

AN ABSTRACT OF THE THESIS OF

ANUWAT WATTANAPONGSIRI for the Ph. D. in Entomology
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Title A REVISION OF THE GENERA RHYNCHOPHORUS AND
DYNAMIS (COLEOPTERA: CURCULIONIDAE)

Abstract approved Signature redacted for privacy.
(Major professor)

A taxonomic study was made on the genera Rhynchophorus and Dynamis of the weevil family Curculionidae which includes all of the species known to occur in the world. The bibliography lists all the important papers published to date on the taxonomy and bionomics of these weevils. A full synonymy is given for each species with the appropriate literature cited in the bibliography. Eight species of Rhynchophorus--barbirostris, glabrirostris, indostanus, kaupi, montrouzieri, pascha, rubrocinctus, signaticollis--and two species of Dynamis--politus, germari--are placed in synonymy. Keys to genera, species, and known pupae and larvae are given. A subgenus Rhynchodynamis Heller is elevated to generic rank. Twenty-two species are treated, twelve of which redescrbed completely and ten of which are described as new. Of these 22 species, filirostris belonged to Rhynchodynamis, 10 belonged to Rhynchophorus, two of

which, distinctus and ritcheri, are new; 11 belonged to Dynamis, eight of which, artornitipae, callirostris, coracinus, palmiphilus, perplexus, perryi, rebecca, and rockefelleri, are new. A brief discussion of the biology, morphology, immature stages, distribution and economic importance of these weevils is included. Distribution maps of genera and species are given as well as 743 figures illustrating characters of adults and immature stages.

A REVISION OF THE GENERA RHYNCHOPHORUS AND DYNAMIS
(COLEOPTERA:CURCULIONIDAE)

by

ANUWAT WATTANAPONGSIRI

A THESIS

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In Charge of Major

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Dean of Graduate School

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A REVISION OF THE GENERA RHYNCHOPHORUS AND
DYNAMIS (COLEOPTERA : CURCULIONIDAE)

INTRODUCTION

The principal purpose of the present study is to clarify the relationships and classification, assemble the more recent published information, make possible the identification, and illustrate completely all the distinctive characters for the genera Rhynchophorus and Dynamis. Keys to the adult and immature stages of both genera are provided and a proposed new genus and several new species are described. This study is based on approximately 8,000 specimens, borrowed from the collections of various museums and private collectors throughout the world.

The weevils of these genera are commonly called "palm weevils". They feed on many species of palms, the larvae boring into and feeding in the trunk while the adults feed on the terminal buds. The damage done by these weevils makes it impossible to save the tree. From an economic standpoint they are serious pests of plants in the family Palmaceae and also cacao, sugarcane, papaya, banana, etc. in the tropics as well as in the southern part of the United States.

There has been no revision since the genera were designated, Rhynchophorus by Herbst in 1795 and Dynamis by Chevrolat in 1882. There has been a great deal of confusion regarding the identification of the species and the genera. The original descriptions of these

genera were inadequate and also inaccurate; therefore, a complete revision of these two genera is much needed. The species are evaluated and redefined. Many of the type specimens could not be located and the writer believes that some were lost or destroyed, so the designation of neotypes is necessary. The writer has also thought it wise to revise the genera and believes that this is of great value to entomologists who are dealing with coconut, cacao, sugarcane, and papaya plantations.

In this study the writer has attempted to study as much material as possible in order to secure all the available data on the distribution, biology, economic importance and host records of the species. The taxonomic information was obtained from an examination of genitalia and external morphological details of both sexes and immature stages when available. The writer has also tried to bring together all of the literature up to the present. Inadequate statements were corrected.

In describing a new genus and species the generic and biological species concepts and various taxonomic characters based on morphology (structures of genitalia etc.), ecology (habitat, variations), zoogeography (distribution patterns and sympatric-allopatric relationships of population), were considered.

Materials and Methods of Study

Material Studied

Most of the specimens used in the course of this study were borrowed from collections of several institutions and of a few private collections. A total of 7,071 adult and 391 immature specimens of Rhynchophorus, 221 adult and five immature specimens of Dynamis, and five adults of Rhynchodynamis were examined. The adult weevils were distributed among the various species as follows:

	male	female	total
<u>Rhynchophorus</u>			
<u>bilineatus</u> (Montr.)	401	348	749
<u>cruentatus</u> (Fabr.)	269	287	556
<u>distinctus</u> n. sp.	1	-	1
<u>ferrugineus</u> (Oliv.)	441	443	884
<u>palmarum</u> (Linn.)	751	2103	2854
<u>phoenicis</u> (Fabr.)	288	270	558
<u>quadrangulus</u> Queden.	19	21	40
<u>ritcheri</u> n. sp.	2	-	2
<u>vulneratus</u> (Panz.)	<u>880</u>	<u>547</u>	<u>1427</u>
	<u>3052</u>	<u>4019</u>	<u>7071</u>
<u>Dynamis</u>			
<u>artorntipae</u> n. sp.	9	2	11

	male	female	total
<u>Dynamis</u>			
<u>borassi</u> (Fabr.)	81	78	159
<u>callirostris</u> n. sp.	6	-	6
<u>coracinus</u> n. sp.	3	3	6
<u>nitidulus</u> (Guér.)	4	4	8
<u>palmiphilus</u> n. sp.	1	2	3
<u>peropacus</u> Champ.	2	4	6
<u>perplexus</u> n. sp.	-	2	2
<u>perryi</u> n. sp.	7	4	11
<u>rebecca</u> n. sp.	2	3	5
<u>rockefelleri</u> n. sp.	<u>3</u>	<u>1</u>	<u>4</u>
	<u>118</u>	<u>103</u>	<u>221</u>

Rhynchodynamis

<u>filirostris</u> Heller	1	4	5
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The immature stages of the following specimens were examined: eggs, larvae, pupae of Rhynchophorus cruentatus, ferrugineus, palmarum, phoenicis, vulneratus; larvae of R. bilineatus, Dynamis borassi; eggs of R. bilineatus, quadrangulus, D. borassi, coracinus, peropacus, perryi and Rhynchodynamis filirostris. The immature stages were distributed among the various species as follows:

	egg	larva	pupa	total
<u>Rhynchophorus</u>				
<u>bilineatus</u> (Montr.)	37	4	-	41

<u>Rhynchophorus</u>	egg	larva	pupa	total
<u>cruentatus</u> (Fabr.)	26	20	8	54
<u>ferrugineus</u> (Oliv.)	24	62	19	105
<u>palmarum</u> (Linn.)	51	45	6	102
<u>phoenicis</u> (Fabr.)	21	2	1	24
<u>quadrangulus</u> Queden.	5	-	-	5
<u>vulneratus</u> (Panz.)	<u>39</u>	<u>19</u>	<u>2</u>	<u>60</u>
	<u>203</u>	<u>152</u>	<u>36</u>	<u>391</u>
 <u>Dynamis</u>				
<u>borassi</u> (Fabr.)	24	4	1	29
<u>coracinus</u> n. sp.	5	-	-	5
<u>peropacus</u> Champ.	8	-	-	8
<u>perryi</u> n. sp.	<u>2</u>	<u>-</u>	<u>-</u>	<u>2</u>
	<u>39</u>	<u>4</u>	<u>1</u>	<u>44</u>
 <u>Rhynchodynamis</u>				
<u>filirostris</u> Heller	7	-	-	7

Of the above adults, 1,454 specimens were in the Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands; 982 adults and 41 immature stages in the United States National Museum, Washington, D. C., U. S. A.; 647 adults in the American Museum of Natural History, New York, U. S. A.; 603 adults in the Carnegie Museum, Pittsburgh, Pennsylvania, U. S. A.; and another somewhat over 4,000 specimens were seen in collections from various institutions

and individuals.

Abbreviations

The abbreviations used to indicate the collections to which the material belongs are as follows: AMNH: American Museum of Natural History, New York City, U. S. A. ; AW: Collection of the writer; BMNH: British Museum (Natural History), London, England; BPBM: Bernice P. Bishop Museum, Honolulu, Hawaii, U.S.A.; CACS: Collection of Dr. Carlos Alberto Campos Seabra, Rio de Janeiro, Brazil; CAS: California Academy of Sciences, San Francisco, U. S. A. ; CM: Carnegie Museum, Pittsburgh, Pennsylvania, U. S. A. ; CNHM: Chicago Natural History Museum, Illinois, U. S. A. ; CIE: Commonwealth Institute of Entomology, London, England; CU: Cornell University, Ithaca, New York, U. S. A. ; DAPN: Department of Agriculture, Territory of Papua and New Guinea, Port Moresby, Papua; EB: Collection received from Dr. E. Bordas, Mexico City, Mexico; FMDA: Federation of Malasia, Department of Agriculture, Kuala Lumpur, Malasia; HAZV: Honduras Agricultura Zootecnia y Verterinaria, Tegucipalga, D. C., Honduras; HEB: Collection of Mr. Harry E. Brown, University of Missouri, Columbia, Missouri, U.S. A. ; NTU: National Taiwan University, Taipei, Taiwan; PANS: Philadelphia Academy of Natural Sciences, Pennsylvania, U. S. A. ; RFMA: Rhodesia Federation Ministry of Agriculture, Salisbury,

Rhodesia; RMNH: Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands; RSCS: Red Ring Research Scheme, Central Experiment Station, Centeno, Trinidad; TDA: Thailand Department of Agriculture, Bangkok, Thailand; TTCR: Trinidad and Tobago Coconut Research Limited, Champs Fleurs, Trinidad; UCR: University of Costa Rica, San José, Costa Rica; UK: University of Kansas, Lawrence, Kansas, U. S. A.; UM: University of Missouri, Columbia, Missouri, U. S. A.; UP: University of Philippines, Laguna, Manila, Philippines; VHO: Collection received from Mr. Virgil H. Owens, Gulfport, Mississippi, U. S. A.; ZSBS: Zoologische Sammlung des Bayerischen Staates, München, West Germany.

Methods

The method of preparing weevils for a study is as follows. All specimens were tentatively identified and arranged according to species and distribution alphabetically. The external morphology and the genitalic structures of both sexes of all species were critically examined and illustrated. In dissecting the genitalia, mouthparts and wings, the weevil was removed from the pin and placed inverted in a relaxing jar for three to four days where the moisture softened the weevil. A few crystals of lacto-phenol was added to the water in the jar to protect from mold. The writer noticed that boiled specimen in hot water or hot water with detergent changed its appearance

from shining to dull, and the general appearance of the body also looked differently from the unboiled-specimen.

The genital capsule was removed by holding the abdomen ventral side up in the left hand, with the venter faced the microscope. The venter and dorsum can easily be pressed apart with thumb and index finger, and sharp pointed forceps used to pull the capsule loose at its point of attachment. This is a delicate operation so requires experience and patience to obtain success. The genitalic capsule was then placed in 15 percent solution of potassium hydroxide in a stendar dish for 12 to 24 hours or until unwanted tissues were dissolved. Then it was neutralized in a two percent solution of glacial acetic acid and cleaned in water. The cleared genitalic structures were placed in 80 percent ethyl alcohol for study. In order to expose these structures it is necessary to tear the endophallic membrane between the endophallus and phallobase. The endophallus and tegmen then will come loose from the phallobase. The aedeagus can be pulled apart gently, by holding the aedeagal apodemes, from the endophallus and tegmen. The spermatheca is very small therefore it was mounted in Hoyer's medium on a glass microscope slide. The structures were studied under a binocular dissecting microscope. The dissected and extended male or female genitalia were stored in glycerine in microvials attached to the specimen from which they were removed.

The mouthparts, especially, the maxillae and mandibles, were

removed by holding the weevil under water in the deep petri-dish, otherwise they will easily be lost. Dissecting the mouthparts must be done under a microscope. A minute hook made from a nadlen pin was used to remove the maxillae from the maxillary scrobes. A similar method was used for removing the mandibles. The maxillae and mandibles were cleared in a 15 percent solution of potassium hydroxide for 15 to 30 minutes. They were then neutralized in a two percent solution of glacial acetic acid for five minutes and washed in water. The cleared mouthparts were mounted in Hoyer's medium on a glass microscope slide in the following manner: one mandible with pleurostoma was mounted dorsally, the other mandible ventrally; maxillae were mounted in the same manner as the mandibles. A compound microscope was used for study of these mouthparts.

To study the wings, both were removed by lifting the elytra upward then pulling them apart gently at the base. The wings were placed in an 80 percent ethyl alcohol and cleaned. The wings were boiled in hot water with detergent for 20 minutes, then spread and mounted in Hoyer's medium on a slide. A reflecting projector and a binocular dissecting microscope were used for study of wing venation.

Mites collected from the weevils were cleared with lacto-phenol, then mounted in Hoyer's medium. In doing so, the mite should be in warm to hot lacto-phenol during the process. Mites were examined

under a compound microscope with transmitted light.

To study the larvae and pupae, a large deep petri-dish was used and about one-third filled with paraffin. The paraffin was grooved to hold the specimens, and if necessary, pins were used to fix the specimens. The head of the larva was removed intact from the thorax, and the mandibles, maxillae, and labium were removed from the head capsule and cleared in a 15 percent solution of potassium hydroxide for 30 minutes. They were then neutralized in a two percent solution of glacial acetic acid for 20 minutes and left in the water overnight. After studying, all the structures were kept in 80 percent ethyl alcohol in a small vial and kept together with the larva from which they were removed.

Measurements

Measurements of the length and width of the egg, larva, pupa, and adult's body, pronotum, elytron, rostrum, and antenna were made with an ocular micrometer in a Bausch and Lomb binocular microscope.

Body length of the larva were measured dorsally from the head capsule to the posterior end of the last abdominal segment; width was measured at the widest point on any abdominal segment, usually on the fourth, fifth, or sixth abdominal sternite. The length of the head capsule was measured medially from the anterior end of the

clypeus to the posterior end of the capsule; width was measured at the widest point across the capsule.

Body length of the pupa was measured dorsally from the anterior end of the pronotum to the posterior end of the last abdominal segment; width was measured across the metanotum.

Body length of the adult was measured from the anterior end of the pronotum to the posterior end of the pygidium; width, at the base of the elytra across the humeri at their widest point. The length of the pronotum was measured dorsally from the middle of the base to the middle of the apical margin; width, at the widest point on the pronotum. The length of the elytron was measured from the base to the apex; width, at the base across its widest point. The length of the rostrum was measured dorsally from the ocular sulcus to the apex of the rostrum or the tip of epistoma.

Drawings

All figures were made with the aid of an ocular grid in a Bausch and Lomb binocular microscope, using 1 x 1 cm graph-paper, except figures 629 to 642 which were made with the squared-scale placed beneath the specimens and then completed free hand for the details in the body. Figures 34 to 35, 37 to 41 and 721 were made with free hand drawing.

Catalogue

Blackwelder's (1947) Checklist of the Coleopterous insects of Mexico, Central America, the West Indies, and South America; Junk and Schenkling's Coleopterorum Catalogus and Leng (1920) Catalogue of the Coleoptera of American, North of Mexico were carefully checked during the course of this study.

Terminology

The terminology used in this paper is found in Torre-Bueno (1937). In regard to the genitalia, a careful survey of the literature show a wide disagreement among the taxonomists and also among the morphologists as to the origin and structure of the parts. Based on a current review of literature the genital homologies of Coleoptera can be summarized as follows:

The "phallobase" of Snodgrass (1935, 1957) is the "aedeagus" of Kolbe (1893), the "basal piece" of Sharp and Muir (1912), the "gonocoxite" of Michener (1944). The "phallobasic membrane" as used in this paper is the "membrane between tegmen and body wall" or "pseudotegmen" of Muir (1919) and the "first connecting membrane" of Sharp and Muir (1912). The "dorsal cleft of phallobase" used in this paper is the emargination medio-posterior of the phallobase.

The "endophallus" of Snodgrass (1935, 1957) is the "internal

sac" of Sharp and Muir (1912). The "endophallic membrane" used in this paper is the "second connecting membrane" of Sharp and Muir (1912), the "membrane between tegmen and median lobe" of Muir (1919), and the "vesica" or prepatial membrane" of Snodgrass (1935). The "tegmen" of Sharp and Muir (1912) is the "ring" of Hopkins (1911), the "shield" of Krautwig (1930), the "gonoforceps" of Michener (1944), the "basal piece + manubium + paramere" of Lindroth and Palmén (1956), and the phallobase + phallomere" of Snodgrass (1957). The "tegmental lobe" as used in this paper is the "lateral lobe" of Sharp and Muir (1912), the "gonostylus" of Michener (1944), and the "paramere" of Snodgrass (1935, 1957). The term "paramere" was first given by Verhoeff in 1893 to the "lateral phallic lobes" of Coleoptera, and thus has unquestioned priority for these structures, though it has been applied to various other parts of the genitalia. Many writers contend that the term is thereby rendered meaningless and should be discarded.

The "tegmental membrane" as used in this paper refers to the connecting membrane between the tegmen and endophallus. The "tegmental apodeme" as used in this paper is the "apodeme or 9th tergite" of Hopkins (1911), the "tegmen + basal piece" of Sharp and Muir (1912), the "tegmental strut" of Muir (1915, 1918, 1919), the "8th sternum" of Krautwig (1930), the "manubium" of Lindroth and Palmén (1956), and the "apodeme of phallobase" of Snodgrass (1957).

The "aedeagus" of Snodgrass (1935, 1957) is the "body or 10th sternite" of Hopkins (1911), the "median lobe" of Sharp and Muir

(1912), the "penis" of Miles (1923), the "dorsal plate + ventral plate + lateral ridge" of Krautwig (1930), and the "basiphallus + basiphallomere" of Gilbert (1964). The "aedeagal orifice", as used in this paper is the "apical opening" of Hopkins (1911), the "median orifice" of Sharp and Muir (1912), the "ventral apex" of Krautwig (1930), the "gonopore" of Metcalf (1932), the "phallotreme" of Snodgrass (1935), the "ostium" of Lindroth and Palmén (1956). The "aedeagus orifical plate" as used in this paper is the "orifical plate" of Sharp and Muir (1912). The "aedeagal fenestra" as used in this paper is the "papilla" of Hopkins (1911), and the "penis valve" of Michener (1944). The "aedeagal apodemes" of Snodgrass (1935, 1957) are the "apodemes or femora" of Hopkins (1911), the "median struts" of Sharp and Muir (1912), the "struts" of Miles (1923), the "9th sternum" of Krautwig (1930), the "anterior fork of median lobe" of Metcalf (1932), the "apophysis of penis" of Lindroth and Palmén (1956), and the "phallic apodemes" of Gilbert (1964). The "ejaculatory duct" as used in this paper is the "flagellum + ejaculatory duct" of Sharp and Muir (1912), and the "trachea of penis" of Miles (1923).

The terms used in reference to the female genitalia are those used by Hopkins (1911), Miles (1923), Pruthi (1924), Tanner (1927), Herberdey (1931), Metcalf (1932), Snodgrass (1935), Dick (1937), Bissel (1937), and Lindroth and Palmén (1956). The term "spiculum ventrale" is used instead of the "baculum" or "chitinous rod".

The homologies of the various terms, used in reference to the parts of genitalia by the writer and by previous writers, are given in Tables 1 and 2.

In the study of the wing, the papers by Forbes (1922, 1926), Graham (1922), and Good (1925) were consulted. The terminology used for the larval structures is that of Cotton (1924), Falcoz (1926), and Anderson (1947, 1948), who were made the most comprehensive study of the curculionid larvae. The papers by Böving (1930), Emden (1938), and Ritcher (1944, 1949) were consulted during the course of the study of the larvae.

History

The genus Rhynchophorus was erected by Herbst in 1795. He spelled the name of the genus in two different ways, "Rynchophorus" in the text and "Rhynchophorus" in the plates. The words "Ryncho" and "Rhyncho" are Greek and both mean the same "a snout, beak". Since then the name "Rhynchophorus" has been adopted by Illiger in 1798 and by many writers up to the present. In the present study, the first revision of the genus, the writer hereby retains "Rhynchophorus" as the correct and valid name of the genus (ICZN Articles 23 (b), and 32 (b)). Herbst included in the genus 22 species, only three of which are true Rhynchophorus. These three species were palmarum, ferrugineus, and cruentatus, listed as the first, second,

Table 1. Terms Used in Male Genitalia

Wattanapongsiri	Gilbert (1952, 1964)	Snodgrass (1935, 1954)	Lindroth and Palmen (1956)	Wood (1952) Michener (1944)	Metcalf (1932)	Krautwig (1930)	Miles (1923)	Sharp & Muir (1912); Muir (1915, 1918, 1919 1924); Sharp (1918); Wilson (1930); List (1932); Bissel (1937); Bruhn (1947)	Hopkins (1911)
phallus	-	phallus	-	-	-	-	-	aedeagus (1912)	-
phallobase	gonocoxite (1952)	phallobase	basal piece	gonoxite	-	-	-	basal piece	-
phallobasic membrane	-	-	1st connecting membrane	-	-	-	-	membrane between tegmen and body wall or pseudotegmen (1919); 1st connecting membrane	-
dorsal cleft of phallobase	-	-	-	-	-	-	-	-	-
dorsal split	-	-	-	-	-	-	-	-	-
endophallus	endophallus (1952) endophallus distal part (1964)	endophallus	internal sac	endophallus (1952)	-	-	internal sac	internal sac	-
endophallic membrane	-	vesic or prepar- tial membrane	2nd connecting membrane	-	-	-	-	membrane between tegmen and median lobe (1919); 2nd connecting membrane	-
phallotreme	-	-	-	-	-	-	-	-	-
tegmen	-	phallobase + phallomere (1957)	basal piece + paramere + manubium	gonoforceps	tegmen	shield	tegmen	tegmen	ring
tegmina membrane	-	-	-	-	-	-	-	-	-
tegmina sclerite	gonostylus (1952)	paramere	paramere	gonostylus	-	-	-	lateral lobe	-
tegmina apodeme	-	apodeme of phal- lobase (1957)	manubium	-	tegmina strut	8th sternum	-	tegmen + basal piece (1912) tegmina strut	apodeme or 9th tergite
tegmina plate	-	-	-	-	-	-	-	-	-
aedeagus	aedeagus (1952) basiphallus + basi- phallomere (1964)	aedeagus	penis	aedeagus	median lobe	dorsal plate + ventral plate + lateral ridge	penis	median lobe	body or 10th sternite
aedeagal orifice	-	phallotreme (1935)	ostium	phallotreme (1952)	gonopore	ventral apex	-	median orifice	apical opening
aedeagus orifical plates	-	-	-	-	-	-	-	orifical plates (1947)	-
aedeagal fenestra	-	-	-	penis valve	-	-	-	-	papilla
aedeagal apodemes	aedeagal apodemes (1952) phallic apodemes (1964)	aedeagal apodemes	apophysis of penis	aedeagal apodemes	anterior fork of median lobe	9th sternum	struts	median struts	apodemes or femora
ductus ejaculatorius	-	ductus ejacu- latorius	ductus ejacu- latorius	-	-	-	trachea of penis	flagellum + ejaculatory duct functional orifice (1918, 1919)	ejaculatory duct

Table 2. Terms Used in Female Genitalia

Wattanapongsiri	Gilbert (1964)	Lindroth and Palmén (1956)	Bissel (1937)	Snodgrass (1935)	Metcalf (1932)	Tanner (1927)	Pruthi (1924) Herberdey (1931)	Miles (1923)	Hopkins (1911)
vaginal base	-	-	-	-	chitinous cylinder	-	-	chitinous plate	-
dorsal cleft of vaginal base	-	-	-	-	-	-	-	-	-
vulva	vulva	vulva	vulva	vulva or gonopore	gonopore	vulva	-	-	apical opening of ovipositor
spiculum ventrale	spiculum ventrale	-	spiculum ventrale	-	chitinous rod	baculum ?	-	chitinous rod	-
spiculum fenestra	-	-	-	-	-	-	-	-	-
vagina	vagina	vagina	vagina	vagina or genital chamber	-	-	-	-	vagina
vaginal chamber	-	-	vestibule	genital chamber	-	-	-	-	-
vaginal plate	-	-	-	-	-	-	-	-	-
oviductus cummunis	common oviduct	oviductus cummunis	common oviduct	oviductus cummunis	-	-	-	-	unpaired oviduct
oviductus lateralis	lateral oviduct	oviductus lateralis	calyx	oviductus lateralis	-	-	-	-	paired oviduct
ovary	ovary	ovary	ovarian tube + oviduct	ovary	-	-	-	-	ovary
ductus spermathecae	-	ductus spermathecae	-	-	-	-	-	-	seminal duct
spermathecal gland	spermathecal duct	spermathecal gland	spermathecal gland	spermathecal gland	accessory gland	-	receptaculum gland	-	spermathecal gland
spermatheca	spermatheca	spermatheca or receptaculum seminis	spermatheca	spermatheca or receptaculum seminis	spermatheca	-	receptaculum seminis	receptaculum seminis	spermatheca
ductus bursae	-	ductus bursae	-	ductus bursae	-	-	-	-	-
bursa copulatrix	bursa copulatrix	bursa copulatrix	-	bursa copulatrix	-	-	-	-	bursa copulatrix
stylus	stylus	stylus, style, genital style	stylus	stylus	genital palp	stylus	stylus	-	genital palpus
ovipositor	ovipositor	-	ovipositor	ovipositor	-	ovipositor	-	-	ovipositor

and sixth species, respectively. No type was designated.

Two years later, in 1797, Thunberg established the genus Cordyle which based on a large, long rostrum and characters of antenna. Thunberg included five species, three of which were palmarum, barbirostris and sexmaculatus. He described the latter two as new. No type was designated. In 1801, Fabricius placed five species of Rhynchophorus in Calandra. These five species were palmarum, phoenicis, cruentatus, ferrugineus and schach. He described phoenicis and schach as new. Later in the same year, Lamarck used the name Calandra and included palmarum in the genus. Latreille, in 1804, redescribed the genus Curculio and included palmarum in the genus. One year later, in 1805, Illiger rearranged the genera and included palmarum, cruentatus, ferrugineus, schach in the genus Calandra. Olivier, in 1807, placed Rhynchophorus as congeneric with Calandra and included palmarum, ferrugineus and schach in Calandra.

Schoenherr (1826) recognized the genus Rhynchophorus and placed Curculio Linnaeus 1758, Cordyle Thunberg 1798, and Calandra Fabricius 1801 as congeneric with Rhynchophorus Herbst 1795. Schoenherr first designated Curculio palmarum Linnaeus 1758 as the "type species" and included phoenicis, schach, ferrugineus in the genus. In 1838, Gyllenhal first clarified the differences between the genera Rhynchophorus, Curculio and Calandra. He rearranged

and redescribed the generic characters and recognized Rhynchophorus palmarum (Linnaeus) as the type species. He included phoenicis, schach, ferrugineus, vulneratus, and barbirostris in the genus.

Castelnau, in 1840, placed Rhynchophorus as a subdivision of Calandra and included palmarum in the genus. Five years later, in 1845, Boheman rearranged and described the species within the genus followed the same pattern as Gyllenhal in 1838. Boheman included phoenicis, schach, pascha, zimmermanni, barbirostris in the genus. In this work he described pascha and Fähræus described zimmermanni as new. Lacordaire, in 1866, accepted the genus Rhynchophorus and placed it under Calandrides, mentioned the generic characters and included a discussion of zimmermanni and palmarum.

In 1882, Chevrolat rearranged, redescribed, and described the species in the tribe Calandrides, and gave a very good arrangement of the species in Rhynchophorus. He divided species as follows: Indian species group--ferrugineus, indostanus, pascha, signaticollis, lobatus; Oceanic species group--bilineatus, rubrocintus; African species group phoenicis, South American and West Indies group--cycadis, palmarum, depressus, lanuginosus; Central American species group--cruentatus, barbirostris. Of these species, lanuginosus, depressus, were described as new in 1880, and indostanus, signaticollis, rubrocintus were described as new in 1882.

Le Conte and Horn in 1876 placed Rhynchophorus in tribe

Rhynchophorini, subfamily Calandridae, and in 1883 they changed the spelling to Calandrinae. Champion (1910) placed Rhynchophorus under group Rhynchophorina, tribe Rhynchophora, and included palmarum in the genus. Blatchley and Leng (1916) placed it in subfamily Calandrinae and included cruentatus and palmarum in the genus. Pierce (1925) reviewed the history of the genera Rhynchophorus, Calendra, Sphenophorus, and Sitophilus and designated Rhynchophorus palmarum (Linnaeus) as type species of the genus Cordyle Thunberg 1797.

In 1882, Chevrolat excluded four species from Rhynchophorus: borassi, germari, politus, nitidulus and established the genus Dynamis for these four species. No type was designated. Champion (1910) described one new species, peropacus, and redescribed borassi, germari, and suggested that politus was probably conspecific with Rhynchophorus palmarum. He also stated that the type of the genus Dynamis will be Calandra borassi F. The writer believes that by so doing Calandra borassi Fabricius 1801 was designated as type species by Champion in 1910.

In brief, the history of the genera Rhynchophorus Herbst 1795, Dynamis Chevrolat 1882, and Rhynchodynamis Heller 1906 may be given as follows:

Rhynchophorus Herbst, 1795, *Natursyst. Ins. Käf.*, vol. 3, pls. 60-61. Type species Curculio palmarum Linnaeus 1758

designated by Schoenherr in 1826.

Rhynchophorus Herbst, 1795, *Natursyst. Ins. Käf.*, 6:3-30.

Type species Curculio palmarum Linnaeus 1758, designated by Schoenherr in 1826.

Cordyle Thunberg, 1797, *Kungl. Vet. Acad. Handl.*, 18:44-

49. Type species Curculio palmarum Linnaeus 1758, designated by Pierce in 1925.

Dynamis Chevrolat, 1882b, *Ann. Soc. Ent. France*, ser. 6, 2:

563-564. Type species Calandra borassi Fabricius 1801, designated by Champion in 1910.

Rhynchodynamis Heller, 1906, *Ent. Zeit. Stettin.*, 47:47.

Type species Rhynchodynamis filirostris Heller 1906, hereby designated.

In the "Catalogue of the Coleoptera of America, North of Mexico" in 1920 Leng placed Rhynchophorus in the tribe Rhynchophorini, subfamily Calandrinae and changed to Rhynchophoridae in the 1927 supplement. No Dynamis or Rhynchodynamis was included in this catalogue. In 1936, Csiki, the writer of "Pars. 149. Curculionidae: Rhynchophorinae; Cossoninae" in Junk and Schenkling "Coleopterorum catalogus" placed the genera Rhynchophorus, Dynamis, and Rhynchodynamis (as subgenus), in the subtribe Rhynchophori, tribe Rhynchophorini, subfamily Rhynchophorinae. He included 18 species in Rhynchophorus, five in Dynamis, and one species in the subgenus

Rhynchodynamis. In the "Checklist of the Coleopterous insects of Mexico, Central America, the West Indies, and South America" of Blackwelder (1947), Rhynchophorus, Dynamis, and Rhynchodynamis (as subgenus) were placed in the tribe Rhynchophorini, subfamily Rhynchophorinae. He included barbirostris, cruentatus, cycadis and palmarum in Rhynchophorus, and borassi, filirostris, germari, nitidulus, peropaca (= peropacus), polita (= politus) in Dynamis.

ECONOMIC IMPORTANCE

The coconut palm, Cocos nucifera Linn., has a wide range from east and west on both sides of equator. It grows throughout the West Indies, Central America, and South America. In Africa, there are large areas devoted to the coconut palms but it is more abundant perhaps on the west coast. Coconut palms also grow on the banks of the Nile and through India. Ceylon, the southern part of Mainland China, Malasia to New Guinea, and Australia. All the Pacific Islands in the tropical zone have coconut palms, from the little reef-fringed coral islands to the great rugged islands of the Solomons, New Hebrides, and Samoan Groups.

It has been estimated that there are 50,000,000 coconut palms cultivated in Ceylon, covering over 650,000 acres, with the export value and home consumption amounting to 2,500,000 dollars. Lepesme (1947) estimated that the damage to coconut palms caused by insects in the Philippines in 1929 amounted to 7,000,000 dollars. Wattanapongsiri (1959) reported that the annual export of copra and coconut oil in Thailand amounted to 2,000,000 dollars.

Seven species of Rhynchophorus and one species of Dynamis are known as the major pests of coconut palms throughout the regions mentioned above. There are numerous reports of their injurious activities from coconut growing regions and suggestions that they are serious pests of other palms as well as of coconut.

Rhynchophorus palmarum (Linn.) and probably R. ritcheri n. sp.

are pests of coconut palms and many other crops in Mexico, Central America, South America and the West Indies; R. cruentatus (Fabr.) is mainly a pest of palms in the southern part of the United States; R. bilineatus (Montr.) in the Pacific Islands including the East Indies; R. ferrugineus (Oliv.), R. vulneratus (Panz.) and probably R. distinctus n. sp. and R. lobatus Rits. in the Oriental Region from India to the Pacific Islands and extending southward as far as Australia; R. phoenicis (Fabr.) and R. quadrangulus Queden. in the Africa; Dynamis borassi (Fabr.) and probably other species of the genus in South America. For example, in 1954, in two heavily infested areas, Narathiwat and Nakornsrihamaraj, Thailand, more than 200,000 out of 2,300,000 palms were infested by R. vulneratus (Panz.) and were cut down in order to destroy the insects. From 1959 to 1964 two more Provinces, Choburi and Rayong, were heavily infested by R. ferrugineus (Oliv.). There are 313,309 palms in 5,031 acres in these two provinces. Within four years about 3,970 palms were cut down. If we estimate the loss of yield in Thailand alone, by 20 dollars per tree per one year, the loss of 200,000 palms will amount to 4,000,000 dollars. The cost of replacement of these palms would be even greater than the above figures.

The weevils attack both healthy and damaged palms and also utilize the holes made by other insects or wounds made by man and

nature for egg-laying. It is the larval stage which is responsible for damaging the coconut palm. Soon after hatching the larvae gnaw and bore through the tissues until they may reach the very heart of the cabbage. Once they have gained access the death of the palm generally follows. Crown infections of old and young trees are characterized by the falling down of the central shoots. In trunk infections there is frequently a gummy exudate while at the same time discarded fiber often projects from holes in the stem.

Many investigators agree that the weevils are extremely difficult to control, because the larvae feed inside the trunk. It was suggested by Ghosh (1940) that as soon as infestation is noticed the safest plan is to cut down and burn the infested tree, thus removing the source of damage to other trees, since many weevils develop from a single infested tree.

Banks (1906) said that the weevil was more serious to coconut palm than the Rhinoceros Beetle, Oryctes rhinoceros (Linn.), also an extremely difficult enemy to combat. Copeland (1931) described the weevil as the most deadly insect of the coconut. Brand (1917) reported that the ingress of the weevil to the tree was not limited to wounds. Hagley (1965) also reported that in Trinidad in the field the most extensive damage was caused by the eighth and ninth instars. When 20 to 30 larvae were present in a single three to five year-old palm, the internal tissues were completely destroyed

within five to six weeks. The upper stem and crown regions of the palm subsequently collapsed and fell over, and trees in this condition were referred to as "pop-necked". Rhynchophorus palmarum is also known as a vector and disseminator of the nematode, Rhadinaphelenchus cocophilus (Cobb) which is the causal agent of red-ring disease of coconut palms.

Besides coconut and other palms, the weevils also attack sugar cane, Saccharum officinarum; cacao, Theobroma cacao; pineapple, Ananas sativa; papaya, Carica papaya; and banana, Musa sapientum. Hagley (1965) reported that adults of R. palmarum will also feed on young shoots of bamboo, Bambusa sp. ; tubers of tannia, Xanthosoma sp. ; tubers of dasheen, Colcasia sp. ; yams, Dioscorea sp. ; carrots, Daucus carota; turnips, Brassica rapa; beets, Beta vulgaris; ripened egg plants, Solanum melongena; ripened tomatoes, Lycopersicum esculentum; ripened cucumbers, Cucumis sativus; ripened pumpkins, Cucurbita pepo; ripened watermelons, Citrullus vulgaris; ripened mangoes, Mangifera indica; ripened golden apples, Spondias cytherea; ripened sugar apples, Anona reticulata; ripened soursops, Anona muricata; ripened avocado pears, Persea gratissima; ripened guavas, Psidium guyava; and ripened oranges, Citrus aurantium.

MITES ASSOCIATED WITH RHYNCHOPHORUS
AND DYNAMIS

Mites on palm weevils first came to the writer's attention in 1964 when several weevils, both adult and immature, were found heavily infested with mites. These mites belonged to the families: Uropodidae, Macrochelidae, Blattisociidae, Diplogyniidae, Acaridae and Anoetidae. Of these families, Uropodidae are the most common and attach themselves with pedicels to the weevils and shelter in clusters on the ventral surface of the body, beneath the elytra and on the legs. Those found on the pupae and larvae usually were found in the intersegmental folds, under pupal wings or elytra, and within cavities of the mouthparts. The other families of mites were found simply lying on the prosternum, or attached to the setae on femora or tibiae.

Chittenden in 1902 found two forms of mites associated with R. cruentatus which were identified by Banks as Uropoda and Holostaspis (treated as a subgenus of Hypoaspis, subfamily Hypoaspidae, family Laelaptidae, Baker and Wharton, 1959). In 1958, Hicks obtained several hundred mites from a single specimen of R. palmarum, which was collected in El Recreo, Nicaragua. On the basis of morphological characteristics he proposed a new genus and species for these mites. Detailed and illustrated descriptions

are included. The new genus Crenamargo is placed under the subfamily Diplogyniinae. The type species is Crenamargo binuseta Hicks, 1958. Baker and Wharton (1959) mentioned in "An introduction to Acarology" that Tetrapolipus rhynchophori Ewing, family Podapolipodidae, was taken from beneath the elytra of R. palmarum, which was collected in Panama.

