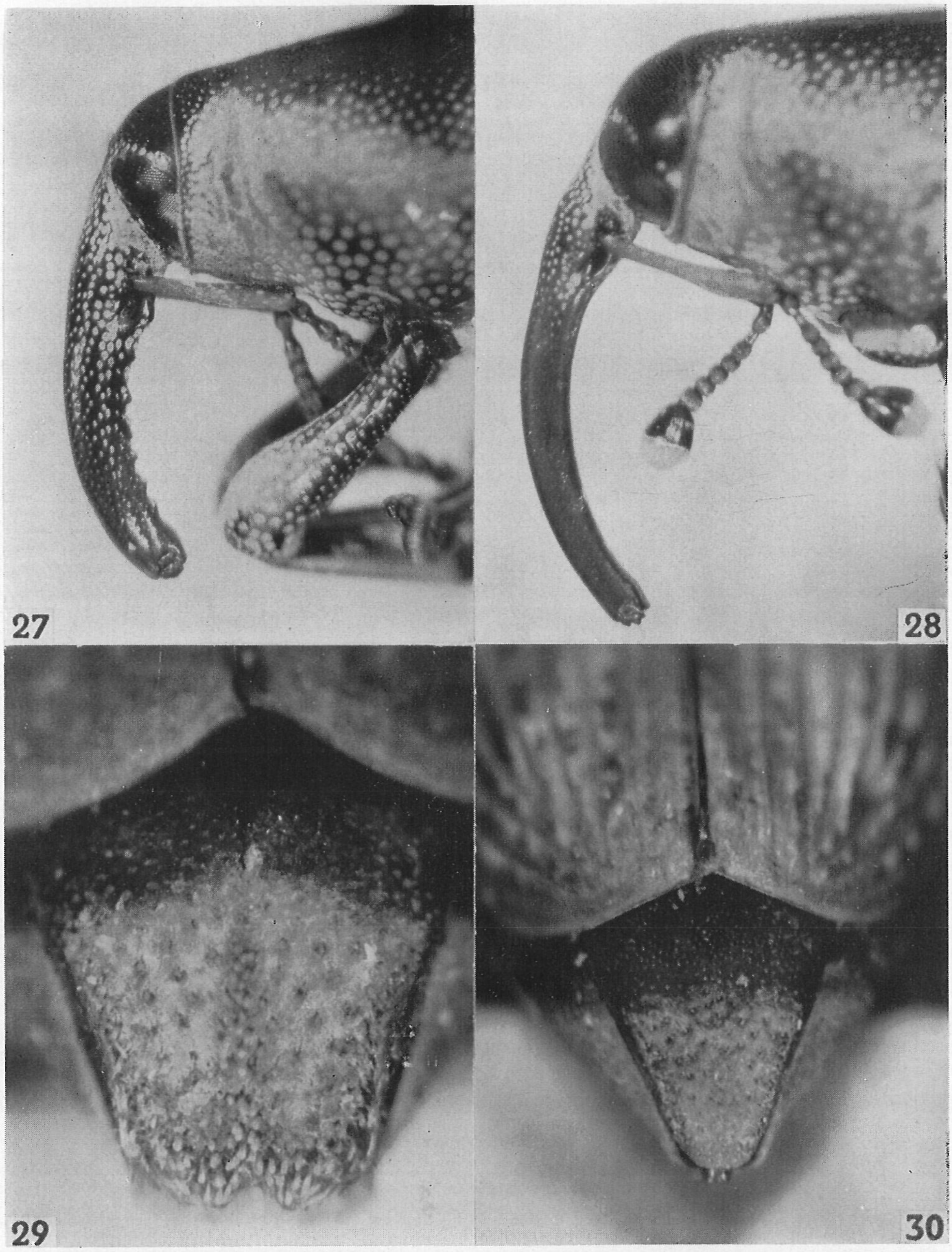

Fig. 27–30. *Rhabdoscelus obscurus* (Boisduval) to show the differences in the male rostrum (27) and female rostrum (28) and the male pygidium (29) and female pygidium (30). The specimens are from Nukuhiva, Marquesas Islands.