Table 3. Mites found in association with Rhynchophorus and Dynamis

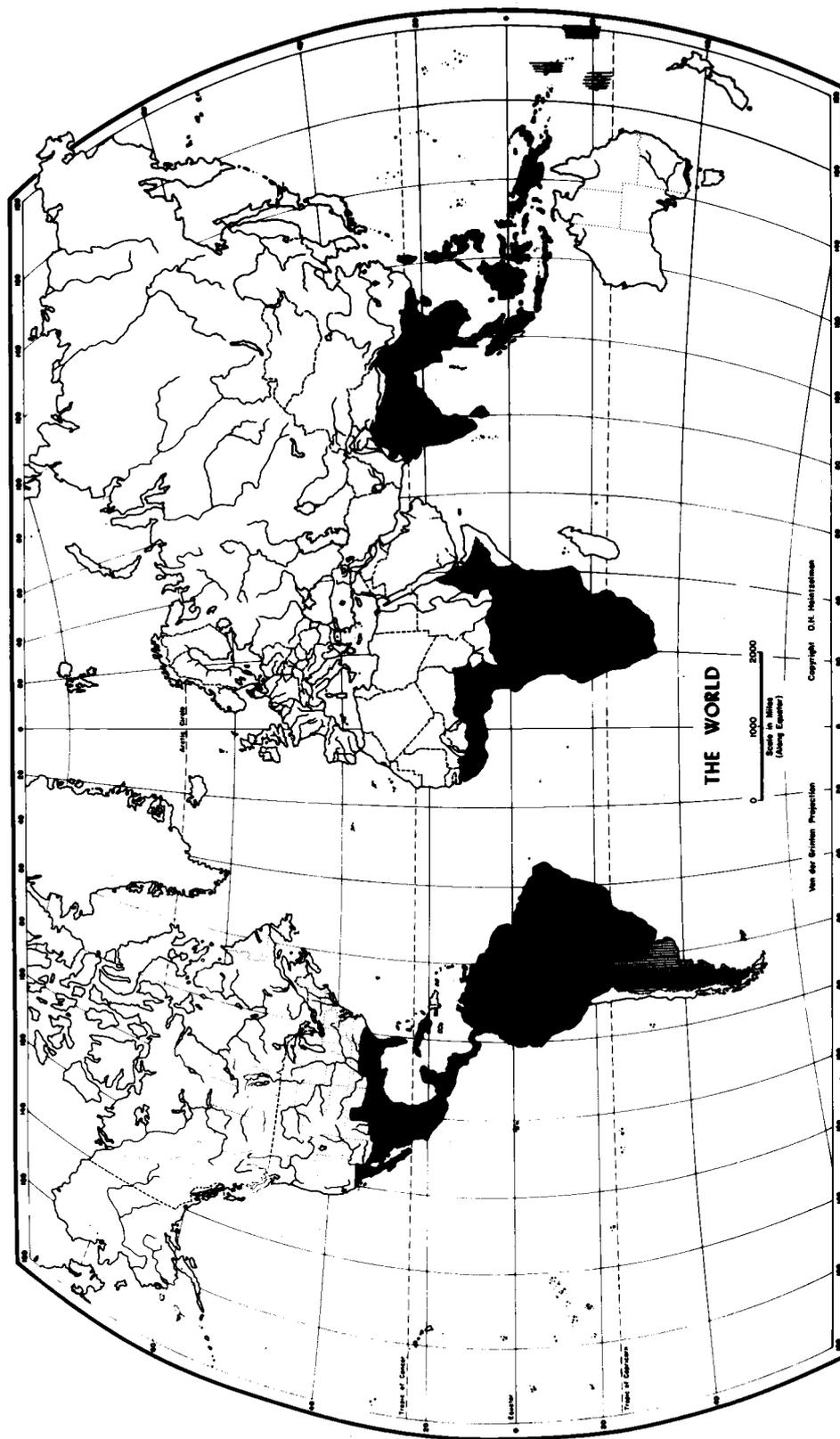
Mites	Stage Found	<u>Rhynchophorus</u> sp.	<u>Dynamis</u> sp.
<u>Uropodidae</u>			
<u>Cilliba</u> sp. 1	deutonymph	<u>palmarum</u> <u>vulneratus</u> <u>phoenicis</u> <u>bilineatus</u>	-
<u>Cilliba</u> sp. 2	deutonymph	<u>quadrangulus</u>	-
<u>Prodinychus</u> sp. 1	adult	<u>quadrangulus</u>	-
<u>Prodinychus</u> sp. 2	adult	<u>ferrugineus</u>	-
<u>Trichouropoda punctata</u> Hirsch. & Zirn.	deutonymph	<u>palmarum</u> <u>vulneratus</u> <u>phoenicis</u> <u>bilineatus</u> <u>ferrugineus</u>	-
<u>Uropoda</u> sp.	larva nymph and few adults	all species	<u>borassi</u> <u>arterntipae</u>
+ New genus (63 slides mounted)	tritonymph	<u>cruentatus</u>	-
<u>Macrochelidae</u>			
* <u>Macrocheles mammifer</u> Berl.	adult	<u>palmarum</u>	-
* <u>Macrocheles</u> n. sp. nr. <u>muscaedomesticae</u>	adult	<u>palmarum</u>	-
* <u>Macrocheles</u> n. sp. nr. <u>bisignata</u>	adult	<u>palmarum</u>	-
<u>Blattisociidae</u>	adult	<u>palmarum</u>	-
<u>Diplogyniidae</u>			
<u>Crenamargo</u> (?) sp.	adult	<u>palmarum</u>	-
<u>Acaridae</u>	adult and hypopus	<u>vulneratus</u>	-

* Identified by Dr. G. W. Krantz

+ Spinauropoda ennsi

DISTRIBUTION

The genus Rhynchophorus is worldwide in distribution. The geographical range extends throughout the Oriental region, Africa, and the New World (Map 1). In the Oriental region, there are five species recorded: bilineatus, distinctus, ferrugineus, lobatus, and vulneratus. These species extend eastward from India, through East Pakistan, Burma, Southern Mainland China, Southern Japan, Taiwan, North Vietnam, South Vietnam, Laos, Cambodia, Thailand, Malasia, Indonesia (Sumatra, Java, Borneo, and neighbouring islands), Territory of New Guinea and Papua, New Caledonia, other islands in the East Indies and Southern Australia. In Africa, there are two species recorded: phoenicis and quadrangulus. The geographical range of these species extends from Guinea, across the continent eastward to Uganda and southward to South Africa. In the New World, there are three species recorded: cruentatus, palmarum, and ritcheri. These species range from the United States of America and Cuba southward into Mexico, Central America, South America, and the West Indies. Most species of Rhynchophorus are restricted to their ranges of distribution: bilineatus in the oceanic islands in the East Indies; cruentatus in the southern part of the United States; distinctus in Borneo; ferrugineus and vulneratus throughout the Oriental region and southern Australia; lobatus



from the literature

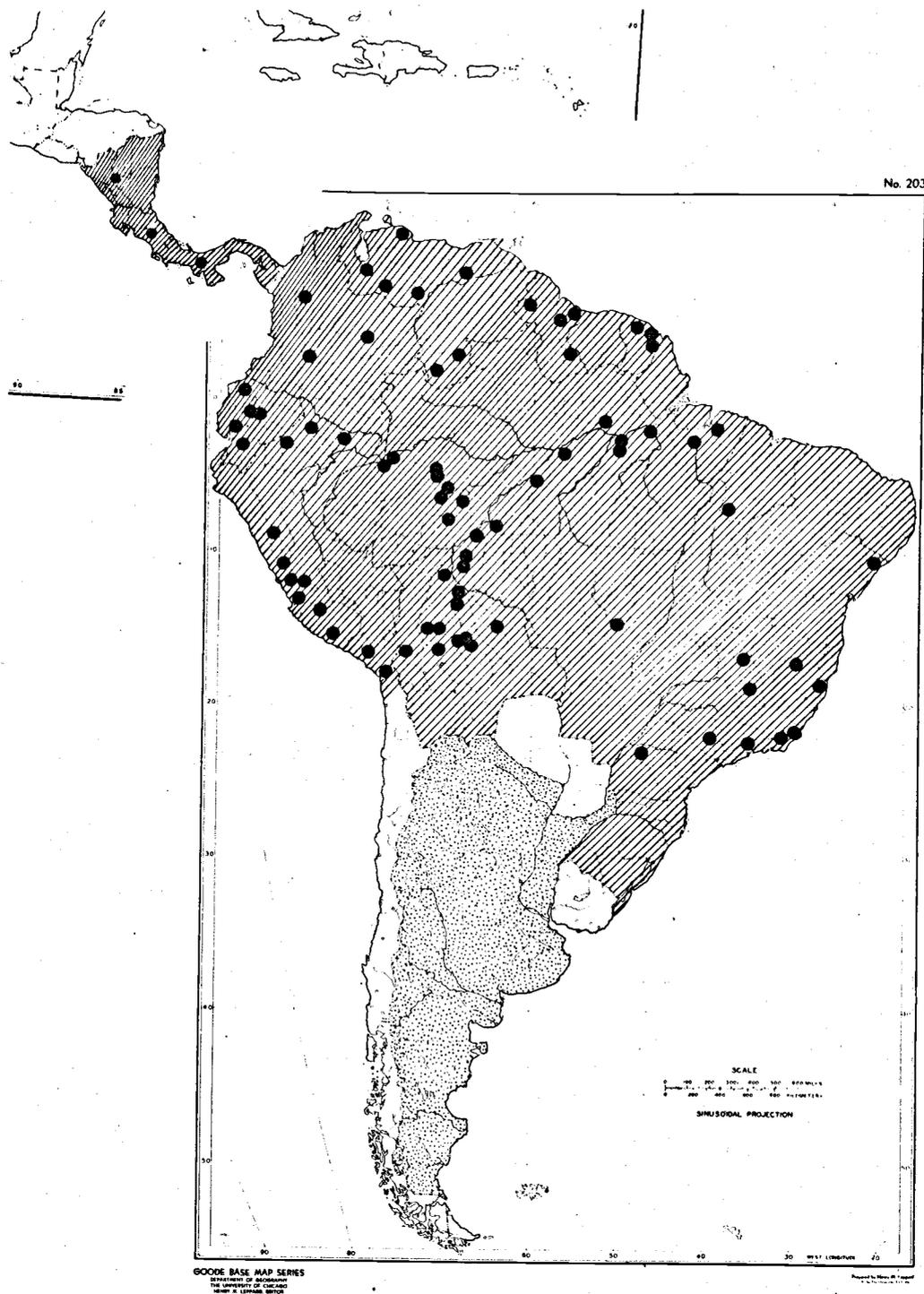
specimens examined

Map. 1. Distribution of the genus Rhynchophorus.

in Sumatra; palmarum from southern California of the United States of America to South America; phoenicis and quadrangulus in Africa; ritcheri in Peru and Brazil.

The geographical range of the genus Dynamis extends southward from Central America into South America (Map 2). In Central America, there are two species recorded: peropacus and palmiphilus. The former species is found in Nicaragua and Costa Rica, the latter is found in Panama and South America. In South America, there are nine species, including palmiphilus, recorded and their distribution extends throughout the continent, except Chile.

The genus Rhynchodynamis is found in Brazil and Bolivia (Map 6.).



Map 2. Distribution of the genus *Dynamis*.

 specimens examined

 from the literature

BIOLOGY

The biologies of all the previously known species of the genus Rhynchophorus, except R. lobatus Rits. and R. quadrangulus Queden., have been studied. In general the weevils are known to breed in the stems of various plants, especially species of "Palmae".

A few generalizations about the life history pattern of the genus Rhynchophorus were made by Blandford (1893), Anon. (1905), Bondar (1921, 1922, 1934, 1940), Bianchi (1935), Verano (1940), Landeiro (1941), Mungia (1958), Wilson (1963) and Hagley (1965) on R. palmarum (Linn.); of Corbett (1923, 1932), Corbett and Ponniah (1923, 1924) on R. vulneratus (Panz.) (under the name R. schach Fabr.); of Banks (1906), Lefroy (1906), Ghosh (1912, 1923, 1940), Fletcher (1914), Munro and Brown (1916), Brand (1917), Leefmans (1920), Hunger (1920), Dammerman (1929), Copeland (1931), Viado and Bigornia (1949), and Nirula (1956) on R. ferrugineus (Oliv.); of Froggatt (1936a, 1936b) on R. bilineatus (Montr.); of Lommel (1925), Lamborn (1932) and Lepesme (1947) on R. phoenicis (Fabr.); of Chapuis and Candéze (1853), Candéze (1861), Summers (1873) and Chittenden (1902) on R. cruentatus (Fabr.)

Copulation

There are four papers reporting the copulation behavior of

these weevils. Ghosh (1912) reported that in copulation, the male was on the back of the female which may be feeding at the time. In the insectary they coupled any time during the day and night. The period of copulation was short, lasting only a few minutes. The longest period noticed was seven minutes. Corbett and Ponniah (1924) reported that the male took up his position on the back of the female and tightly enfolded her with its legs. Copulation continued in any position and frequently the weevils may be seen lying on their sides. Viado and Bigornia (1949) stated that the weevils mated at any time of the day, in the morning and also late in the afternoon. Fifty percent of the weevils mated upon emergence. The male trailed the female wherever it went, occasionally tapping the female's elytra with its antennae. After several minutes the male mounted the female. Copulation took place from 15 to 30 seconds only and more than once. Hagley (1965) also described that mating normally commenced 12 to 24 hours after emergence and took place thereafter anytime during the day and night. Copulation lasted two to 11 minutes, and occurred frequently. The males often remained mounted on the backs of the females for 30 to 40 minutes, during which time copulation occurred about four to five times. A single female mated freely with several males, and continued to feed and to move around during mating, carrying the male on her back.

The Adult

The weevil lays its eggs on the palms in the soft tissues at the base of the leaf-sheath, terminal shoots or in the cuts made by man in the trunk. It is capable of laying eggs on the day after emergence from the cocoon. The female makes a small hole for each egg with its long snout, then turns around and deposits an egg in the hole. The burrows of other insects especially Oryctes sp. give the weevil access to the inside of the palm, of which full advantage is taken, and eggs deposited in or on the burrow walls in preference to any other spot. Several eggs are laid at one time, close together but not in contact. One female weevil is capable of laying from 30 to 832 eggs. The egg hatches in three to four days (see Table 4).

The Larva

The eggs hatch and give rise to stout whitish or yellowish-brown larvae, which eat out galleries through the softest tissue, thereby doing a maximum amount of damage, since they destroy the heart of the palm cabbage. The top of the palm falls over, indicating the presence of the weevil but only after the damage done is past any remedy. The larvae feed from 25 to 105 days and molt nine to 20 times during their life (see Table 4).

Table 4. Life History of Species of Rhynchophorus and Dynamis

Species of weevil	Number Egg per female	Incuba- tion period (day)	Larva (day)		Pupa (day)		Life cycle period (day)	Longevity (day)		Authority and Place Studied
			Number molt	Larval period	Prepupal period	Pupal period		Male	Female	
<u>Rhynchophorus</u>										
<u>ferrugineus</u> (Oliv.)	127-276	3-4	-	25-61	-	18-33	48-82	50-90	50-90	Ghosh 1912, India
	531	3	-	60-105	3-6	13-17	60	107	107	Leeffmans 1920, Indonesia
	300	3-4	-	30-105	-	17-50	60-165	-	-	Ghosh 1923 & 1940, Burma
	30-800	3	-	60	-	15	90-180	-	-	Lepesme 1947, Literature
male	162-350	3	9	35	2-11	11-19	45-68	63-109	39-72	Viado & Bigomia, 1949, Philippines
female				38	2-11	12-19	45-67			
<u>palmarum</u> (Linn.)	250	2-3	-	-	-	-	55-70	-	-	Bondar 1922 and 1940, Brazil
	40-50	3-4	-	30	-	17-18	-	-	-	Verano 1940, Colombia
	-	-	-	-	-	-	120-180	-	-	Mungia 1958, Mexico
	90-718	2-4	11	42-62	4-17	8-23	70-88	28-87	26-56	Hagley 1965, Trinidad
<u>phoenicis</u> (Fabr.)	-	-	-	-	-	26	60	-	-	Lepesme 1947, Literature
<u>vulneratus</u> (Panz.) (studied under the name <u>schach</u>)	832	3	16-20	59	-	25	87	117	116	Corbett 1923, 1932; Corbett & Ponniah 1923, 1924, Malaya
<u>Dynamis borassi</u> (Fabr.) (Studied under the name <u>D. politus</u> Gyll.)	-	-	-	-	-	-	180	-	-	Landeiro 1941, Brazil

The Cocoon

At maturity, the larvae cease feeding and prepare a cocoon made of the fibers or vascular bundles from the stem around them. The inside fibers are more closely matted together than those outside and arranged spirally. The interior of the cocoon is smooth and generally plastered with a yellowish or blackish-colored secretion. The cocoon is oval in shape, varying in length from 55 to 110 mm. and width from 18 to 60 mm., the average length being 80 mm. and width, 35 mm.

Pupation

Most investigators refer to the stage when the last instar larva has contracted and lost its form as a prepupa. It becomes a pupa when the last instar sheds its exuvium. The prepupal stage varies from two to 17 days and the pupal stage from eight to 50 days.

Hagley (1965) reported that the mature larva of R. palmarum (Linn.) often burrowed out of the palm stem into the soil for a varying depth, but pupation did not occur in the soil and the larva always re-entered the palm to pupate in the base of the petioles or in the harder tissue at the periphery of the stem.

General Habits

In general the weevil breeds at all seasons and there is no evidence that cold weather retards its development. However, Summers (1873) reported that egg-laying of R. cruentatus (Fabr.) may be retarded due to the cold weather. The life cycle varies from 45 to 180 days.

The weevil is a very strong flyer. Chittenden (1902) reported that R. cruentatus (Fabr.) in the United States could fly three to four miles in search of a diseased plam. Leefmans (1920) found R. ferrugineus (Oliv.) in Indonesia was capable of finding freshly cut stems of sago palms at least 900 meters away. Goonewardena and Valu (1958) reported that a flight of R. ferrugineus (Oliv.) in Ceylon ranges from 1/2 to 3/4 mile. Hagley (1965) stated that the average flight of both male and female of R. palmarum (Linn.) in Trinidad was about 20 feet per second, the fastest rate was found in male about 50 feet per second and the longest completed flight was about 900 yards. Rhynchophorus vulneratus (Panz.) in Malaya is active at 6 to 9 A. M. (Corbett, 1932), R. ferrugineus (Oliv.) in India between sunrise to 9 A. M. and between 5 P. M. to sunset (Nirula, 1956), and R. palmarum (Linn.) in Colombia 9 to 11 A. M. (Verano, 1940), in Trinidad 9 to 11 A. M. and 5 to 7 P. M. (Hagley, 1965).

Parasites

Only parasites of R. vulneratus (Panz.) and R. ferrugineus (Oliv.) are known. The parasite of the former, Scolia erratica Smith, found at Malacca, Malasia, by Burkill in 1917 (he called R. ferrugineus instead of R. vulneratus) and the parasite of the latter, Sarcophaga fascicauda Boett., found in South of India by Iyer in 1940.

Dynamis

The biology of the genus Dynamis has been known only for Dynamis borassi (Fabr.). It was studied by Bondar (1940) and Landeiro (1941), under the name Rhynchophorus politus Gyll., in Brazil. They reported that its appearance and biology were very similar to Rhynchophorus palmarum (Linn.) except for a longer life cycle and preference for living plant tissues.

The life history from the literature of Rhynchophorus and Dynamis has been condensed in Table 4.

DISCUSSION OF CHARACTERS

The following discussion is based primarily on the results of observations and dissection of adult weevils and the immature stages by the writer during the past three years. This study was restricted to the characters which might be used in the classification of the species. The principle object of the writer in the dissection and detailed illustration was to determine the significant taxonomic characters which would furnish a sound basis in determination, naming, and description of the species. The following characters include those of the egg, larva, pupa, and adult.

EggEgg (figs. 213-224)

The eggs of species of the genera Rhynchophorus, Dynamis, and Rhynchodynamis have the same general appearance: elongate-oval, posterior end usually broader than the anterior end, both ends smoothly rounded; color varying from whitish-yellow to brown, especially eggs of most species of Dynamis are brown or darker than that of Rhynchophorus or Rhynchodynamis; chorion may or may not be distinctive; average size of eggs 0.74 to 1.50 mm. in width by 2.50 to 3.89 mm. in length for Rhynchophorus, 1.10 to 2.02 by 3.50 to 5.29

mm. for Dynamis, and 1.10 by 3.50 mm. for Rhynchodynamis.

The size of the eggs is not proportional with the body size of the individual female, both within the species or the genera. For example, the egg of D. perryi is larger than the egg of Rhynchodynamis filirostris. The comparison of the size of the females and eggs were as follows:

	Female average size mm.		Egg average size mm.	
	length	width	length	width
<u>Rhynchophorus</u>				
<u>bilineatus</u>	31.00	12.40	2.62	0.90
<u>cruentatus</u>	29.00	12.00	2.50	0.74
<u>ferrugineus</u>	34.00	13.50	2.96	0.98
<u>palmarum</u>	36.80	15.20	2.50	0.90
<u>phoenicis</u>	35.60	13.20	3.89	1.04
<u>quadrangulus</u>	40.15	14.70	2.90	1.50
<u>vulneratus</u>	37.00	15.00	3.24	1.02
<u>Dynamis</u>				
<u>borassi</u>	44.00	17.00	3.70	1.10
<u>coracinus</u>	26.25	11.45	5.12	1.79
<u>peropacus</u>	35.00	14.25	5.29	2.02
<u>perryi</u>	22.88	9.28	4.78	1.95
<u>Rhynchodynamis</u>				
<u>filirostris</u>	54.75	21.75	3.50	1.10

Up to the present study no distinctive generic or specific characters of the eggs have been found.

Larva

Head

The head is distinctively sclerotized and nearly round. The capsule is of a uniform color and usually dark brown. The head of the larva is most important so far as characters of taxonomic value are concerned. The general structure of the head is shown in figure 7. The more striking differences in the head capsule are found in the labrum, mandible, labium, and maxilla. The morphological details of these characters are shown in figures 7, 10, 658-720.

Labrum (figs. 685-691)

The labrum is prominent. Distinctive characters on the ventral surface of labrum are the shape of epipharynx (figs. 10, 679-684), position of epipharyngeal setae and epipharyngeal sensory pores, and the number of the lateral setae.

Mandible (figs. 658-678)

The mandible is stout, with distinct globular condyle and concave fossa. The shape and size of the mandible varies strikingly

between species.

Labium (figs. 692-698)

Characters of taxonomic value are found on both ventral and dorsal sides. The shape of the hypopharynx, position of postmental setae and the pigmentation of the premental sclerite differ significantly.

Maxilla (figs. 699-714)

The maxilla is simple. The second segment of the maxillary palpus bears the dorsal sensory spot which may be useful in distinguishing the genera (figs. 729 - 730). The other significant taxonomic character is the number of dorsal setae of the mala (figs. 699-706) which can be used in determination of genera and species.

Thorax

The pronotum is undivided and dorsally has a paired distinct sclerotized plates, bearing five to six setae on each side. The genus Dynamis usually bears six setae while Rhynchophorus usually bears five setae. The mesonotum and metanotum are each divided into two distinct regions, the prodorsum and postdorsum. The prodorsum of both Dynamis and Rhynchophorus bears one seta. The postdorsum bears four setae in Rhynchophorus and only two in Dynamis. The

thoracic spiracle is located on the epipleuron near the mesothoracic segment and is herein called the mesothoracic spiracle. A prothoracic sternal opening is found in Dynamis and a depression in Rhynchophorus (figs. 8-9). This depression or opening may be useful as a taxonomic character in separating the genera. No distinctive specific characters are found on the thorax.

Abdomen

Abdominal characters may be more useful in distinguishing the genera rather than for separating species. The arrangement of the setae on the abdomen is alike in both genera except the size and length of the setae are different. The setae on the intersegmental fold and scutum in Rhynchophorus are more prominent than those of Dynamis. Most of the setae on the abdomen of Dynamis are usually obsolete or difficult to see. The anus shows some significant characters in separating the species when used in conjunction with other characters. The shape of the anal opening, preanal, median, and lateral lobes, and the presence or absence of these lobes may be useful in distinguishing between species (figs. 12, 650-655).

Pupa

Head

The general shape of the pupae is shown in figures 637-642.

The head bears several structures which are useful for separating species, such as the epicranial tubercles and tubercle-borne setae on the epicranium and rostrum. None of these characters are useful for separating genera, however.

Thorax

The distinctive generic characters are found mainly on the thorax. The shapes of the pronotum and scutellum may be useful in generic determination. Specific characters are the setae on pronotum, e. g., vulneratus (fig. 641) and ferrugineus (fig. 642); and the presence or absence of metanotal setae (figs. 638-639). On the elytron, the striae or ridges, interstices or intervals, may also be useful for specific separation.

Abdomen

Most of the abdominal tergites are armed with distinct dorsal spines. The number and arrangement of these spines differ from one species to the other. The differences found are discussed in the description of species.

Adult

Color

The body color of specimens of the genera Dynamis and

Rhynchodynamis is usually uniform and is black. Therefore the color of these two genera is not significant in distinguishing the species.

In the genus Rhynchophorus, the color ranges from ferrugineous to reddish-brown and to deep black. This coloration, together with the markings on the pronotum, is characteristic of the species and is reliable for normal, fully colored individuals. An attempt has been made to point out such color variations in the descriptions and discussion along with the illustrations of each species which follow.

The use of color and markings on the pronotum, however, in distinguishing species, especially by the person who is not familiar with the group, has caused much confusion in the past. Therefore, it is the opinion of the writer that coloration should not be relied upon alone and that other characters should be used whenever possible.

Size

Considerable variation in size in conjunction with variation in color is found in individuals of R. ferrugineus and R. vulneratus. This is believed to be due to the limitation of the food available to the larva which later affected the adult form. Therefore size alone is not of specific value and is often useless in classification, except when used with other characters.

Head

No significant characters have been found on the head except the punctation on the frons of R. quadrangulus.

Eye

The eyes are large, elongate oval, narrowly or widely separated above. The eye itself furnishes no distinctive generic or specific characters. The interocular space has been found very useful as a taxonomic character for distinguishing species.

Rostrum

The most important taxonomic characters, so far as the adult is concerned, are found on the rostrum. Between species, there are striking differences in the general shape of the rostrum, length, sculpturing, setae of the rostrum and the mouthparts such as mandible, maxilla, and submentum. The general shape, length, sculpturing and setae of the rostrum are shown in figures 125 to 162 and 240 to 275; of mandibles in figures 334 to 351; of maxillae in figures 34 to 35, 37 to 41 and 721; and of the submentum in figures 318 to 333. The above mentioned characters are important in the determination of both genus and species. For example, the genus Rhynchodynamis may be distinguished from the other genera by the filiform, long,

slender, polished rostra (figs. 147-148 and 256-257). In contrast, Dynamis has a very stout and very strongly compressed rostrum, which is important in diagnosing that genus from the rest of the genera in the subtribe Rhynchophori. The genus Rhynchophorus may be distinguished from the other genera by the cylindrical rostrum and in the male by the close, erect dorsal setae. Some species may be identified by the sculpturing of the rostrum: e. g. the male of R. cruentatus has a strongly rugose rostrum and no rostral setae, while on the male rostra of other species the rostral setae are present. R. quadrangulus has a distinct nasal plate, in other species it is absent or almost obsolete. The mandible is more useful in separating species: e. g. R. ritcheri has a narrowly rounded mandible while R. cruentatus has a broadly rounded mandible. The mandible of R. distinctus is tridentate with sharply pointed teeth; D. borassi has a rounded, convex, or emarginate mandible but all other species have the distal half of mandibles strongly depressed. In many species of the genus Rhynchophorus characters of the submentum are more diagnostic than many other characters: e. g. R. palmarum, the submentum is oval distally but it is truncate in R. distinctus and tridentate in R. bilineatus.

Antenna

The characters of antennae are shown in figures 192 to 202.

The length of the antennal scape and funicular segments varies only slightly. The size of the club varies in some species (e. g. distinctus, fig. 192, palmarum fig. 195, ritcheri fig. 196). They are difficult to study and are nearly identical in general shape for all species. However, the antennal characteristics are useful in separating the genera, e. g. Rhynchodynamis has long, slender, elongate funicular segments (fig. 193), while the antenna is thick in Dynamis and rather thick in Rhynchophorus.

Pronotum

The general shape, proportions, lateral margins and color markings of the pronota of the Rhynchophorus, Dynamis and Rhynchodynamis are shown in figures 42 to 124. The general shape, viewed dorsally, of the pronotum is useful in distinguishing the genera and species. The genera Dynamis and Rhynchodynamis have pronota which are produced at their bases while in Rhynchophorus it is rounded. At the specific level the pronotum is much more useful in distinguishing the species in Rhynchophorus than in the Dynamis.

A discussion and illustration of the pronotum are included in the systematic section following the description of the species.

Elytra

The ratios of the length of the elytron to its width or to the

length of the pronotum were found slightly different between the species. The color of the elytra is sometimes useful in identification of the species, e.g. the elytra of R. palmarum are always deep black, while in the ferrugineus usually ferrugineous. The confluence of the striae among the species is extremely variable and is unreliable. In some species of Dynamis, such as nitidulus, coracinus and peropacus, they may be distinguished from other species by the vestiture of their elytra. The general shape of the elytron in most specimens is usually very similar.

Scutellum

The scutellum (figs. 173 to 177 and 225 to 239) differs significantly between the genera and to some extent in some of the species. However, it is not considered to be of much value in identification of species.

Femur

Characteristics of femur are most useful in determination of the genera rather than the species, but in a few instances species may be identified by the length of the femur. The front femur of Dynamis is strongly curved ventrally (figs. 388, 394, 398) but it is not in Rhynchophorus (figs. 379-380).

Tibia

The general shape of the tibiae is shown in figures 368-378, 381-387, 391-393, 397, 407, 411. The tibia is fairly constant in size and form and may differ from one species to another in shape. The tibia of R. ritcheri is very characteristic of the species and readily distinguishes it from all other species in the genus. The tibia of R. distinctus is also different from that of all other species.

Tarsus

The relative length and width of the tarsal segments vary between species. However, the most striking differences in the tarsus are found in the third tarsal segment (figures 203-212).

Abdomen

The abdomen is of a type common to all of the Rhynchophora except in some species the punctation and the presence or absence of the setae on the fourth or fifth abdominal sternites is distinctive.

Pygidium

The general shape, punctation and the arrangement of hairs are shown in figures 352 to 364. These characters are good for identification of some species. For example, the pygidia of the

genus Dynamis are narrower and fringed with longer setae than those of Rhynchophorus or Rhynchodynamis. So far as species are concerned, R. distinctus has a flat, smooth pygidium, but the pygidium of R. quadrangulus is convex and strongly punctured while that of R. phoenicis is similar to quadrangulus except it is smooth.

Genitalia

The shape and ratios of the width to the length of the phallobase or vaginal base and the tegminal base are useful in generic determination. The genitalia of all the genera studied in this paper have been found to possess excellent taxonomic characters of specific value. The main differences lie in the shapes of dorsal cleft of the phallobase or vaginal base, tegminal plate, aedeagus, aedeagal fenestra, orifical plate of aedeagus, aedeagal valve, and the length or the presence or absence of the dorsal split of the phallobase.

The form of the spiculum ventrale of the female genitalia is also useful in species determination but subject to some variation. The characteristics of the spermatheca are more diagnostic and more constant in shape than those of the aedeagus.

An attempt has been made to present the characteristics in the description of each species.

Male Genitalic Structures (figs. 1-5)

The phallus of most species is dark brown and consists of a phallobase, endophallus, tegmen, and aedeagus. The phallobase is broad posteriorly, narrow anteriorly, flat, concave ventrally, and convex dorsally. The dorsum has a dorsal cleft medioposteriorly. Dorsal cleft is narrowly convergent from two-thirds to three-fourths of its total length. Dorsolaterally, with or without setae. Each side of dorsal cleft is concave and divergent posteriorly. The length of the dorsal split of the phallobase varies according to the species. Venter of the phallobase has two separated sclerotized plates, here refers to as "ventral sclerites", one of which bears several slender brown setae. Apex of phallobase is thick and usually sparsely punctured. Phallobase may or may not be edged with membranous tissue latero-posteriorly.

The endophallus is tubular, strongly concave, and curved ventrally; one-third of posterior part broad, and heavily sclerotized, the other two-thirds is transparent and narrowed to the phallotreme. The proximal part of the endophallus is connected to the base of the tegmen, which is called "tegminal base", by a large tubular membrane, which is named "tegminal membrane". At the anterior end of the endophallus where it joins the phallobase with the "phallobasic membrane", it forms a narrow tube which allows

the aedeagus to move through it but does not admit of any lateral motion.

The tegmen is heavily sclerotized, consisting of a strong sclerotized ring, which is named "tegminal sclerite", incompletely sclerotized on the dorsal area where the tegminal sclerite curves down anteriorly or nearly so, but does not meet. Tegminal apodeme is large, and broad posteriorly. The posterior part of the tegminal apodeme triangular with straight or gradually curved edges called "tegminal plate". It varies somewhat in shape and size in different species. Dorsal side with a strong keel which is called "dorsal keel", on the surface of the apodeme.

The aedeagus is strongly curved ventrally, connected to the endophallus at the apex with "endophallic membrane". The aedeagus is a long, flat, structure, heavily sclerotized with split at the apex. It consists of four sclerotized parts: the dorsal part is called "aedeagal fenestra", the two lateral parts which are strongly sclerotized and may or may not be connected with the aedeagal apodemes, they are called "lateral arms", and the ventral part is called "ventral plate". The aedeagal fenestra is broad anteriorly and narrowly convergent posteriorly, and is produced at the posterior end farther than the ventral plate. The apex of the aedeagal fenestra is somewhat oval or sometimes nearly truncate. The ventral plate is broader than the aedeagal fenestra and usually joins or fuses with the lateral arms.

The aedeagal apodemes are heavily sclerotized and where they join with the lateral arms they are less sclerotized. They extend freely posteriorly.

Female Genitalic Structure (fig. 6)

The female genitalia is simple, and consists of a vaginal base, spiculum ventrale, genital styli, and vaginal chamber. The latter two are enclosed in the vaginal base. The vaginal base is triangular in shape, pointed posteriorly, dark brown, sclerotized, and somewhat homologous to phallobase in the male genitalia. It is convex dorsally, with the dorsal cleft narrowly convergent toward the posterior end. Lateral sides of the vaginal base are folded ventrally and connected with the spiculum ventrale with sclerotized membrane. Each side of the dorsal cleft is abruptly divergent posteriorly, sometimes almost meeting dorsoposteriorly. The area of the dorsal cleft varies from one-fourth to one-half as long as the vaginal base. Dorsum of the vaginal base with posterior one-third coated with membrane, and at the anterior end fringed with setae both dorsally and laterally. Ventral side is slightly depressed and curved ventro-anteriorly.

The spiculum ventrale is flat and elongate, length varying in length from two-thirds to four-fifths as long as the length of the vaginal base. The posterior end varies in shape according to species;

the anterior end is truncate and fringed with small brown setae.

The two genital styli are inserted beneath and connected with the spiculum ventrale by membrane. Each stylus is sclerotized and fringed with setae anteriorly.

The vaginal chamber is membranous and transparent, with a vaginal plate lying beneath it. The vaginal plate joins the vaginal chamber at the base and usually bears two small dark brown sclerites on each side of the plate anteriolaterally.

Spermatheca is somewhat C-shape, usually with distinct ventral lobes. The number of ventral lobes varies according to the species, and it also varies in shape and size in different species. The spermathecal gland is broadly oval, sac-like, membranous and nearly transparent.

In this study only the descriptions of the type species: Rhynchophorus palmarum (Linnaeus), 1758; Dynamis borassi (Fabricius), 1801; and Rhynchodynamis filirostris Heller, 1906 are given in full detail under the systematic section.

Individual Variation

Intraspecific variation in body size is usually found in all three genera, but variations in color and markings are found only in the genus Rhynchophorus. The greatest variation in color, markings and size occurred in R. ferrugineus and R. vulneratus. Variation

in color and in body size to a lesser extent is also found in bilineatus, cruentatus, phoenicis, and quadrangulus. Such fluctuations within a single population are evidently due to environmental factors, for example, rapid drying or disease of the tissues during the larval and pupal development may result in smaller body size of the weevil. Most of the specimens of R. ferrugineus and R. vulneratus collected from the Coconut Plantation areas are large and uniform size; those from road side and backyard coconut plantings are extremely variable in size and usually in color and markings.

A discussion of variation is also included in the systematic section following the description of each species which exhibits variation.

Sexual Dimorphism

The males and females of Rhynchophorus, Dynamis and Rhynchodynamis are usually about equal in size and abundance. In the genus Rhynchophorus the variation in color and markings is similar in both sexes. The sexes of these three genera are always easily distinguished by the presence or absence of the setae on the ventral side of the front femur, the curvature of the rostrum, and shape of the pygidium. (See below.) In addition, in Rhynchophorus the sexes are also easily distinguished by the presence or absence of the rostral setae and the sculpturing of the rostrum. In both

Rhynchophorus and Rhynchodynamis the length of the rostrum can also enable determination of the sexes. In Dynamis the sexes are distinguished by the curvature of the front femur.

The following are the comparative sexual characters of the genera Rhynchophorus, Dynamis and Rhynchodynamis.

	<u>Rhynchophorus</u>		<u>Dynamis</u>		<u>Rhynchodynamis</u>	
	♂	♀	♂	♀	♂	♀
Setae on front femur	present	absent	present	absent	present	absent
Curvature of rostrum	straight	curved	straight	curved	straight	curved
Shape of pygidium at apex	less pointed	pointed	less pointed	pointed	less pointed	pointed
Rostral setae	present	absent	absent	absent	absent	absent
Sculpturing of rostrum	rugose	smooth	smooth	smooth	smooth	smooth
Length of rostrum	short	long*	short	long	short	long
Curvature of front femur	not strongly curved	not strongly curved	strongly curved	not strongly curved	not strongly curved	not strongly curved

* found only in ferrugineus and vulneratus

SYSTEMATIC SECTION

Key to some genera of the subtribe *Rhynchophori*

1. Rostrum thick, shorter or very slightly longer than pronotum;
 antennal scape one-half or less than one-half the length of
 rostrum; funicular segments thick, conical 2
- Rostrum slender, one-third to one-half longer than pronotum;
 antennal scape one-fourth to one-fifth the length of rostrum;
 funicular segments slender, elongate
 Rhynchodynamis p. 61
2. Scutellum small; rostrum strongly compressed; front and
 middle femora curved ventrally Dynamis p. 230
- Scutellum large; rostrum cylindrical, if compressed with
 distinct rounded nasal plate; front and middle not curved
 ventrally Rhynchophorus p. 321

Genus Rhynchophorus Herbst

Rhynchophorus Herbst, 1795, *Natursyst. Ins. Käf.*, vol. 6, pls. 60-61; Illiger, 1798, *Verz. Käf. Preuss.*, p. 498; Schoenherr, 1826, *Disp. Meth. Curc.*, p. 23, 326; 1838, *Gen. Spec. Curc...*, 4(2):816-818; Lacordaire, 1866, *Hist. Nat. Ins.*, *Gen. Col.*, 7:271, 275-276; Horn, 1873, *Proc. Amer. Phil. Soc.*, 13:408-409; Blatchley and Leng, 1916, *Rhynchoph. N. E. Amer.*, p. 548-549; Lepesme, 1947, *Les Ins. Palm.*, p. 611; Vaurie, 1951, *Amer. Mus. Nat. Hist. Bull.*, 98:52.

Rynchophorus Herbst, 1795, *Natursyst. Ins. Käf.*, 6:3-4.

Cordyle Thunberg, 1797, *Kungl. Sven. Vet. Akad. Handl.*, 18:44-46.

Description

Adult male. Length 31.00 to 39.60 mm., width 11.50 to 15.05 mm.. Color varying from ferrugineous or reddish-brown to deep black. Rostrum shorter than pronotum, tapering and more or less arcuate at the apex, minutely to strongly punctured or tuberculate; rostral setae present, if not tuberculate; all the species with rostral setae except cruentatus and sometimes quadrangulus. Gular suture always distinct, narrow or wide. Mandible varying from oval distally to four dentates with sharply pointed teeth. Antennal scape of variable thickness, one-half the length of rostrum;

funicular segments medium thick to very thick. Pronotum usually broadly rounded, oval or slightly produced posteriorly, but much less than in Dynamis. Scutellum large, long, one-fourth to one-fifth the length of elytron. Elytra wider than pronotum, feebly convex at base and more convex dorsoposteriorly; each elytron varying from two and one-half to three times its own length, and with five or six deep striae and traces of four or three more at side. Front and middle femora not strongly curved ventrally. Third tarsal segment dilated, area covered by ventral setae varying from one-sixth of the area to the entire area. Ratio of width to length of phallobase 1:2, except distinctus 1:1 and ritchieri 1:4.

Adult female. Length 29.00 to 40.15 mm., width 12.00 to 14.70 mm.. Similar to male except setae on front femur absent, on front tibia much shorter; rostrum longer, more strongly curved, smooth or less punctured, much more cylindrical; only the rostra of ferrugineus and vulneratus slightly longer than pronotum. Rostral setae absent. Pygidium more pointed. Ratio of width to length of vaginal base 1:3. Spermatheca truncate distally.

Type Locality

India (?)

Linnaeus (1758) originally described the habitat as "Habitat in Indiae Palmis," which means "Indian palm" and may be grown in

South America. R. palmarum has never been known from the Oriental Region and it is restricted to the New World and the West Indies. However, Linnaeus in 1764 and 1767 redescribed the habitat as "Habitat utraque India, . . ." and "Habitat in Indiae Palmis, . . ." respectively.

Types and Location

Type species is male Rhynchophorus palmarum (Linnaeus), 1758, designated by Schoenherr in 1826. Type is at the Uppsala Museum, Sweden.

Description of Larva

Body length 25 to 64 mm., width 13 to 25mm., Head length 7 to 13 mm., width 6.0 to 11.5 mm.. Body setae usually distinct. Epicranium with five to six dorsal setae and three to seven postdorsal setae. Labrum with sixteen to thirty lateral setae. Epipharynx with two pairs of dorsal setae, two pairs of sensory pores and sensory spines absent; distance between epipharyngeal setae 2 as wide as or slightly wider than distance between setae 1. Epipharynx varying from Y-shaped to oval or broadly rounded. Mala with eighteen to twenty-seven dorsal setae, some bifurcate and trifurcate. Second segment of maxillary palpus with oval sensory spot. Prothoracic sternum with a depression.

Description of Pupa

Body length 27 to 51 mm., width 13 to 21 mm.. Pronotum more or less subquadrate, broadly rounded posteriorly; spines on pronotum scattering or placed along margins. Scutellum long, broad at base, blunt or sharply pointed posteriorly. Rostrum not obviously sinuate at side.

Discussion

The genus was redescribed by Schoenherr in 1826 and 1838, by Lacordaire in 1866. When the above writers redescribed the genus, Dynamis was not yet erected and all of its forms were included in Rhynchophorus. Therefore, the generic characters of Schoenherr and Lacordaire covered both Rhynchophorus and Dynamis. Lepesme (1947) was the first to redescribe the genus after Dynamis was erected by Chevrolat in 1882. His redescription was given as follows: "Corps de grande taille, déprimé en dessus, de coloration noir, variée de rouge, très variable dans le corps d'une même espèce. Rostre allongé et droit, avec une crête antérieure dorsale chez les ♂♂. Articles du funicule antennaire courts; massue transverse, sécuriforme, lisse et luisante. Mandibles simples. Thorax plus long que large, avec un sillon transverse antérieur. Élytres plans à stries plus ou moins nettes. Pattes moyennes; fémurs et

tibias comprimés; apex du tibia crochu. Pygidium largement découvert. Métasternum déprimé. Prosternum avec une saillie post-coxale échancrée couvrant partiellement le mésosternum. Épisternes du métasternum très larges, épimères très grandes. "

A taxonomic study of the larva was made in 1853 by Chapuis and Candeze and later by Candeze (1861), Cotton (1924), Anderson (1948), Viado and Bigornia (1949), and Wattanapongsiri (1959). However the general description has been given by many writers. The earliest general description is that of Guilding in 1828. The first figures of the adult and larva go back to 1726 when figured by Merian, in her remarkable "Dissertation sur la Generation et les Transformations des Insectes de Surinam, & c." published in 1726. The first recognisable drawing of the cocoon and the pupa was that of Guilding in 1828.

Rhynchophorus is distributed throughout the Tropical Regions (Map 1.) and is abundant in areas where palms are grown, especially in the coconut plantations in the Tropics. The biology and economic importance have been very well studied. Out of a total of ten species, seven are known to attack palms. The weevils also attack sugarcane, cacao, papaya, etc. Detailed discussion of the biology and economic importance is discussed under the preceding sections and under the species studied.

Diagnostic characters for adults of this genus are: rostrum

cylindrical, male with rostral setae, if not tuberculate; antennal scape one-half the length of rostrum; scutellum long and broad at base; front and middle femora not strongly curved ventrally; spermatheca truncate distally.