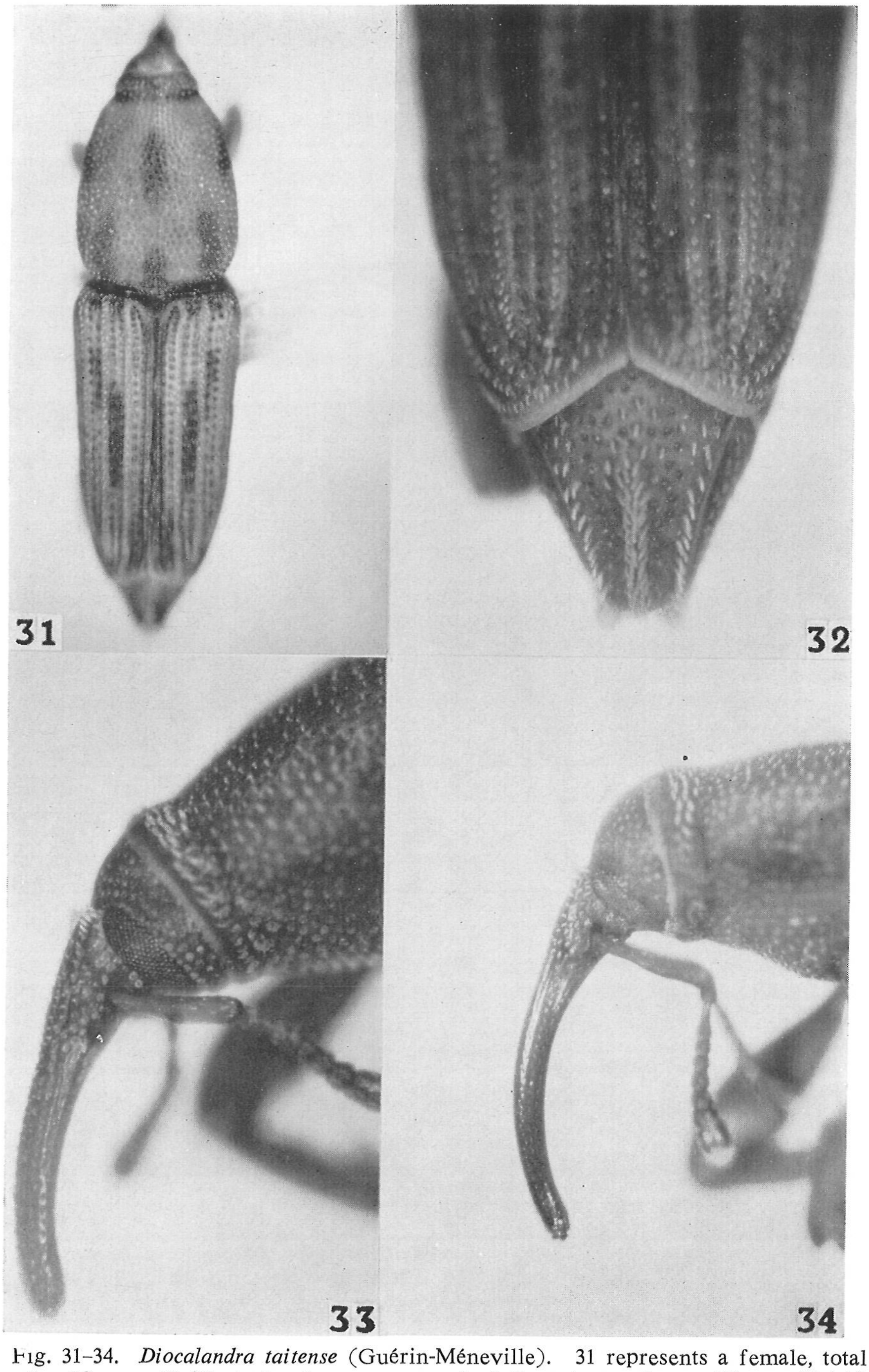

Fig. 31–34. *Diocalandra taitense* (Guérin-Méneville). 31 represents a female, total length: 6.0 mm. 32 illustrates the arrangement of the setae on the pygidium. 33 (♂) and 34 (♀) illustrate the sexual differences in the rostrum. The specimens are from Nukuhiva, Marquesas Islands.

Adamson). Raiatea: 6 specimens from Tetuna, III. 1955 (N. L. H. Krauss). Line Islands—Christmas Island: 1 specimen from Grieg's Grove, elevation 2 m (Zimmerman).

Considering the abundance of this species at various times in some localities, it is of interest that so few specimens were collected by the above-mentioned collectors. It is of particular significance that only one collection was made in the Marquesas by the several collectors who worked there for several years for the Pacific Entomological Survey. My failure to collect more specimens is probably a reflection of the fact that I spent comparatively little time collecting on cultivated plants during the Mangarevan Expedition, because I concentrated on searching for endemic species in areas of native vegetation.

This was the first weevil to be listed from Tahiti and the first from southeastern Polynesia. In some references, the date of description is given as 1844, but that seems to be in error, because the name appears in Schoenherr, 1838: 982 (see additional comment under Guérin-Méneville in the bibliography).

Fairmaire, 1849: 70, was confused when he stated that the weevil was found in decomposed trunks of banana. Perhaps this was caused by an error in transcribing the field notes of Vesco. This species is not known to feed upon banana. It appears to be confined mostly or entirely to coconut palm.

There is some disagreement amongst observers as to the damage done to coconut palms by this weevil. I have not considered it a particularly serious pest where I have seen it, and have believed it to be a species that preferred usually to attack injured and aging areas, although the larvae do bore in sound tissue. However, the studies by Doane, Herms, Risbec and others contain observations of real damage of economic importance. In 1941: 100, writing upon the species in Hawaii, I stated that "This weevil feeds in the living or injured tissue of fronds, flower stalks and wounds of the coconut. Its presence can usually be detected by an amber colored exudation along the margins of the bases of the fronds or other places where the larvae are feeding. The species does not appear to be of economic importance in Hawaii."

Swezey, 1924: 388, reporting on the species in Samoa, said "Its larvae feed in the edges of the lower part of the leaf stalk, and as it is the older leaves that are most often attacked, they are not significantly injurious to the trees. They, too, are likely to be more abundant in stubs of cut-off leaves."

Doane, 1909: 222, in the first report on the habits of the weevil (in Tahiti) stated:

"The smaller weevil, *C. taitensis*, seems to be much more abundant and on account of its habits is perhaps more injurious than the larger species [*Rhabdocelus obscurus*]. It is found most commonly boring into the edge of the base of the leaf-stem. Its presence is indicated, as with the larger species, by the presence of a gummy exudation mixed with castings. These are often in the shape of long twisted strings, 6–13 mm long. As the larvae do not work as deep in the tissue of the leaf as do those of the larger species, the damage here is not very great, but when they work further out at the base of the leaflets many of the leaflets are destroyed.

"A still more serious damage is done where the larvae attack the spikelets, killing them at the point of attack and working toward the base. As long as they confine their work to the portion of the spike having only the male flowers the damage is not serious, because the number of these flowers is so great. But when they attack the spikelet below the female or fruiting flower, the young fruit is killed. After the larva has become full grown it makes for itself a rather long cell, with a very thin wall on one side, and, without making a cocoon, changes to the pupa..."

Risbec, 1935: 169, pl. 2, illustrates and discusses the damage done to the bases of the trunks of mature coconut trees.

The most extensive report on the biology of this weevil that I have seen is that by my old teacher, Prof. Herms, 1926, who reported upon his observations of the species on Fanning and Washington Islands. His observations on the feeding of the larvae are as follows (pp. 260-270):

"The larva...enters the healthy tissue of the coco palm (apparently its only host plant), where it grows rather slowly, frequently burrowing from 1 to 1.5 inches deep into heavy fronds and often tunneling (very slowly) a distance of 5 to 6 inches before coming to rest for pupation near the surface or at a crevice produced by splitting or hacking. The position of the older larvae is marked by twisted strings of dark brown frass and castings, by discoloration of the tissue, and exudations from the plant (plate 7, fig. 1). When the larva tunnels near the surface of the frond or base of a spike its course can be traced by the blackened plant tissue. Infection of the frond is usually located along the edges of the midrib and at the base, frequently at the basal connection with the trunk and, less frequently, at the axils of the leaflets, when the frond soon presents a very ragged appearance, the leaflets turning yellow, and fractures result (Plate 5, fig. 2). The larvae also attack the trunks of older trees from which we frequently took both larvae and pupae.