Prior to the present study, ten species were known. Two new species are described in this paper, all the old species are redescribed and eight species are placed in synonymy. The species are listed with the writer, date when the species was described and synonyms:

bilineatus (Montrouzier), 1857

kaupii Schaufuss, 1864, New synonymy.

velutinus Fairmaire, 1877

montrouzieri Chevrolat, 1882, New synonymy.

rubrocinctus Chevrolat, 1882, New synonymy.

cruentatus (Fabricius), 1775

zimmermanni Fähræus, 1845

distinctus new species

ferrugineus (Olivier), 1790

sanguarios Rhumpf, 1750-1755 (not valid ICZN

Articles 3, 11 (a), 86)

sexmaculatus Thunberg, 1797

indostanus Chevrolat, 1882, New synonymy.

signaticollis Chevrolat, 1882, New synonymy.

labatus Ritsema, 1882

palmarum (Linnaeus), 1758

barbirostris Thunberg, 1797, New synonymy.

cycadis Erichson, 1847

depressus Chevrolat, 1882

lanuginosus Chevrolat, 1882

phoenicis (Fabricius), 1801

quadrangulus Quedenfeldt, 1888

ritcheri new species

vulneratus (Panzer), 1798

schach Fabricius, 1801

pascha Boheman, 1845, New synonymy.

glabrirostris Schaufuss, 1885, New synonymy.

Key to Species of Adult Rhynchophorus

1. Mandible distally rounded or oval (figs. 338-339, 341-342)
 2
- Mandible distally toothed (figs. 334-337, 340) 4
2. Nasal plate absent (figs. 248-249, 251); setae beneath the third
 tarsal segment covering one-sixth the entire area (figs. 204,
 208); pronotum oval posteriorly (figs. 44, 54); gular suture
 narrowed (figs. 165, 167); tip of rostrum not convex ventrally,

slightly compressed or cylindrical, and not convex or oval basodorsally (figs. 132, 137-138, 246-251); submentum truncate distally (figs. 319, 323) 3

Nasal plate present, distinct rounded (figs. 244-245); setae beneath the third tarsal segment covering two-thirds the entire area (fig. 206); pronotum almost square and broadly rounded posteriorly (fig. 51); gular suture wide (fig. 168); tip of rostrum strongly convex ventrally, strongly compressed, convex and oval baso-dorsally (figs. 135-136, 244-245); submentum oval distally (fig. 324)
 quadrangulus p. 188

3. Front tibia broad, flat, with two broad distal lobes (figs. 375, 387); middle and hind tibiae truncate distally (fig. 383); pronotum with sides curved and broadened before constricting anteriorly (fig. 54); rostrum quadrate and slightly compressed, dorsally concave or grooved at apex (figs. 132, 251); submentum truncately concave distally (fig. 323); mandible narrowly oval distally (fig. 339); male rostral setae thick, erect (figs. 132, 251).....ritcheri p. 198

Front tibia not flat; middle and hind tibiae not truncate; pronotum with sides straight before constricted anteriorly (fig. 44); rostrum cylindrical, oval or feebly convex at apex (figs. 137, 138, 248, 249); submentum sharply concave distally (fig. 319); mandible broadly oval distally (figs. 341, 342); male rostral setae absent, represented by tubercles dorsally (figs. 137, 249) cruentatus p. 125

4. Pronotum produced at base (figs. 49, 50); gular suture narrowed (figs. 163, 169); ventral space between antennal scrobes narrowed (figs. 163, 169); tip of rostrum dorsally grooved or nearly truncate (figs. 240, 241, 250); interocular space always one-third or less than one-third the width of rostrum at base (figs. 240, 250) 5

Pronotum oval or broadly rounded at base (figs. 52, 53); gular suture wided (fig. 116); ventral space between antennal scrobes broadened (fig. 166); tip of rostrum not grooved but oval distally (figs. 242, 243); interocular space not less than one-third the width of rostrum at base (figs. 242, 243, 254, 255) 6

5. Mandible deeply tridentate and sharply pointed distally (fig. 334); ventral space between antennal scrobes smooth, without setae

(fig. 169); middle and hind tibiae with distinct spines at base of uncus (fig. 381); pygidium flat dorsally; setae beneath third tarsal segment almost covering the entire area (fig. 203); submentum tridentate, sharply pointed and curved inwards (fig. 318); antenna small, slender (fig. 192); scutellum sharply pointed posteriorly (fig. 176); body ferrugineous with black patches distinctus p. 144

Mandible with two broad lobes (fig. 335); ventral space between antennal scrobes rugous with several long, slender setae (fig. 163); middle and hind tibiae without distal spines (fig. 385); pygidium convex dorsally; setae beneath third tarsal segment covering one-half the entire area (fig. 210); submentum oval (fig. 322); antenna thick (fig. 195); scutellum produced posteriorly (fig. 173); body completely black palmarum p. 77

6. Pygidium smooth; setae beneath third tarsal segment without two rows of lateral setae (fig. 209); interocular space nearly one-third the width of rostrum at base (fig. 254, 255); base of pronotum broadly rounded, usually with two long red stripes extending the entire length (figs. 52, 55 - 58); scutellum very narrowly produced posteriorly (fig. 226)..... phoenicis p. 173

Pygidium punctured; setae beneath third tarsal segment with two rows of lateral setae (fig. 207); base of pronotum oval or broadly oval, usually with one broad red or two small, short red stripes, or several spots on pronotum (figs. 43, 45, 53); scutellum somewhat pointed posteriorly (figs. 174, 239) 7

7. Gular suture uniformly broadened to the base (fig. 164); mandible four-dentate (fig. 336); submentum truncate with small triangular median depression confined to the apex (fig. 320); body black, usually with small narrowed, short, red stripes on pronotum (figs. 93-99) bilineatus p. 111

Gular suture with elongate-oval shape before narrowing to the base (fig. 166); mandible tridentate (fig. 337); submentum truncately concave with narrowly elongate median depression, extending throughout its length (fig. 321); body black or ferrugineus, usually with one broad red stripe or spots on pronotum (figs. 43, 53) 8

8. Pronotum broadly oval at base, curved at sides more uniform anteriorly (fig. 43); body usually ferrugineus with black spots on pronotum (figs. 101-123) ferrugineus p. 150

Pronotum broadly oval but strongly and narrowly curved anteriorly (fig. 53); body usually black with a broad, red stripe on center of pronotum (figs. 77-85)
 vulneratus p. 205

Key to Known Species of *Rhynchophorus* and *Dynamis* Larvae

1. Labrum with ten lateral setae (fig. 679); epipharyngeal setae 2 thick, distance between setae 2 twice as wide as between setae 1 (fig. 679); epipharynx V-shaped (fig. 679); second segment of maxillary palpus with circular sensory spot distally (fig. 730); prothoracic sternum with crescent-shaped opening (fig. 9) *Dynamis borassi* p. 242

Labrum with 16 to 30 lateral setae (figs. 10, 680-684); epipharyngeal setae 2 simple, slender, distance between setae 2 as wide as or slightly wider than between setae 1 (figs. 10, 680-684); epipharynx not V-shaped (figs. 10, 680-684); second segment of maxillary palpus with oval sensory spot distally (fig. 729); prothoracic sternum with median depression (fig. 8) *Rhynchophorus* p. 63 ..2

2. Epipharyngeal sensory pores placed closer to epipharyngeal setae 2 than 1 (figs. 680, 681); labrum with 16 to 22 lateral setae (figs. 680, 681) 3

Epipharyngeal sensory pores placed at or near the mid point
 between epipharyngeal setae 1 and 2 (figs. 682-684); labrum
 with 24 to 30 lateral setae (figs. 682-684) 4

3. Labrum with 16 short, lateral setae (fig. 680); distance from
 sensory pores to epipharyngeal setae 1 nearly three times as
 long as to setae 2 (fig. 680); eighth abdominal tergite without
 prodorsal setae (fig. 647); epipharynx without enlarged portion
 lateroanteriorly (fig. 680); mala with bifurcate dorsal setae
 (fig. 699) cruentatus p. 132

Labrum with 22 long lateral setae (fig. 681); distance from
 sensory pores to epipharyngeal setae 1 less than twice as long
 as to setae 2 (fig. 681); eighth abdominal tergite with four
 prodorsal setae (fig. 646); epipharynx with enlarged portion
 lateroanteriorly (fig. 681); mala with both bifurcate and tri-
 furcate dorsal setae (fig. 703)
 ferrugineus p. 158

4. Mandible toothed or bilobed (figs. 658-660, 670-672); epipharynx
 broadened anteriorly (figs. 10, 682); mala with 26 or 27 dorsal
 setae (figs. 700, 702) 5

Mandible not toothed or lobed (figs. 661-663, 676-678);
 epipharynx narrowed or tapering anteriorly (figs. 683, 684);

- mala with 18 to 20 dorsal setae (figs. 704, 705)
 6
5. Labrum with 24 lateral setae (fig. 10); epipharynx Y-shaped
 (fig. 10); apical tooth of mandible distinctly pointed (figs. 658-
 660); mala with bifurcate dorsal setae (fig. 700); distance
 between epipharyngeal setae 1 to epipharynx shorter than to
 setae 2 (fig. 10) palmarum p. 87
- Labrum with 28 lateral setae (fig. 682); epipharynx broad at
 base, not Y-shaped (fig. 682); apical tooth of mandible obtuse
 (figs. 670-672); mala with both bi- and trifurcate dorsal setae
 (fig. 702); distance between epipharyngeal setae 1 to
 epipharynx four times longer than to setae 2 (fig. 682)
 vulneratus p. 213
6. Labrum with 30 lateral setae (fig. 684); mala with 20 dorsal
 setae (fig. 705); mandible large, very thick and stout (fig. 676-
 678); eighth abdominal tergite with two prodorsal and two
 postdorsal setae (fig. 649) phoenicis p. 181
- Labrum with 24 lateral setae (fig. 683); mala with 18 dorsal
 setae (fig. 704); mandible small, not stout (fig. 661-663);
 eighth abdominal tergite without prodorsal or postdorsal setae
 (fig. 644) bilineatus p. 118

Key to Known Species of *Rhynchophorus* and *Dynamis* Pupae

1. Pronotum with two or three pairs of setae (figs. 641, 642);
 mesonotum with one pair of setae (figs. 641, 642); with one or
 two pairs epicranial setae (figs. 731, 732, 741)
 2
- Pronotal and mesonotal setae absent (figs. 637-640); epicranial
 setae absent, or if present with one pair (figs. 737-740)
 3
2. Distance subequal between the pairs of setae on pronotum;
 rostrum with three pairs of tubercle-borne setae, some of
 which are bifurcate (fig. 741)..... vulneratus p. 215
- Distance between the anterior pair of pronotal setae twice as
 long as the posterior pair; rostrum with two to four pairs of
 tubercle-borne setae (figs. 731-736)
 ferrugineus p. 161
3. Epicranium setae absent (figs. 738, 740); metanotum usually with
 one pair of setae (figs. 639, 640); rostrum with elevated dorsal
 tubercle between antennal space (figs. 738, 740)
 4

- With one pair of epicranial setae (figs. 737, 739, 740);
 metanotum without setae (figs. 637, 638); rostrum usually
 without elevated tubercle (figs. 737, 739, 740) 5
4. Rostrum with one pair of dorsal setae, and with elevated dorsal
 tubercle between antennal space (fig. 740)
 cruentatus p. 135
- Rostrum with three pairs of tubercle-borne setae, two located
 on the elevated tubercle at base of rostrum (fig. 738)
 palmarum p. 95
5. Rostrum with four or more pairs of setae; rostrum dorsally
 without elevated tubercle (figs. 737, 739) 6
- Rostrum with one pair of setae; rostrum dorsally with elevated
 tubercle between antennal space (fig. 740)
 cruentatus p. 135
6. Rostrum with four pairs of tubercle-borne setae, all posterior
 to the bases of antennae; sides of rostrum more or less
 sinuate (fig. 737) D. borassi p. 248
- Rostrum with seven pairs of tubercle-borne setae, two placed
 nearly at the tip of rostrum; sides of the rostrum not sinuate
 (fig. 739) phoenicis p. 183

Rhynchophorus palmarum (Linnaeus)

Figs. 1-5, 7-8, 10-12, 37, 50, 129-130, 163, 173, 178, 195, 210, 213, 240-241, 294-295, 322, 335, 357-358, 369, 379-380, 384-385, 472-476, 563, 575-577, 629, 639, 643, 658-660, 685, 693, 700, 711, 723, 729, 738, 742-743.

Curculio palmarum Linnaeus, 1758, Syst. Nat. Ed. X, 1:377;

1764, Mus. S. R. M. Lud. Ulr., p. 42; 1767, Syst. Nat. Ed. XII, 1(2):606; Gronovius, 1763, Zooph. Gronov., t. 16, fig. 4; Petiver, 1764, Gazoph., t. 35, fig. 5; Scopoli, 1772, Ann. Hist. Nat., 5:89; Degeer, 1775, Mem. Hist. Ins., 5:269-271, t. 15, fig. 26; Fabricius, 1775, Syst. Ent., p. 128; 1781, Spec. Ins., p. 162; 1787, Mant. Ins., 1:97; 1792, Ent. Syst., 1:395; Sulzer, 1761, Kenn. Ins., t. 3, fig. 20; 1776, Abgek. Gesch. Ins., pt. 2, t. 3., fig. 20; Herbst in Browski, 1784, Gemein. Naturg. Thier., 6:106-107; in Füessly, 1784, Arch. Ins., 4:68; Gmelin in Linnaeus, 1790, Syst. Nat. Ed. XIII, 1(4):1740-1741; Olivier, 1790, Encyclo. Meth. Hist. Nat. Ins., 5(2):472; Panzer in Voet, 1798, Beschr. Ubbild. Ins. Col., 4(1):58-61, and 4(2):t. 37, fig. 25.

Rhynchophorus palmarum (Linnaeus); Herbst, 1795, Natursyst. Ins.

Käf., 6:5, t. 60, figs. 1-2; Gyllenhal in Schoenherr, 1838,

Gen. Spec. Curc., 4(2):820-821; Boheman in Schoenherr, 1845,
 Gen. Spec. Curc., 8(2):216; Lacordaire, 1866, Hist. Nat. Ins.,
 7:269; LeConte and Horn, 1876, Proc. Amer. Philos. Soc.,
 15(96):424; 1883, Smith. Misc. Coll., 26(4):506; Chevrolat,
 1882, Bull. Soc. Ent. France, 2:138; 1882b, Ann. Soc. Ent.
 France, ser. 6, 2:561; Heyne and Taschenberg, 1908, Exot.
 Käf., p. 233, t. 32, fig. 3; Champion, 1910, Biolo. Centr.
 Amer. Col., 4(7):81, t. 4, figs. 3-4; Blatchley and Leng,
 1916, Rhynchopho. N. E. Amer., p. 549; Hustache, 1932,
 Faun. Colon. Franc., 5(24):376-377; Lapesme, 1947, Les
 Ins. Palm., p. 612-613; Voss, 1947, Rev. Ent. Rio de
 Janeiro, 18:63; Kuschel, 1955, Rev. Chil. Ent., 4:266, 281.

Cordyle palmarum (Linnaeus); Thunberg, 1797, Kungl. Sven. Vet.
 Akad. Handl., 18:46-47.

Cordyle barbirostris Thunberg, 1797, Kungl. Sven. Vet. Akad.
 Handl., 18:46-47. New synonymy.

Calandra palmarum (Linnaeus); Fabricius, 1801b, Syst. Eleut., 2:
 430; Lamarck, 1801, Hist. Nat. Anim. Vertebr., 4:354;
 Latreille, 1804, Hist. Nat. Crust. Ins., 11:99, t. 24, fig. 7;
 Illiger, 1805, Mag. Ins., 4:137; Olivier, 1807, Ent. Hist.
 Nat. Ins., 5(83):77, t. 2, figs. 16, a ♂, b ♀; Schoenherr, 1826,
 Curc. Disp. Meth., 4:327; Lacordaire, 1830, Ann. Soc. Nat.,
 21:167; Castelnau, 1840, Hist. Nat. Ins. Col., 2:364.

Rhynchophorus barbirostris (Thunberg); Schoenherr, 1838, Gen.

Spec. Curc. 4(2):828; Chevrolat, 1882b, Ann. Soc. Ent.

France, ser. 6, 2:562.

Rhynchophorus cycadis Erichson, 1847, Arch. Naturg., 13:136;

Chevrolat, 1882b, Ann. Soc. Ent. France, ser. 6, 2:561;

Kuschel, 1955, Rev. Chil. Ent., 4:281.

Rhynchophorus depressus Chevrolat, 1880, Le Naturaliste, 2:315;

1882b, Ann. Soc. Ent. France, ser. 6, 2:561; Hustache, 1932,

Faun. Colon. France, 5(24):376.

Rhynchophorus lanuginosus Chevrolat, 1880, Le Naturaliste, 2:315;

1882b, Ann. Soc. Ent. France, ser. 6, 2:561; Hustache, 1932,

Faun. Colon. France, 5(24):376.

Description

Adult male. Length 29.0 to 44.0 mm., width 11.5 to 18.0 mm. Body elongate-oval, flat dorsally, convex ventrally, deep black; dorsum dull or shining, except pronotum of some populations with velvety pubescence, venter shining.

Rostrum stout, shorter than pronotum; in profile, slightly arcuate at apex, broad at base and tapering to apex; viewed dorsally, broad at base and tapering to apex, with close confluent punctation on basal half of rostrum and trace of central carina; spical half on upper surface with thick, erect, fulvous setae, or similar setae

extending from anterior of antennal scrobes to apex; epistoma deeply grooved and emarginate; viewed ventrally, with small, thin, subequal lateroanterior grooves from the base of the mandibles and confluent with gular suture about two-thirds of rostrum; space between antennal scrobes narrowed, strongly punctured with several long slender setae; submentum spatulate and rounded anteriorly; lateral arms of hypostoma triangular and pointed anteriorly; mandibular scrobe quadrate and opened anteriorly; maxillary scrobe narrowed and opened anteriorly.

Mouthparts brownish-black and located at apex of rostrum; mandible two-thirds the width of rostrum at base, anteriorly bilobed, teeth deeply divided, basal tooth sometimes slightly depressed; pleurostoma broadly rectangular; maxilla brown, small, with three segmented maxillary palpi; first segment broad, nearly quadrate; second similar and one-half size of the first; third truncate basally and oval distally, one-third size of the first, bearing three to five setae, usually three, distally; palpifer almost triangular, obtuse distally, truncate basally, with inner margin slightly concave; stipe quadrate, nearly one-half as long as palpifer; cardo elongate somewhat pointed distally, slightly sinuate basally; mala elongate, constricted distally, with a series of long slender marginal setae, four to five large setae closely grouped distally and seven to nine mesally.

Antenna arising laterally from scrobe at base of rostrum;

scrobe deep, broad and widely opened ventrally; scape elongate, longer than funicle and club combined or equal to one-half length of rostrum; funicle with six segments; first funicular segment as long as next two segments combined; second and third short, subequal, and almost rounded; fourth and fifth slightly broader than second or third but narrower than sixth; third with one seta, fourth with two; sixth almost triangular with two setae; antennal club large, broadly triangular with several setae dorsally and ventrally; inner side of spongy area with eight to ten setae.

Head dull to shining, bulbous, almost rounded, posterior end trilobed, with interocular sulcus; interocular space narrowed about one-fifth the width of rostrum at base; frons finely punctured; occiput concealed in pronotum; genae smooth, brown.

Pronotum black, longer than wide, flat, opaque, velvety to shining, narrowed to apex and constricted anteriolaterally, base produced posteriorly, covered with brown setae, beneath the posterior border, bisinuate on either side, with fine raised margin; very finely and diffusely punctured, more strongly at sides and apex, with traces of a median longitudinal carina. In profile, margin convex ventrally; under side completely black, finely punctured, punctures being close and rough on mesosternum and anterior parts of metasternum. Prosternum elevated, spinasternum extending over apex of mesosternum with a longitudinal fossula posteriorly and with patch

of fulvous hairs anterior to spinasternum; proepisternum lacking. Mesosternum emarginate posteriorly, covered with fine brown setae; mesepisternum triangular, roughly punctured with fine brown hairs; mesepimeron smooth with fine brown hairs. Metasternum subrectangular, large, smooth, medial basal area flat, curved up laterally; metepisternum large, subrectangular, roughly punctured posteriorly with fine fucous hairs, lateral margin straight almost parallel to elytron; metepimeron small, nearly triangular with fine fucous hairs, outer margin paralleled to elytron.

Legs black with fine punctation, front coxae separated by a distance equal to one-fourth width of a coxa, bulbous, almost rounded, with scattered fine fulvous hairs and punctation; middle coxa similar to front coxa but covered with patch of long slender fulvous setae; hind coxae eye-shaped, widely separated. All trochanters triangular, pointed distally; femora flat, broad distally; front femur shorter than hind femur and about as long as middle femur; tibiae slightly curved outward and tapering distally, each with long recurved uncus and a small subuncus about one-fifth the length of uncus; front tibia as long as hind tibia but longer than middle; all tibiae similar in shape; tarsi four segmented; first segment elongate, twice as long as second; third segment dilated, one-half of the entire area beneath covered with matted fulvous setae; fourth segment elongate, as long as the first three tarsal segments combined, with

more than ten slender fulvous setae scattered beneath; two simple, slender, movable claws. Setae on ventral side of femora, tibiae, and first three tarsal segments dark brown. These setae are conspicuous on the legs of the male. Femora with two to three long dark brown setae proximally; setae on first tibia twice as long as the setae on femora and longer than setae on middle or hind tibia.

Scutellum always black, smooth, large, triangular-elongate, produced at apex, about one-fourth the length of elytron, concave anteriorly.

Elytra wider than pronotum, length of each elytron two and one-half times its own width, narrowed posteriorly with side almost straight, thence more abruptly narrowed, posterior border slightly emarginate; each with six deep striae and traces of three more at side; sutural striae not prolonged to base; fourth stria confluent posteriorly with fifth; sixth with seventh; interstices five to eight times as wide as striae, somewhat convex with feeble diffuse punctation posteriorly.

Wing brown, almost hyaline from lower part of median area to anal area; all veins dark brown, heavily sclerotized and thick, costa with thick rows of brown setae ventrally, ventrocostal setae extending nearly to distal end of subcosta; subcosta uniting with basal stem of radius; the latter abruptly constricted near distal end; radius ₁ separated from basal stem, broad, thick at base,

paralleled to radius 2 ; radius $3+4+5$ joining with radius 2 at about two-thirds distally; basal stem of media $1+2$ narrowed and pointed proximally, one-third as long as basal stem of media $3+4+Cu$, with spurious vein near the base and joining radius 2 ; media $1+2$ narrowed, strongly tapering and straight to distal margin; basal stem of media $2+3+Cu$ pointed proximally; media $3+4+Cu$ very narrow, with short, small vein, on the distal end; 1st+2nd anal vein nearly twice as long as 3rd+4th anal vein, both gradually curved to distal margin; radial, medial, cubital lobes distinct, especially third anal lobe very sharply distinct.

Abdomen completely black, ventrally convex, with five segments, first abdominal sternite shorter and medially fused with second, the latter one and one-third times wider than third and fourth combined; fifth segment broad, almost triangular, fringed with a row of thick, long dark brown setae laterally, and without apical emargination; punctured dorsolaterally.

Pygidium black, triangular with central elevation, strongly punctured at base, sides and apex; more diffusely at the middle; edged with lateral fucous setae; pygidium slightly wider than the female.

Adult female. Length 26 to 42 mm., width 11 to 17 mm.

Similar to male except rostrum without setae; more slender and cylindrical, uniformly curved from posterior third to apex,

punctation weaker and less confluent; setae on first femur lacking. Pygidium narrowed and more pointed at apex.

Male genitalia. Eleven males were dissected. Dorsal cleft of phallobase very narrowly convergent to three-fourths of its length, and dorso-laterally covered with setae. Sides of cleft concave and divergent. Dorsal split of phallobase one-third length of contiguous area between dorsal cleft and split. Ventral sclerites placed longitudinally to phallobase, bearing setae both anteriorly and laterally, broadly concave posteriorly. Tegminal plate triangular. Dorsal side of tegminal apodeme with two dorsal keels running parallel on surface of apodeme and extending two-thirds length of plate. Tegminal sclerite broad, nearly triangular ventrally; on dorsal side very narrowly extending anteriorly about three-fourths length of tegminal base. Aedeagus oval distally and truncate proximally, lateral arms slender and joining aedeagal apodemes. Aedeagal fenestra spatulate, oval distally and narrowly convergent to almost straight proximally. Orifical plates incompletely sclerotized. Aedeagal chamber elongate, extending for one-third length of aedeagal apodemes.

Female genitalia. Nine females were dissected. Dorsal cleft of vaginal base narrowly convergent to anterior end of base. Side of cleft abruptly divergent posteriorly and curved inward to almost meet dorsoanteriorly. Cleft not widely open posteriorly, forming somewhat

oval shape. Spiculum ventrale three-fourths length of vaginal base. Spiculum fenestra very narrowed, nearly one-half length of spiculum ventrale and opened distally. Vaginal plate with two lateral sclerites basally. Spermatheca without distinct ventral lobes, strongly curved at both ends, broad and rounded posteriorly.

Measurements. The following measurements were taken from the 14 males and 14 females upon which the description is based.

	Male mm.		Female mm.	
	Mean	Range	Mean	Range
Body length	36.40	29.00-44.00	36.80	26.00-42.00
Body width	15.10	11.50-18.00	15.20	11.00-17.00
Elytron length	19.10	15.00-21.50	19.00	14.00-21.00
Elytron width	7.55	5.75- 9.00	7.80	5.50- 8.50
Pronotum length	13.80	11.00-17.00	13.80	10.00-15.00
Pronotum width	11.80	9.00-14.50	12.20	9.00-13.00
Rostrum length	13.90	10.50-17.50	13.90	10.00-14.00
Rostrum length before antennal scrobe	8.00	6.50- 9.00	8.10	6.50- 9.00
Scape length	5.44	4.80- 6.40	4.96	4.80- 5.60
Funicle length	3.76	3.20- 4.40	3.84	3.20- 4.80
Club length	1.46	1.44- 1.52	1.39	1.28- 1.44
Club width	2.48	2.24- 2.72	2.73	2.24- 3.12

Egg. Yellowish-brown, smooth, shining, slender, cylindrical with rounded ends; averaging 0.9 by 2.5 mm. (small, considering the size of the adult female); chorion very thin and hyaline; vitelline membrane yellowish-brown.

Larva. Description based on the following material:

Three larvae collected from coconut trunk at "Juan Diaz,"

Venezuela, March 1918, by H. Pittier. Loaned by United States National Museum.

Three larvae collected from base of trunk and growing terminal

of coconut palm at Masachapa, Nicaragua, September 4,

1951, by Swain and Pinell, Swain number 6, 5/8189

(WHA-1951). Loaned by United States National Museum.

One larva associated with a male adult collected from Carica

papaya at Sata Tecla, El Salvador, March 10, 1949, by

E. J. Hambleton. Loaned by United States National Museum.

Two larvae associated with one male adult collected from

coconut trees near Tumaco, Colombia--near Ecuadorean

Border, 1912, by G. H. Williams. Loaned by United States

National Museum.

Ten larvae associated with one male adult and two pupae collected

from banana at Coto, Costa Rica, December 27, 1955, by

C. E. Palm. Loaned by Cornell University.

Nine larvae collected from palms at Tegucigalpa, Honduras, December 4, 1962, by M. R. Morillo Z. Given to the writer by Dr. M. R. Morillo Z.

Five larvae associated with eight females and eight male adults collected at Tecoman, Colema, Mexico, February 1963, by E. Bordas. Given to the writer by Dr. E. Bordas.

Twelve larvae associated with several eggs and two pupae (broken) collected from coconut trees at Champs Fleurs, Trinidad, September 23, 1963, by D. W. Fenwick. Given to the writer by Dr. D. W. Fenwick.

Larva cyphosomatic, yellowish-white, large, robust, largest at fourth or fifth abdominal segment and rapidly or abruptly narrowing to both sides, with small sclerotized seta-bearing areas on thorax and the eight abdominal segment.

Head dark brown, eucephalic, nearly rounded, narrowing posteriorly and with curved sides; surface of the head above frontal sutures divided by fine furrows into small hexagonal areas. With two longitudinal subparallel depressions located at center of frons, extending from posterior frontal sensilla for about two-thirds length of frons.

Ocelli absent, but a pair of very pale spots, one on each side of head capsule, placed at anterior end of frontal suture.

Antenna very small, two segmented; basal segment large,

conical, distal segment slender, directed anteriolaterad.

Epicranial, paraepicranial, and frontal sutures broad and distinct; paraepicranial suture abruptly curved at anterior end where it joins frontal suture then curved back to parallel epicranial suture for about one-third length of epicranial suture; frontal suture curved inward at anterior ends forming sharply pointed angle posteriorly where joining epicranial suture. Epicranium with five pairs of dorsal setae, three pairs of sensilla, five pairs of postdorsal setae and four pairs of lateral setae; dorsal epicranial setae 1 as long as 2 or slightly longer than 5 but shorter than 4, placed on paraepicranial suture at point where suture become distinct; dorsal epicranial setae 2 placed near, not on, anterior ends of paraepicranial suture; dorsal epicranial setae 3 small, about one-sixth as long as 1 or 2, placed at equal distance between 2 and 4; dorsal epicranial 4 and 5 placed laterally; lateral epicranial setae hardly seen from above.

Frons triangular with sharply pointed posterior angle and distinct oval lobes of cataphopysis, provided with two pairs of sensilla and five pairs of setae; posterior frontal sensilla located at middle distance between frontal setae 1 and 2; anterior frontal sensilla placed close to base of frontal setae 4; right frontal seta 1 small, slightly longer than 2 but one-fifth to one-fourth as long as 3, 4, and 5 respectively, located close to frontal suture nearly the

middle distance between anterior ends of epicranial and paraepicranial sutures; left frontal seta 1 subequal both in size and length to right frontal seta 1 but located more anteriorly; frontal setae 2 placed at middle of its median depression; frontal setae 3 and 5 placed laterally; frontal setae 4 anterior to 2 and about equidistant from 3 and 5.

Clypeus broadly transverse, curved laterally; anterior end strongly curved and slightly concave posteriorly, bearing two pairs of setae; clypeal seta 2 five times longer than 1, placed laterally.

Labrum broader than long, with anterior margin more broadly curved, dorsally with two deep longitudinal furrows, which narrow posteriorly; trilobed, median lobe subtruncate and slightly concave medially; provided with two pairs of sensilla, three pairs of dorsal setae, 20 to 22 lateral setae (if 20 the posterior pairs absent), and three pairs of anterior setae; posterior labral sensilla about one-half size of anterior sensilla, located either at posterior end of median lobe or medioposterior end of lateral lobes, usually on the latter; all dorsal labral setae simple, thickened, subequal, and with broad rounded sensilla at their bases; dorsal labral setae 1 placed on median lobe at about middle distance between anterior and posterior labral sensilla; dorsal labral setae 2 and 3 placed on lateral lobes; lateral labral setae varying in length, usually longer at the middle, shorter and thicker anteriolaterally, and smaller

posteriorly; all lateral labral setae placed ventrally on margins of lateral lobes; anterior labral setae 1 and 2 thickened, subequal, usually setae 2 longer than 1 and may curve inwardly; anterior labral setae 3 nearly three times as long as 2; all anterior labral setae placed ventrally on anterior margin of median lobe, usually anterior labral setae 3 placed more dorsally.

Epipharynx setose, with sclerite broad anteriorly, narrowed and subtruncate posteriorly, with one pair of sensory pores and two pairs of setae on epipharyngeal sclerite; setose portion of epipharynx pear-shaped, slightly elevated at posterior end; epipharyngeal setae 1 much shorter and smaller than 2, sometimes reduced to very minute setae; distance between epipharyngeal setae 1 to epipharynx shorter than to setae 2; epipharyngeal sensory pores placed at middle of distance between epipharyngeal 1 and 2.

Mandible triangular, stout, with two teeth, one broad molar lobe, and three dorsal setae; apical and subapical teeth equally pointed; median tooth much reduced and usually not pointed; molar area broad with depressions or ridges; all mandibular setae placed dorsally in deep pits.

Maxillary palpus two segmented; basal segment slightly more than twice as broad as distal segment, medially with a transverse row of three posterior sensory spots; distal segment finger-like, bearing one, broad, oval, sensory spot.

Mala somewhat truncate distally, bearing three anterior setae, five ventral setae, two lateral setae, and 26 to 38 dorsal setae; dorsal setae on posterior half small, short, and placed at random, six bifurcate; on the anterior half setae long and slender, placed more or less in row with four bifurcate setae; ventral setae 1, 3 and 5 of mala subequal in length; 3 and 4 placed close to each other at posterior end of mala; 2 and 5 subequal, both placed marginally on stipe; lateral setae of mala 1 one-half as long as 2, both 1 and 2 placed on margin of palpifer.

Postmentum, prementum, ligula and maxillary articulating areas fused; prementum and maxillae brownish-yellow; color darker on prementum, labial and maxillary palpi, and cardo; postmentum with three pairs of setae, setae 1 two to three times as long as 2 and 3 respectively; postmental setae 1 placed on median lobe, 2 and 3 on lateral lobes; prementum truncate distally and triangular proximally, with one pair of setae and one pair of sensilla; premental sclerite divided into three distinct lobes, median triangular and pointed anteriorly, lateral lobes subrectangular and pointed anteriolaterally.

Ligula curved and nearly triangular distally, not setose, bearing two pairs of setae; all setae of ligula and prementum subequal; distance between ligula setae 1 about one-half distance between ligula setae 2, or one-third of premental setae.

Labial palpus two segmented, similar to maxillary palpus both

in shape and size.

Hypopharynx broader anteriorly, somewhat pear-shape, densely setose both anteriorly and laterally, fleshy area smooth with a furrow medially.

Prothorax not divided dorsally, with paired heavily sclerites, each bearing six pairs of small setae; mesothorax and metathorax divided into spindle shaped, prodorsum and postdorsum; prodorsum with one pair of setae and postdorsum with four pairs of setae; prodorsal setae 3 and 4 of both mesothorax and metathorax placed on brownish-yellow sclerites; sclerites at base of prodorsal setae 4 broader and longer than 3; prodorsal setae 1 and 2 with smaller sclerites at their bases; pleura of all thoracic segments subdivided as follows: on each side of prothoracic pleuron subdivided into two lobes, the upper pleural lobe bearing no setae, the lower pleural lobe bearing two setae on a small brownish-yellow sclerite; pleura of mesothorax and metathorax each with three lobes, the upper pleural lobe bearing one seta on a small brownish-yellow sclerite, middle pleural lobe bearing no setae, lower pleural lobe bearing one seta on a small brownish-yellow sclerite; thoracic sternum divided into an eusternum and two coxal lobes; eusternum of each thoracic sternum bearing two setae, each coxal lobe with four small setae; prothoracic eusternum with crescent-shaped opening absent, usually with a small depression.

Abdominal segments divided dorsally into four distinct plicae, intersegmental fold, praescutum, scutum, and scutellum; subdivisions on epipleural, pleural, and hypopleural regions poorly defined. Abdominal segments provided with setae as follows: on each side of abdominal segments 1 to 7 bearing one prodorsal seta on intersegmental fold, one spiracular seta on praescutum and five postdorsal setae on scutellum; eighth abdominal segment bearing only four postdorsal setae; epipleuron of each abdominal segment, except ninth, bearing two epipleural setae; hypopleuron of each abdominal segment, except ninth, subdivided into four lobes, one superimposed upon the other, the second lobe bearing one pleural seta, coxal lobe one seta, and eusternum four setae; eighth abdominal segment smaller than the other segments and somewhat fused with ninth dorsally, bearing heavily sclerotized areas anteriolaterally of spiracle; on each of these sclerotized areas with seven sensilla and two spiracular setae, nearly subequal in length, placed anteriorly and laterally to spiracle respectively; ninth abdominal segment broad, flattened both dorsally and ventrally, concave posteriorly, bearing four long setae (two epipleural and two eusternal setae) on each side; anterior end close to the base of epipleural seta 1 with group of four anterior sensilla and medioposteriorly to the epipleural seta 2 with two posterior sensilla.

Nine pairs of spiracles present, one pair on mesothorax and

eight pairs on abdominal segments 1 to 8; mesothoracic spiracle bilabiate and all abdominal spiracles simple, elliptical and of the same size except mesothoracic and eighth abdominal spiracles subequal and three to four times longer than those on abdominal segments 1 to 7; peritreme of the mesothoracic spiracle with six setae in row along the anterior margin of spiracle, and one spiracular seta placed posterior to spiracle.

Anus transverse; preanal lobe subrectangular, medially concave, bearing two setae; median lobe slightly curved anteriorly and broadly transverse posteriorly, bearing no setae; lateral lobes subtriangular, each bearing two setae; both eusternum of eighth and ninth abdominal sternum each bearing four setae.

Measurements. Body length 44.0 to 57.0 mm., width 22.0 to 25.0 mm.; head length 10.5 to 13.0 mm., width 9.5 to 11.0 mm.

Pupa. Description based on the following material:

Two pupae associated with ten larvae and one male adult collected from banana at Coto, Costa Rica, December 27, 1955, by C. E. Palm. Loaned by Cornell University.

Four pupae collected from coconut palms at Centeno, Trinidad, March 23, 1965, by G. P. Blair. Given to the writer by Dr. G. P. Blair.

Pupae of this species may be characterized as follows: body yellowish-brown, elongate-oval; widest at mesothorax, gradually

tapering anteriorly and posteriorly.

Head concealed from above, compressed on anteroventral region of prothorax. Tubercle on each side of epicranium without setae, each tubercle subdivided by longitudinal ridges into four to seven small longitudinal lobes.

Rostrum lying posteriorly along sternum, with antenna extending laterally along front femur; rostrum extending to front tibiae and reaching base of middle legs; rostrum dorsally with three pairs of tubercle-borne setae, two on large elevated tubercle, placed above the base of antenna, tubercle divided into three or four, usually three, transverse lobes by small, distinct ridges; other pair of setae placed below the base of antenna; sometimes one single seta present and almost always placed on the left side at about the middle distance between the rostral setae below the base of antenna and the apex of rostrum (dotted setae on fig. 738).

Pronotum subovate, covered with short numerous spines of varying size along the margins, more densely on posteriolaterally and without spines mediolaterally. Mesonotum and metanotum partly visible dorsally, overlapped by folded wings; metanotum with one pair of small tubercle-borne setae, sometimes absent.

Front legs folded over prosternum, base of femora and tibiae overlapping anterior half of middle legs. Tarsus aligned posteriorly along sternum. Middle legs arranged similarly as front legs; both

folded angles of femora and tibiae of front leg and middle leg darker color than the rest of the body. Hind legs partly covered by both elytra and wings, folded in the same fashion as other legs.

Scutellum subtriangular, located between the base of wings, elevated, extending three-fourths length of metanotum posteriorly.

Both elytra and wings fold obliquely over meso- and meta-pleura, terminating at anterior half of second abdominal sternite; elytra above and about three-fourths length of hind wings. Elytra with five tuberculate parallel ridges covered with numerous minute spines, widely separated; intervals between ridges also covered with small spines; wings almost meeting on middle line of abdominal sternite 2. Elytra not covering first abdominal spiracles dorsally.

Abdomen divided into nine subequal segments, seven visible dorsally; tergites 1 to 6 each with two transverse rows of short spines and with numerous shallow lateral folds of tegument; tergite 1 with two to four pairs of setae (usually two), placed close to each other; tergites 2 to 6 each with four pairs of small tubercle-borne setae, sometimes fourth tergite with five, and sixth and seventh each with six. Each pleural region with two setae. Seventh tergite subtriangular, more heavily sclerotized, with numerous small short spines posteriolaterally, and with two pairs of small tubercle-borne setae. Tergite 8 similar to 7 but one-half size of 7; tergite 9 transversely subelliptical; both tergite 8 and 9 darker than 7.

Abdominal sternites similar to tergites both in shape and size except the first sternite twice as broad as tergites and other sternites, with many sharply defined lateral folds of tegument. Third, fourth and fifth sternites, each with a median elevation, fourth and fifth each with median elevation extending longitudinally across its width, third with median elevation extending one-third its width posteriorly.

Mesothoracic spiracle bilabiate, with anterior side obviously curved, placed ventrally at posterior margin of prosternum above front coxa. Spiracles on abdominal segments 1 to 5 well-developed, oval, with gill-like structure inside and heavily sclerotized peritremes; spiracles on sixth and seventh abdominal segments small, rudimentary; all abdominal spiracles located on lateroanterior margin of each tergite,

Measurements. Body length 40 to 51 mm., width 16 to 20 mm.

Discussion

This species is easily distinguished by having the pronotum sharply produced posteriorly and the ventral space between antennal scrobes roughly rugose, bearing several setae. Other characters are given in the key.

There are several specimens in the collection of the United

States National Museum from El Salvador, Costa Rica, Bolivia, and Paraguay which are small in size and have the rostral setae greatly reduced to almost absent. These specimens are also readily distinguished from other species by the characters mentioned above and those given in the key.

Thunberg, in 1797, described a male specimen from South America as "Cordyle barbirostris." The name was later changed to "R. barbirostris" by Schoenherr in 1838. From the original description, there is no doubt that Thunberg based his description upon a male with glabrous pronotum. The writer found no differences between R. palmarum based on Thunberg's description of R. barbirostris. Therefore, R. barbirostris (Thunberg) is placed in synonymy with R. palmarum (Linnaeus).

In 1847, Erichson described a male specimen from Peru as "R. cycadis." It was placed as conspecific with R. palmarum (Linn.) by Kuschel in 1955 after examining Erickson's type. In 1880, Chevrolat described a large male and a small female from Guadeloupe as R. lanuginosus and R. depressus respectively. They were both placed in synonymy with R. palmarum (Linn.) by Champion in 1910.