"The greatest damage is done when the larvae attack the spikelets, or, more particularly, the base of the spike itself. Spikelets with female flowers or young nuts, when thus attacked, will not mature their fruit and, when the base of the spike is well bored (Plate 7, fig. 2), a total loss of all its nuts is generally certain. Deformed nuts, which soon drop off, will result from *Diocalandra* borings, as shown in Plate 5, fig. 3. I have seen many trees which should have been in bearing, many spikes being present, yet they were entirely devoid of nuts, or burdened with deformed nuts, as shown in the figure, which on inspection showed the marks of the borer in every spike examined...

"Borers also frequently attack very young nuts at the point of attachment, causing them to drop. Husks of older nuts are frequently bored, and I have seen traces of larvae having burrowed completely through the husk and into the nut. Such attacks generally result in badly deformed nuts or in dehiscence.

"As stated earlier in this paper, the borers appear not to attack (or at least to do so rarely) young trees under about 4 years of age, while trees from about 6 to 10 years old seem to suffer most, particularly trees just about beginning to bear. The old trees and their fruit appear to suffer but little damage from borer attack, although the insects are frequently present. I have taken several beetles from between the sheath and the base of badly bored and nutless spikes on a tree 50 feet high.

"While I do not believe that *Diocalandra* will directly kill a tree of any age, I have seen trees that were beyond redemption due to a combination of *Diocalandra* and caterpillar attack, resulting in a badly twisted and dwarfed condition...That young trees are weakened by *Diocalandra* borings alone appear to be obvious, and that a marked reduction in nut production often results due to boring in spikes, spikelets, and young nuts is certain.

"The burrowing of the borers also paves the way for bacterial and fungous attack which usually augments the damage. Consversely, also, wounds infected with bacteria and fungi offer acceptable points of attack for the beetles...

"The eggs are nearly a millimeter in length, slender, and well rounded at both ends (Plate 4, fig. 4). When first laid they are pearly white in appearance, becoming somewhat milky white as incubation proceeds. I have taken the eggs in the field in various situations where the adult beetles found good harborage, a good location being in the crevice of a more or less split coco frond, where decay has already set in, or under the strainer at the base of an old frond, also between the sheath and base of the spike. The eggs are apparently frequently deposited in scattered masses ranging from eleven to thirty-one and, more frequently, singly. The number of eggs deposited by the individual female beetle was not ascertained; however, the number deposited under experimental conditions in the laboratory was never large, ranging from two to four, even by females newly emerged from the pupa and mated. Presumably the number laid in nature may be represented by the number taken in egg clusters, although that point also is difficult to determine, since the adults frequently occur in groups (as many as ten or twelve) always protected, of course, in a crevice or under the strainer folded over the edges of the frond.

"Under temperature conditions already described the incubation period varies from four and a half to eight and a half days. Movements of the embryo can easily be seen through the egg shell twenty-four hours prior to hatching.

"In laboratory experiments I have found that the larvae do not readily attack smooth, tough frond tissue, but find lodgement in small cuts or pits produced by the gnawing beetles, which openings they enter and soon begin to burrow. Nevertheless, the heavy, otherwise unblemished base of the coco frond, particularly along the fibrous edges, presents a favorite location for the larvae, as do the axils of the leaflets...From a combination of evidence, both field and laboratory, it would appear that the larval stage requires from eight to ten weeks...The full-grown larva (Plate 4, fig. 2) is cream colored and rather plump, and measures from 9 to 10 millimeters in length.