Rhynchophorus palmarum was originally described by Linnaeus in 1758 as "Curculio palmarum" in Systema Naturae 10th ed., page 377. The specimen was found in Indian Palm. Many

entomologists in error give the original date of description and the habitat by referring to Linnaeus, 1764, in *Museum S. R. M.*

Ludonicae ulricae Reginae. . . page 42 and habitat as "India."

Anderson (1948) used the morphological characters of this species and *cruentatus* to represent the generic characters in his paper.

The weevil was known as the parent of "gru gru" worms, which were eaten by natives of Central America and South America, as mentioned by most writers of early times. Among them were Merian (1726), Guilding (1828), Kirby and Spence (1843), Schomburgk (1847), Schomburgk (1848), and Wallace (1853). Blatchley and Leng (1916) quoted from Dr. R. E. Kunze that the larva of this species was called "grougrou" in the West Indies, where it furnished an epicurean morsel when roasted and fried and had moreover the singular property of producing milk in women. A similar species was used by Tuscan peasants as a charm for tooth-ache, by the simple process of crushing the larvae between the fingers until the latter had absorbed sufficient oil with which to anoint the tooth.

Timon-David (1930) first made a study of the comparative chemistry of the composition of fats in *R. palmarum*, of the metabolism of these fats and of the factors that may influence the latter.

Type Locality

Indian Palm (South America).

Types and Location

Type, male; in the Uppsala Museum, Sweden. The type was seen by Kuschel (1955) in 1954.

Biology

The host plant records which follow were taken from the material examined: "Cocos nucifera," Juan Diaz, Venezuela, March 1918, H. Pittier (USNM); Masachapa, Nicaragua, September 4, 1951, Swain and Pinell (USNM); Tumaco, Colombia, 1912, G. H. Williams (USNM); Champs Fleurs, Trinidad, September 23, 1963, D. W. Fenwick (TTCR); Centeno, Trinidad, March 23, 1965, G. P. Blair (AW); Guayaguil, Ecuador, F. Campos R. (USNM); Cedar, Trinidad, April 10, 1907, J. R. Johnston (USNM); Costa Rica, November 15, 1934, F. Nevermann (USNM); Nicaragua, September 4, 1951, Swain (USNM); Ceiba, Honduras, May 3, 1920, W. M. Mann (USNM), Truxillo, Honduras, September 18, 1891, J. B. Hickey (USNM), Chara, Costa Rica, September 15, 1912, (USNM); Guyton, Nicaragua, April, C. W. Richmond (USNM).

"palms," Tegucigalpa, Honduras, December 4, 1962,

M. R. Morillo Z. (HAZV).

"sugar cane," Gallego Medellin, Colombia, F. Louis
(USNM).

"Carica papaya," Santa Tecla, El Salvador, March 10, 1949,
E. J. Hambleton (USNM); Finca San Victor Escuintla, September 12,
1948, R. D. Mitchell (USNM).

"Musa sapientum," Coto, Costa Rica, December 27, 1955,
C. E. Palm (CU); Chara, Costa Rica, May - September 23, 1934,
250-300 m., F. Nevermann (USMN).

Rhynchophorus palmarum is known as "gru gru worm,"
"American Palm Weevil" or "Palm Weevil." The latter name is
more commonly used. The biology was first discussed by Merian
in 1726. She gave the first good, recognizable drawings of the
weevil and larva. Guilding (1828) published the first paper in
English on R. palmarum. He described the adult, larva, pupa and
cocoon in Latin then translated the descriptions into English. He
also made excellent drawings of the lateral and dorsal views of the
adults, lateral view of the larva, pupa, cocoon, and detailed
characters of antennal club, femur and tibia, ventral and dorsal
views of rostrum. Blanchard (1845) figured the female, larva and
cocoon of this species in his "Histoire Naturelle des Insectes" but
gave no description. Gorkum (1916) first attempted to study the life
history of R. palmarum in Brazil, giving good colored illustrations

of the life stages. Campos (1926) and Mohammed (1963) reported that the adult weevil was attracted by sugar liquid or molasses. Bianchi (1935) exhibited specimens of R. palmarum reared from the large roots of papaya in Guatemala.

The life history of the weevil was first studied in Brazil by Bondar, in 1922. Bondar reported that the female laid 250 eggs, the incubation period was two to three days and the life cycle ranged from 55 to 70 days. Verano (1940) studied its life history in Colombia and reported that the females laid 40 to 50 eggs with an incubation period of three to four days, a larval period of about 30 days, and a pupal period of from 17 to 18 days. Mungia (1958) stated that 120-180 days were required for completion of the life cycle under varying climatic conditions in Mexico. One of the recently detailed study of its life history, habits and food plants is that of Hagley (1965). Hagley reported the females laid 90 to 400 eggs, with a maximum of 718; the incubation period was two to four days; there were six to ten larval molts; the larval period was 42 to 62 days; the prepupal period was 4 to 14 days; the pupal period was 8 to 23 days; and the entire life cycle required 70 to 88 days for laboratory-reared insects and 59 to 85 days for insects reared in standing palms. Adult longevity was 28 to 62 days for males and 25 to 56 days for females. Adults were most active at 5 to 7 P. M. and 7 to 11 A. M.

Parasites. The only information available at present is that of Urich (1913) who reported that an undetermined tachinid fly preyed upon the larvae.

Host and food plants. Many writers, among them Guilding (1828), Morris (1881), Blandford (1893), Ballou (1912), Bondar (1921, 1939, 1940), Wolcott (1933), Wille (1940), Verano (1940), Mungia (1958) and Hagley (1965), recorded one or more of the following as host plants of palmarum: gru gru palm, Acrocomia aculeata; Acrocomia lasiopatha; Acrocomia sclerocarpa; cohoon palm, Attalea cohune; black roseau palm, Bactris major; bamboo palm, Chrysalidocarpus lutescens; coconut palm, Cocos nucifera; Cocos coronata; Cocos fusiformis; Cocos romanzofiana; Cocos schizophylla; Cocos vagans; picmoe palm, Desmoncus major; African oil palm, Elaie guineensis; manac palm, Euterpe broadwayana; Guilielma sp.; timite palm, Manicaria saccifera; cocorite palm, Maximiliana caribaea; cabbage palm, Oreodoxa olercea; big thatch palm, Sabal umbraculifera; carat palm, Sabal sp.; Gynerium saccharoides; sugar cane, Saccharum officinarum; paw paw, Carica papaya; Jarracatia dodecaphylla; pine apple, Ananas sativa; banana, Musa sapientum; Ricinus sp. The adult weevil also feeds on many other vegetable crops as discussed under "economic importance" section.

As the vector of red-ring disease. The nematode causing red-ring disease of coconut palm was described by Cobb in 1919 as

"Aphelenchus cocophilus." The name was later changed to "Rhadinaphelenchus cocophilus" by Goodey in 1960. At present red-ring disease is considered by many coconut growers as a serious disease of coconut palms especially in Trinidad and other islands in the West Indies.

Ashby (1921) first suggested that R. palmarum might act as a carrier of red-ring disease. In 1924, Ashby stated that since the nematodes were transmitted through the snout of the weevil, in South America, the weevil should be known as a "vector" instead of a "carrier" of the disease. Cobb (1922, 1923) reported that 50 percent of the weevils in Panama carried nematodes. Fenwick (1957, 1958, 1962), Fenwick and Mohammed (1961), Maharaj (1964), and Hagley (1963) in Trinidad, found that 16.3 to 38.5 percent of the field weevils examined carried nematodes on their body surface and 14 percent in the gut and body cavities. Hagley also showed that there was a high degree of correlation between red-ring disease infection and the palm weevil infestation. Fenwick and Mohammed (1963) found no obvious correlation was discernible between weevil populations in either experiment and incidence of red-ring disease detected. Rhynchophorus palmarum (Linn.), however, has been shown by many investigators, among them Ferreira Lima and Da Cruz (1945), Batista (1948), Joffily (1948), Tidman (1951, 1959), Bain and Fédon (1951), and Mungia (1958), to be a vector and

disseminator of the disease.

Economic Importance

Rhynchophorus palmarum is a serious pest of coconut palms and many other crops in Mexico, Central America, South America and the West Indies. It has been reported as a serious pest of banana, papaya, cacao, sugar cane, coconut and other palms in Mexico and Central America.

Distribution

It was once doubted that R. palmarum is really found in the United States. LeConte and Horn (1876, 1883) believed and insisted that it occurred in southern part of California. LeConte, in 1876, stated that it was collected by Mr. Hardy, in southern California, west of San Diego and sent to him by Dr. David Sharp. However, the distribution of this species is still in question and frequently talking about it among Curculionists. Blatchley and Leng (1916) said that they were unable to find a record of its occurrence in the United States. The writer carefully checked the distribution of this species and found that R. palmarum does occur in the southern part of California and Texas, as the following records indicate.

1. Quoting from the abstract of Dr. David Sharp's letter, probably written to Blatchley and Leng, and published in the Journal

of the New York Entomological Society in 1918, volume 26, pages 225 to 226:

Just now I am giving much attention to Calandridae. I see that in your nice book you have been unable to give information about Rhynchophorus palmarum in North America. I can give information about this and will do so as it involves several points of considerable importance. Upwards of fifty years ago, the late Edwin Brown, G. R. Crotch and myself contributed to sending a young collector, J. R. Hardy, to California to get beetles for our collections; and it fell to me to arrange and name what we received. I could only do this by sending a set to Dr. LeConte, which I did, giving him permission to keep whatever he liked. Among them was a unique specimen of a large black Rhynchophorus which he said was R. palmarum, but expressed the opinion to me that it was not N. American but had got into the lot by some error.

Enquiry of Hardy showed that it was certainly not an error. He did what at that time was a marvel, viz.: penetrated on foot from San Diego to Fort Yuma, and found this specimen in a groove of palm trees there. LeConte was quite satisfied and so R. palmarum was placed in your lists. But is the specimen really R. palmarum? I doubt it. I find that R. palmarum is a different genus from the Asiatic Rhynchophorus, and so far as I can judge from your book (I have no specimens) your R. cruentatus agrees with the Asiatic forms, and not with R. palmarum. It would be worth while to have the specimen examined as it is probably still extant in the LeConte collection. R. palmarum instead of having the pronotum simply curved at the base, is sinuate on each side there, so as to be lobed in the middle, and it has the rostrum extremely coarsely sculptured at the base beneath, while it is smooth in other species. I may add that I have an idea from your book that R. cruentatus may be a different genus from the Asiatic Rhynchophorus.

2. There are two specimens in the H. Klages Collection, of the Carnegie Museum one of which is a female, C. M. Acc. 12676, labeled "Santa Rosa, Lower California" and the other a male,

C. M. Acc. 11414, labeled "Lower California"; two males and two females in the collection of the United States National Museum labeled "El Pazo, Texas"; and one female in the A. F. Fenyés Collection in the California Academy of Sciences labeled "Barett, S. of State."

There is also a specimen in the Mares Collection of the Chicago Natural History Museum labeled "Cuba." The distribution in this region was reported early in 1881 by Morris who found it destroyed sugar cane in Jamaica. Busck (1902) reported that on his investigation of diseases of coconut palms in Cuba he expected to find it there but it was not present at that time.

In summary, with the reasons above and mainly from the materials examined indicate that the range of R. palmarum extends from southern parts of California and Texas southward through Mexico into South America and eastward in the West Indies up to Cuba.

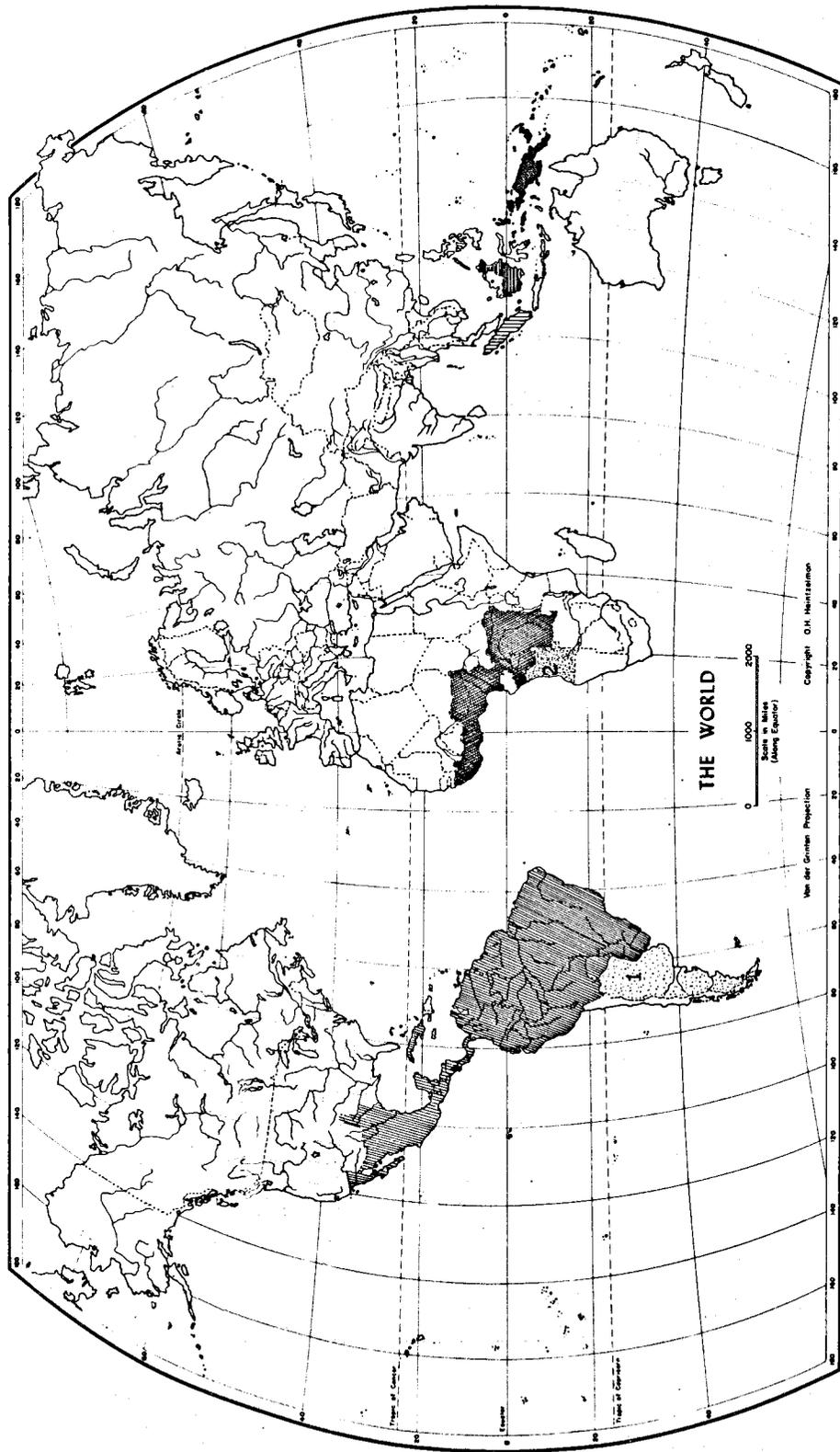
Total specimens examined	2854
Males	751
Females	2103

Collecting dates: January 4 to December 31.

Elevations: up to 5,000 feet.

Map 3. Distribution of five species of the genus Rhynchophorus based on specimens examined and localities given in the literature.

- | | |
|---|---|
|  <u>palmarum</u> |  <u>palmarum</u> , from the literature |
|  <u>quadrangulus</u> |  <u>quadrangulus</u> , from the literature |
|  <u>lobatus</u> |  <u>distinctus</u> |
| |  <u>bilineatus</u> |



Rhynchophorus bilineatus (Montrouzier)

Figs. 41, 45, 93-100, 127-128, 164, 174, 184, 201, 207, 215,
246-247, 280-281, 320, 336, 363-364, 372, 377, 424-426,
484-487, 559, 581-583, 632, 644, 650, 661-663, 683, 690,
695, 704, 714, 718, 724.

Calandra bilineata Montrouzier, 1857, Ann. Soc. Agr. Lyon, ser. 2,
7:55.

Sphenophorus palmarum Montrouzier, 1860, Ann. Soc. Ent. France,
ser. 3, 8:911.

Rhynchophorus kaupii Schaufuss, 1864, Sitzber. Isis. Dresden, 1-3:
22; 1877, Nunq. Otios., 2:448; 1885, Russkoe Ent. Obshch.,
19:202; Fairmaire, 1883, Ann. Ent. Soc. Belgique, 27:40-41;
Lepesme (kaupi), 1947, Les Ins. Palm., p. 612 and 614.
New synonymy.

Rhynchophorus velutinus Fairmaire, 1877, Pet. Nouv. Ent., 2:
185; 1879, Jour. Mus. Godeffroy, 14:112-113; 1883, Ann.
Ent. Soc. Belgique, 27:40-41.

Rhynchophorus pascha var. papuanus Kirsch, 1877, Dresden Mus.
Mitth., 2:156. New synonymy.

Rhynchophorus montrouzieri Chevrolat, 1882a, Bull. Soc. Ent.
France, 2:138. New synonymy.

Rhynchophorus rubrocinctus Chevrolat, 1882b, Ann. Soc. Ent.

ser. 6, 2:563. New synonymy.

Rhynchophorus bilineatus (Montrouzier), Faust, 1899b, Ann. Mus.

Civ. Genova, ser. 2, 20(40):118.

Description

Adult male. Length 30 to 35 mm.; width 12 to 14 mm. Body elongate-oval, deep black; color variation found only on pronotum; elytra, pygidium and rest of body always black; dorsum dull or shining; pronotum of some populations with velvety pubescent but not distinctive as in palmarum. Venter mostly shining.

Rostrum black; in profile (fig. 127), straight, cylindrical, broad at base and tapering to apex; viewed dorsally (fig. 247), broad at base, abruptly narrowed at one-third of rostrum and straight to apex, proximal one-sixth of rostrum smooth, with three rows of small tubercles to apex, between rows strongly punctured; subapical half with thick, erect, fulvous setae extending from subapical of rostrum or behind epistoma to less than one-half length of rostrum, not reaching antennal scrobe; epistoma with very feeble nasal plate, usually absent; viewed ventrally, smooth; space between antennal scrobes (fig. 164) gradually narrowed posteriorly, smooth and setae absent; gular suture straight and slightly broadening at base; submentum (fig. 320) truncate with triangular depression distally,

slightly broadened at sides to the posterior end; lateral arm of hypostoma curved proximally at inner side, gradually curved at outer side, pointed anteriorly.

Mouthparts brown; mandible nearly two-thirds width of rostrum at apex, four-dentate distally with apical tooth short and not deeply divided from subapical; subapical, median, and basal teeth deeply lobed; maxilla light brown, all maxillary segments strongly retracted; third segment bearing four setae distally; palpifer broadly elongate, nearly rectangular, at inner margin slightly concave mesally and basally; stipes somewhat quadrate meso-distally and triangular basally; cardo small, elongate, convex at outer margin and with eight plegmatia, four of which pointed meso-posteriorly the other four rounded and placed basally; mala broadly evaginated at inner margin, strongly convex at outer margin, bearing six large setae meso-distally.

Antenna black; first funicular segment as long as next two segments combined; second longer than third; first to fifth conical; sixth much broader than fourth, bearing five setae laterally; antennal club broad with several setae laterally; inner side of spongy area with 13 to 15 setae.

Head dull to shining, occiput slightly pointed posteriorly; interocular space three-fifths width of rostrum at base; frons diffusely punctured and with small dark brown setae.

Pronotum slightly velvety-pubescent to shining dorsally; ground color black; pronotum black with a transverse narrow reddish stripe and an inverted U-shaped area on the center with two arms extending posteriorly (fig. 93), or with a transverse narrow reddish stripe and a H-shaped area on the center with arms extending both anteriorly and posteriorly (fig. 94), or with two small, short stripes slightly diagonal, and an inverted U-shaped area with arms extending posteriorly (fig. 95), or with a transverse narrow reddish stripe anteriorly and three reddish diamond-shaped areas medially, with the lateral two broadly extending posteriorly (fig. 96), or with transverse narrow reddish stripes anteriorly and two pairs of narrowly-elongate stripes on the middle, or with two small, short, reddish stripes anteriorly, or completely black; sides of pronotum strongly curved and broadly-oval posteriorly; smooth dorsally, sparsely punctate at sides; under side black and shining, sometimes with broad reddish stripe extending from anterior end to the posterior end of spinasternum; mesosternum diffusely punctured posteriorly and strongly punctured anteriorly, hairs absent; mesepisternum strongly punctured; mesepimeron sparsely punctured; metasternum, metepisternum, metepimeron diffusely punctured.

Legs varying from reddish-brown to black, strongly punctured, especially tibiae; front coxae separated by a distance equal to one-third width of a coxa, strongly punctured proximally and finely

punctate distally; middle coxa strongly punctured and covered with short brown hairs; front femur as long as middle femur but shorter than hind femur; front tibia as long as hind tibia and longer than middle tibia; distal end of front tibia with two small lobes; first tarsal segment twice as long as second and longer than third; third with one-third to one-half of entire area beneath covered with matted reddish-brown setae and two rows of small setae extending to the base, covered with soft setae longer than setae in rows; fourth tarsal segment longer than the first three segments combined and with six slender setae ventrally.

Scutellum smooth, triangular, produced but not sharply pointed posteriorly; one-fourth the length of elytron.

Elytra smooth; each elytron with five deep striae and traces of four more at side; sutural striae not prolonged to the base; third stria feebly confluent posteriorly with eighth; fourth with fifth; sixth with seventh; fourth and fifth opened posteriorly; interstices four to ten times as wide as striae.

Wing with subcosta broad at base, narrowly extending to the costal margin; basal stem of radius with triangular membrane meso-distally, and a small, short, rectangular vein placed proximally to the radius $3+4+5$; media $1+2$ narrowed and tapering to the distal margin; media $3+4+Cu$ with one vein placed anteriorly and paralleling and joining distally with media $3+4+Cu$; 1st + 2nd anal vein one and

one-half longer than 3rd + 4th anal vein, both veins broad basally and strongly narrowing distally; median and cubital lobes not separate from other lobes; radial, and anal lobes distinct.

Abdomen completely black, strongly punctured at sides and as described for palmarum.

Pygidium black, sparsely punctured on the posterior half, broadly curved at sides with short setae dorsolaterally.

Adult female. Length 25 to 32 mm.; width 10 to 15 mm. Similar to male except rostrum more slender, more cylindrical, longer, and gradually curved to apex; without rostral setae and tubercles but sparsely and more or less strongly punctured.

Male genitalia. Six males were dissected. Dorsal cleft of phallobase with sides concave and not parallel, convergent and sharply pointed anteriorly. Dorsal split of phallobase two-thirds length of contiguous area between dorsal cleft and the split. Ventral sclerites quadrate with inner margins pointed posteriorly, bearing setae laterally and setae not meeting anteriorly. Tegminal plate broadly fan-shaped. Dorsal keel broad at base and narrowly extending nearly to posterior end of plate. Ventral side of tegminal sclerite rounded anteriorly, dorsal side narrowly elongate, extending four-fifths length of tegminal base. Aedeagus nearly oval anteriorly, lateral arms broadened posteriorly, joining aedeagal apodemes. Aedeagal fenestra obtuse anteriorly, converging and with

triangular-emarginated posteriorly. Orifical plates small, elongate-oval, widely separated, sclerotized. Aedeagal chamber broadly rounded posteriorly and with an additional sclerotized plate located beneath chamber posteriorly, extending for two-fifths length of aedeagal apodemes.

Female genitalia. Five females were dissected. Dorsal cleft of vaginal base narrowly convergent to anterior end of base. Side of cleft abruptly divergent posteriorly; at lateroposterior end of base with large truncate membranous area. Spiculum ventrale three-fourths as long as length of vaginal base. Spiculum fenestra elliptical-elongate, one-fifth length of spiculum ventrale, closed anteriorly and pointed posteriorly. Vaginal plate oval posteriorly with a sclerotized T-shaped area at middle of plate, with stem of T extending posteriorly. Spermatheca distally truncate and with distinct ridge dorsally in front of base of spermathecal gland; posteriorly rounded, with three distinct ventral lobes.

Measurements. The following measurements were taken from the 13 males and 14 females upon which the description is based.

	Male mm.		Female mm.	
	Mean	Range	Mean	Range
Body length	32.00	30.00-35.00	31.00	25.00-32.00
Body width	12.50	12.00-14.00	12.40	10.00-15.00
Elytron length	15.00	14.00-17.00	15.20	12.00-18.00
Elytron width	6.25	6.00- 7.00	6.20	5.00- 7.50
Pronotum length	12.50	12.00-13.50	12.00	10.00-14.00
Pronotum width	10.00	9.50-12.00	10.10	8.50-12.00
Rostrum length	10.50	10.00-11.00	11.50	9.00-12.50
Rostrum length before antennal scrobe	6.30	6.00- 7.00	6.70	6.00- 8.50
Scape length	4.53	4.30- 4.80	4.54	3.60- 4.80
Funicle length	3.16	3.00- 3.20	3.10	3.00- 3.20
Club length	1.57	1.48- 1.60	1.59	1.44- 1.60
Club width	2.02	1.92- 2.68	1.98	2.10- 2.24

Egg. Whitish-yellow, smooth, shining, cylindrical with rounded ends, slightly narrower at anterior end; averaging 0.90 by 2.62 mm.; chorion and vitelline membrane not distinctive.

Mature larva. Description based on the following material:

Four mature larvae collected from coconut at Sinaeada, Milne Bay District, Papua, August 13, 1963, by L. Smee, No. WT/95. Loaned by Papua and New Guinea Department of Agriculture.

Larvae of this species may be characterized as follows:

epicranium with sensilla absent; only dorsal epicranial setae 1 located on each paraepicranial suture, four pairs of postdorsal setae present. Paraepicranial suture extending about three-fourths length of epicranial suture posteriorly. Frons with two longitudinal centrally located, median depressions extending further than posterior end of frontal setae 3; one pair of frontal sensilla present and placed close to base of frontal setae 1; posterior angle of frons not sharply pointed; frontal sutures not reaching the base of apophyses. Only clypeal setae 1 present, if clypeal setae 2 present then very much reduced. Labrum with 26 lateral setae, labral sensilla absent. Epipharynx with two pairs of thickened setae and two pairs of sensory pores on pharyngeal sclerite; the latter heavily sclerotized, and very distinct from the setose portion; epipharynx elongate-oval, very finely setose. Mandible broadly triangular, stout, with one blunt apical tooth and one or two small median teeth; no distinct molar area. Mala with 18 setae, six of which bifurcate and one trifurcate. Premental sclerite similar to palmarum. Ligula broadly oval, anteriorly bearing two pairs of setae. Hypopharynx anteriorly emarginate then slightly depressed on each side densely setose, median fleshy area with poorly defined median furrow. Thoracic and abdominal setae with heavily sclerotized areas at their bases; each thoracic coxal lobes bearing five setae. Eighth abdominal segment

dorsally with heavily sclerotized area anterior to each of spiracles, each sclerotized area bearing three setae and four to five sensilla. Ninth abdominal segment heavily sclerotized along the anterior margin, with 11 to 12 sensilla. Anus transverse, preanal lobe bearing two setae and folded medially; lateral lobes gradually curved medio-posteriorly, longer than wide; median lobe small, subtriangular with narrowed angle directed anteriorly, both lateral lobes and median lobe bearing no setae.

Measurements. Body length 25 to 42 mm., width 13 to 18 mm.; head length 7 to 9 mm., width 6 to 8 mm.

Pupa. Pupa unknown.

Discussion

This species was first described by Montouzier in 1857. Three years later, in 1860, he described weevils from Aru Island as "Sphenophorus palmarum." It is evidently conspecific with bilineatus since he described the species as "Noir avec trois-taches confluentes a la base du corselet d'rounge brun fonce le corselet est noir avex deux taches d'un rounge ferrugineus sur les côtes en arrière et une au melieu, un peu plus bas de même couleur; . . ."

Schaufuss (1864) described the black form of the male with a reddish antennal segment from New Guinea as "Rhynchophorus kaupii,"

in the honor of Dr. Kaup. His description is as follows, "Das ganze Thier ist schwarz, nur die letzten Fühlerglieder sind röthlich, die Flügeldecken sind ringsum sehr schmal, der verdere untere Rand des Halsschildes schmal, die Tarsen un Innenkanten der Schienen und Schenkel, wie der letzte Hinterleibring breiter röthgelblich bewimpert. . . ." From the above description it is obvious that it is synonymous with bilineatus. In 1877, Fairmaire described the black form of bilineatus from New Britain as "Rhynchophorus velutinus"; and later in 1883 he placed velutinus in synonymy with kaupii and made a comment that "Il serait très possible que cet insecte fut identique avec la Calandra bilineata Montr. (Faune de Woodlark, p. 55); la seule difference consistrait en deux lignes rouges, courtes et difficiles a distinguer, sur le corselet." Kirsch (1877) also treated 17 black specimens from New Guinea as Rhynchophorus pascha var. papuanus.

In 1882a, Chevrolat changed Sphenophorus palmarum Montr. to montrouzieri and made only a short comment that "Suivant l'habitude, ayant à changer la denomination spécifique, je nommeri cette dernière espèce C. montrouzieri"; and in the same year (1882b) he described a female specimen from Kalau, New Guinea as "Rhynchophorus rubrocintus" with the following description ". . . prothorace antice profunde in margine antico et postio rubro, maculisque 2 rubris ante medium notato; . . ." Again with the two red

stripes on pronotum indicate that it is synonymous with bilineatus. Faust (1899b) redescribed bilineatus from specimens from New Guinea and stated that both kaupii Schauf. and velutinus Fairm. might be synonymous with bilineatus since they have red stripes on the pronotum.

Rhynchophorus bilineatus is one of the most serious pests of coconut plantations from west of Celebes, Indonesia, to many small Islands of the Territory of New Guinea and Papua near the International Date Line.

In general appearance, the black form of this species resembles the black forms of ferrugineus and vulneratus. It differs from those two species in having four-dentate mandibles; gular suture uniformly broadened to the base; submentum truncate with triangular median depression confined to the apex; the male and female genitalia differ distinctively from all other species.

It is easily distinguished from all other species if fully developed color is shown on the pronotum. The characteristics of the color patterns are shown in figs. 93 to 100.

Type Locality

Woodlark Island, New Guinea.

Types and Location

Holotype (?) male, probably at the Museum Natural d'Histoire Naturelle, Paris, France. The type was searched for by Dr. Guy Colas and could not be located. However, a "neotype" is not designated in the present study since the writer intends to examine the type in Europe in the future.

Biology

The following records of host plants were taken from the material examined: "flight near Coelococcus sp." at Nggeloe, near Malaita, Solomon Islands, March 20, 1934, R. A. Lever, (CIE); "in dead trunk of Coelococcus amicarum" at Loevora, Guadalcanal, Solomon Islands, February 21, 1934, H. T. Pagden, (CIE); "Metroxylon," Solomon Islands, November 1931, R. J. A. W. Lever (CIE); "Coelococcus solomonensis," Auki, Malita, Solomon Islands, October 18, 1935, R. A. Lever, (CIE); "Ex coconut palm," Tinganalom Vill., Gazelle Peninsula, New Britain, December 5, 1962, B. R. Johnston, (DAPN); "Ex coconut palm," Volupai Plantation, Talasea, New Britain, December 6, 1962, H. Humphries, (DAPN); "Ex Hoop Pine Trunk," Bulolo, New Guinea, March 1963, L. Clifford, (DAPN); "in Sago Palm," Kokoda, Papua, July 13, 1958, F. K. Mayer, (DAPN); "on three years old coconut," Lagakot

Plantation, New Ireland, August 3, 1955, E. Kanjiri, (DAPN);
 "Ex coconut log," Sinaeda, Milne Bay, Papua, August 8, 1963,
 L. Smee, (DAPN).

Montrouzier (1857) described this species from coconut palm.
 Lever (1943) reported that this weevil preferred ivory nut palm
Metroxylon solomonense Becc. and coconut. Froggatt (1936a, 1936b)
 and Lepesme (1947) gave Metroxylon sagu Rottb. as host plant of
 this species.

Distribution

The range of this species may extend from Buru Island and
 Morotai Island westward into the far west of the Territory of New
 Guinea and Papua Island. There is one specimen in the
 Rijksmuseum van Natuurlijke Historie, Leiden, collected in
 Sarawak, Malasia, by Bernstein. This record is questionable.

Total specimens examined	749
Males	401
Females	348

Collecting dates: January 1 to December 12.

Elevation: Up to 3,000 feet.

Rhynchophorus cruentatus (Fabricius)

Figs. 13-20, 35, 44, 87-92, 101-124, 137-138, 167, 175, 186, 194,
204, 216, 248-249, 276-277, 319, 341-342, 359-360, 373, 382,
430-432, 492-495, 562, 590-592, 634-635, 640, 647, 655,
664-666, 680, 688, 697, 699, 706-707, 710, 715, 725, 740.

Curculio cruentatus Fabricius, 1775, Syst. Ent., p. 128; 1781,
Spec. Ins., 1:162; 1787, Mant. Ins., 1:97; 1792, Ent. Syst.,
1(2):395; Olivier, 1790, Encycl. Meth., 5(2):472-473; Gmelin
in Linnaeus, 1790, Syst. Nat. 13th ed., p. 1741.

Calandra cruentata (Fabricius); 1801, Syst. Eleuth., 2:430-431;
Olivier, 1807, Ent., 5(83):82, t. 12, fig. 147; Illiger, 1805,
Mag. Ins., 4:137.

Rhynchophorus cruentatus (Fabricius); Herbst, 1795, Natursyst. Ins.
Käf., 6:12, t. 61, fig. 2; Horn, 1873, Proc. American Philos.
Soc., 13:408-409; 1878, Trans. Amer. Ent. Soc., 7:39;
Chevrolat, 1882a, Bull. Soc. Ent. France, 2:139; 1882b, Ann.
Soc. Ent. France, ser. 6, 2:562; LeConte and Horn, 1876,
Proc. Amer. Philos. Soc., 15(96):330; 1883, Smith. Misc.
Coll., 26(4):506; Chittenden, 1902, USDA Bur. Ent. Bull., 38:
26-27, figs. 1a-f; Champion, 1910, Biol. Centr. Amer., 4(7):
81; Blatchley and Leng, 1916, Rhynchoph. N. E. America,
p. 549, figs. 118 a-b; Lepesme, 1947, Les Ins. Palm.,

p. 612-614.

Rhynchophorus zimmermanni Fähræus in Schoenherr, 1845, Gen.

Spec. Curc., 8(2):219-220; Lacordaire, 1866, Hist. Nat. Ins.,
7:268-269; Chevrolat, 1882a, Bull. Soc. Ent. France, 2:138;
1882b, Ann. Soc. Ent. France, ser. 6, 2:562; Champion, 1910,
Biol. Centr. Amer., 4(7):81; Blatchley and Leng, 1916,
Rhynchopho. N. E. Amer., p. 549.

Description

Adult male. Length 27 to 33 mm., width 10 to 13 mm. Body elongate-oval, robust, subdepressed above, color variable, dull to shining; color variable on pronotum, elytra and pygidium.

Rostrum cylindrical, two-thirds length of pronotum; viewed dorsally rostral setae absent; tubercles sparse, larger on lateral sides, with a row of tubercles at the middle of rostrum, extending one-third distance from base to distal end; epistoma convex and rounded distally; lateral sides and venter smooth, shining; latero-anterior grooves from base of mandibles not confluent with gular suture but parallel to base of rostrum; space between antennal scrobes strongly constricted, diffusely punctured and deeply depressed posteriorly; submentum concave distally, median depression nearly twice as wide as rostrum at apex; lateral arm of hypostoma pointed anteriorly and gradually curved laterally.

Mouthparts varying from dark brown to black; mandible nearly one-half width of rostrum at apex, broadly rounded or slightly depressed distally; maxilla brown, third maxillary palpus nearly rectangular without setae; palpifer small, less than one-half size of stipes, with a narrowly extending portion basally; stipes bulbous at inner margin and almost straight at outer margin; cardo gradually curved at outer margin, strongly convex at inner margin and somewhat truncate proximally; mala hook-like at inner margin, with five to eight (usually five) large, closely grouped setae meso-distally.

Antenna dark brown to black; antennal scrobe broad, rounded posteriorly, close to the eye and flared ventrally; scape elongate, slightly longer than the funicle and club combined; first funicular segment shorter or nearly as long as the next two segments combined; second to fourth conical; fifth broader than fourth, bearing two setae; sixth nearly truncate, bearing three setae; club broad, with three setae at base and 11 or 12 setae on spongy area.

Head dull to shining; interocular space three-fourths width of rostrum at base; frons sparsely and finely punctured.

Pronotum varying from reddish-brown to black (figs. 87-92); oval, base obtusely rounded, sides feebly curved and abruptly constricted anteriorly; sparsely and finely punctured laterally; lower surface also varying from reddish-brown to black; prosternum and mesosternum minutely punctured; metasternum smooth, shining;

mesepisternum sparsely punctured; mesepimeron, metepisternum, and metepimeron very finely and diffusely punctured and shining.

Legs variable in color; sparsely punctured; front coxae separated by a distance equal to one-third width of a coxa; sparsely punctured, one-fourth of anterior part covered with minute reddish-brown hairs; middle coxa strongly punctured; front femur broad and nearly rectangular, as long as middle but shorter than hind femur; middle and hind femora broad distally; all tibiae similar in shape, long, slender; front tibia as long as hind tibia and longer than middle; front and middle tibiae mucronate at apex, external margin bidentate; lateral side of front tibia with a row of reddish-brown setae; hind tibia nearly truncate distally; first tarsal segment twice as long as second and longer than third; one-sixth of entire area beneath third tarsal segment covered with matted reddish-brown setae; fourth tarsal segment as long as first three segments combined, with eight setae ventrally; setae on hind tibia more densely at proximal end but not as thick as on front or middle femur.

Scutellum about one-fourth length of elytron, black or nearly so, feebly elevated at middle, attenuate and sharply pointed at apex.

Elytra smooth, truncate posteriorly; varying from reddish-brown with black spots to completely black (figs. 13-20); length of each elytron nearly three times as long as wide; each with six deep striae, sixth stria shorter than the other five, and traces of three

more at side; sutural striae not prolonged to the base, especially first stria extending not more than one-half length of scutellum; third feebly confluent posteriorly with eighth; fourth with fifth, and sixth with seventh; interstices two to four times as wide as striae; first to sixth interstices feebly convex, seventh to ninth flat.

Wing with ventro-costal setae dark brown, extending more than one-half the length from base of costa to distal end of subcosta; subcosta for about two-thirds of its length parallel to costa then abruptly curved upward to join costal margin just in front of the basal stem of radius; basal stem of radius broad with elliptical membranous area distally, elongate and tapering proximally, widely separated from radius $_1$ at nearly the middle of the costal margin; radius $_{1+2}$ and radius $_{3+4+5}$ distinct; the former larger and longer than the latter and fused together distally; base of media $_{1+2}$ separated from basal stems of radius and media $_{3+4+Cu}$, tapering distally to the margin; basal stem of media $_{3+4+Cu}$ narrow, elongate proximally, turn upward distally; media $_{3+4+Cu}$ branched and parallel to about four-fifths of its length then fused to distal margin. First plus second anal vein nearly twice as long as third plus fourth anal vein; both veins broad proximally and strongly tapering distally; radian, median, and anal lobes less distinct.

Abdomen shining beneath, sparsely and very minutely punctured; first segment as wide as third and fourth combined; second

very broad; third and fourth segments always black; second mostly black or with large reddish-brown spots on the ventrolateral margin; fifth always reddish-brown if the body not black, coarsely punctured, and with a thick row of reddish setae laterodorsally.

Pygidium varying from reddish-brown to black, posterior half usually black; sparsely and coarsely punctured, more sensely at posterior end; for one-fifth distance from anterior and covered with very minute light brown hairs; sometimes with median carina; lateral setae absent.

Adult female. Length 24.0 to 32.0 mm., width 9.8 to 12.2 mm. Similar to male except rostrum (fig. 248) smooth, longer, more cylindrical, slender and arcuate at apex; pygidium less punctured posteriorly.

Male genitalia. Five males were dissected. Phallobase smooth. Dorsal cleft of phallobase triangular extending about one-half length of phallobase, and sharply pointed anteriorly. Side of cleft divergent. Dorsal split of phallobase about one-fourth length of contiguous area between dorsal cleft and split. Ventral sclerites widely separated, nearly rounded anteriorly and slightly concave posteriorly, bearing several long, slender setae along margin; spurious membrane between sclerites rounded posteriorly and broadened anteriorly. Endophallus small, narrowly elongate. Tegminal plate very broad, nearly triangular. Dorsal keel narrowly

extending to posterior margin of plate. Tegminal base much narrower than tegminal plate. Tegminal sclerite diagonally rectangular, extending two-thirds length of base. Aedeagus oval distally; lateral arms broadly emarginate posteriorly, not joining aedeagal apodemes. Aedeagal fenestra emarginate distally and which narrow triangular emargination proximally; ventral side of aedeagus broadly concave proximally. Orifical plates almost crescent-shaped, widely separated. Aedeagal chamber broadly-oval, membranous, extending for one-third length of aedeagal apodemes.

Female genitalia. Four females were dissected. Dorsal cleft of vaginal base narrowly convergent and sharply pointed anteriorly, extending for two-thirds of length of phallobase then fused. Sides of cleft abruptly divergent posteriorly and concave, forming an oval, and with distinct membranous region at posterior end. Spiculum ventrale three-fourths as long as vaginal base; with two spiculum fenestra, posterior three times as long as anterior fenestra, the latter opened and bearing several setae anteriorly. Vaginal chamber oval. Spermatheca with three pointed ventral lobes; nearly truncate anteriorly; dorsoanterior end flat then abruptly elevated to base of spermathecal gland.