"The full-grown larva comes finally to rest in an enlarged burrow near the surface, not necessarily at the surface, which it lines with finely cut borings (frass), producing a crude capsule (Plate 4, fig. 3). In a remarkably short time the larva takes on pupal form, showing the proboscis, appendages, and general outlines of the imago with remarkable clearness (Plate 4, fig. 2). The color of the pupa remains shining white to cream color until about time for emergence, when it darkens somewhat, not really taking on the rust red markings and general color of the adult until it has actually emerged from its cell. I have taken pupae from many parts of the coco tree, including particularly the edges of old fronds and axils of leaflets also from the bases of spikes and spikelets. Ten to twelve days are required for the pupal period. Thus the time required to complete the life history of the species (egg to emergence of imago) appears to be from ten to twelve weeks.

"Males often engage in a veritable rough-and-tumble conflict, butting each other about like rams for the possession of a female. When paired they may remain in copulation literally for hours at a time. The adult insect is a small, narrow weevil, measuring somewhat over one-quarter inch (7 millimeters) in length. It is pitchy black in ground color with reddish yellow legs; there are clouded markings on the thorax, and the wing covers vary from practically all red to red with six black spots or markings, two basal median, and two apical."

"Natural enemies of *Diocalandra* on Fanning Island seem to be entirely absent...In our breeding and life-history experiments hundreds of beetles, numerous pupae and larvae, and many eggs were kept for adequately long periods...and always a careful watch was kept for parasites, but none was observed. Because of the difficulty in controlling this species by so-called artificial means, biological control through the agency of natural enemies seems particularly desirable.

"Pests of the coco palm on Fanning and Washington Islands are rats..., which gnaw young nuts and the bases of spikelets; robber crabs (*Birgus latro*) almost extinct on Fanning; white scale (*Hemichionaspis aspidistrae*), well parasitized by *Aspidiotiphagus citrinus*; mealy bugs (*Pseudococcus pandani*), not abundant; caterpillars, belonging to two species not identified, particularly damaging to very young trees; *Xyleborus confusus*, a shot-hole borer, in old fallen nuts in particular; and the lesser coconut borer (*Diocalandra taitensis*), the most important of all."

Genus **Sitophilus** Schoenherr

Sitophilus Schoenherr, 1838: 967. Type-species: *Curculio oryzae* Linnaeus, cited by Schoenherr, 1838: 967.
Calendra Clairville and Schellenberg, 1798: 62; rejected name.
Calandra Clairville and Schellenberg, 1798, pl. 2; rejected name.
See Hemming, 1957, for extensive details regarding synonymy and official rejection of names.

This is predominantly an Old World genus which contains, among others, several widespread or nearly cosmopolitan species which have been dispersed by commerce. It includes well known pests of seeds, grains and cereals. I have seen only three species from southeastern Polynesia, but it is possible that some of the other widespread species may also occur in the area.

Key to the Sitophilus known in Southeastern Polynesia

1. Rostrum with subbasal expansion gentle and not subbulbose; dorsal part of posterior section of scrobe contiguous to eye; punctures along dorsal margin of eye bearing inconspicuous, microscopic setae that hardly project above margins of punctures; scutellum with anterior corners sloping rapidly downward and cephalad and only slightly elevated and obviously not subtuberculiform................................ **linearis** (Herbst)
   Rostrum with subbasal expansion abrupt and subbulbose; dorsal part of posterior section of scrobe obviously separated from eye by a coarsely punctate area; setae along dorsal margin of eye conspicuous, erect, clavate or narrowly spatulate and projecting far above derm; scutellum with anterior corners protuberant, subtuberculiform and projecting above level of adjacent parts of elytra... 2
2. Length, excluding head and rostrum, usually less than 3.0 mm; dorsum of aedeagus evenly convex in cross-section, without longitudinal dorsal grooves; normally redder with coarser microsculpture and duller .... **oryzae** (Linnaeus)
   Length, excluding head and rostrum, usually distinctly more than 3.0 mm; dorsum of aedeagus with 2 longitudinal grooves, thus dorsally sinuous in cross-section; normally blacker with fine microsculpture and more shiny................................**zeamais** Motschulsky

Sitophilus linearis (Herbst) Fig. 20.

Rhynchophorus linearis Herbst, 1797: 5, pl. 100, fig. 1, 1A
For synonymy and bibliography, see Csiki, 1936: 74. For biology, see Cotton, 1920.