Measurements. The following measurements were taken from the 10 males and 16 females, some of the specimens upon which the description is based.

	Male		Female	
	mm.		mm.	
	Mean	Range	Mean	Range
Body length	31.00	27.00-33.00	29.00	24.00-32.00
Body width	11.50	10.00-13.00	12.00	9.80-12.20
Elytron length	14.00	12.50-15.40	14.00	12.00-15.20
Elytron width	5.58	5.00- 6.50	6.00	4.90- 6.10
Pronotum length	11.20	9.50-12.20	11.10	9.50-12.00
Pronotum width	9.50	8.00-10.00	9.00	7.80-10.00
Rostrum length	7.80	7.00- 8.00	8.20	7.00- 9.00
Rostrum length before antennal scrobe	4.60	4.00- 4.80	5.80	5.00- 6.00
Scape length	4.00	3.36- 4.08	4.00	3.20- 4.80
Funicle length	2.48	2.08- 2.80	2.80	2.40- 3.00
Club length	1.44	1.20- 1.52	1.48	1.38- 1.52
Club width	2.24	1.68- 2.32	2.24	1.84- 2.32

Egg. Whitish-yellow to yellowish-brown, smooth, shining, elongate oval with rounded ends; slightly narrowed at anterior end; averaging 0.74 by 2.50 mm.; chorion, vitelline membrane usually distinct.

Larva. Description based on the following material:

Two larvae collected from palm, Phoenix canarensis, at

Sarasota, Florida, by Prince Cantacăzene. Loaned by United

States National Museum.

One larva associated with one female adult collected from
Cabbage Palm, at Orlando, Florida, February 1915, by
W. W. Yothers. Loaned by United States National Museum.

Seven larvae collected in Florida, 1875 (?), by Hubbard and
Schwarz, Hubb. 509 (a). Loaned by United States National
Museum.

Two larvae collected from date palm, at Fort Ogden, Florida,
September 12, 1901, USDA 6462. Loaned by United States
National Museum.

Two larvae associated with two pupae, one male, and two fe-
male adults collected from Palmetto, at Orlando, Florida,
September 13, 1930. Loaned by United States National
Museum.

Six larvae associated with six pupae collected from Sabal
palmetto, at South Miami, Florida, April 1, 1944, Spec,
Surv. 16983, 44-16131. Loaned by United States National
Museum.

Larvae of this species may be characterized as follows:

epicranium with one pair of sensilla, dorsal epicranial setae 1
placed on paraepicranial suture, dorsal epicranial setae 3 placed
close to paraepicranial suture where suture joins the frontal suture;
six pairs of postdorsal setae present and placed in a row on each side

of epicranium. Paraepicranial suture extending posteriorly nearly two-thirds length of epicranial suture. Frons anteriorly with two, widely separated, longitudinal depressions; posterior angle of frons gradually curved and not pointed, two pairs of sensilla present, anterior pair placed close to base of frontal setae 3, and posterior pair placed near base of frontal setae 1. Clypeal setae 1 and 2 not joining with a groove at their bases. Labrum with 16 thickened, simple, lateral setae, and six anterior setae; one pair of labral sensilla present, located near anterior margin of labral median lobe. Epipharynx setose, elongate-oval, somewhat subtriangular anteriorly and rounded posteriorly; with two pairs of simple, thickened setae on anterior end of epipharyngeal sclerite and two pairs of epipharyngeal sensory pores; anterior sensory pores placed closer to epipharyngeal setae 2 than setae 1; distance from sensory pore to setae 1 nearly three times as long as to setae 2; posterior sensory pores placed about two-thirds of epipharynx posteriorly. Mandible triangular with one blunt or broad tooth and one either rounded or pointed median tooth; mola flat. Mala with 19 to 24 dorsal setae of which three to six may be bifurcate. Premental sclerite similar to that of palmarum except the lateral parts divided and not joining the median one. Ligula slightly concave anteriorly and gradually curved anteriorly laterally. Hypopharynx broader anteriorly, subtriangular, concave anteriorly, densely setose laterally, median furrows of the fleshy

area branched. Thoracic coxal lobe with five setae. Eighth abdominal tergite without prodorsal setae, three pairs of spiracular sensillae present and placed in a row posterior to spiracle. Ninth abdominal segment sclerotized at anterior margin both dorsally and laterally; at base of each epipleural setae 1 with a row of four sensillae, lying anteriorly. Anus transverse; preanal lobe with two setae, subtriangular with anterior angle broadly rounded, subdivided into small triangular lobe; two lateral lobes similar to phoenicis except each lateral lobe bearing two setae; median lobe small, somewhat round posteriorly, truncate and broader anteriorly, bearing no setae.

Measurements. Body length 33 to 41 mm., width 13 to 15 mm.; head length 8 to 9 mm., width 7 to 8 mm.

Pupa. Description based on the following material:

Two pupae associated with two larvae, one male, and two female adults collected from Plametto, at Orlando, Florida, September 13, 1930. Loaned by United States National Museum.

Six pupae associated with six larvae collected from Sabal palmetto, at South Miami, Florida, April 1, 1944, Spec. Surv. 16983, 44-16131. Loaned by United States National Museum.

Pupae of this species may be characterized as follows:

tubercles on each side of epicranium with both longitudinal and oblique ridges, one specimen found bearing one seta on each side of epicranium (see dotted line in fig. 740).

Rostrum with one pair of setae, not tubercle-borne, placed at base, and a highly elevated tubercle subdivided into three lobes by distinct ridges, placed at base of antennae.

Pronotum subovate, covered with numerous minute spines along margins.

Scutellum extending about three-fourths length of metanotum.

Elytra covering first abdominal spiracles dorsally; with five or six, usually five, tuberculate parallel ridges, each covered with minute spines; intervals between ridges with scattered spines only basally and distally; wings almost meeting medially on the mid portion of fourth abdominal sternite, except one specimen whose wings almost meet at anterior margin of second abdominal sternite.

Abdominal tergite 1 with three or four pairs of tubercle-borne setae (usually four); tergite 2 with four pairs; tergites 3 to 5 with five or six pairs (usually five pairs); tergite 6 bare except for two pairs of lateral tubercles; tergites 1 to 6 with median tubercle, placed medially on posterior margin on each segment, larger on sixth; tergite 7 triangular, with two pairs of tubercle-borne setae and with numerous minute spines placed posteriorly.

Measurements. Body length 31 to 34 mm., width 14 to 16 mm.

Discussion

The color variations of this species are as follows:

Variant 1 (fig. 13). Body above reddish-brown, four or five black spots on pronotum. Each elytron in greater part red with three black spots and margin black. Body beneath with combination of reddish-brown and black. Pro-, meso-, metasternum, first and fifth abdominal sternites, and legs reddish-brown; rest of body red.

Variant 2 (fig. 14). Body similar to Variant 1 except at middle of pronotum with two large black areas covering one-fifth of pronotum.

Variant 3 (fig. 15). Body similar to Variant 1 except pronotum with black spot on each side and median black stripe, broad, truncate or pointed posteriorly but not reaching posterior end of pronotum.

Variant 4 (fig. 16). Pronotum similar to Variant 3; each elytron red with two large, broad, black spots.

Variant 5 (fig. 17). Elytra similar to Variant 4; pronotum red, side broadly margined with black and a median constricted black stripe.

Variant 6 (fig. 18). Pronotum similar to Variant 4. Elytron black with large reddish spot on middle of surface of elytron.

Variant 7 (fig. 19). Pronotum similar to Variant 4. Elytron

brownish-black, without any reddish spot.

Variant 8 (fig. 20). Body above and beneath totally black.

The absence of rostral setae in the male readily distinguished it from all other species. The shape of the scutellum and the color of typical specimens are also useful in separating this species.

Other characters are mentioned in the key.

Fähraeus described the black form of this species as zimmermanni in 1845, and it was placed in synonymy with cruentatus by Chevrolat in 1882. However, the name zimmermanni is often used as a subspecific name, referring to the black form. I find from the present study, that the black form is only a color variation and of no taxonomic significance. The black form is found living together with the other variants discussed above, throughout their distribution.

Type Locality

Carolina.

Types and Location

Type of sex undetermined; in the British Museum (Natural History), London, England. Presence of type confirmed by Mr. R. T. Thompson of the British Museum.

Biology

The following records of host plants were taken from the specimens examined: "in Phoenix canariensis," Sarasota, Florida, Prince Cantacazene (USNM), New Orleans, Louisiana, October 11, 1917, E. Foster (USNM), November 1934, T. F. Catchings (USNM); "cabbage palm," Orlando, Florida, February 1915, W. W. Yothers (USNM); "date palm," Fort Ogden, Florida, September 12, 1901 (USNM), Palm Beach, Florida, January 21, 1925 (USNM), Sutherland, November 9, 1894 (USNM); "Sabal palmetto," Charleston, South Carolina, February 14, 1911 (USNM), Orlando, Florida, September 13, 1930 (USNM), Florida, 1941, C. M. Breder (AMNH), Palm Beach, Florida, October 1896 (USNM), South Miami, Florida, April 1, 1944, Tuthill and Sorrell (USNM); "injuries bark plum," Plaquemine, Louisiana, May 17, 1926, S. N. Broussard (USNM); "in palm," Vera, Florida, February 7, 1937 (USNM), Sanford, Florida, September 14, 1944, Bottger (USNM), Miami, Florida, July 1948, R. A. Cooper (USNM); "in cut stump of cabbage palmetto," Parker Islands, Florida, June 13, 1955, H. S. Dybas (CNHM); "kill chicken," West Palm Beach, Florida, June 5, 1911, J. J. Fox (USNM), Florida, May 14, 1933 (USNM); "clinging to the head of chicken," Coconut Groove, Florida, June 1914, D. E. Smith (USNM); "pine apple," Fort Pierce, Florida, March 27, 1944,

M. R. Osburn (USNM); "on bark, owl pellets," Mynhka State Park, Florida, March 13, 1957, M. Wible (CM); "from root of palm tree," Audubon Park, Louisiana, July 10, 1911, E. R. Barber (USNM).

The following plants are recorded as hosts of cruentatus in the literature: cabbage palmetto, Sabal palmetto, in New Orleans, Louisiana, Summers (1873), LeConte and Horn (1876, 1883); in Florida, Riley and Howard (1891), Blatchley and Leng (1916); at Fort Ogden, Florida, and Atlanta, Georgia, Chittenden (1902); at Enterprise, Florida, Beutenmuller (1890a, 1890b, 1893a, 1893b); Sabal serulata, in Florida, Riley and Howard (1893); date palm, in Florida, Bowdman (1888), Riley and Howard (1888), Blatchley and Leng (1916), and Blatchley (1925); breeds in trunk of palm tree, Cotton (1924); Sabal sp. and Phoenix sp., Lepesme (1947).

Chittenden (1902) gave good general descriptions of the larva, pupa, and adult. Cotton (1924) used the larval characters of cruentatus as representative of the genus. Böving helped and advised Cotton during the study, therefore Böving may have used the characters of this species as representative of the genus in his 1930 publication on the Coleopterous larvae. In 1915 Knab observed the cocoon making of the larva. Bare (1929) reported that cruentatus was attracted to automobile paint. Young in 1959 reported that there was a fossil of this species from Vero Pleistocene.

Economic Importance

The materials examined indicate that cruentatus may be found as a pest of Phoenix canariensis, Sabal palmetto, pine apple, plum.

Distribution

Records from the material examined indicate that the range of cruentatus extends from South Carolina southward throughout the state of Florida and the Florida Keys and westward through the southern portion of the Great Plain in the Gulf States into Texas. There is one male in the collection of the American Museum of Natural History, two females in the collection of Rijksmuseum van Natuurlijke Historie, labelled "South America"; one female in the collection of the United States National Museum labelled "West Indies"; and two females in the collection of Zoologische Sammlung des Bayerischen Staates labelled "Ecuador." Therefore, its distribution may extend southward into South America and the West Indies.

Total specimens examined	556
Males	269
Females	287

Collecting dates: February 12 to December 20.

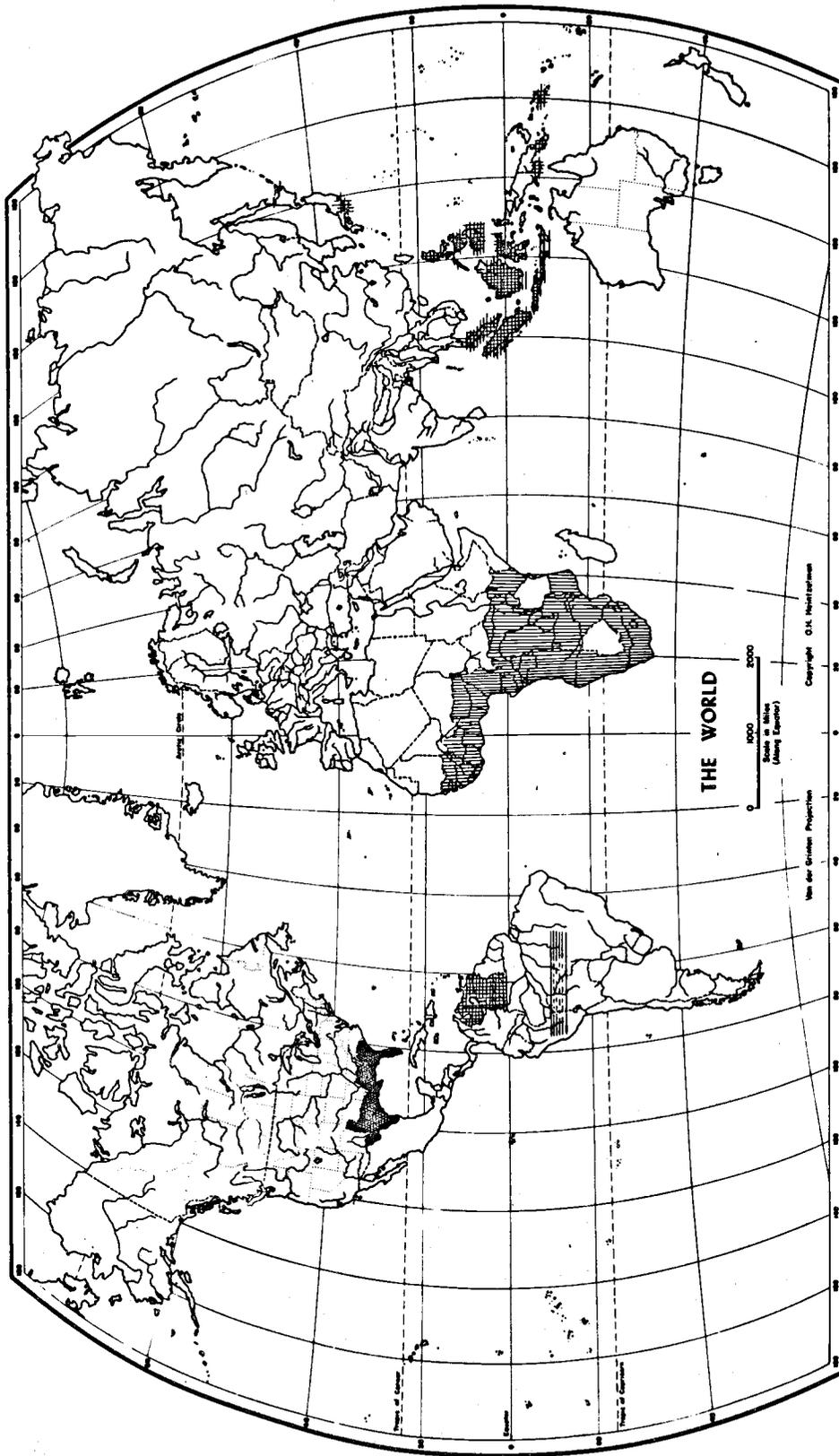
Map. 4. Distribution of four species of the genus Rhynchophorus
based on specimens examined.

 cruentatus

 ritcheri

 phoenicis

 vulneratus



Rhynchophorus distinctus New Species

Figs. 24-25, 49, 131, 169, 176, 182, 191-192, 203, 250, 278-279,
318, 334, 356, 368, 381, 427-429, 599-601.

Description

Adult male. Length 32.0 mm.; width 11.5 mm. Body slender, elongate, ferrugineous with black patches on pronotum and elytra; dorsum and venter shining.

Rostrum dark brown, three-fourths as long as pronotum; in profile, straight, broad at base and with uniform width to apex, rugose; viewed dorsally, gradually depressed medially, slightly dilated at apex, with a row of small tubercles on both edges, without carina, roughly rugose, subapical two-thirds with thick, erect, ferrugineous setae; setae extending from subapical to anterior end of antennal scrobe; epistoma convex, slightly emarginate; viewed ventrally, space between antennal scrobes glabrous; submentum tridentate anteriorly, median lobe curved inward, lateral hypostoma somewhat sickle-shaped, pointed anteriorly.

Mouthparts reddish-brown; mandible one-third width of rostrum at apex, tridentate, each lobe sharply pointed and curved inward; pleurostoma rectangular; maxillary palpus small, third segment small; second and first subequal; stipes straight, flat; cardo

reduced; mala flat, with several setae.

Antenna reddish-brown; scape as long as funicle and club combined or less than one-half length of rostrum; first funicular segment as long as next two segments combined; second longer than next four segments, the latter four subequal, almost rounded except sixth segment somewhat quadrate and broader than other segments; sixth with two setae ventrally; antennal club triangular, almost pointed distally, with two setae ventrally and two dorsally.

Head shining, glabrous, black dorsally and brown ventrally; interocular space one-fourth width of rostrum at base; frons almost smooth; gena reddish-brown with very fine indistinct punctation.

Pronotum ferrugineous with two broad, black areas; constricted anteriolaterally, flat, shining, narrowly to apex, base almost rounded, slightly and ovoidly produced posteriorly; very finely and diffusely punctured at sides; dorsum smooth; under side ferrugineous except near coxal areas, mesepisternum, mesepimeron, anterior margin of metasternum and both margins of metepisternum, metepimeron, posterior margins of second, third, and median portions of fourth and fifth abdominal sternites, dark brown; whole venter glabrous; spinasternum extending over apex of mesosternum posteriorly; hairs anterior to spinasternum absent; mesosternum broadly emarginate posteriorly, without setae, finely punctured; mesepimeron somewhat quadrate; metasternum quadrate, medio-basally

flat, curved upward laterally; metepisternum broadly elongate, pointed posteriorly; lateral margin straight almost parallel to elytron; metepimeron broad and somewhat triangular.

Legs ferrugineous, except distal ends of femora and proximal ends of tibiae dark brown; fore coxae separated by a distance equal to one-third width of a coxa, with finely and diffusely punctation; middle coxa strongly punctured; femora flat, broad mediodistally; front femur shorter than hind femur but subequal to middle; tibiae distally and internally straight and slightly curved on outer edges, each with recurved uncus, subuncus short and not pointed; first tibia as long as hind tibia but much longer than middle tibia; middle and hind tibiae with distinct spines distally; first tarsal segment cone-shaped, elongate, twice as long as second; third segment dilated, bilobed, all lower surface covered with matted reddish-brown setae except narrow median triangular area; fourth tarsal segment shorter than first three tarsal segments combined, ventral surface with two proximal setae and four distal setae; setae on ventral sides of femora, tibiae and first three tarsal segments reddish-brown; setae on first tibia more than twice as long as setae on hind femur and tibia.

Scutellum reddish-brown, sharply triangular, pointed posteriorly, with a distinct median carina, about one-fourth the length of elytron.

Elytra smooth, length of each elytron three times its own width; slightly narrowed posteriorly; posterior margin truncate; each with only five, deep striae and traces of four more at side; ninth stria close to margin of elytron; second, third, and fourth sutural striae prolonged nearly to base; third stria confluent posteriorly with seventh; fifth with sixth; interstices slightly convex, five to eight times as wide as striae; both sides of each stria with a row of brownish-black nearly quadrate spots.

Wing brown, ventro-costal setae reddish-brown, extending one-half distance from base to distal end of subcosta; subcosta reaching the margin; first and second radius united, broad, and fused with radius $3+4+5$ distally; media $1+2$ narrowly elongate; media $3+4+Cu$ not reaching the ventral margin; basal stem of media $1+2$ one-half as long as basal stem of media $3+4+Cu$; 1st + 2nd anal vein one-third time longer than 3rd + 4th anal vein, of which the latter is strongly curved ventrally; radial, medial, cubital, and fourth anal lobes sharply distinct.

Abdomen ferrugineous; first abdominal sternite oval and produced anteriorly, extending between hind coxae to metasternum, medially fused with second and almost same width; second sternite as long as third and fourth combined; fifth sternite broad, nearly triangular, fringed with a row of reddish-brown setae laterally, apical oval, dorsolaterally very fine punctation.

Pygidium ferrugineus, with central elevation, very finely punctured at sides and apex, black basally and brown laterally; lateral setae absent.

Male genitalia. The one known male was dissected.

Phallobase with numerous setae dorsolaterally. Dorsal cleft of the phallobase triangularly convergent to two-thirds of its length. Side of cleft abruptly divergent. Dorsal split of phallobase absent. Ventral sclerites diagonally to phallobase and all surface covered with long slender brown setae. Setae on membranous area between the two sclerites absent. Tegminal plate small, slightly larger than width of tegminal apodeme, and not constricted before apodeme. Dorsal keel extending one-half length of plate. Tegminal sclerite ventrally crescent-shaped, on dorsal side longitudinal-elongate and extending almost to anterior edge of tegminal base. Aedeagus oval, lateral arms thick, and not joining aedeagal apodemes; ventral side oval posteriorly and concave anteriorly. Aedeagal fenestra broadly oval. Orifical plates somewhat oval and contiguous, sclerotized. Aedeagal chamber elongate with small oval sclerotized plate-like structure anteriorly, extending for one-half length to aedeagal apodemes.

Measurements. The following measurements were taken from the holotype.

	Holotype Male mm.
Body length	32.00
Body width	11.50
Elytron length	15.00
Elytron width	6.20
Pronotum length	11.90
Pronotum width	7.90
Rostrum length	9.60
Rostrum length before antennal scrobe	6.40
Scape length	4.10
Funicle length	3.00
Club length	1.20
Club width	2.00

Female and immature stages unknown.

Discussion

This species differs from all known Rhynchophorus in having deeply tridentate mandibles, small and slender antennae, pronotum broadly produced posteriorly, and distance from the tip of rostrum to the rostral setae as long as the width of rostrum at apex, and very narrowed interocular space. The male genitalia is very distinctive

since its phallobase lacks a dorsal split.

Type Locality

Prakka Sugut, Borneo.

Types and Location

Holotype, male, Prakka Sugut, Borneo, N. O., will be returned and placed at the Rijksmuseum van Natuurlijk Historie, Leiden, Netherlands.

Biology

No biological data on this species is presently available.

Distribution

Known only from the type specimen, Prakka Sugut, Borneo.

Rhynchophorus ferrugineus (Olivier)

Figs. 40, 43, 180, 214, 284-287, 418-420, 477-479, 558, 593-595, 633, 642, 646, 651, 667-669, 681, 691, 698, 703, 712, 716, 727, 731-736.

Cossus saguarius Rhumpf, 1750-1755, Herb. Amboin., 1:78-79,

t. 17, figs. D, E, F, G.

Curculio hemipterus Sulzer, 1776, Abgek. Gesch. Ins., p. 39, t. 4,
fig. 5.

Curculio ferrugineus Olivier, 1790, Encycl. Meth., 5(2):473;
Fabricius, 1792, Ent. Syst., 1(2):396.

Rhynchophorus ferrugineus Herbst, 1795, Natursyst. Ins. Käf.,
6:8, t. 60, fig. 3; Schoenherr, 1826, Curc. Disp. Meth.,
4:327; Gyllenhal in Schoenherr, 1838, Gen. Spec. Curc.,
4(2):827-828; Boheman in Schoenherr, 1845, Gen. Spec. Curc.,
8(2):218; Chevrolat, 1882a, Bull. Soc. Ent. France, 2:138;
1882b, Ann. Soc. Ent. France, ser. 6, 2:561; Schaufuss,
1885, Russ. Ent. Obsch., 19:203-204; Haller, 1885, Schweiz,
Ent. Ges. Mitth., 7(4):198-199; Heyne and Taschenberg, 1908,
Exot. Käf., p. 233, t. 32, fig. 2; Lepesme, 1947, Les. Ins.
Palm., p. 612, 614-617, fig. 508; Wattanapongsiri, 1959,
Thailand Dept. Agr. Tech. Bull., p. 11-12, pl. 1, fig. 3,
pl. 7, figs. 1-5.

Cordyle sexmaculatus Thunberg, 1797, Kungl. Svens. Vet. Akad.
Handl., 18:46, 49.

Calandra ferruginea Fabricius, 1801, Syst. Eleuth., 2:433; Illiger,
1805, Mag. Ins., 4:138; Olivier, 1807, Ent. Hist. Nat. Ins.,
5(83):79-80, t. 2, fig. 16 c, d, e; Bélanger, 1834, Voy. Indes-
Orientales., p. 487, t. 2, fig. 5.

Rhynchophorus indostanus Chevrolat, 1882b, Ann. Soc. Ent. France,

ser. 6, 2:561-562. New synonymy.

Rhynchophorus signaticollis Chevrolat, 1882b, Ann. Soc. Ent.

France, ser. 6, 2:561-563; Faust, 1894, Ann. Mus. Civ.

Genova, 14(34):330; Lepesme, 1947, Les Ins. Palm.,

p. 612-613. New synonymy.

Rhynchophorus ferrugineus var. Schaufuss, 1885, Russ. Ent.

Obsch., 19:203; Haller, 1885, Schweiz, Ent. Ges. Mitth.,

7(4):198-199, figs. type, α , β , γ .

Rhynchophorus pascha var. cinctus Faust, 1892, Ann. Soc. Ent.

France, 61:520.

Rhynchophorus ferrugineus var. seminger Faust, 1894, Ann. Mus.

Civ. Genova, 14(34):330.

Rhynchophorus signaticollis var. dimidiatus Faust, 1894, Ann.

Mus. Civ. Genova, 14(34):330.

Description

Adult male. Length 19 to 42 mm., width 8 to 16 mm. Body elongate-oval, general color ferrugineous to black, legs lighter colored than body; elytra dark red to black, shining or slightly pubescent; black spots on pronotum extremely variable.

Rostrum varying from ferrugineous to black; usually ferrugineous; nearly four-fifths length of pronotum; in profile, straight, broad at base, smooth to minutely punctured; viewed dorsally widest

at base; apical or subapical with thick, erect, setae; extending more than one-half length of rostrum and not reaching antennal scrobe; rows of tubercles present or not; if present, one row on each side of rostrum; carina at the middle, if not strongly punctured; epistoma nearly rounded at apex; ventrally very finely punctured; space between antennal scrobes strongly narrowing posteriorly; gular suture oval at base but less concave than in vulneratus; submentum as described for vulneratus.

Mouthparts brown, mandible similar in shape to vulneratus; about one-half width of rostrum at base; tridentate distally and all teeth sharply pointed; apical and subapical teeth widely divided; maxillary palpus segments flat-rectangular, third segment without setae; palpifer triangular, nearly pointed distally, strongly convex at outer margin, concave at inner margin, and truncate basally; stipe one-half as long as palpifer, one-third lateroanteriorly pointed then broadened to nearly quadrate; cardo pointed at both ends, sinuated at both sides, more than three times as long as stipes; mala with narrow invagination at inner margin, gradually curved at outer margin, bearing six to seven, (usually seven), large and closely grouped setae.

Antenna as described for vulneratus except club usually ferruginous or reddish-brown with eight to fifteen setae on inner side of spongy area.

Head dull to shining; smooth to finely punctured; interocular space slightly more than one-half width of rostrum at base.

Pronotum with sides gradually curved to apex and abruptly constricted anteriolaterally; slightly pubescent to shining; posterior margin nearly rounded; color mostly ferrugineous and varying to dark brown and black; if not black with extremely variable markings on the surface; variation from no markings to more than ten black spots or with large black spot on pronotum; under side of pronotum mostly ferrugineous or dark brown, may vary to almost black, very minutely punctured.

Leg usually punctured on outer edges of both femur and tibia; front coxa strongly globose, widely separated; middle coxa covered with soft reddish-brown hairs; front femur as long as middle but shorter than hind femur; first tibia as long as hind and longer than the middle; first tarsal segment twice as long as second or slightly shorter than third; reddish-brown setae beneath third segment as described for vulneratus; fourth as long as first three segments combined, with nine to twelve setae ventrally.

Scutellum varying from reddish-brown to black; somewhat pointed posteriorly.

Elytra smooth or slightly velvety pubescent, nearly rectangular; with punctation along the outer edges; length of each elytron about two and one-third times its own width; with five deep striae and

traces of four more at side; third to fifth striae sometimes prolonged to base; third stria weakly confluent posteriorly with eighth, fourth, fifth; sixth with seventh; if not, third with eighth, fourth with seventh, and fifth with sixth.

Wing with costa broad, with two concave areas basally; subcosta small, narrowed, parallel with the basal stem of radius; radius broad, thick and separated from basal stem; radius $_2$ shorter than radius $_1$; both fused distally; base of media $_{1+2}$ free from basal stem of media $_{3+4+Cu}$ and sharply pointed proximally; media $_{1+2}$ broad and abruptly narrowed at distal end before reaching margin; basal stem of media $_{3+4+Cu}$ narrowly tapering to nearly pointed proximally, strongly curved upward; media $_{3+4}$ and cubitus small, slender and not fused distally; 1st + 2nd anal vein gradually curved to margin, one and one-half times longer than 3rd + 4th anal vein, both broad at base and gradually curved to margin; only radial and anal lobes distinct.

Abdomen usually ferrugineous, but may vary from ferrugineous to almost black; first abdominal sternite as long as third and fourth combined but much shorter than second, sparsely and diffusely punctured medially, strongly punctured laterally; fifth strongly punctured dorsolaterally.

Pygidium varying from ferrugineous to nearly black, mostly ferrugineous or dark brown, sparsely and minutely punctured

posteriorly and dorsolaterally.

Adult female. Length 26 to 40 mm. , width 10 to 16 mm.

Very similar to male in body size, color, markings on pronotum, except rostral setae absent; snout longer, slender and more cylindrical, setae on front femur absent and on front tibia much shorter.

Male genitalia. Nineteen males were dissected. Dorsal cleft of phallobase triangular and sharply pointed anteriorly, extending more than two-thirds its length; abruptly concave and divergent posteriorly. Dorsal split of phallobase slightly less than one-half length of contiguous area between dorsal cleft and split, with several small setae dorsolaterally. Ventral sclerites sharply truncate posteriorly and gradually curved at outer margins, bearing several setae laterally, membranous area between sclerites rectangular. Tegminal plate broadly fan-shaped; more rounded in smaller specimens. Tegminal apodeme thick and tapering anteriorly. Dorsal keel with two branches, extending less than one-half length of plate; in rounded tegminal plate, dorsal keel not branching and extending to posterior end of plate. On dorsal side, each end of tegminal sclerite with a distinct emargination distally and extending three-fourths distance from tegminal base; on ventral side, varying from oval to angular in shape, extending two-thirds length of tegminal base. Aedeagus narrowly oval anteriorly, lateral arms small, slender, and joining aedeagal apodemes. Aedeagal fenestra nearly pointed anteriorly,

broadened on both margins for about two-thirds distance from anterior end then abruptly narrowing and again widely broadened with broad concavity at posterior border. Orifical plates elongate with obsolete ends anteriorly. Aedeagal chamber broadly oval posteriorly, with two sclerotized plates beneath, extending nearly one-half length of aedeagal apodemes.

Female genitalia. Thirteen females were dissected. Dorsal cleft of vaginal base widely opened posteriorly and abruptly convergent for one-half of its length then narrowly parallel to anterior end. Sides of cleft edged with dark brown bands and with large membranous invagination posteriolaterally. Spiculum ventrale long-rectangular, three-fourths as long as length of vaginal base; spiculum fenestra one-fourth length of spiculum ventrale. Vaginal chamber broad, truncate posteriorly, with two semi-circular sclerotized plates. Spermatheca with four deep irregular ventral lobes; and with two strongly convex dorsal lobes located near base of spermathecal gland.

Measurements. The following measurements were taken from the 18 males and 18 females upon which the description is based.

	Male mm.		Female mm.	
	Mean	Range	Mean	Range
Body length	33.00	19.00-42.00	34.00	26.00-40.00
Body width	13.00	8.00-16.00	13.50	10.00-16.00
Elytron length	15.00	10.50-19.00	15.30	12.30-21.00
Elytron width	6.50	4.00- 8.00	6.75	5.00- 8.00
Pronotum length	12.50	8.00-15.20	13.00	9.50-15.50
Pronotum width	10.50	6.80-13.00	11.00	8.00-13.10
Rostrum length	9.80	7.00-12.00	12.00	9.00-14.00
Rostrum length before antennal scrobe	6.00	4.00- 8.00	8.50	6.50-10.00
Scape length	4.16	2.72- 5.60	4.80	3.36- 5.60
Funicle length	3.60	2.15- 4.16	3.44	2.72- 4.00
Club length	1.52	1.04- 1.68	1.44	1.36- 1.76
Club width	2.40	1.68- 2.80	2.40	1.76- 3.20

Egg. As described for vulneratus; averaging 0.98 by 2.96 mm.

Larva. Description based on the following material:

Nine larvae associated with seven pupae, two female and one male adults collected from coconut trunk at Banglamung, Cholburi, Thailand, July 20, 1957, by Prasert Penchitra. Loaned by Thailand Department of Agriculture.

Eight larvae associated with seven pupae and two male adults collected from coconut trunk, at Banglamung, Cholburi, Thailand, August 2, 1957, by Prasert Penchitra. Loaned by Thailand Department of Agriculture.

Seven larvae associated with two pupae and four male adults collected from coconut trunk, at Bangkhen, Bangkok, Thailand, May 6, 1961, by A. Wattanapongsiri. In the writer's collection.

Three larvae associated with three female and two male adults collected from coconut trunk, at Bangkhen, Bangkok, Thailand, August 4, 1961, by A. Wattanapongsiri and will be deposited at the United States National Museum.

Twenty-eight larvae associated with one pupa, four female and three male adults collected from coconut trunk, at Bangkhen, Bangkok, Thailand, September 27-28, 1962, by Boonsom Meksongsee. In the writer's collection.

Seven larvae associated with two pupae collected at Calamba, Luzon Is., Philippines, November 21, 1962, by S. M. Cendana. Loaned by the University of Philippines.

Larvae of this species may be characterized as follows:

epicranium with one pair of sensilla, dorsal epicranial setae 1 and 3 placed on paraepicranial suture, six to seven pairs of postdorsal epicranial setae, if six present one close to epicranial suture absent;

all postdorsal epicranial setae in an irregular row. Paraepicranial suture extending for four-fifths length of epicranial suture posteriorly. Frons with two straight longitudinal depressions; posterior angle of frons rounded, two pairs of sensilla present, anterior pair placed close to base of frontal setae 3, posterior pair located at about midpoint between frontal setae 1 and 2, usually closer to setae 2 than 1. Clypeal setae 1 long, four to five times longer than clypeal setae 2. Labrum with 22 to 24 simple, thickened, lateral setae and six anterior setae, usually only 20 lateral setae present; labral sensilla absent. Epipharynx setose, elongate-oval, rounded posteriorly, abruptly enlarged lateroanteriorly, with two pairs of simple, thickened setae, at anterior end of epipharyngeal sclerite and two pairs of epipharyngeal sensory pores, distance from anterior sensory pores to epipharyngeal setae 1 less than twice as long as to setae 2; posterior sensory pores placed about one-half length of epipharynx on epipharyngeal sclerite. Mandible subtriangular with one blunt apical tooth; one median tooth may be present, molar area divided into three irregular lobes. Mala with 23 dorsal setae, nine bifurcate and seven trifurcate. Premental sclerite of three lobes, median lobe rounded anteriorly and triangular posteriorly; two lateral lobes rectangular. Ligula rounded anteriorly. Hypopharynx subtriangular, broad and densely setose laterally; median furrows of fleshy areas poorly defined, extending less than one-half its length. Thoracic

coxal lobes with five setae. Eighth abdominal tergite with four prodorsal setae and with five pairs of spiracular sensillae in group posterior to each spiracle. Ninth abdominal segment sclerotized, with group of two to five sensillae at base of epipleural setae 1, and two at base of each epipleural setae 2. Anus transverse, preanal lobe bearing two setae, subrectangular, wider posteriorly, subdivided into a small subrectangular; two lateral lobes nearly rounded, with two setae; median lobe one-half size of lateral lobe, rounded and wider posteriorly, truncate anteriorly, bearing no setae.

Measurements. Body length 36 to 47 mm., width 15 to 19 mm.; head length 8 to 9 mm., width 7 to 8 mm.

Pupa. Description based on the following material:

Seven pupae associated with nine larvae, two female and one male adults collected from coconut trunk at Banglamung, Cholburi, Thailand, July 20, 1957, by Prasert Penchitra. Loaned by Thailand Department of Agriculture.

Seven pupae associated with eight larvae and two male adults collected from coconut trunk, at Banglamung, Cholburi, Thailand, August 2, 1957, by Prasert Penchitra. Loaned by Thailand Department of Agriculture.

Two pupae associated with seven larvae and four male adults collected from coconut trunk, at Bangkhen, Bangkok, Thailand, May 6, 1961, by A. Wattanapongsiri. In the

writer's collection.

One pupa associated with 28 larvae, four female and three male adults collected from coconut trunk, at Bangkhen, Bangkok, Thailand, September 27-28, 1962, by Boonsom Meksongsee. In the writer's collection.

Two pupae associated with seven larvae collected at Calamba, Luzon Is., Philippines, November 21, 1962, by S. M. Cendana.

Pupae of this species may be characterized as follows:

tubercles on each side of epicranium not highly elevated, with one seta and several oblique ridges, one seta on lateral margin of each epicranial half usually present.

Rostrum with two to four pairs, usually two pairs, of tubercle-borne setae as follows: if two pairs present, both pairs placed above base of antennae, anterior pair wider separated; if two pairs and one seta present, pairs as mentioned above but one seta placed at base of antenna; if three pairs present anterior pair placed at base of antennae and widely separated; if three pairs and one seta present, posterior pairs widely separated and placed at base of rostrum and one single seta placed on right at base of antenna; if four pairs present, anterior pairs farthest apart, posterior pair and pair next to anterior pair subequal both in size and distance.

Pronotum subovate, with two pairs of tubercle-borne setae; distance between two setae of posterior pair about one-half or more than distance between setae of anterior pair; anterior pair sometimes absent or only one seta present. Minute spines scattered over pronotum denser on posterior half. Metanotum with one pair of tubercle-borne setae.

Scutellum extending posteriorly four-fifths or more length of metanotum, with one pair of tubercle-borne setae.

Elytra not covering the first abdominal spiracles, with five tuberculate paralleled ridges; ridges 1 to 3 covered with minute spines; ridges 4 and 5 with fewer spines than 1 to 3; intervals between ridges smooth, without spines. Wings almost meeting in middle line on anterior half, middle or posterior margin of second abdominal sternite.

Abdominal tergite 1 with three to five pairs of tubercle-borne setae, usually four; tergite 2 with five to seven pairs, usually seven; tergites 3 to 6 with six to seven pairs, usually seven; tergite 7 broadly triangular, with four pairs of tubercle-borne setae, three placed mediolaterally and one pair medially on anterior margin. Abdominal sternites 3 to 5, each with high median elevation, extending longitudinally across sternite.

Measurements. Body length 27 to 40 mm., width 13 to 16 mm.

Discussion

The differences between this species and a closely related species, vulneratus, are discussed on pages 217-220.

The weevil of this species was perhaps first found on sago palm, Sagu campas, in Ceylon, by Rhumpf in 1750-1755. He also first described and figured the larva, cocoon, and dorsal and ventral views of the adults as Cossus sagurios. This name, however, is not valid according to the ICZN Articles 3, 11 (a), and 86.

In 1776, Sulzer figured and identified the weevil from India as Curculio hemipterus Linnaeus, 1758. The weevil was later described as Curculio ferrugineus by Olivier in 1790 and this name has been used since. When Herbst erected the genus Rhynchophorus, he pointed out that R. ferrugineus (Oliv.) was commonly mistaken for Curculio hemipterus Linn. He also pointed out the differences between the two species.

In 1797 Thunberg described a male specimen from India as Cordyle sexmaculatus. It was placed in synonymy with R. ferrugineus (Oliv.) by Csiki in 1936. Chevrolat in 1882b described the male and female specimens from Assam as "Rhynchophorus indostanus" and a male from Ceylon as "Rhynchophorus signaticollis" based on the shapes and numbers of spots on the pronotum. Chevrolat described indostanus as "Ruber nitidus, antennis prothorace supra atque infra,

maculis 5 vel 7 pectore ... prothorace rubro, supra maculis 5 vel 7 nigris; ..." and signaticollis as "prothorace ... maculis 4 nigris et vitta longitudinali maculis 2 formata; ..." from the descriptions mentioned, it is obvious that both R. indostanus Chev. and R. signaticollis Chev. are conspecific with R. ferrugineus (Oliv.). However, R. signaticollis was once placed in parenthesis after R. ferrugineus by Dammerman in 1929 when he studied the biology of this species.

Faust described many colored forms of many species in Rhynchophorus as "varieties," such as the red colored variant of R. phoenicis as R. phoenicis var. ruber and the black colored variant as R. phoenicis var. niger; and the red colored variant of R. quadrangulus as R. quadrangulus var. rex. He did so in this species, describing the red colored variant with three black spots on the pronotum from Saigon (North Vietnam) and Pnomh-Penh (Cambodia) as R. pascha var. cinctus in 1892; and two more forms from Burma, one red in color with a large black spot on pronotum as R. ferrugineus var. seminiger and the other with one black median stripe and two to four black spots on pronotum as R. signaticollis var. diminiatus. Haller also called the variants of this species varieties, based on the spots on the pronotum: type, α , β and γ .

Type Locality

East Indies

Types and Location

The type-series may be deposited in the Museum National d'Histoire Naturelle, Paris, France.

Biology

Banks (1906) first studied the biology of R. ferrugineus in the Philippines and gave an account of the damage caused by this weevil on coconut with short descriptions of the egg, full grown larva, pupa, and adult. Ghosh (1912) first studied the biology of this species in India and reported that it required 48 to more than 82 days to complete its life cycle. The average was two months. Nirula (1956) stated that the life cycle required 81 days in India. Leefmans (1920) studied the biology in Indonesia reported the larval period in the open was two months and in the laboratory 3.5 months; the prepupal period ranged from three to six days, and the pupal period 13 to 17 days. The longest period of life of the adult in captivity was 107 days. Leefmans also reported that there were some nematodes in the gut of the adult weevils. Ghosh (1923, 1940) studied the biology of R. ferrugineus in Burma, where he found that the life cycle

ranged from 2 to 5.5 months according to the season. Eggs hatched in about two to four days, the larval stage ranged from 1 to 3.5 months, and the pupal stage 17 to 50 days. The adult lived for about two months with each female laying about 300 eggs. Dammerman (1929) summarized the information then extant on the biology of R. ferrugineus (signaticollis Chev.). He stated that the life cycle was about two months. Copeland (1931) reviewed the biology of the weevil and reported that it was most commonly known in Ceylon and Malasia as the "Red Beetle," although it was also known as the "Asiatic Palm Weevil."

Host plants. Ghosh (1912) reported that in India the following plants are hosts of ferrugineus: date palm, Phoenix sylvestris, and Plamyra or Toddy plam, Borassus flabellifer. Leefmans (1920) in Indonesia reported that, besides coconut, R. ferrugineus also attacked and bred in Metroxylon sagu, Arenga pinata, Elaeis guineensis, Corypha gebanga, Phoenix sylvestris, and Borassus flebellifer. Viado and Bigornia (1949) in the Philippines reported the following plants as hosts of R. ferrugineus: Buri palm, Corpha elata; coconut, Cocos nucifera; kaong, Arenga pinata; pugahan, Caryota maxima and Caryota cumingii; African oil palm, Elaeis guineensis; royal palm, Oreodoxa regia; and betel nut palm, Areca catechu.

Economic Importance

Rhynchophorus ferrugineus is the most serious and destructive pest of coconut in the oriental region, Ghosh (1912) stated that the weevil was very destructive to palm trees, especially in southern India. Nirula and Menon (1957) reported that it was the most destructive pest of young coconut palms throughout India. Henry (1917) stated that as a pest, this weevil is widely spread and common in Ceylon whenever coconut were grown. Mel (1928) reported that it was the most dangerous pest of coconut in Ceylon. Paul (1929) in Ceylon also reported that R. ferrugineus stood foremost in losses caused to the coconut industry. Its attacks were generally confined to young palms which were gradually killed. Barnett and Mackie (1912) reported the weevil was most destructive insect attacking coconuts in the Philippines.

The weevil was also reported as serious and destructive as follows: in Ceylon by Ferguson (1885), Anon. (1915, 1933), Bunting (1928, 1930), Hutson (1930); in the Philippines by Banks (1906), Jones (1913), Woodworth (1921), Anon. (1939), Viado and Bigornia (1949); in India by Shortt (1888), Lefroy (1906), Venkatsubba (1934), Deshpande and Krandikar (1948); in Burma by Ghosh (1923, 1937, 1940).

In the East Gulf areas of Thailand, especially in the

Provinces of Cholburi and Rayong, coconut growing has suffered much from R. ferrugineus and O. rhinoceros (Linn.). The eradication work in Cholburi started in 1959 and within two years about 2,500 heavily infested coconut palms were cut down and 2,665 newly infested trees were treated. There are 313,309 palms in 5,031 acres in these two Provinces. In 1963 and 1964 about 1,470 heavily infested palms in Rayong Province were cut down from among 40,580 palms.

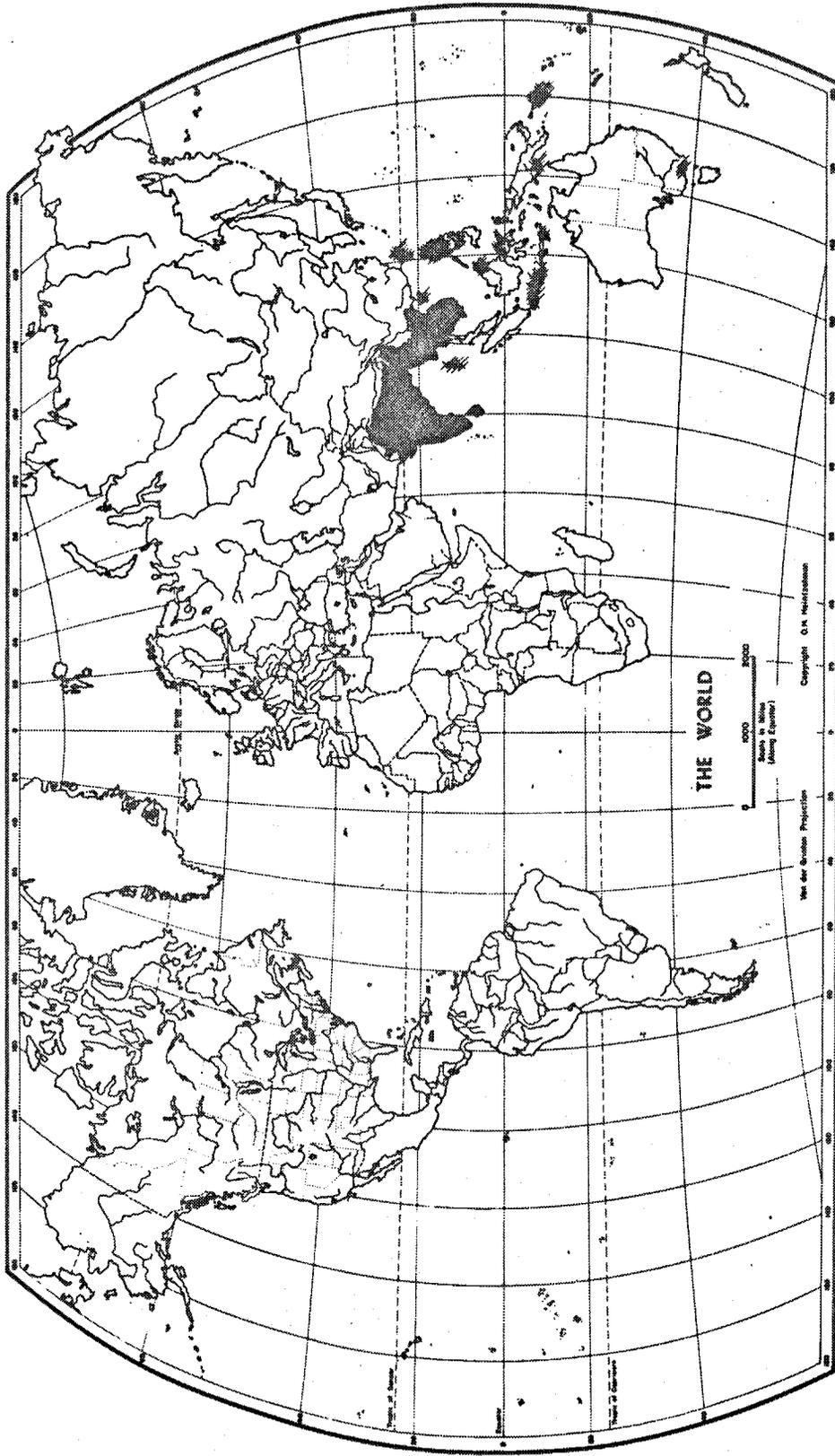
Distribution

Present records indicate that the range of ferrugineus extends from Ceylon northward to India and westward through Burma, Thailand (except southern part), North Vietnam, South Vietnam and across the ocean to Taiwan, Hainan Islands, and the Philippines. It is randomly distributed on the Islands of the East Indies and may also be found in the southern parts of Japan (Kobe) and Australia (Victoria).

Total specimens examined	884
Males	441
Females	443

Collecting dates: January 16 to December 28.

Elevation: Up to 3,000 feet.



Map 5. Distribution of the specimens examined of *Rhynchophorus ferrugineus* (Oliv.)

Rhynchophorus lobatus Ritsema

Rhynchophorus lobatus Ritsema, 1882, Not. Leyden Mus., 4:179-180.

Description

The following is the original description:

Length (the rostrum included) 37 mm. , width of the shoulders of the elytra 14 mm. ; deep black, smooth and subshining.

The scape of the antennae and the rostrum are finely and remotely punctured; the latter is slightly curved at its apical half, and a little wider and distinctly convex at its base; its upper surface before the convex portion is provided with two longitudinal ridges formed by more or less confluent tubercles, which end at a compressed median tubercle placed a little before the apex of the rostrum. Between the eyes a small rounded fovea is present.

The prothorax is regularly convex, and about one and a half as long as broad; its sides are regularly rounded anteriorly, nearly parallel towards the base which is narrowly margined; the basal lobe has the shape of a triangle with rounded tip; it is separated from the disk of the thorax by a transverse slightly curved impression and provided with a few rather shallow punctures. The contracted anterior portion of the thorax is well-defined and provided with a few rather large punctures. On the disk, which shows an exceedingly

delicate sculpture intermixed with fine punctures, a trace of a raised line may be observed along its whole length. The scutellum is flat, narrow and elongate.

The elytra are proportionally short, wide at the shoulders, strongly attenuated towards the end, and conjointly emarginated at the base and at the apex; they are covered with exceedingly fine granules not visible without the aid of a lens. Each elytron shows five longitudinal lines between the suture and the shoulder; the first of these lines which are faintly crenulated anteriorly, does not extend quite to the base, the third to fifth are much more delicate but considerably wider at the base; external to the second line the base of the elytra is slightly reflexed and somewhat thickened. The pygidium is curved downwards (convex in a transverse direction, rather remotely punctured, and provided on the middle of the apical two-thirds with a faint longitudinal keel; the apex is obtusely rounded.

The pro- and mesosternum as well as the anterior femora are densely covered with small but distinct granules, the rest of the legs is finely and very sparsely punctured. The metasternum and abdomen are covered with exceedingly fine granules, not visible without the aid of a lens, leaving however a smooth streak on the middle. The last ventral segment shows on the middle of the hind margin a semicircular impression which is provided with and surrounded by a few very distinct punctures. The undersurface of the femora and

tibiae is covered with a long and dense ferrugineous black pubescence.

The tarsi are spongy beneath.

A single male specimen from Kotta Zuydewijn near Solok
(J. H. Schagen van Leeuwen).

Leyden Museum, April 18, 1882.

Discussion

This species was described from a single male in Leyden Museum not seen by the writer. The original description fits both ferrugineus and vulneratus, therefore, this species is possibly synonymous with one of these two species. Since the writer is unable to distinguish lobatus from ferrugineus or vulneratus, the name of the species is allowed to stand at this time.

Rhynchophorus phoenicis (Fabricius)

Figs. 52, 55-58, 133-134, 185, 197, 209, 217, 226, 254-255, 288-289, 340, 361-362, 371, 386, 421-423, 480-483, 561, 584-586, 630, 638, 649, 652, 676-678, 684, 687, 696, 705, 709, 720-721, 726, 739.

Calandra phoenicis Fabricius, 1801, Syst. Eleuth., 2:430; Illiger, 1805, Mag. Ins., 4:137.

Rhynchophorus phoenicis (Fabricius), Schoenherr, 1826, Curc.

Disp. Meth., 4:327; Gyllenhal in Schoenherr, 1838, Gen. Spec.

Curc., 4(2):825; Gerstaecker in Peters, 1862, Nat. Reise nach., p. 317; Quedenfeldt, 1888, Berl. Ent. Zeitschr., 32:302; Faust, 1899a, Ann. Soc. Ent. Belgique, 43:424; Hesse, 1935, Ann. Transvaal Mus., 17(1):54; Lapesme, 1947, Les Ins. Plam., p. 612, 614; Voss, 1947, Rev. Ent. Rio de Janeiro, 18:63-64.

Rhynchophorus phoenicis var. Chevrolat, 1882b, Ann. Soc. Ent. France, ser. 6, 2:561.

Rhynchophorus phoenicis var. niger Faust, 1899a, Ann. Soc. Ent. Belgique, 43:424.

Rhynchophorus phoenicis var. ruber Chevrolat, 1882b, Ann. Soc. Ent. France, ser. 6, 2:561; Faust, 1899a, Ann. Soc. Ent. Belgique, 43:425.

Description

Adult male. Length 28 to 43 mm., width 11 to 16 mm. Body elongate-oval, varying from black to nearly red; dorsum shining and darker than venter.

Rostrum reddish-brown to black, two-thirds length of pronotum; in profile, broad at base and tapering to apex; viewed dorsally, broad about one-third distance from posterior end then abruptly tapering to apex; dorsal area from ocular sulcus to antennal scrobes smooth and from smooth area to apex with scattering tubercles; apical one-half

with thick, reddish-brown setae; epistoma slightly depressed then feebly convex distally; viewed ventrally, with small, thin, subequal lateroanterior grooves from base of mandibles and confluent with gular suture for about three-fourths from the tip of rostrum; space between the antennal scrobes similar to palmarum except less punctures and without setae; submentum elongate as described for palmarum except median depression not sharply pointed distally; lateral arm of hypostoma triangular and pointed anteriorly.

Mouthparts brownish-black; mandible nearly one-half width of rostrum at apex, tridentate, apical and subapical teeth deeply divided; maxilla brown, third maxillary segment bearing four short setae distally; palpifer rounded basally and inner margin convex mesally; stipes as long as palpifer, slightly concave with outer margin somewhat pointed distally, broadly oval basally; cardo elongate, nearly triangle, broad basally; mala elongate, gradually curved at outer margin, hook-like at inner margin, mesodistally with six to seven setae.

Antenna thick, gradually enlarged to apex; antennal scrobe broad posteriorly, deep, opened ventrally; scape elongate, longer than club and funicle combined or nearly one-half length of rostrum; second funicular segment longer than third and almost rounded; fourth and fifth segments broader than second or third; fourth as long as third, narrower than sixth; fifth segment with six setae,

sixth with nine; antennal club large, broadly triangular; inner side of spongy area with five to seven setae.

Head somewhat shining; interocular space nearly one-third width of rostrum at base; frons smooth; genae finely punctured, reddish-brown to black.

Pronotum varying from black to reddish-brown, constricted anteriolaterally, base not produced posteriorly, lateral margins finely punctured and narrowed anteriorly; color variable, if pronotum red then with three black stripes or if pronotum black then with only two red stripes extending length of pronotum; under side smooth, varying from dark brown to reddish-brown, never completely black; anterior to spinasternum without patches of hairs; mesosternum emarginate posteriorly, without setae; mesepisternum and mesepimeron diffusely punctured and without setae; metepisternum curved anteriorly, pointed posteriorly; lateral margin sinuate, not parallel to the elytron; metepimeron small, triangular, diffusely punctured, outer margin parallel to elytron.

Legs varying from dark brown to red, strongly punctured; front coxae separated by a distance equal to one-fourth width of a coxa, sparsely punctured, without hairs; middle coxa similar to front coxa but smaller and covered with reddish-brown hairs; outer sides of all femora strongly punctured and inner sides finely punctured; all femora similar in shape and subequal in size; first femur longer than

middle but as long as hind femur; all tibiae similar in shape; front tibia longer than middle or hind tibia; hind tibia longer than middle; first tarsal segment one and one-half times as long as second or as long as third; one-half of the entire area beneath third tarsal segment covered with soft reddish-brown setae; fourth as long as or slightly longer than first three segments combined, bearing eight to ten setae ventrally; ventral sides of femora, tibiae and first three tarsal segments with reddish-brown setae.

Scutellum varying from black to reddish-brown, one-fifth the length of elytron, very narrowly produced posteriorly and slightly depressed anteriorly.

Elytra varying from black to reddish-brown, smooth, subequal; length of each elytron almost three times its own width and with side tapering posteriorly; posterior border gradually curved from lateral margin. Elytron with five deep striae and traces of four more at side; usually sutural striae 2, 3, 4 prolonged to base; fourth confluent posteriorly with fifth, sixth and seventh, or only with seventh; fifth stria confluent with sixth; interstices three to five times as wide as striae; smooth and slightly convex posteriorly.

Wing with brown ventro-costal setae, extending nearly to distal end of subcosta; subcosta freely extending to margin; basal stem of radius divided from radius vein at costal margin almost medially, broad distally and narrowly tapering proximally; radius ₁

and radius $_2$ fused and joining with radius $_{3+4+5}$ distally; proximal end of radius $_{3+4+5}$ joining with media $_{1+2}$; the latter proximally enlarged with short spurious vein at distal end, inverted proximally and not forming a close cell; basal stem of media $_{3+4+Cu}$ narrowly rectangular with distal end inverted to join basal stem of radius; media $_{3+4+Cu}$ with spurious vein inverted upward, nearly one-half its length. First plus second anal vein one and one-half times as long as third plus fourth anal vein; both veins strongly curved but not reaching distal margin and with a spurious vein placed proximally; radian and median lobes slightly distinct, cubital and anal lobes indistinguishable.

Abdomen varying from dark brown to reddish-brown, darker at fifth segment, all segments smooth medially and sparsely punctured laterally; first segment medially fused with second and slightly longer than first or third and fourth combined; fifth segment strongly curved ventrally and fringed with thick rows of reddish-brown setae laterally.

Pygidium as described for quadrangulus except color varying from black to reddish-brown, smooth or very finely and diffusely punctured, and with reddish-brown setae laterally.

Adult female. Length 27 to 41 mm., width 10 to 15 mm. Similar to male except rostrum more slender and cylindrical, strongly curved from posterior third to apex, smooth or very finely

punctured; pygidium smooth without lateral setae.

Male genitalia. Seven males were dissected. Dorsal cleft of phallobase broadly triangular, narrowly convergent for two-thirds its length anteriorly; dorsolaterally strongly punctured, without setae. Sides of cleft straight and divergent. Dorsal split of phallobase one-fourth length of contiguous area between dorsal cleft and split. Ventral sclerites at outer margins nearly parallel to edges of phallobase, inner margins slightly diagonal, bearing setae laterally and anteriorly but setae not join confluent at anterior end. Tegminal plate fan-shaped and slightly concave at posterior margin and broadly joining tegminal stem. Dorsal keel extending about two-thirds length of tegminal plate then branched with left branch reaching edge of tegminal plate and right branch about at middle of plate. Tegminal sclerite ventrally uniform width extending and nearly rounded anteriorly; on dorsal side broad at base extending laterally then abruptly turning anteriorly to about two-thirds length of tegminal base. Aedeagus nearly rectangular, slightly curved at sides anteriorly, lateral arms thick, joining aedeagal apodemes. Aedeagal fenestra narrowly spatulate sharply concave posteriorly; ventral side of the aedeagus nearly truncate posteriorly. Orifical plates of aedeagus kidney-shaped, heavily sclerotized, widely separated. Aedeagal chamber pear-shaped, broad posteriorly, with a median sclerotized plate, extending nearly one-half length of

aedeagal apodemes.

Female genitalia. Six females were dissected. Dorsal cleft of vaginal base narrowly triangular and convergent toward anterior end of the base. Each side of cleft gradually concave and divergent. With cordate membranous invagination lateroposteriorly. Spiculum ventrale four-fifths as long as vaginal base. Spiculum fenestra slightly more than two-thirds length of spiculum ventrale and opened distally. Vaginal chamber oval, membranous. Spermatheca with four distinct ventral lobes and without dorsal protrusible base of spermathecal gland. The latter placed near distal end.

Measurements. The following measurements were taken from the 11 males and 12 females, some of the specimens upon which the description is based.

	Male		Female	
	mm.		mm.	
	Mean	Range	Mean	Range
Body length	36.60	28.00-43.00	35.60	27.00-41.00
Body width	14.00	11.00-16.00	13.20	10.00-15.00
Elytron length	15.40	14.00-20.00	18.10	14.00-20.50
Elytron width	7.00	5.50- 8.00	6.60	5.00- 7.50
Pronotum length	12.40	10.00-14.00	12.10	9.00-14.00
Pronotum width	11.20	8.00-13.00	10.88	8.40-12.50
Rostrum length	10.70	9.00-12.00	12.30	10.00-14.00

	Male		Female	
	mm.		mm.	
	Mean	Range	Mean	Range
Rostrum length before antennal scrobe	6.80	5.50- 7.50	8.30	7.00- 9.00
Scape length	4.94	3.60- 5.76	4.93	3.60- 5.60
Funicle length	3.23	2.24- 3.92	3.27	2.40- 3.76
Club length	1.44	1.36- 1.52	1.41	1.20- 1.60
Club width	2.16	1.68- 2.48	2.18	1.84- 2.40

Egg. Yellowish-brown to light brown, smooth and somewhat shining, cylindrical-elongate with rounded ends; slightly wider at anterior end and curved mesally; averaging 1.04 by 3.89 mm.; chorion very thin and hyaline; vitelline membrane whitish-yellow.

Larva. Description based on the following material:

Two larvae associated with one male adult and one pupa collected at Aburi, Gold Coast, 1913-1914, by L. Armstrong. Loaned by British Museum (Natural History).

Larvae of this species may be characterized as follows:

epicranium with sensilla absent, six pairs of dorsal setae with dorsal setae 1, 2, 4, placed on each side of paraepicranial suture; and five pairs of postdorsal setae, four in a row and the other pair placed on the margin. Paraepicranial suture extending more than three-fourths length of epicranial suture posteriorly. Frons with

two median longitudinal depressions, curved and widely separate anteriorly; posterior angle of frons not sharply pointed; frontal setae 1 on the same level, one pair of sensilla present and located close to base of frontal setae 2. Clypeal setae 1 and 2 joining with a small narrow groove at their bases. Labrum with 28 or 30 lateral setae and six anterior setae; the latter six short, thick; labral sensilla absent. Epipharynx with two pairs of setae and two pairs of sensory pores; posterior pair of sensory pores somewhat elongate and placed on epipharyngeal sclerite at about middle of the epipharynx and anterior pair placed between epipharyngeal setae 1 and 2; posterior half of setose portion of epipharynx broadly oval then abruptly triangular anteriorly. Mandible broadly triangular, very stout, without distinct tooth. Mala with 15 to 20 setae, three bifurcate and two trifurcate; if 15 setae present then five small setae placed at posterior end absent. Premental sclerite broadly Y-shaped and arms of "Y" longer than stem. Ligula rounded anteriorly. Hypopharynx emarginate anteriorly and with triangular portion extending posteriorly, sinuate laterally, more densely setose anteriorly, median fleshy area without furrows. Each thoracic coxal lobe bearing five setae. Abdominal segments with distinct dorsal plicae widest at sixth abdominal segment. Eighth abdominal tergite with heavily sclerotized areas close to spiracles, each of the sclerotized areas with five sensilla placed posteriorly to spiracle;

and with two prodorsal and two postdorsal setae. Ninth abdominal segment heavily sclerotized both dorsally and ventrally and broadly rounded anteriorly, bearing 24 to 28 dorsal sensilla. Anus broad, V-shaped; preanal lobe subtriangular posteriorly, subdivided into small nearly rounded lobes, medially convex, bearing two setae; lateral lobes subtriangular, without setae; median lobe small, narrow, convex, equal in size to preanal lobe, anteriorly without setae.

Measurements. Body length 59 to 64 mm., width 19 to 24 mm.; head length 12 to 13 mm., width 11 to 11.50 mm.

Pupa. Description based on the following material:

One pupa associated with two larvae and one male adult

collected at Aburi, Gold Coast, 1913-1914, by L. Armstrong.

Loaned by The British Museum (Natural History).

Pupae of this species may be characterized as follows:

Tubercle on each side of epicranium with one seta, and subdivided by several longitudinal and obliquely ridges.

Rostrum with seven pairs of tubercle-borne setae, one pair of lateral tubercles, and one unpaired seta on the right; the setae placed as follows: two pairs apical, one unpaired seta on left margin, one pair medially below the base of antennae, one pair wider separated about two-thirds width of rostrum and placed at base of antennae; three pairs above base of antennae, two of which placed

anteriorly and not widely separated and placed more medially than basal pair; and one pair of small tubercles placed laterally below base of antennae.

Pronotum subquadrate, narrow anteriorly, covered with numerous minute spines of varying sizes on the posteriolateral margins which are much sparser much less anteriorly; metanotum without setae.

Scutellum extending posteriorly only one-half length of metanotum.

Elytra not covering first abdominal spiracles dorsally, with only four tuberculate parallel ridges, first two ridges covered with minute spines along their length; third ridge covered with spines only on basal one-sixth; fourth ridge and intervals between ridges smooth, bearing no spines. Wings almost meeting in the middle line of the fourth abdominal segment at posterior margin.

Abdominal tergites 1 to 6 without transverse rows of short spines; tergite 1 with two tubercle-borne setae on the left and three setae on the right; tergite 2 with four pairs of setae; tergites 3 to 5 with six pairs of setae; tergite 7 with six pairs in a row and one pair placed medially close to the anterior margin; tergite 7 more rounded than triangular, with two pairs of setae and numerous minute spines mediolaterally. Abdominal sternites 3 to 5 each with a high median elevation, extending longitudinally across sternites.

Measurements. Body length, 45 mm. , width, 21 mm.

Discussion

This species is very uniform both in color and body size. Fully colored individuals differ distinctively from those of all other species by having either two red or three black stripes on the pronotum. Other characters are given in the key.

The morphological characters of the aedeagus were first studied by Kolbe in 1893. Muir (1915) pointed out that Kolbe had mistaken the "eighth abdominal segment" for the "aedeagus" and "rectum" for the "ejaculatory duct." If we consider the "aedeagus" of Kolbe as the "eighth abdominal segment," which is called in this paper "phallobase," then the "endophallus" would be "the ninth abdominal segment" and "aedeagus" would be "the tenth abdominal segment." The writer intends to count the number of abdominal segments, however, as they appear externally and those that are internal and form the reproductive organs as "genitalia." The latter structure is discussed in the discussion of characters section and its parts labelled on the figures.

Chevrolat (1882b) described the reddish or dark brown form from Abyssinia as new variety. Faust (1899a) described the two black males from Gabon as variety niger and two reddish forms one of which male from Calabar, the other female from Gabon as variety

ruber. Hesse (1935) discussed the color varieties found at Kalahari in the Union of South Africa that they were different from those from East Africa, Southeast Tropical Africa and Ovamboland. The writer has found the range of color variation of this species from the specimens examined mentioned by the above writers. By carefully checking its distribution and morphological characters the writer found no significance in geographical variation. Therefore, all the varieties or subspecies listed in this paper stand only as variants of the species.

Type Locality

Guinea.

Types and Location

Type male, probably in the Museum at Lund, Sweden.

Biology

No host plant data were taken from the materials examined. There are many writers reporting on the biology of this species. In 1925, Lommel reported the following as host plants of phoenicis in Mozambique: Coconut palm, Borassus sp., date palm, Phoenix reclinata, Hyphaene sp., oil palm, Elaeis guineensis. Lamborn

(1932) stated there was a series of ants as an inquiline in the borings made by phoenicis in Naiwale palm, Hyphaene crinita, in Nyasaland. Lepesme (1947) wrote that phoenicis required at least 60 days to complete its life cycle and 26 days for the development of the larva. He also recorded the following as its host plants:

Elaeis guieensis, Hyphaene sp., Phoenix dactylifera, Phoenix reclinata, Borassus aethiopum, Raphia vinifera.

Economic Importance

Rhynchophorus phoenicis was reported as a pest of coconut palms by Vosseler in 1907. It was also reported as a pest of coconut palms in the Tropical Africa by Burkill (1913); in Tanganyika by Harris (1937); in Uganda by Gowdey (1909-1910); in the Union of South Africa by Hesse (1935); in Brazil and Africa by Voss (1947); in Quelimaine, Mozambique by Lommel (1925); in Gold Coast and Ethiopia by Nirula (1956). Mansfield-Aders (1919) reported it as pests of coconut and oil palms, Elaeis guineensis in Pemba, Zanzibar. Lamborn (1932) stated it was a borer in the leaf stem of Niwale palm, Hyphaene crinita, in Nyasaland, and pest of oil palms in Sierra Leone by Hargreaves in 1937.

Distribution

Records from material examined indicate that phoenicis may

be found in the western Africa extending from Senegal eastward to Kenya and southward to the Union of South Africa, except Bechuanaland. There are one male and one female in the collection of the Zoologische Sammlung des Bayerischen Staates labelled from Sao Paulo and Catharina, Brazil; and one male and one female in the collection of Cornell University labelled from Mexico. Records from the literature indicates that this species may also be found in Ethiopia (Chevrolat, 1882b and Nirula, 1956).

Total specimens examined	558
Males	288
Females	270

Collecting dates: January 1 to December 23.

Elevation: Up to 4,000 feet.

Rhynchophorus quadrangulus Quedenfeldt

Figs. 39, 51, 59-61, 135-136, 168, 179, 198, 206, 222, 225, 244-245, 282-283, 324, 338, 354-355, 370, 415-417, 488-491, 557, 596-598.

Rhynchophorus quadrangulus Quedenfeldt, 1888, Berl. Ent. Zeitschr., 32:302-303; Faust, 1899a, Ann. Soc. Ent. Belgique, 43:425; Lepesme, 1947, Ins. palm., p. 617.

Rhynchophorus quadrangulus var. rex, Faust, 1899a, Ann. Soc. Ent. Belgique, 43:425.

Description

Adult male. Length 33.5 to 44.0 mm.; width 12.5 to 15.0 mm. Body broadly-oval, varying from red to black, dorsum may or may not be shining.

Rostrum reddish-brown to black; two-thirds length of pronotum; in profile, strongly compressed, slightly tapering to apex; viewed dorsally, for about one-third distance from base broad and strongly convex, then abruptly narrowed and slightly dilated to apex, strongly punctured to apex; subapical one-fourth with few scattered reddish-brown setae, sometimes absent; with small median carina extending from base for three-fourths length of rostrum; epistoma with distinct round nasal plate; viewed ventrally, with small, thin, subequal lateroanterior grooves from base of mandibles not confluent with gular suture but parallel to base of rostrum; space between antennal scrobes smooth, setae absent, strongly curved at sides then narrowing in straight line almost to base; submentum strongly convex ventrally, oval distally, median depression joining gular suture and extending one-third to one-half the length of rostrum posteriorly; lateral arm of hypostoma almost uniform width to near the anterior end then abruptly pointed distally.

Mouthparts nearly black; mandible about one-third width of rostrum at apex, broadly rounded distally; maxilla dark brown, first

segment of maxillary palpus nearly quadrate; third slightly concave and bearing seven setae distally, four long, the other three short; palpifer strongly convex along outer margin and much reduced basally; stipes as long as palpifer, broadly bulbous at inner side; cardo somewhat pointed distally, convex disto-mesally with a row of eleven plegmatia along outer margin; mala broadly-rounded along the outer margin and with a small narrow emargination at inner margin, bearing three large setae closely grouped distally and three mesally.

Antenna reddish-brown to black; scape as long as funicle and club combined or one-half length of rostrum; first funicular segment longer than the next five or as long as next two combined; second to fourth conical, somewhat subequal in length; fifth with two setae; sixth with four to five setae, broader than fifth; antennal club large, inner side of spongy area with ten to twelve brown setae.

Head shining, strongly punctured dorsally; two or three sulci may be present, one placed on frons (frontal sulcus), one between eyes (interocular sulcus), and on base of rostrum (rostral sulcus); interocular space two-thirds width of rostrum at base; frons with Y-shaped patch of strong punctures extending from occiput; gena smooth, brownish-black to black, usually black.

Pronotum smooth, very uniform in shape, only the color varying from red to black, nearly quadrate, sharply constricted anteriorly; base very broadly curved, not at all produced posteriorly;

ventral side varying from red to black, laterally punctured. Weevil if red then ventrolaterally black with two black stripes on prosternum; weevil if black then under side completely black. Prosternum smooth; spinasternum flat, glabrous, similar to phoenicis; mesosternum emarginate posteriorly, strongly punctured, setae absent; mesepisternum, mesepimeron, strongly punctured; metepisternum diagonal anteriorly and nearly triangular posteriorly, lateral margin almost parallel to elytron; metepimeron small, triangular, strongly punctured, always black.

Legs varying from reddish to black, strongly punctured; front coxae separated by a distance equal to one-third width of a coxa, diffusely punctured, hairs absent; middle coxa smaller than front coxa, may or may not be covered with short reddish hairs; both outer and inner sides of all femora strongly punctured, similar in shape, front femur as long as middle but shorter than hind femur; all tibiae similar in shape, front as long as hind but longer than middle. First tarsal segment two and one-half times as long as second or as long as or slightly longer than third; two-thirds of entire area beneath the third tarsal segment covered with matted reddish-brown setae; fourth as long as the first three segments combined, with eight or nine setae ventrally. Setae on ventral sides of femora, tibiae, and other three tarsal segments reddish-brown; setae on first tibia three times as long as the setae on other femora

or tibiae.

Scutellum always black, each corner sharply pointed, one-fifth length of elytron.

Elytra varying from reddish to black, smooth. Length of each elytron three times as long as its own width and side straight posteriorly, with five or six deep striae, sixth stria sometimes as deep as first five but shorter, and traces of three more at side sometimes these three striae very distinctive. Sutural striae two, three, and four prolonged to base; third confluent posteriorly with eighth; fourth with fifth; sixth with seventh; interstices three to six times as wide as striae, more convex posteriorly.

Wing with ventro-costal setae dark brown, extending one-half distance from base to distal end of subcosta; subcosta very broad at base then abruptly narrowing and freely extending to margin; basal stem of radius tapering proximally and divided from the radius vein at the costal margin medially; radius ₁ and radius ₂ united, broad, and strongly curved along the costal margin and joining radius ₃₊₄₊₅ distally; basal stem of media ₁₊₂ free from basal stem of media _{3+4+Cu}; media ₁₊₂ broad and abruptly narrowing with strongly curved almost right angle to distal margin; basal stem of media _{3+4+Cu} with spurious vein distally joining basal stem of radius by turning upward and backward posteriorly; media _{3+4+Cu} slightly depressed medially, narrowing tapering to distal margin and

with spurious vein paralleling posteriorly to media $3+4+Cu$ and hardly reaching the distal margin; 1st + 2nd anal vein one and one-third times longer than 3rd + 4th anal vein, both strongly curved and narrowly tapering to distal margin; radial, median, cubital and third anal lobes distinct.

Abdomen varying from reddish to black, if reddish then last three abdominal segments dark brown; first to fourth abdominal sternites smooth medially and strongly punctured laterally; fifth strongly punctured both medially and laterally and fringed laterally with broad and thick rows of reddish-brown setae.

Pygidium from dark brown to black mostly darker at posterior end, oval, gradually convex dorsally; three-fourths from posterior end strongly punctured, the other one-fourth smooth and edged with reddish-brown setae lateroposteriorly.

Adult female. Length 34.0 to 45.0 mm.; width 12.5 to 16.0 mm. Similar to male except rostrum smooth, stronger compressed; rostrum slightly arcuate at apical end and without rostral setae; pygidium more pointed, lateral setae absent.

Male genitalia. Seven males were dissected. Phallobase smooth, setae absent dorsally. Dorsal cleft of phallobase with sides parallel for two-thirds of its length then forming a sharply pointed triangular anteriorly. Dorsal split of the phallobase about one-half length of contiguous area between dorsal cleft and split. Ventral

sclerites deeply emarginate posteriorly, both outer and inner sides parallel to the phallobase, bearing setae both anteriorly and laterally; between the two sclerites with a narrow spurious membrane. Tegminal plate narrow and nearly truncate posteriorly, hardly distinct from tegminal apodeme. Dorsal keel extending posteriorly two-thirds length of tegminal apodeme then branching. Tegminal sclerite dorsally broad at base, narrowed and pointed anteriorly, extending anteriorly for four-fifths length of tegminal base; rounded anteriorly. Aedeagus gradually curved lateroanteriorly; lateral arms thick and joining aedeagal apodemes. Aedeagal fenestra almost truncate anteriorly and narrowly constricted with broad concavity posteriorly; ventral side gradually concave posteriorly. Orifical plates narrowly elongate, with irregular, medial serrations, and widely separated. Aedeagal chamber membranous, broadly elongate, extending more than two-thirds length of aedeagal apodemes.

Female genitalia. Eight females were dissected. Dorsal cleft of vaginal base narrowly convergent toward anterior end of the base. Sides of cleft concave and broadly divergent; posteroventrally with membranous invagination. Spiculum ventrale shorter than vaginal base. Spiculum fenestra very narrowly elongate, one-fourth the length of spiculum ventrale and opened distally. Vaginal chamber membranous, and somewhat truncate posteriorly and narrowed

anteriorly. Spermatheca with seven distinct ventral lobes; bluntly pointed distally and oval posteriorly; spermathecal gland with highly elevated base.

Measurements. The following measurements were taken from the seven males and nine females upon which the description is based.

	Male		Female	
	Mean	Range	Mean	Range
Body length	38.95	33.50-44.00	40.15	34.00-45.00
Body width	14.00	12.50-15.00	14.70	12.50-16.00
Elytron length	18.00	17.00-19.50	18.90	16.00-22.00
Elytron width	6.95	6.25- 7.50	7.33	6.25- 8.00
Pronotum length	12.30	11.00-13.00	12.70	11.50-14.50
Pronotum width	11.40	10.50-12.00	12.00	11.00-14.00
Rostrum length	8.62	8.00-10.00	9.10	8.00-10.00
Rostrum length before antennal scrobe	5.46	5.00- 6.00	5.86	5.00- 6.00
Scape length	4.32	4.00- 4.50	4.30	4.00- 4.50
Funicle length	2.28	2.10- 2.50	2.24	2.00- 3.00
Club length	1.70	1.40- 1.85	1.68	1.30- 1.80
Club width	1.98	1.90- 2.80	2.22	2.00- 2.60

Egg. Light brown, smooth, shining, broadly oval; averaging

1. 50 by 2. 90 mm. ; chorion and vitelline membrane not distinct.

Larvae and pupae were not available for study.

Discussion

Rhynchophorus quadrangulus Queden. is the only species in the genus Rhynchophorus that has a compressed rostrum and a distinct nasal plate. It is recognized by its rostrum convex dorso-basally and ventro-apically; mandible broadly rounded distally; pronotum nearly quadrate; male rostral setae not thick, scattering, sometimes absent; color in general varying as follows, reddish, black with reddish only on lateral sides of pronotum, brownish or reddish-black dorsally and black ventrally, and completely black. The male and female genitalia are very distinctive.

There are three specimens of this species from Togo which are bright reddish and one which is black. Faust (1899a) treated this reddish form as variety (subspecies) rex. The writer found intermediate forms, brownish or reddish-black in the collection from Congo (AMNH) and found no distinct taxonomic characters between these forms except for color variation. Therefore the subspecies name rex is not recognized in the present study.

Type Locality

Angola, West Africa.

Types and Location

No holotype was designated. Quendenfeldt evidently described this species from more than one specimen, and his type-series is probably at the Naturkunde-Museum or the Dresden Museum, both of which are in East Germany.

Biology

Only a single host plant record was taken from material examined; "on palm," collected at Suakoko, Liberia, April 10, 1952, 10, no. 52-56-39, by C. C. Blickenstaff (USNM). Hargreaves (1937) recorded oil palm, Elaeis guineensis Jacq., as a food plant of this species in West Africa.

Distribution

Records taken from the material examined indicate that the range of this species may extend along the west coast of Africa from Guinea southward into Congo. The range may also extend into Angola since Quedenfeldt (1888) described this species from there.

Total specimens examined	40
Male	19
Female	21

Collecting dates: March 29 to November 30.

Rhynchophorus ritcheri New Species

Figs. 34, 54, 132, 165, 177, 181, 196, 208, 251, 292-293, 323, 339,
375, 383, 387, 433-435, 578-580.

Description

Adult male. Length 38.1 to 41.1 mm.; width 14.0 to 16.1 mm.

Body elongate-oval, dorsum and venter shining.¹

Rostrum black, two-thirds as long as pronotum; in profile, almost straight and same width to apex; viewed dorsally, broad and highly elevated at base, depressed mediodorsally, rugose with two or three large tubercles at base and three rows of small tubercles extending from base for two-thirds length of rostrum; subapical half with thick and closely set, erect, dark brown setae, extending from subapex of rostrum to middle of antennal scrobe; epistoma depressed and distinctly emarginate; viewed ventrally, with small, subapical, lateroventral grooves from bases of mandibles and confluent with gular suture for about two-thirds distance from tip of rostrum; space between antennal scrobes smooth, setae absent; submentum truncately-concave anteriorly; lateral arm of hypostoma sharply pointed anteriorly, median depression narrowly triangulate

¹When the writer boiled the paratype so the wings could be dissected, the specimen which was originally shiny became dull.

posteriorly.