The Tamarind Weevil

DISTRIBUTION: India, Africa, Seychelles, Hawaii, Society Islands, North and South America, East Indies, Type locality: "Amerika".

Host plant: Feeds in the pods of tamarind.

New data: 1 specimen from Papeete, Tahiti, Society Islands, III.1955 (N. L. H. Krauss).

This species has not been recorded from southeastern Polynesia heretofore, but it is probably established on various islands. It is widely spread to most areas where the tamarind is grown.

Sitophilus oryzae (Linnaeus) Fig. 22.

Curculio oryzae Linnaeus, 1763: 395 (original spelling *oryza* suppressed; see Hemming, 1957: 45).

Curculio frugilegus De Geer, 1775: 273.
Calandra oryzae funebris Rey, 1895: 50.
Calandra olizae minor Sasaki, Insects Injurious to Japanese Crops, 1899, also 1910: 485, fig. 202 (in Japanese and not seen).
Calandra sasakii Takahashi, Insects Injurious to Field Crops, 1928: 164 (in Japanese and not seen). This is an unnecessary replacement name for *minor* Sasaki.
For revised synonymy, see Kuschel, 1961: 243. For bibliography, see Csiki, 1936: 74. For biological, physiological and other data, see Richards, 1944, Floyd and Newsom, 1959, and Halstead, 1963. For biology and descriptions of egg, larva, pupa and adult, see Cotton, 1920 and 1924: 610.

The Rice Weevil

DISTRIBUTION: Nearly cosmopolitan and widely dispersed over the world by man. Originally an Oriental species.

Host plants: Cereal grains and products.

New data: Society Islands—Two specimens from Tahiti, without specific locality, 2. VIII.1926 (G. P. Wilder), and 1 specimen from Maaia, Papiari, Tahiti, 16.III.1925. (G. P. Wilder): 57 specimens taken from bags of flour on Raiatea, 26.I.1927 (G. P. Wilder).

Parasite: *Anisopteromalus calandrae* (Howard) (= *Aplastomorpha vandinei* Tucker) (Hymenoptera: Pteromalidae).

This species surely is more widespread in southeastern Polynesia, and it must frequently be reintroduced by commerce. It appears to be a "domestic" species seldom found far from human habitation in Polynesia. See further discussion under *zeamais* below.

Sitophilus zeamais Motschulsky Fig. 21.

Sitophilus zea-mais Motschulsky, 1855: 77.
Cossonus quadrimacula Walker, 1859: 219.
Calandra chilensis Philippi, 1864: 374.
Calandra oryzae platensis Zacher, 1922: 55.
For details on synonymy, see Kuschel, 1961: 244. For bibliography, see Csiki, 1936: 76. For biological and other details, see Richards, 1944, Floyd and Newsom, 1959 and Halstead, 1964.

DISTRIBUTION: This is a widespread species, but because of confusion with *oryzae* its true distribution is not recorded. Kuschel, 1961: 244, is of the opinion that it "seems to be as widely distributed as *oryzae* but is somewhat less common. It was originally an Oriental species." I discussed its presence in Hawaii, 1941: 102, and in Guam, 1942: 145.

Host plants: Cereal grains and products.

New data: Society Islands—Tahiti: Two specimens taken by sweeping vegetation and one from dead leaves of *Hibiscus tiliaceus*, 2.5 km northeast of Papeete, 1.III.1934 (Zimmerman); 1 taken at Arihiri, Pare, 26.III.1934 (Zimmerman). Raiatea, 1 taken "1926–27" (J. W. Moore).

Although there is some overlapping in size and color between specimens of series of *oryzae* and *zeamais*, *zeamais* is usually a distinctly larger species. It is also usually a distinctly blacker species. The abdominal tergites are usually blacker on *zeamais* and redder on *oryzae*, and *oryzae* has the microsculpture of the derm somewhat more coarsely reticulate. These differences are more easily appreciated when comparing specimens than by description. The male aedeagus displays a positive feature for differentiating the species, as outlined in the key above.

It appears that this species is more feral than is *oryzae*, and it has been found widely spread in the field.

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