Mouthparts black; mandible three-fourths width of rostrum at apex, narrowly oval distally, slightly depressed dorsally; pleurostoma narrowly rectangular; maxilla light brown, third segment of maxillary palpus bearing eight to ten setae distally; palpifer broad basally, bulbous on outer margin, and on inner margin meso-basally angular; stipes one-half as long as palpifer, nearly rectangular, with inner margin gradually curved basally; cardo as long as stipes, bulbous on inner margin, gradually curved on outer margin; mala on inner margin narrowly emarginate; strongly curved on anterior portions of outer margin, with one large bifurcate seta and one stout distal seta; large lateral setae absent.

Antenna black; scape slightly longer than funicle and club combined or about one-half length of rostrum; first funicular segment as long as next two segments combined; all other segments subequal in length and gradually enlarged to distal end; fifth with one or two setae; sixth with more than five setae; antennal club somewhat quadrate with several setae dorsally and ventrally.

Head shining; interocular space wide, four-fifths width of rostrum at base; frons strongly punctured; gena smooth, black.

Pronotum black, oval, flat, smooth, shining, strongly constricted anteriolaterally; base broadly rounded posteriorly; finely punctured anteriolaterally; under side completely black;

spinasternum extending over apex of mesosternum with a longitudinal fossula posteriorly; fucous hairs anterior to spinasternum absent; mesosternum widely emarginate posteriorly, covered with fine fucous setae and strongly punctured; mesepisternum triangular, finely punctured, with fine fucous hairs; hairs on mesepimeron absent, finely punctured; metasternum quadrate, glabrous, basal area flat medially, curved up laterally; metepisternum broad, quadrate, glabrous, pointed posteroventrally; lateral margin slightly convex and nearly parallel to elytron; metepimeron small, triangular with fine punctured.

Legs black with rough punctation; fore coxae separated by a distance equal to one-third width of a coxa, with scattered fine fucous hairs and punctation; middle coxa densely with slender fulvous setae; all femora flat, broad distally, narrowed proximally; front femur as long as middle but shorter than hind femur, strongly punctured; front tibia differing from other tibiae by having distinct two broad, deeply emarginate lobes, flat externally, as long as hind tibia but longer than middle; middle similar to hind tibia, enlarged and somewhat abruptly truncate distally, with very short subuncus; first tarsal segment elongate, as long as the second and third combined; third slightly dilated, convex, one-sixth of entire area beneath covered with soft fulvous setae; fourth longer than first three segments combined, with four slender fulvous setae proximally, one

distally; setae on venters of femora, tibiae, and first three tarsal segments black; setae on first tibia twice as long as setae on femur and longer than setae on middle and hind tibiae.

Scutellum black, triangular, produced posteriorly; one-fourth length of elytron.

Elytron smooth, subequal; length of each elytron almost two and one-half times its own width, very slightly narrowed posteriorly, with six deep striae and traces of three more at side, sutural striae not prolonged at base; third stria confluent posteriorly with eighth, if not, with second; fourth with fifth; fifth with sixth and seventh; interstices five to eight times as wide as striae, slightly convex with very fine punctation laterally and posteriorly.

Wing brown, ventro-costal setae dark brown extending three-fourths distance from base to distal end of basal stem of radius; subcosta small, united with costa and basal stem of radius distally, not reaching margin; radius $_1$ arising independently to distal margin; radius $_2$ shorter than and parallel to radius $_1$; radius $_{3+4+5}$ strongly curved on distal half and meeting radius $_1$ distally; media $_{1+2}$ narrowly slender and tapering distally; basal stem of media $_{1+2}$ one-fourth as long as basal stem of media $_{3+4+Cu}$; media $_{3+4+Cu}$ hardly reaching the margin; 1st + 2nd anal vein twice as long as 3rd + 4th anal vein; both anal veins strongly curved ventrally; radial, medial, cubital, anal lobes similar to palmarum.

Abdomen black, first abdominal sternite extending posteriorly to metasternum, laterally narrower than second; the latter as long as third and fourth combined; fifth broad and almost triangular, fringed with a row of short dark brown setae laterally, without apical emargination; roughly punctured dorso-laterally.

Pygidium black, without central elevation, strongly punctured dorsally; lateral setae absent.

Male genitalia. Two males were dissected. Dorsal cleft of phallobase narrowly convergent for three-fourths of its length. Sides of cleft abruptly divergent and oval-shaped anteriorly. Dorso-lateral setae very small and much smaller and shorter than setae of palmarum. Dorsal split of phallobase slightly longer than length of contiguous area between dorsal cleft and the split. Ventral sclerites lying longitudinal to phallobase and bearing setae both posteriorly and laterally which are less thick than palmarum, deeply concave and outer posterior end pointed. Tegminal plate large, fan-shaped, and constricted at base before tegminal apodeme. Dorsal keel narrowly extending to anterior end of plate. Tegminal sclerite ventrally broad; and on dorsal side small, longitudinal, extending anteriorly about one-third of tegminal base. Aedeagus nearly rectangular, elongate, lateral arms thick, and joining aedeagal apodemes. Aedeagal fenestra spatular-shaped, slightly concave posteriorly and deeply triangular-emarginate anteriorly; on ventral side rectangular,

slightly oval anteriorly and truncate posteriorly. Orifical plates of aedeagal crescent-shaped, membranous, curved inward, almost meeting each other medio-anteriorly. Aedeagal chamber oval, extending one-fourth length of aedeagal apodemes.

Measurements. The following measurements were taken from the holotype from La Merced, Chanchamayo, Peru, (USNM); and from the paratype from Chapada, Brazil (CM).

	Male		
	Mean mm.	Holotype mm.	Paratype mm.
Body length	39.60	38.10	41.10
Body width	15.05	14.00	16.10
Elytron length	19.95	18.90	21.00
Elytron width	8.00	7.00	9.00
Pronotum length	15.00	14.00	16.00
Pronotum width	12.95	11.90	14.00
Rostrum length	10.35	10.10	10.60
Rostrum length before antennal scrobe	6.20	6.00	6.40
Scape length	4.20	4.20	4.20
Funicle length	3.47	3.15	3.80
Club length	1.10	1.00	1.20
Club width	1.40	1.40	1.40

The female and immature stages are not known.

Discussion

This species may be readily distinguished from other species in having the mandible strongly curved distally, front tibia with broad lobes distally and flat externally, middle and hind tibiae truncate distally, pronotum broadly rounded posteriorly, epistoma depressed and distinctly emarginate, distance from the tip of rostrum to rostral setae in male twice as long as the width of rostrum at apex. The male genitalia is very distinctive in having crescent-shaped orifical plates of the aedeagus and ventral sclerites which are deeply emarginate and sharply pointed on the outer posterior end.

Type Locality

La Merced, Chanchamayo, Peru.

Types and Location

Holotype, male, La Merced, Chanchamayo, Collection Bovie through Buchanan. Type lacks right front, middle and hind fourth tarsal segments, left middle tarsal segment and left hind fourth tarsal segment. The type will be returned and placed in the United States National Museum, Washington, D. C., U.S.A.

Paratype, male, Chapada, Brazil, Acc. No. 2966, Chapada Forest, Nov. (CM).

Biology

No host-plant data or other biological information on this species is presently available.

Distribution

Records taken from the specimens of the type-series indicate that the range of ritcheri may extend from Peru eastward into Brazil.

The writer is very pleased to name this species in honor of Dr. Paul O. Ritche who has been helpful in many ways and made this study possible.

Rhynchophorus vulneratus (Panzer)

Figs. 38, 53, 77-86, 125-126, 166, 183, 187-190, 218, 239, 242-243, 290-291, 321, 337, 412-414, 469-471, 560, 587-589, 631, 641, 654, 656-657, 670-672, 682, 689, 692, 702, 708, 717, 728, 741.

Curculio vulneratus Panzer in Voet, 1798, Besch. Ubbild. Ins.

Coleop., 4:(10-11), tab. Tit., fig. 4 (see after plate 25).

Calandra schach Fabricius, 1801, Syst. Eleuth., 2:433; Illiger,

1805, Mag. Insektenk., 4:138; Olivier, 1807, Ent. Hist. Nat.

Ins., 5(83):80, t. 16, fig. 204.

Rhynchophorus schach Schoenherr, 1826, Curc. Disp. Meth., 4: 327; Gyllenhal in Schoenherr, 1838, Gen. Spec. Curc. . . . , 4(2):827; Boheman in Schoenherr, 1845, Gen. Spec. Curc. . . . , 8(2):218; Chevrolat, 1882a, Bull. Soc. Ent. France, 2:139; Wattanapongsiri, 1959, Thailand Dept. Agr. Tech. Bull., p. 12-13, pl. 1, fig. 4; pl. 8, figs. 1-4.

Rhynchophorus vulneratus (Panzer); Gyllenhal in Schoenherr, 1838, Gen. Spec. Curc. . . . , 8(2):218.

Rhynchophorus schach var. β , γ , δ , Boheman in Schoenherr, 1845, Gen. Spec. Curc. . . . , 8(2):218.

Rhynchophorus pascha Boheman in Schoenherr, 1845, Gen. Spec. Curc., 8(2):218; Chevrolat, 1882b, Ann. Soc. Ent. France, ser. 6, 2:561. New synonymy.

Rhynchophorus pascha var. β , Boheman in Schoenherr, 1845, Gen. Spec. Curc. . . . , 8(2):218.

Rhynchophorus ferrugineus var. tenuirostris Chevrolat, 1882b, Ann. Soc. Ent. France, ser. 6, 2:561. New synonymy.

Rhynchophorus glabrirostris Schaufuss, 1885, Russkoe. Ent. Obsch., 19:203. New synonymy.

Description

Adult male. Length 30 to 40 mm.; width 12 to 18 mm. Body

elongate-oval, black or reddish-brown, usually black; dorsum dull or shining; venter shining.

Rostrum black to reddish-brown, nearly as long as pronotum; in profile, cylindrical, straight, broad at base, sparsely and minutely punctured; viewed dorsally, broad at base then almost abruptly narrowed and straight to apex, basal half usually orange-red; apical half with rostral setae and three rows of tubercles, one on center and one on each side of rostrum, very finely punctured or smooth at base; epistoma almost rounded at apex; viewed ventrally, sparsely and very finely punctured; space between antennal scrobes, strongly narrowed to base with minute punctures, scrobe broadly open ventrally; gular suture concave at both sides medially before reaching base of rostrum; submentum truncately-concave distally and slightly concave laterally, median depression very narrowly-elongate more than twice as wide as rostrum at apex.

Mouthparts brown; mandible one-third to one-half width of rostrum at base; anteriorly tridentate, apical and subapical teeth deeply divided; apical and basal teeth pointed, median obtuse or nearly rounded, sometimes with lateral depression; maxilla with third maxillary palpal segment broad; second and first somewhat narrowly-rectangular; palpifer narrowed distally, broad and slightly concave basally; stipes flat, L-shaped, about one-third as long as palpifer; cardo oval distally, medially angulate at inner margin and

slightly depressed at outer margin, and truncate basally; mala broadly emarginate with two distinct lobes on inner margin, outer margin strongly curved, with seven or eight large, closely grouped setae meso-distally.

Antenna as described for palmarum except club broader and not pointed ventrally, scape and funicle black with club orange-red bearing ten to thirteen sensory setae on inner side of the spongy area.

Head dull to shining, occiput and frons sparsely and minutely punctured; interocular space about three-fifths width of rostrum at base.

Pronotum broadly rounded at base, strongly narrowed to apex then constricted, velvety, dull or shining; smooth medially, sparsely and minutely punctured laterally; black or usually black with orange-red stripe down median line of pronotum. This stripe variable in shape and size, usually broadening, then narrowing slightly or strongly constricted near middle, then broadening again, and sometimes with a small narrowed transverse band anteriorly; underside mostly black except metasternum reddish-brown; spinasternum, mesepimeron, mesepisternum, metapimeron brownish-black; metepisternum always black; strongly punctured dorso-laterally.

Legs black, sometimes reddish-brown, strongly punctured, especially femora and tibiae; front coxa separated by a distance equal

to one-third width of a coxa; sparsely and minutely punctured; middle coxa strongly punctured and on the anterior half covered with reddish-brown hairs; front femur as long as middle but shorter than hind femur; tibiae similar in shape, front as long as hind but longer than middle; first tarsal segment twice as long as second or longer than third; one-third (as in bilineatus) entire area beneath third segment covered with matted reddish-brown setae and with two rows, one on each side, of small reddish-brown setae extending to the base; fourth as long as first three segments combined, bearing eight to nine setae ventrally, four of which placed meso-proximally and the other four or five closely grouped distally.

Scutellum broadly-triangular, varying from orange-red to black; frequently with an indication of an orange or red tinge.

Elytra smooth, reddish-brown or black, usually black; length of each elytron slightly two and one-half times as long as its own width. Each elytron with five deep striae and traces of four more at side; sutural striae not prolonged to base; fourth stria weakly confluent posteriorly with fifth; occasionally found in the reddish form with third stria confluent with eighth, and sixth with seventh; interstices four to eight times as wide as striae.

Wing with costa thick and broad basally; subcosta small, extending freely to costal margin; basal stem of radius not fused with the radius; three radius veins present, fused and with spurious vein

distally; basal stem of media $_{1+2}$ broad proximally and fused with basal stem of media $_{3+4+Cu}$; media $_{1+2}$ broad, pointed proximally and tapering distally; media $_{3+4}$ separated from cubitus, longer and more slender than cubitus, extending to distal margin; 1st+2nd anal vein strongly tapering and twice as long as 3rd+4th anal vein, both veins broad basally and distal end hardly reaching margin; only radial and anal lobes distinguishable, especially anal lobe sharply divided.

Abdomen with first and second abdominal sternites usually with a transverse orange-red stripe on posterior half, rarely deep black; others often tinged with orange-red posteriorly or black; first abdominal sternite shorter than second or as long as third and fourth combined.

Pygidium, black, often edged with orange-red; lateral setae absent; strongly punctured on posterior half.

Adult female. Length 24 to 39 mm.; width 9 to 17 mm.

Similar to male except rostrum much longer and more slender, strongly curved, and tubercles on rostrum absent; sparsely and very finely punctured, rostrum always slightly longer than length of pronotum.

Male genitalia. Eight males were dissected. Dorsal cleft of phallobase broadly-triangular extending more than two-thirds its length and sharply pointed anteriorly, very widely opened posteriorly.

Dorsal split of phallobase one-half length of contiguous area between dorsal cleft and split. Ventral sclerites nearly truncate anteriorly, curved at outer margins and emarginate posteriorly, bearing setae along margins but not on membrane between two sclerites. Membranous area between sclerites long, narrowly-rectangular. Tegminal plate very broad, and nearly angulate posteriorly. Tegminal apodeme thick, tapering anteriorly; dorsal keel extending to base of tegminal plate then branched into two or three small keels, usually three, the lateral two longer than the middle. Tegminal sclerite broad posteriorly on dorsal side, directed and pointed anteriorly; ventral sides join together and forming rounded angle and extending anteriorly for two-thirds length of tegminal base. Aedeagus oval anteriorly, lateral arms somewhat slender and joining aedeagal apodemes. Aedeagal fenestra nearly truncate anteriorly, broadening on both sides for about one-half its length then abruptly narrowed and again strongly broadening toward posterior end; slightly concave at posterior edge. Orifical plates elongate, sclerotized. Aedeagal chamber oval, rounded posteriorly, with sclerotized plate beneath and extending beyond posterior end of the chamber; latter extending for about one-third length of aedeagal apodemes.

Female genitalia. Six females were dissected. Dorsal cleft of vaginal base oval, extending to anterior end of base. Both sides of cleft, for two-thirds of distance from posterior end, edged with

dark membranous bands and with broad membranous invagination lateroposteriorly. Spiculum ventral elongate, three-fourths as long as vaginal base. Spiculum fenestra usually absent, if present very narrow and short at anterior end. Vaginal chamber oval with a long transverse sclerotized plate, placed at middle of vaginal plate. Spermatheca with three or four distinct ventral lobes; area in front spermathecal gland truncate and highly elevated; oval proximally.

Measurements. The following measurements were taken from the 17 males and 14 females upon which the description is based.

	Male		Female	
	Mean	Range	Mean	Range
Body length	35.00	30.00-40.00	37.00	24.00-39.00
Body width	15.00	12.00-18.00	15.00	9.00-17.00
Elytron length	17.50	14.00-20.50	17.00	12.00-20.00
Elytron width	7.50	6.00- 9.00	7.50	4.50- 8.50
Pronotum length	13.00	10.00-16.50	13.00	9.00-15.50
Pronotum width	12.00	9.50-15.20	12.00	8.00-13.50
Rostrum length	12.00	9.50-12.50	13.60	9.00-14.50
Rostrum length before antennal scrobe	7.50	6.00- 8.00	8.50	6.00-10.00
Scape length	4.80	3.52- 6.24	4.80	3.36- 5.60
Funicle length	3.80	3.44- 5.60	3.76	2.40- 5.00
Club length	1.44	1.28- 1.54	1.44	1.28- 1.60
Club width	2.16	1.84- 2.24	2.32	2.16- 2.56

Egg. Whitish-yellow, smooth, very shiny, cylindrical with rounded ends, slightly narrower at the anterior end; averaging 1.02 by 3.24 mm.; chorion and vitelline membrane usually distinct.

Mature larva. Description based on the following material:

Three larvae associated with one pupa collected at Kepahiang, Sumatra, January 4, 1926, by H. C. Kellers. Loaned by Department of Entomology, Cornell University.

Nine larvae collected from coconut trunk at Takbai, Narathiwat, Thailand, June 22, 1956, by Rien Saithong. Loaned by Thailand Department of Agriculture.

Seven larvae associated with one pupa and four male adults collected from coconut trunk, at Narathiwat, Thailand, August 31, 1961, by Anuwat Wattanapongsiri. In the writer's collection.

Larvae of this species may be characterized as follows: epicranium with three pairs of sensilla, anterior sensilla placed closer to dorsal epicranial setae 5 than 4, of the posterior pairs, one closer to base of dorsal epicranial setae 2, the other placed nearly equidistance between setae 1 and 2; epicranial setae 1 and 2 placed on paraepicranial suture; and four pairs of post-dorsal setae also present. Paraepicranial suture extending for about one-half length of epicranial suture. Frons with two straight longitudinal

depressions; posterior angle of frons rounded, with one pair of frontal sensilla, placed close to frontal setae 2 anteriorly. Clypeal setae 1 three to four times longer than 2 and distinctly separated. Labrum with 26 to 28, usually 28, simple, thickened, lateral setae, and six anterior setae; labral sensilla absent. Epipharynx setose, elongate oval, rounded posteriorly and for about two-thirds of its length abruptly broadened and constricted anteriorly, with two pairs of simple, thickened, setae placed close to each other on the anterior end of epipharyngeal sclerite, and two pairs of epipharyngeal sensory pores, anterior sensory pores placed at equal distance between epipharyngeal setae 1 and 2, other sensory pores placed one on each side at about one-half length of epipharynx on epipharyngeal sclerite; distance between epipharyngeal setae 1 to epipharynx four times longer than to setae 2. Mandible subtriangular with apical tooth broad and obtuse or flat, sometimes shallowly bidentate but not distinctly divided as in palmarum, median tooth pointed; molar area irregular, usually divided into two continuous lobes. Mala with 26 dorsal setae, six bifurcate and five trifurcate. Premental sclerite similar to ferrugineus except median lobe with broad base and rounded posteriorly, and two lateral lobes usually emarginate anteriolaterally. Ligula subtruncate anteriorly. Hypopharynx subtriangular with anteriolateral half broad and more densely setose than posterior half; median furrow fleshy and extending about three-fourths

length of hypopharynx. Thoracic coxal lobe with five setae. Abdominal segments 1 to 3 or only 6 sometimes reduced to about one-half size of next segment; when segment 6 reduced then seventh, eighth, and ninth enlarged to about the size of fourth or fifth segment. Anus transverse, preanal lobe nearly rounded, with two setae, and subdivided into a small subtriangular lobe with sharp angle directed anteriorly, lateral lobes broad, elongate-oval; median lobe broad, subdivided into two lobes anteriorly, bearing one setae on each divided lobe.

Measurements. Body length 41 to 59 mm., width 18 to 25 mm.; head length 10.00 to 12.00 mm., width 9.00 to 10.50 mm.

Pupa. Description based on the following material:

One pupa associated with three larvae collected at Kepahiang, Sumatra, January 4, 1926, by H. C. Kellers, Loaned by Department of Entomology, Cornell University.

One pupa associated with seven larvae and four male adults collected from coconut trunk at Narathiwat, Thailand, August 31, 1961, by Anuwat Wattanapongsiri. In the writer's collection.

Pupae of this species may be characterized as follows: tubercle on each side of epicranium with one seta, highest area nearly rounded with three longitudinal ridges; right epicranium with one

lateral simple seta.

Rostrum with three pairs of tubercle-borne setae, and one simple seta; basal pair widely separated with two setae on the right; median pair with three setae, one on the left and two placed close together on the right, all setae bifurcate; anterior pair with left seta bifurcate; one simple seta placed laterally on the right near the base of right antenna.

Pronotum truncate and broader posteriorly, oval anteriorly, with three pairs of tubercle-borne setae, two placed close together medioanteriorly, the other pair widely separated with larger tubercle at their bases and placed posteriolaterally; covered with minute spines along margin, more densely on posteriolaterally; metanotum with one pair of tubercle-borne setae.

Scutellum extending posteriorly three-fourths length of metanotum; with one pair of setae.

Elytra not covering first abdominal spiracles dorsally, with five tuberculate parallel ridges; ridges 1 to 3 covered with distinct minute spines along their length; 4 to 5 with few, scattered spines basally; interval between ridges smooth, bearing no spines. Wings almost meeting in median line on anterior half of second abdominal sternite.

Abdominal tergites 1 and 2 with five pairs of tubercle-borne setae; tergites 3 to 6 with seven pairs; tergite 7 broadly triangular,

with three pairs of tubercle-borne setae placed mediolaterally and one pair of spine-like setae placed medially on anterior margin. Abdominal sternites 3 to 5, each with high median elevation, extending longitudinally across the width of the sternites.

Measurements. Length, 32 mm., width, 14 mm.

Discussion

This species was first described as Curculio vulneratus by Panzer in 1798. His description was fully detailed and the color drawing of the adult was very distinctive with the orange-red stripe on pronotum. The locality of the specimen he described was from South America, however, which is doubtful since this species is found only in the Orient. Three years later, Fabricius (1801) described the male weevil from Sumatra as Calandra schach. He said that the weevil is larger than ferrugineus and gave the different characters of these two weevils. It is fortunate that he described the thorax as "...thorax laevis, ater, obscurus, dorso purpurascens. ..." which obviously indicates that the species he described is conspecific with vulneratus. In 1805, Illiger listed schach under genus Calandra. Olivier in 1807, redescribed and figured schach and again placed in Calandra. Olivier stated that the species was found in Surinam. In 1826, Schoenherr placed this species under the name schach in Rhynchophorus for the first time. In 1838, Gyllenhal

redescribed the weevils from East India and placed it, under the name schach, in Rhynchophorus. He said that this species was very distinctive from ferrugineus and stated the different characters. He also listed vulneratus as a separate species from schach and for the first time in Rhynchophorus.

Boheman, in 1845, was the first to put ferrugineus 1790 and vulneratus 1798 in synonymy with schach 1801 and placed it in the genus Rhynchophorus without any statement why he was doing so. He also described the males and females from the Philippines as Rhynchophorus pascha and Rhynchophorus pascha var. β , based on the shape of stripe on the pronotum. He described the thorax as "...thorace convexiore, laevi, postice obtusissime rotundato, vitta lata dorsali purpurascente ornato, ..."

In 1882a, Chevrolat placed pascha in synonymy with Rhynchophorus nitidulus Guérin (Dynamis nitidulus). Later in the same year (1882b) he erected the genus Dynamis and rearranged the species within the genera Rhynchophorus and Dynamis. He placed ferrugineus and pascha as valid species and dropped both vulneratus and schach from the genus Rhynchophorus. He also described the black form of the male and female vulneratus from Singapore as Rhynchophorus ferrugineus var. tenuirostris.

Schaufuss again in 1885 described the black form of vulneratus from Sunda Island as Rhynchophorus glabrirostris and stated

"...thorace subtusque rubro variegatis ..." He also considered ferrugineus a valid species. In 1908, Heyne and Taschenberg, again without explanation, placed schach and vulneratus as conspecific with ferrugineus.

Dr. A. K. Marshall (Corbett and Ponniah, 1923) once suggested that it would be wiser to treat the two forms, ferrugineus and schach, which are so different in coloration, as distinct species until specific identification has been proved. Corbett (1924, 1932) and Corbett and Ponniah (1923, 1924) who made a very intensive study of the biology of this species, consistently used the name schach and strongly believed that schach and ferrugineus are two different species.

In 1956, Vestal wrote an article on the coconut pests of Thailand in an FAO Plant Protection Bulletin, in which he stated that there are two species of coconut weevils, ferrugineus and schach, known as the red palm weevils. He distinguished them by the markings on the pronotum. In 1959, Wattanapongsiri, after his taxonomic studies at Cornell University, pointed out that this species differs taxonomically at the specific level from ferrugineus but he wrongly used the name schach instead of vulneratus, the former being conspecific with the latter.

This species is very closely related to ferrugineus, varying in general body shape, color, and in having a broad, orange-red or

ferrugineous, longitudinal stripe extending from the front to the base of the pronotum. The variation of color and patterns of the stripe is found mostly on the pronotum. The elytra and abdomen are either black or reddish-brown. Normal fully colored specimens are easily distinguished from all other species by having an orange-red, longitudinal stripe or band on the pronotum. However, the completely black form is easily confused with bilineatus and ferrugineus. The former species is readily distinguished by the characters discussed on page 122; the latter can be distinguished by the shape of pronotum and gular suture. The pronotum of vulneratus is strongly and narrowly curved anteriorly while in ferrugineus the pronotum is gradually curved at the sides and more uniform anteriorly. The gular suture in vulneratus is more concave at both sides before reaching the base of the rostrum.

The larvae and pupae can be separated only by use of the combination of characters described in the key on page 72.

Type Locality

South America (?)

Types and Location

Type male; location of type not known by the writer.

Biology

The following records of host plants were taken from the material examined: "coconut," Canlubang, Philippines, October 1, 1930, F. C. Hadden (BPBM); "coconut trunk," Takbai, Narathiwat, Thailand, January 11, 1956, Rien (TDA), August 31, 1961, A. Wattanapongsiri (AW).

Rhynchophorus vulneratus is known as the "red stripe" weevil in the Orient. Its biology was studied by Corbett (1923, 1932) and Corbett and Ponniah (1923, 1924) in Malasia. According to the literature, Simon (1888) first reported on the biology of this species under the name Calandra palmarum. Simon stated that the weevil could be recognized by a black color, with an orange-hued spot on its back but sometimes its color is wholly dark orange. In 1889, Ridley called it "red beetle" and said it was "Rhynchophorus ferrugineus" but his description states "the thorax broadest behind and narrowed in front is black with a broad red base in the centre, smooth and polished . . . The red beetle is nocturnal in its habits, flying at night to deposit its eggs in the coconut trees . . . lays its eggs at the base of the leaf-stalk of the palm. It frequently makes use of the holes made by Oryctes rhinoceros."

Banks (1906) while he was in the Philippines, reported that the habits and the immature stages of this insect are similar to those of

ferrugineus. These two weevils are found indiscriminately in company on the same tree, and no differences are noted until the adults are compared. However, the writer has never seen vulneratus living in the same tree with ferrugineus, except together with Oryctes gnu Mohn. or Oryctes rhinoceros (Linn.) in Thailand. Corbett and Ponniah (1923, 1924) and Corbett (1923, 1924) recorded that more eggs were laid during the night than during the day. In an experiment, 428 were deposited at night and 401 during the day time. The maximum number of eggs laid by an individual in captivity was 832, the average daily number being 7.1 and the maximum 35. Eggs may be laid by the female on the day after emergence from the cocoon. The larva moults 16 to 20 times during its life. The maximum time taken to complete the life cycle, egg to adult, was 87 days: egg stage, 3 days; larval stage, 59 days; prepupal stage, 5 to 11 days; pupal stage, 11 to 15 days (time in cocoon 25 days). The maximum observed life of the female weevil was 116 days that of the male 107 days.

Rhynchophorus vulneratus occasionally takes advantage of the borings in the crowns of coconut palms made by other insects, or areas damaged by lightning, storms and by man, for egg-laying. Corbett and Ponniah (1923, 1924) and Corbett (1923, 1932) reported that the insects which produced suitable conditions for egg-laying were: Black or Rhinoceros beetle, Oryctes rhinoceros Linn. ;

White ants, Coptotermes curvignathus Holmgr. ; Trochorrhopalus strangulatus Gyll. ; Xylotrupes gideon Linn. ; and Manila beetle, Diocalandra frumenti Fabr. The writer has found R. vulneratus in the same situation as Oryctes gnu Monh. , in the southern part of Thailand. Therefore, Oryctes gnu may also produce suitable conditions for vulneratus to lay its eggs.

Host plants. Burkill (1913), under the name ferrugineus, Corbett and Ponniah (1923, 1924) and Corbett (1923, 1932) and Cater (1925), all under the name schach, recorded the following plants as hosts of vulneratus: coconut palm, Cocos nucifera; sago palm, Metroxylon sagu; sugar or Kabong, Arenga saccharifera; African oil palm, Elaeis guineensis; serdang, Levistonina chochinensis; nibong, Oncosperma tigillaria; Areca or betel nut, Areca catechu; royal palm, Oreodoxa regia; gebong, Corypha genbaga, and bagas, Oncosperma horrida. They also said the weevil appeared to prefer sago, Metroxylon sagu and nibong, Oncosperma tigillaria to other palms for breeding purposes. Bunting and Gorgi (1924), Corbett (1928), Bunting (1928), and Corbett and Pagden (1941) reported that African oil palm, Elaeis guineensis, as its breeding place. Sand (1930), Pagden and Lever (1935), Simmonds (1938) and Vestal (1956) reported that the coconut palm, Cocos nucifera, as its host.

Economic Importance

Rhynchophorus vulneratus was first brought to attention in the Orient by Simon in 1888. Simon reported it as a pest of coconut in Straits Settlements (Malay peninsular and Singapore). In 1889, Ridley reported that the red beetle was almost more destructive than Oryctes rhinoceros (Linn.) in Malaya. The grub did the injury by burrowing through the soft growing portion of the palm. Corbett and Ponniah (1923) and Corbett (1923) first called it the "red stripe" weevil and said that the larva was much more dangerous to the life of the tree than was any other coconut insect. It tunneled in the tissue of the plant, and one such may cause its death by eating into the growing point.

Corbett and Ponniah (1924) suggested that weevils coming from a diseased tree may be carriers of fungus or bacterial diseases to the palms if the conditions there were suitable for egg-laying. South (1924) reported that the weevil was a pest of coconut but not commonly found within the Wellesly, Pahang, or parts of Negri Sembilan in Malaya. Bunting and Gorgi (1924), Cater (1925), Corbett (1928), Bunting (1928), and Corbett and Pagden (1941) reported it as a serious pest of African oil palm, Elaeis guineensis. Sand (1930) reported it as a serious pest of coconut in Kurama, Da' at, and Lambuan; Pagden and Lever (1935) in Guadal Island, Florida

Island, Vella Lavella Island and Ganomga Island; and Simmonds (1938) Malanesia and South of Polynesia; Vestal (1956) in Narathiwat, Thailand.

Rhynchophorus vulneratus is confined to the southern part of Thailand where it does great damage. According to 1954 records, when an Eradication Campaign was started in Narathiwat and Nakornsri thammaraj Provinces, two heavily infested areas, more than 200,000 out of 2,300,000 coconut palms were infested by this weevil and Oryctes gnu Mohn. The former is more abundant and more destructive. All the infested palms were cut down in order to destroy the insects.

Brown (1903) in Malasia, stated that the larva of this weevil was very injurious to the cabbage and in combating this pest it was practicable to dig out the weevil larva from the infested tree. Bunting and Gorgi (1924) reported that this species killed palms by boring through the main stem. Bunting (1928) in Malasia reported that five years old oil palms were badly attacked by the larvae.

In brief, Rhynchophorus vulneratus (Panz.) at one time known as Rhynchophorus schach (Fabr.), Rhynchophorus ferrugineus (Oliv.) or even Calandra palmarum (Linn.) in Malasia, is now considered one of the most serious pests of coconut palms in the southern part of Thailand, Malasia, Sumatra and Borneo.

Distribution

Present records indicate that the range of vulneratus extends from the southern part of Thailand southward and westward to Malaya, Singapore, Borneo, Sumatra, Java, Timor, Celebes, Philippines and randomly distributed on the other Islands of the East Indies.

Total specimens examined	1427
Males	880
Females	547

Collecting date: January 12 to December 27.

Elevation: Up to 6,000 feet.

Genus *Dynamis* Chevrolat

Dynamis Chevrolat, 1882b, Ann. Soc. Ent. France, ser. 6, 2:563;
Champion, 1910, Biol. Centr. -Amer., 4(7):79; Lepesme,
1947, Les Ins. Palm., p. 617.

Description

Adult male. Length, 23.17 to 47.34 mm., width, 9.17 to 18.67 mm. Color black, shining. Rostrum shorter than pronotum, stout, strongly compressed, smooth or minutely punctured; rostral setae absent; in most of the specimens rostra dilated dorsally to

apex; gular suture narrow, distinct; or wide, almost obsolete. Antennal scape thick, one-half the length of rostrum; funicular segments thick, conical. Pronotum strongly produced posteriorly. Scutellum small, short, one-tenth to one-twelfth length of elytron. Elytra wider than pronotum, flat at base, sides and posterior half dorsally convex; each varying from two and one-half to slightly more than three times its own length, each with five deep striae and traces of four more at side. Front and middle femora strongly curved ventrally. Third tarsal segment dilated or broadly rounded, setae on underside covering one-half to three-fourths of the entire area. Ratio of width to length of phallobase 1:1.5.

Adult female. Length 21.88 to 44.00 mm., width 8.83 to 17.00 mm. Similar to male except setae on front femur absent, on front tibia much shorter than male, rostrum stronger curved, and front femur less curved. Ratio of width to length of vaginal base 1:2. Spermatheca narrowly and strongly tapering anteriorly.

Type Locality

South America.

Types and Location

The type species is Dynamis borassi (Fabricius), 1801, designated by Champion in 1910. Location not known.

Description of larva. Body length 44 mm. , width 14 mm.

Head length 10.50 mm. , width 9.50 mm. Body with small setae.

Labium with ten lateral setae. Epipharynx with two pairs of dorsal setae and one pair of epipharyngeal sensory spines; distance between epipharyngeal setae 2 twice as wide as between setae 1; epipharynx V-shaped. Mala with 14 to 16 dorsal setae, some bifurcate. Second segment of maxillary palpus with circular sensory spot. Prothoracic sternum with crescent-shaped opening.

Description of pupa. Body length 44 mm. , width 20 mm.

Pronotum oval, slightly produced posteriorly; spines on pronotum denser dorsoposteriorly. Scutellum short and sharply pointed.

Rostrum sinuate at side.

Discussion

When the genus was first erected Chevrolat included four tropical American species. These were Calandra borassi Fabricius, 1801, Calandra germari Perty, 1830, Rhynchophorus politus Gyllenhal, 1838, and Rhynchophorus nitidulus Guérin-Meneville, 1844. He also placed Rhynchophorus noxius Gyllenhal, 1838, and Rhynchophorus nitidipennis Boheman, 1845, as conspecific with borassi and nitidulus respectively. In 1906, Heller described one more new species, filirostris, and named Rhynchodynamis as a subgenus, which is elevated to generic rank in the present study. The

most recently described species, D. peropacus, was described by Champion in 1910 from several specimens from Nicaragua.

Champion also briefly discussed the generic characters of Dynamis. Lepesme, in 1947, also discussed the characters of Dynamis, which he said differed from Rhynchophorus by having the mesepisternum trapezoidal, and not triangular, the body smooth and shining, and the rostral setae absent. On these characters, only the male of Dynamis can be separated from Rhynchophorus. From the material studied the writer found that all the characters mentioned by Lepesme, except rostral setae, are found in Rhynchophorus.

A taxonomic study of the larva was made in 1948 by Anderson. He used the characters of D. borassi as representative of the genus. With the courtesy of Dr. W. H. Anderson, the writer has the opportunity to use the same materials which were studied by him.

Prior to the present study, eleven species were known. Eight new species are described in this paper and all the old species are redescribed. D. politus has been placed in synonymy with D. borassi. The new species are: artorntipae, callirostris, coracinus, palmiphilus, perplexus, perryi, rebecca, and rockefelleri.

Diagnostic characters for adults of the genus are: rostrum shorter than pronotum and strongly compressed; male rostral setae absent; antennal scape less than one-half length of rostrum; funicular segment stout, thick; spermatheca strongly and narrowly tapering

anteriorly.

Key to Species of Adult *Dynamis*

1. Gular suture narrow, always distinct (fig. 171); antennal scrobe opened ventrally (fig. 155); interocular space one-half or more the width of rostrum at base (fig. 258); third tarsal segment broad, subtriangular (fig. 212) 2

- Gular suture wide, nearly obsolete (fig. 172); antennal scrobe closed ventrally (fig. 151); interocular space one-third or less the width of rostrum at base (fig. 273); third tarsal segment more rounded distally (fig. 205) 3

2. Rostrum dorsally of uniform width to apex (fig. 258); mandible entire or emarginate distally (figs. 343-346)
 borassi p. 234

- Rostrum dorsally dilated at apex (fig. 367); mandible with distal half strongly depressed (fig. 348)
 rockefelleri p. 314

3. Pronotum and elytra shining; pronotum gradually or abruptly narrowing to apex (figs. 66, 69), strongly punctate laterally 4

- Pronotum and elytra strongly pruinose, not at all shining;
 pronotum broad, nearly square in appearance, (fig. 68),
 smooth or very feebly punctate laterally
 peropacus p. 292
4. Pronotum with posterior half convex (figs. 366, 367); elytra
 smooth, glabrous, very shiny; antennal club triangular,
 nearly pointed ventrally (fig. 202) 5
- Pronotum flat; elytra velvety pubescent with distinct or feeble
 punctation, somewhat shiny; antennal club blunt ventrally
 (fig. 199) 6
5. Pronotum strongly convex medio-posteriorly (fig. 367), shiny;
 dorso-lateral setae on third and fourth abdominal sternites
 present, more dense and numerous on fourth (fig. 352); size
 large, length 25 to 28 mm., width 10 to 11.90 mm.
 coracinus p. 270
- Pronotum convex medio-posteriorly (fig. 366), less shiny;
 dorsolateral setae on third abdominal sternite absent, on
 fourth short and not dense; size small, length 17.50 to
 26.00 mm., width 7.00 to 10.50 mm.
 nitidulus p. 276

6. Pronotum abruptly and strongly narrowing to apex (figs. 64, 66)
 7

Pronotum gradually narrowing to apex (figs. 62, 65, 73, 75) ..
 8

7. Posterior border of elytra shallowly emarginate (fig. 29);
 pronotum very shiny; tip of rostrum dorsally (epistoma) with
 distinct median nasal plate and lateral ridges (fig. 252); size
 large, length 39 to 40 mm., width 15 to 16 mm. (fig. 29) ..
 palmiphilus p. 283

Posterior border of elytra deeply emarginate (fig. 27), pronotum
 less shiny, with feeble median carina; tip of rostrum dorsally
 without distinct lateral ridges, somewhat tridentate (fig. 271);
 size small, length 33 mm., width 12 mm. (fig. 27)
 perplexus p. 298

8. Scutellum narrowly elongate-triangular (figs. 229, 232);
 epistoma with distinct median and somewhat elevated lateral
 projections, wavy or strongly concave distally (figs. 268,
 272-273) 9

Scutellum broadly triangular (figs. 235, 336); epistoma with
 only median projection distinct or feebly convex, not strongly

- concave (figs. 262-263) 10
9. Epistoma strongly concave distally (fig. 268); scutellum
broad but short (fig. 232); lateral setae on fifth abdominal
setae long callirostris p. 266
- Epistoma not strongly concave distally (figs. 272-273);
scutellum narrow but long (fig. 229); lateral setae on fifth
abdominal sternite short artorntipae p. 255
10. Scutellum broad at base, usually with feeble median carina or
ridge (fig. 235); epistoma median projection absent or feebly
projected distally (fig. 263); size small, length 19.50 to
26.00 mm., width 8.00 to 10.20 mm. (fig. 21)
..... perryi p. 302
- Scutellum narrow at base, without median carina (fig. 234);
epistoma with distinct median projection (fig. 261); size
large, length 27.00 to 32.00 mm., width 10.50 to 13.00
mm. (fig. 26) rebecca p. 309

Dynamis borassi (Fabricius)

Figs. 9, 33, 48, 71-72, 155-158, 171, 200, 212, 223, 227, 258-259,
302-303, 326-329, 343-346, 376, 378, 388-397, 445-447, 500-
503, 547, 565, 611-613, 636-637, 648, 653, 673-675, 679, 686,
694, 701, 713, 719, 722, 730, 737.

Calandra borassi Fabricius, 1801, Syst. Eleuth., 2:430; Schoenherr,
1826, Curc. Dispo. Method., 4:327.

Calandra germari Perty, 1830, Del. Anim. art. . . . , p. 82, t. 16,
fig. 12.

Rhynchophorus borassi (Fabricius); Gyllenhal in Schoenherr, 1838,
Gen. Spec. Curc. . . . , 4(2):818-819; Boheman in Schoenherr,
1845, Gen. Spec. Curc. . . . , 8(2):216.

Rhynchophorus noxius Gyllenhal in Schoenherr, 1838, Gen. Spec.
Curc. . . . , 4(2):821-822; Boheman in Schoenherr, 1845,
Gen. Spec. Curc. . . . , 8(2):216.

Rhynchophorus politus Gyllenhal in Schoenherr, 1838, Gen. Spec.
Curc. . . . , 4(2):819-820; Boheman in Schoenherr, 1845,
Gen. Spec. Curc. . . . , 8(2):216.

Dynamis politus (Gyllenhal); Chevrolate, 1882b, Ann. Soc. Ent.
France, 6(2):564; Champion, 1910, Biol. Centr. Amer. Col.,
4(7):79; Landeiro, 1941, Bol. Minist. Agric. Rio de Janeiro,
30(11):2-6, figs. 2-3; Lepesme, 1947, Ins. palm., p. 617-618;

Wattanapongsiri, 1964, Proc. Mo. Acad. Sci., 1(2):29.

New synonymy.

Dynamis germari (Perty); Chevrolat, 1882b, Ann. Soc. Ent. France,

6(2):563; Champion, 1910, Biol. Centr. Amer. Col., 4(7):80;

Kuschel, 1955, Rev. Chil. Ent., Santiago 4:281;

Wattanapongsiri, 1964, Proc. Mo. Acad. Sci., 1(2):29.

Rhynchodynamis politus (Gyllenhal) n. comb.; Kuschel, 1955, Rev.

Chil. Ent., Santiago 4:281.

Dynamis borassi (Fabricius); Chevrolat, 1882b, Ann. Soc. Ent.

France, 6(2):563; Champion, 1910, Biol. Centr. Amer., Col.,

4(7):79, 177; Kuschel, 1955, Rev. Chil. Ent., Santiago,

4:281; Wattanapongsiri, 1964, Proc. Mo. Acad. Sci., 1(2):29.

Description

Adult male. Length 46 to 50 mm.; width 18 to 20 mm. Body oblong-oval, flat dorsally, deep black, convex ventrally, both dorsum and venter shining.

Rostrum shorter than pronotum, stout; in profile, strongly compressed, broad at base, slightly tapering and arcuate at apex; viewed dorsally, broad at base for about one-third distance to apex then abruptly narrowed and with uniform width to apex, sparsely punctured at base and more diffusely to apex; epistoma with shallow depression posteriorly, slightly concave with small median nasal

plate anteriorly; ventrally with small thin subequal latero-anterior grooves from base of mandibles and confluent with gular suture at one-half of rostrum; gular suture flaring to base of rostrum; area between antennal scrobes glabrous; submentum suboval, rounded on slightly concave anteriorly, with or without median groove; lateral arms of hypostoma sickle-shaped, pointed anteriorly; mandibular scrobe quadrate and opened anteriorly; maxillary scrobe narrowed and also opened anteriorly.

Mouthparts black; mandible nearly two-thirds of width of tip of rostrum, subquadrate, with or without shallow median emargination; pleurostoma rectangular; maxilla black, concealed in scrobe between submentum and lateral arm of hypostoma.

Antenna arising laterally near base of rostrum; scrobe large, deep, widely opened ventrally; scape elongate, narrowed basally, longer than funicle and club combined or equal to one-third length of rostrum; funicle with six segments, first funicular segment as long as next two segments combined; second, third, and fourth short, subequal and almost rounded; sixth slightly broader than fifth, with two dorsal and two or three ventral setae; antennal club broad with several setae laterally and two to three both dorsally and ventrally; innerside of spongy area with 14 to 18 setae scattering over surface.

Head shining, bulbous, posterior end with three sinuate lobes, median lobe larger and somewhat pointed, two lateral lobes small,

not pointed but curved inward; with interocular sulcus; interocular space one-half width of base of rostrum; occiput strongly punctured; finely punctured on frons; genae sparsely and minutely punctured.

Pronotum black, longer than wide, constricted anteriorly, laterally, narrowed to apex, base strongly produced posteriorly; covered with dense brown hairs beneath the posterior edge; strongly punctured at sides. In profile, margin convex ventrally; underside black, minutely and diffusely punctured, less to very minutely and diffusely punctured on mesosternum and metasternum; prosternum elevated posteriorly; spinasternum extending over two-thirds of mesosternum with a deep longitudinal groove posteriorly; mesosternum emarginate posteriorly, diffusely punctured, with hairs absent, more strongly punctured at sides; mesepisternum triangular, sparsely punctured; mesepimeron sparsely and diffusely punctured; metasternum subquadrate, large, smooth, basal area flat medially, curved up laterally; metepisternum broad, subrectangular, sparsely and diffusely punctured, lateral margin straight, parallel to elytron; metepimeron small, triangular with more or less sharply pointed angle posteriorly, outer margin parallel to elytron.

Legs black strongly punctured on innerside; fore coxae separated by a distance equal to one-fourth width of a coxa, smooth; middle coxae similar to fore coxae, except more widely separated and with punctation; hind coxae elliptical, widely separated, sparsely

punctured on the anterior border. All trochanters triangular, pointed distally; femora thick, broad distally; front femur as long as middle and hind femora, very strongly curved; middle femur strongly punctured, slightly narrower and less curved than front femur; hind femur minutely and sparsely punctured, distally broader than front and middle femora, straight. Tibiae slightly curved externally and tapering distally; each with long recurved uncus with two small, short subuncus at the tip of tibia; front tibia longer than middle or hind tibia and with groove-like depression medially; front uncus shorter but stouter than the uncus of middle or hind tibia; middle and hind tibiae similar in shape, subequal in length; tarsus four segmented; first segment elongate, three times as long as second, broader distally; second short, subconical; third dilated, three-fourths of entire area beneath covered with matted light brown setae distally; fourth elongate, long as first three combined, with four to five simple, slender, light brown setae, one or two placed proximally and three distally. Brownish-black setae on ventral side of front and middle femora, all tibiae and first three tarsal segments; setae on front tibia as long as setae on femur but three times as long as setae on the middle or hind tibia.

Scutellum smooth, small, triangular, sharply pointed at apex, about one-twelfth of length of elytron.

Elytra smooth, wider than, or slightly shorter than pronotum;

elytron subequal in length to almost three times its own width; slightly narrowed posteriorly with side gradually tapering; each with five deep striae and traces of three more at side; sutural striae nearly prolonged to base; third stria weakly confluent posteriorly with eighth; sixth with seventh; fourth strongly and deeply confluent posteriorly with fifth; interstices three to five times as wide as striae, somewhat convex posteriorly.

Abdomen completely black, ventrally convex, with five segments; first abdominal sternite medially fused with second, two-thirds as wide as second; both sparsely and very minutely punctured; third and fourth subequal in width, diffusely punctured medially and strongly punctured laterally; third and fourth combined as long as first; fifth broad, subtriangular, fringed with a row of thick, long, brownish-black setae laterally on each side, strongly punctured laterally.

Pygidium black, triangular, posterior two-thirds strongly punctured, with or without lateral setae, usually worn off; wider and less pointed than female.

Adult female. Length 43 to 45 mm. ; width 16 to 18 mm.

Similar to male except rostrum shorter and more arcuate at tip; front femur broader proximally and shorter than male, setae lacking; all femora less curved; setae on front tibia much shorter than setae in the male; both femora and tibiae also shorter than male; pygidium

narrower but more pointed at apex.

Male genitalia. Twenty-five males from various localities were dissected. Dorsal cleft of phallobase narrowly convergent for more than two-thirds of its length, dorsolaterally covered with minute hairs; sides of cleft abruptly divergent. Dorsal split of phallobase slightly less than one-third of contiguous area between dorsal cleft and split. Ventral sclerites broad, subrectangular, parallel to phallobase, bearing setae anteriorly. Tegminal plate subtriangular. Dorsal side of tegminal apodeme with one dorsal keel running parallel on surface of apodeme and extending one-half length of plate. Tegminal sclerite ventrally broad and rounded at base; on dorsal side narrowed, sometimes meeting and extending posteriorly three-fourths length of tegminal base. Aedeagus subtriangular distally and more or less concave proximally, lateral arms slender and joining aedeagal apodemes. Aedeagal fenestra oval distally, gradually narrowing from distal end for four-fifths of its length then broad, and concave proximally. Orifical plates weakly sclerotized. Aedeagal chamber nearly elongate-oval, extending for one-third length of aedeagal apodemes.

Female genitalia. Twenty-one females from various localities were dissected. Vaginal base strongly punctured. Dorsal cleft of vaginal base narrowly convergent to anterior end and forming a sharply pointed triangular area medially. Sides of cleft abruptly

divergent and curved slightly outward posteriorly; cleft widely opened posteriorly. Spiculum ventrale nearly as long as length of vaginal base. Spiculum fenestra elliptical with pointed posterior end for one-fourth of its length and closed distally. Vaginal plate with sclerites along each side at base, extending from base to one-half length of vaginal plate. Spermatheca subtriangular distally and broadly rounded to truncate proximally, with concavity on dorsal side where gland joining spermatheca, ventral side with two lobes, sometimes indistinct.

Measurements. The following measurements were taken from the five males and five females upon which description is based.

	Male mm.		Female mm.	
	Mean	Range	Mean	Range
Body length	47.34	46.00-50.00	44.00	43.00-45.00
Body width	18.67	18.00-20.00	17.00	16.00-18.00
Elytron length	24.40	23.00-26.00	22.68	22.00-23.00
Elytron width	9.40	9.00-10.00	8.50	8.00- 9.00
Pronotum length	21.00	20.00-22.00	19.00	18.00-20.00
Pronotum width	16.50	15.50-17.00	14.68	14.00-15.00
Rostrum length	15.00	14.00-16.00	12.00	11.00-13.00
Rostrum length before antennal scrobe	9.40	9.00-10.00	7.00	7.00
Scape length	6.17	5.50- 7.00	5.00	5.00

	Male mm.		Female mm.	
	Mean	Range	Mean	Range
Funicular length	4.00	4.00	3.00	3.00
Club length	1.40	1.20- 1.50	1.20	1.20
Club width	2.30	2.00- 2.40	2.25	2.20- 2.30

Egg. Yellowish-brown, smooth, somewhat shining, slender-cylindrical with broadly rounded ends, slightly broader at the anterior end; averaging 1.1 by 3.7 mm.; chorion and vitelline membrane sometimes distinct.

Mature larva. Description based on the following material:

One mature larva and two early instars associated with one pupa and one male adult collected from palms in Ecuador, May 13, 1924, from F. Campos R. received through H. Morrison. Loaned by United States National Museum.

Larvae of this species may be characterized as follows: body brownish-yellow, large, robust, provided with several small sclerotized seta-carrying areas.

Head capsule narrowing posteriorly and with curved sides, dark brown, oval, with two longitudinal subparallel, dorsal depressions at center of frons between pairs of frontal setae 1 and 2. Ocellus absent. Antenna placed at anterior end of frontal suture; very small, two segmented, basal segment conical and much larger

than distal segment; distal segment slender, directed anteriolaterad. Epicranial, paraepicranial, and frontal sutures broad and distinct; paraepicranial suture parallel posteriorly for about two-thirds length of epicranial suture. Frontal suture narrowing to anterior end of head; suture slightly sinuate at posterior end. Epicranium with six pairs of dorsal setae and two pairs of posterior setae; dorsal epicranial setae 1 and 3 placed on paraepicranial suture, latter more than three times as long as former and placed anterior to 1; dorsal epicranial setae 1, 2, and 4 subequal, 2 and 4 not on paraepicranial suture but placed anteriolaterally to 1 and 3 respectively; dorsal epicranial setae 5 as long as 3 or nearly two-thirds as long as 6; both 5 and 6 placed anteriolaterally. Frons subtriangular, with blunt posterior angle, and distinct oval lobe of catapophysis; with two pairs of sensilla and five pairs of setae; posterior pair of sensilla larger than anterior pair; frontal setae 1, 2, and 4 short, subequal in length, 2 closer to 1 than to 4 and placed nearly at the same level to 3; frontal setae 3 and 5 subequal in length, more than three times as long as frontal seta 1. Clypeus broadly subtrapezoidal, with two pairs of clypeal setae placed at both sides posteriolaterally; clypeal seta 1 two to three times as long as 2. Labrum broader than long, with anterior margin broadly concave, trilobed, the median lobe subtruncate and emarginate medially; with two pairs of sensilla, three pairs dorsal setae, ten to twelve lateral setae, and three pairs

anterior setae; posterior and anterior labral sensilla subequal; dorsal labral setae long, simple, thickened, with broad rounded sensilla at bases; dorsal labral seta 1 placed on median lobe, 2 and 3 on lateral lobes; lateral labral seta similar to dorsal labral seta, all lateral labral setae placed ventrally on margin of lateral lobes; anterior labral setae 1 and 2 subequal in size, 1 shorter than 2, both 1 and 2 shorter and more slender than 3, all ventrally on the anterior margin of median lobe. Epipharynx setose, with broad sclerite, one pair of sensory pores, two pairs of setae and one pair of epipharyngeal sensory spines on epipharyngeal sclerite; setose portion of epipharynx V-shaped, elevated at posterior end; epipharyngeal sensory spine short, small, slender, placed on sclerite nearly at middle of setose portion or at middle of pharyngeal sclerite; epipharyngeal seta 1 twice as long as sensory spine with large rounded sensilla at base, placed about mid-distance between anterior end of labrum and anterior end of setose portion of epipharynx; epipharyngeal seta 2 thick, twice as long as 1, widely separated; distance between setae 2 twice as wide as distance between setae 1; epipharyngeal sensory pores placed closer to epipharyngeal setae 2 than 1, distance between two pores as wide as the distance between setae 2. Mandible triangular, stout, with four teeth, simple mola, and two dorsal setae; apical tooth less pointed than subapical; two median teeth pointed. Maxillary palpus two-segmented; basal segment broad,

distance between pair of premental setae; ligula sensilla very small, placed between ligula setae 1 and 2. Labial palpus two segmented, similar to maxillary palp both in shape and size, except basal segment of labial palpus slightly larger and conical. Hypopharynx fleshy, median area smooth, with small median furrow branching posteriorly, mediolateral area densely setose.

Prothorax not divided dorsally, with pair of heavily sclerites, each bearing six small setae; mesothorax and metathorax divided into spindle-shaped prodorsum and postdorsum; prodorsum with one pair of small setae; postdorsum with two pairs of setae; pleuron of all thoracic segments subdivided as follows: on each side of prothoracic pleuron subdivided into two lobes; pleuron of mesothorax and metathorax subdivided into three lobes; the lower lobe of prothoracic pleuron with two setae of mesothoracic and metathoracic pleura with one seta; sternum of thorax divided into one eusternum and two coxal lobes; eusternum of each thoracic segment bearing two setae; each coxal lobe of prothoracic sternum with five setae, of mesothoracic and metathoracic with four setae; eusternum of prothorax with a crescent-shaped opening.

Abdominal segments divided dorsally into four distinct plicae, intersegmental fold, praescutum, scutum, and scutellum; less distinct on abdominal segments five to nine; subdivision both on epipleuron, pleural, and hypopleural regions poorly defined. Abdominal

segments provided with setae as follows: on each side of abdominal segments 1 to 3 bearing one seta (prodorsal seta) on intersegmental fold; segments 1 to 7 each bearing one seta (spiracular seta); and segment 8 with two setae on praescutum; segments 1 to 7 each bearing four setae (postdorsal setae) and segment 8 with two setae on scutum; setae on scutella of all abdominal segments absent; hypopleuron of each abdominal segment subdivided into four-lobes, one superimposed upon the other, second lobe bearing one seta; coxal lobe with one seta, and eusternum four setae. Eighth abdominal segment smaller than other segments and somewhat fused with ninth dorsally; ninth segment broad, flattened both dorsally and ventrally, slightly concave posteriorly, with four long setae (two epipleural and two eusternal setae) and one pair of sensilla on each side; sensilla placed close to epipleural setae 1.

Only mesothoracic spiracles and spiracles on eighth abdominal segment distinct, spiracles on abdominal segments 1 to 7 obsolete; mesothoracic and eighth abdominal spiracles subequal, but three to four times larger than those on abdominal segments 1 to 7. Peritreme of mesothoracic spiracle with seven sensilla placed in row anterior to spiracle and two sensilla above the spiracle. Spiracular opening elliptical.

Anus transverse with preanal lobe truncate posteriomedially; median anal lobe broad, rounded anteriorly and truncate posteriorly;

both preanal and median lobes without setae; two lateral lobes broad, subquadrate, each bearing one small seta; eusternal setae on eighth and ninth abdominal segments absent.

Measurements. Mature larva, body length 44 mm., width 14 mm.; head length 10.5 mm., width 9.5 mm. Young instar, body length 22 to 32 mm., width 8 to 11 mm.; head length 5.5 to 10 mm., width 4.5 to 8.5 mm.

Pupa. Description based on the following material:

One pupa associated with three larvae and one male adult collected from palms in Ecuador, May 13, 1924, from F. Campos R. received through H. Morrison. Loaned by United States National Museum.

Pupae of this species may be characterized as follows: body uniform, yellowish-brown, elongate-oval, widest at third abdominal tergite, gradually tapering anteriorly and posteriorly.

Head concealed from above, compressed on anteroventral region of prothorax; tubercle on each side of epicranium flat, bearing one seta and one small tubercle with latter placed anterior to former; tubercle on epicranium subdivided by oblique ridges.

Rostrum lying posteriorly along sternum, with antenna extending laterally along femur of fore leg; rostrum extending to between the tibiae of fore legs and also reaching the base of middle legs; with four pairs of tubercle-borne setae, one pair placed

posteriorly and with large tubercle at base; distance between the setae as wide as the anterior pair; the two median pairs placed on smaller tubercles and distance between setae shorter than posterior and anterior pairs; all these four pairs of setae placed above base of antennae; at middle of length of rostrum, below base of antennae, with two pairs of small raised areas close to lateral margin of rostrum.

Pronotum subovate, broadly rounded anteriorly, covered with short numerous spines of varying size on anterior and posterior margins, denser and larger spines on posteriolateral margins; mediolateral areas bare. Mesonotum and metanotum partly visible dorsally, most area overlapped by folded wings; metanotum without setae.

Forelegs folded over prosternum, base of femora and tibiae overlapping anterior half of middle legs. Tarsi aligned posteriorly along sternum. Middle legs arranged similarly as forelegs; folded angles of femur and tibia of foreleg and middle leg same color as rest of body. Hind legs partly covered with both elytra and wings, folded in the same fashion as other legs.

Scutellum subtriangular, located between base of wings, elevated, extending three-fourths length of metanotum posteriorly.

Both elytra and wings obliquely over meso- and metapleura, terminating at anterior half of the fourth abdominal sternite; elytra

over and about three-fourths length of hind wings. Each elytron with five tuberculate ridges, only ridges 1 to 3 covered with poorly defined minute spines; intervals between ridges and ridges 4 to 5 smooth and bearing no spines. Elytra covered first abdominal spiracles dorsally; wings almost meeting in middle line of fourth abdominal sternite at anterior margin.

Abdomen divided into nine subequal segments, seven of which visible dorsally; tergite 1 to 6 subrectangular; each without transverse row of short spines, but numerous sharply defined lateral folds of tegument; tergites 1 and 2 each with three pairs of small tubercle-borne setae, placed more close together on tergite 1 than 2; tergites 3 to 6 each with six pairs of small tubercle-borne setae. Each pleural region with two setae; seventh tergite subtriangular, more heavily sclerotized, with one pair of small tubercle-borne setae anteriorly, a transverse row of four pairs of spines medially, and numerous minute short spines posteriolaterally; tergite 8 similar to seventh but one-half size of seventh; tergite 9 transversely subelliptical. Abdominal sternites similar to tergites both in shape and size, except first sternite two times broader than tergites and other sternites and with many sharply defined lateral and median transverse folds of tegument. Only fourth sternite with a median elevation extending longitudinally across its width.

Mesothoracic spiracle bilabiate, with the anterior side

obviously curved, and posterior side concave; placed ventrally at the posterior margin of prosternum, above front coxa. Spiracles on abdominal segments 1 to 5 well developed, elongate-oval, with spiculate processes inside and heavily sclerotized peritremes; spiracles on sixth and seventh small rudimentary; all abdominal spiracles located on lateroanterior margin of each tergite.

Measurements. Body length 44 mm. , width 20 mm.

Discussion

Champion (1910) considered D. politus (Gyll.) a synonym of the female of R. palmarum (Linn.) based on the original description of Gyllenhal who described D. politus as having the rostrum attenuate and not reflexed at the apex, and the surface shining. However, Champion failed to note the description of the rostrum and leg in which it was stated that the rostrum was narrowed and the front femur and tibia were ventrally fringed with long dense setae. The writer has examined 2103 females of R. palmarum (Linn.) and found none of the last mentioned characteristics in the female of R. palmarum (Linn.). The above description, however, fits very well with the male of D. borassi (Fabr.). The figures of D. politus (Gyll.) given by Landeiro (1941) are undoubtedly of variants of D. borassi (Fabr.). In 1955, Kuschel placed D. politus (Gyll.), under the name Rhynchodynamis politus (Gyll.), as a combination of D. borassi

(Fabr.).

There are series of specimens of this species from Venezuela in Carnegie Museum and Department of Entomology, Cornell University, which vary considerably in regard to shape and size of the rostrum and pronotum. These series fit well with the original description of D. politus (Gyll.); "Rhynchophorus borassi simillimus ejusdemque longitudinis, sed angustior, rostro longiore, attenuate, apice non reflexo, . . . femoribus tibiisque anterioribus subtus barba longa et densa atra ciliatis, . . ." After carefully studying 159 specimens of D. borassi (Fabr.) the writer concluded that the variation in shape and size of rostrum and pronotum is sufficiently covered in the above description of politus (Gyll.). The writer has also concluded that Dynamis politus (Gyllenhal, 1838) is conspecific with Dynamis borassi (Fabricius, 1801). This synonymy is based only upon the original description.

Having examined the Perty's type, Kuschel (1955) placed germari in synonymy with borassi. The writer agrees with Kuschel in placing this species in synonymy, since Perty's description is obviously referring to borassi, especially the shiny elytra and size-- "Aterima, polita; . . . Lg. 19'" sine rostro; rostri 5-1/2'". Lat. hum. 7'". . . Elytra profunde striata, polita. . ."

The earliest and the only description of a larva of this species was that of Anderson (1948). The adult was first figured by Bondar

(1940), and larva and pupa were figured by Landeiro (1941).

Dynamis borassi (Fabr.) differs from all other species by having its rostrum dorsally uniform in width to apex and mandible without median depression. This species is rather uniform except for variation in the situation of sides of the pronotum especially in the female. Also the distal end of the mandible varies from entire to emarginate.

Type Locality

South America.

Types and Location

Holotype male. Location not known.

Biology

Host plants. Cocos nucifera Linn., C. schizophylla Mart., C. vagans Bond., Borassus sp., and other palms.

A single host plant record was taken from the material examined, "from palms," Ecuador, May 13, 1924, (USNM).

Bondar (1940) reported that the larva of this species, under the name Rhynchophorus politus (Gyll.), preferred the terminal tissue of C. schizophylla Mart. In 1941, Landeiro studied the biology of this species and reported that the adult laid its eggs in the terminal

bud. After hatching the larvae tunnelled downward from the tip of C. nucifera Linn., C. schizophylla Mart., and C. vagans Bond. until reaching the base of the trunk where they completed their development. The complete life cycle requires at least six months. The biology is very similar to R. palmarum (Linn.) except for a longer life cycle and a preference for young, live, terminal tissue. The latter habit indicates that this species is more harmful than R. palmarum (Linn.). Lepesme (1947) suggested that D. borassi (Fabr.) perhaps lives on Borassus sp. if we judge by its scientific name, but the literature does not furnish any information on this point.

Distribution

Records taken from the material examined indicate that D. borassi (Fabr.) is widely distributed in South America, except Paraguay, Uruguay, Argentina, and Chile. However, from studies of the literature the following range of distribution was found: South America (Fabricius, 1801; Gyllenhal, 1838, Boheman, 1845); Amazon, Brazil (Perty, 1830); Boston, North America (Gyllenhal, 1838); Cayenne (Gyllenhal, 1838; Boheman, 1845; Chevrolat, 1882b); Chiriqui, Panama, (Champion, 1910); Vila Velha, Espirito Santo, Brazil (Landeiro, 1941); South America, Cayenne, Panama (Csiki, 1936), and Panama, Venezuela, Fr. Guiana, Argentina (Blackwelder,

1947). The material examined covered all the distribution areas indicated in the literature except Panama and Argentina.

Total specimens examined	159
Males	81
Females	78

Collecting dates: January 11 to December 26.

Elevation: 1600 meters above sea level.

Dynamis artorntipae New Species

Figs. 30, 65, 151-152, 172, 205, 229, 272-273, 314-315, 349,
404-411, 439-441, 516-518, 541, 553, 571, 620-622.

Description

Adult male. Length 32.0 to 34.0 mm.; width 12.0 to 12.8 mm. Body elongate-oval; feebly shining.

Rostrum stout; in profile, curved, strongly compressed, basal two-thirds broad, then narrowed to apex, sometimes slightly arcuate at apex, strongly punctured at base and above antennal scrobe, less and minutely punctured to apex; viewed dorsally, strongly punctured throughout dorsal surface, one-fourth from base flat, broadly oval and abruptly narrowing at middle and again dilated to apex; two specimens, one from Sao Paulo, Brazil (CU) and the other from Chanchamayo, Peru (AMNH) with few setae on dorsal

Map 6. Distribution of specimens examined of the genera
Dynamis and Rhynchodynamis.

○ D. borassi

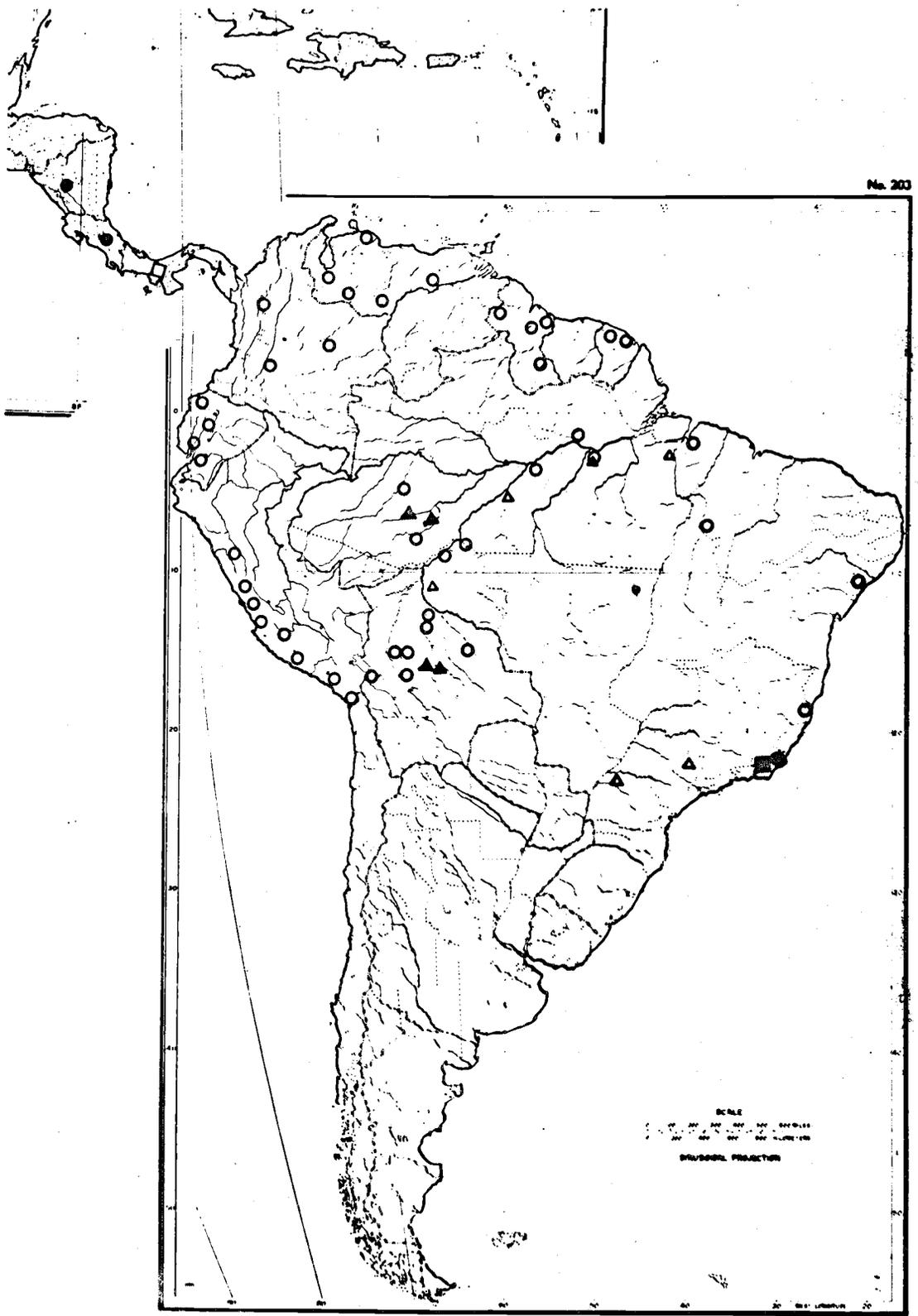
● D. peropacus

△ D. artorntipae

▲ Rhynchodynamis filirostris

□ D. palmiphilus

■ D. rebecca



No. 203

SCALE
1:100,000
1:200,000
1:500,000
1:1,000,000
1:2,000,000
1:5,000,000
1:10,000,000
1:20,000,000
1:50,000,000
1:100,000,000
1:200,000,000
1:500,000,000
1:1,000,000,000

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surface of the rostrum; epistoma flat with distinct median and slightly sinuate lateral lobes distally; viewed ventrally, very narrowed medially and dilated towards base and apex; sparsely and strongly punctured anteriomedially and posteriolaterally, punctation in irregular rows; with small, almost obsolete sutures from base of mandibles and confluent with gular suture for two-thirds from tip of rostrum; gular suture flaring to base; space between antennal scrobes smooth medially, sparsely and strongly punctate laterally; submentum broadly oval, narrowly concave anteriorly, with broad, flat, oval median depression; lateral arm of hypostoma somewhat pointed distally.

Mouthparts black except pleurostoma varying from dark brown to black; mandible two-thirds of width of rostrum at base, distal half broadly rounded, flat, slightly pointed ventrally; posterior half thick, strongly convex; pleurostoma subquadrate, usually distinct and not concealed in mandibular scrobe. Maxilla small, brownish-black, maxillary palpus brown.

Antennal scrobe small, deep, closed ventrally; scape elongate, somewhat rounded and broadened distally; much longer than funicle and club combined or slightly shorter than one-half length of rostrum; first funicular segment as long as next two segments combined; second and third subequal, conical; fourth and fifth subequal, broader than third, each with two dorsal and one ventral setae; sixth

trapezoidal with one dorsal and three to four ventral setae; antennal club subtriangular, inner side of spongy area with six to eight setae.

Head less shining than thorax; interocular space narrowed, usually less than one-third width of rostrum at base; frons and occiput strongly punctured.

Pronotum usually with distinct median carina, gradually narrowing from base for two-thirds of its length then abruptly curved and constricted lateroanteriorly; strongly produced posteriorly; dorsomedially minutely punctured and shining; strongly punctured dorsolaterally; prothoracic sternum smooth medially, sparsely and minutely punctured laterally; meso- and metasterna sparsely punctured; punctation more stronger on episterna and epimera.

Legs feebly shining, sparsely punctured; front coxa sparsely and diffusely punctured; middle coxa strongly punctured and covered with several brown setae; front femur as long as middle femur but shorter than hind femur; front tibia longer than middle or hind tibia, curved externally and broad distally; middle tibia as long as hind tibia; third tarsal segment nearly rounded distally, more than two-thirds of area beneath covered with matted brown setae; fourth as long as the first three segments combined, with three to four setae ventrally, two proximal, the other one or two distal; setae on front tibia thick, as long as setae on femora, but longer than setae on middle or hind tibia.

Scutellum small, triangular, the long apical portion very narrow and sharply pointed; without distinct lanceolate longitudinal carina.

Elytra more than three times its own width, narrowed and strongly depressed on either side posteriorly; posterior border deeply emarginate; second and third striae prolonged to the base; first and second may or may not confluent anteriorly; fourth feebly or strongly or not at all confluent posteriorly with fifth; the outer striae more or less obsolete and may be represented by four sinuate lines of fine punctures, stronger on anterior half of the ninth stria; usually sixth stria almost obsolete and feebly confluent posteriorly with seventh and curved, almost meeting tip of fifth; interstices two to five times as wide as striae, feebly convex, subshining, velvety pubescent, outer striae flat and more pubescent.

Pygidium strongly convex; posterior end strongly punctured; lateral setae brownish-black, short, usually with distinct longitudinal median elevation.

Abdominal sternites strongly punctured at sides; first as long as or slightly shorter than third and fourth combined or shorter than second; fifth fringed with short, brownish-black setae dorsolaterally, not extending to the fourth sternite.

Adult female. Length 32.0 to 34.0 mm.; width 12.1 to 13.1 mm. Similar to male except setae on front femur much fewer and on

front tibia much shorter.

Male genitalia. Four males were dissected. Phallobase strongly punctured and covered with small setae dorsoanteriorly, minutely and diffusely punctured dorsolaterally. Dorsal cleft of phallobase narrowly convergent for two-thirds its length. Sides of cleft abruptly and widely divergent posteriorly. Dorsal split of phallobase shorter or as long as contiguous area between cleft and split. Ventral sclerites broadly rectangular and broadly rounded anteriorly, slightly diagonal posteriorly, lying longitudinal to phallobase, bearing few small setae anteriorly. Tegminal plate thick, triangular posteriorly, almost parallel at sides and sharply constricted at base; dorsal keel thick, very broad at base, highly elevated, extending to posterior end of plate. Tegminal sclerite broad, heavily sclerotized, oval ventrally; on dorsal side, narrowly extending from sides then abruptly directed anteriorly to three-fourths length of tegminal base; at anterior margin of base usually with small square sclerotized plate medially. Aedeagus broadly rounded distally, on ventral side broadly and deeply concave proximally. Aedeagal fenestra spatulate with gradually narrowing to two-thirds of its length, and rounded distally; one-third posterior end abruptly narrowed then gradually broadened proximally; posterior border shallowly concave. Orifical plates small, elliptical-elongate, heavily sclerotized. Aedeagal valve small, narrowly-triangular.

Aedeagal chamber broad anteriorly then abruptly narrowed, extending posteriorly one-fourth length of aedeagal apodemes.

Female genitalia. Two females were dissected. Vaginal base dorsoanteriorly punctured, with few small setae. Dorsal cleft of vaginal base narrowly convergent to anterior end of base. Sides of cleft widely divergent, triangular posteriorly. Spiculum ventrale slightly shorter than vaginal base. Spiculum fenestra triangular, one-third the length of spiculum ventrale, widely opened distally. Vaginal plate broadly cordate with two subtriangular sclerotized plates anteriolaterally. Spermatheca with two distinct ventral lobes, at one-third distance from distal end; strongly constricted anterior to juncture with spermathecal gland.

Measurements. The following measurements were taken from one male from Brazil (USNM), one male from St. Catharina, Brazil (CM), one male from Kartabo (CM) - "holotype"; one female from Sao Paulo, Brazil (PANS); one female from Iquito, Peru (USNM) - "allotype."

	Holotype	Male		Female	
	Male mm.	Mean	Range	Mean	Range
Body length	32.00	32.67	32.00-34.00	33.00	32.00-34.00*
Body width	12.00	12.30	12.00-12.80	12.60	12.10-13.10
Elytron length	17.00	16.67	16.00-17.00	17.50	16.50-18.50
Elytron width	6.00	6.13	6.00- 6.40	6.35	6.10- 6.60
Pronotum length	12.50	11.90	11.20-12.50	12.40	12.00-12.80
Pronotum width	10.00	10.03	10.00-10.10	10.30	10.00-10.60
Rostrum length	10.00	10.00	9.50-10.20	11.25	10.50-12.00
Rostrum length before antennal scrobe	6.00	6.00	6.00	7.50	7.00- 8.00
Scape length	4.00	4.07	4.00- 4.20	4.90	4.80- 5.00
Funicle length	2.50	2.50	2.40- 2.60	2.40	2.30- 2.50
Club length	0.90	0.93	0.90- 1.00	0.95	0.90- 1.00
Club width	1.60	1.60	1.40- 1.80	1.60	1.40- 1.80

*Measurements of allotype.

Discussion

This species is closely related to perplexus, callirostris, perryi and rebecca. It is most easily separated by use of male or female genital characters. However, it can be separated by the combination of characters given in the key. Of these species, perryi is easily distinguished by its small size (σ , length 23.0 to 26.0 mm., width 9.0 to 10.2 mm.; ♀ length 19.5 to 25.0 mm., width 8.0 to 10.1 mm.), shape of pronotum and epistoma; callirostris is of large size (σ length 36.4 to 38.0 mm., width 13.6 to 14.8 mm.), pronotum very shiny, and epistoma strongly concave distally; perplexus is of medium size (♀ length 33 mm., width 12 mm.) and with pronotum abruptly narrowing to apex; rebecca is also of medium size (σ length 30.0 to 32.0 mm., width 12.0 to 13.0 mm.; ♀ length 27.0 to 31.0 mm., width 10.5 to 12.0 mm.) but pronotum not abruptly narrowed to apex; artorntipae differs from the previously mentioned species by having the pronotum less shiny and usually or almost always with distinct median carina (always flat and shining in rebecca), and also differs in the shape of the pronotum.

Some specimens of this species from the British Museum of Natural History (Fry Collection) were possibly misidentified as germari by Champion in 1910.

Type Locality

Kartabo, Brazil and Iquito, Peru.

Types and Location

Holotype, male, Kartabo, June 21, 1925, Car. Mus. Acc. 11988, will be returned and placed in the Carnegie Museum, Pittsburgh, U.S.A. Holotype lacks right antenna.

Allotype, female, Iquito, Peru, Fredk. Knab, will be returned and placed in the United States National Museum, Washington, D. C., U.S.A. Allotype is in excellent condition.

Paratypes, one male, St. Catharina, Brazil, H. Klages Coll., C. M. Acc. 11414 (CM); one male, Santharem, Brazil, Acc. No. 2966 (CM), will be retained and placed in the Entomological Museum, Department of Agriculture, Bangkok, Thailand, by the writer; one male, Chanchamayo, Peru, III-28, F. 6032, H. Bassler Collection, Acc. 33591 (AMNH); one male, State Sao Paulo, Brazil, Hammar Coll., Cornell U. Lot 529, Sublot 348, 148 (CU); one male, State Sao Paulo, Brazil, Hammar Coll., Cornell U. Lot 529, Sublot 349, 149 (CU); one male, Rio Brazil, W. Robinson, bequest 1929 (USNM); one female, Sao Paulo, Brazil, VIII-7-22 (PANS); one male, Brazilia, Fry Coll. 1905-100 (BMNH); one male, unknown locality (AW).

The above data follows the sequence on the labels attached to the specimens of the type-series.

Distribution

Present records indicate that the range of artorntipae may extend from northern Peru eastward into Brazil.

Total specimens upon which the description is based	11
Males	9
Females	2

Collecting dates: June 21 to August 7.

The writer is pleased to name this species after his wife, Dr. Artorntip, in acknowledgement of her consistent help during the course of this study.

Dynamis callirostris New Species

Figs. 28, 62, 153, 232, 268, 300-301, 442-444, 602-604

Description

Adult male. Length 36.4 to 38.0 mm.; width 13.6 to 14.8 mm. Body broadly oval, shining.

Rostrum stout, strongly compressed; slightly convex ventrally at apex; strongly punctured dorsally; sparsely and feebly punctured

laterally; ventrally smooth, lateral sides of space between antennal scrobes strongly punctured; gular suture widely broadened basally, sometimes obsolete; epistoma strongly concave with a distinct median projection.

Mouthparts and head as described for artorntipae.

Pronotum shining, feebly convex posteriorly, finely punctured dorsomedially, stronger punctured anteriolaterally; both sides gradually curved to apex and constricted anteriolaterally; prosternum shining, smooth, with spinasternum covering mesosternum almost completely; metasternum smooth medially; very feebly punctured on episterna and epimera.

Legs as described for artorntipae except more shiny.

Scutellum small, narrowly-triangular, usually with distinct lanceolate longitudinal ridge.

Elytra shining, anterior half of the elytra not velvety-pubescent; depressed medioanteriorly and very shiny; feebly convex to posterior end; fourth stria feebly or strongly confluent posteriorly with fifth; sixth almost obsoletely confluent posteriorly with seventh; interstices three to six times as wide as striae, with few sparsely punctures on fourth stria; from fifth to the margin of elytron feebly punctured except strongly punctured on anterior and posterior ends.

Abdomen and pygidium as described for artorntipae, except very shiny and minutely punctured medially; strongly punctured

laterally; fifth sternite fringed with very short setae laterally; pygidium less punctate and the median elevation on posterior end more distinct.

Male genitalia. Four males were dissected. Phallobase smooth with small setae dorsoanteriorly and dorsolaterally. Dorsal cleft of phallobase narrowly convergent for two-thirds of its length. Sides of cleft somewhat gradually and widely divergent posteriorly. Dorsal split of phallobase about one-half or less than one-half length of contiguous area between dorsal cleft and split. Ventral sclerites broad, strongly curved at side, concave posteriorly, bearing small brown setae anteriorly. Tegminal plate broadly rounded posteriorly and abruptly straight to tegminal apodeme. Dorsal keel extending almost to posterior end of plate. Tegminal sclerite broad-U-shaped ventrally, on dorsal side irregular in shape, lateral sides narrowed and gradually broadened, abruptly constricted, extending three-fourths length of tegminal base. Aedeagus oval distally, on ventral side widely and deeply concave posteriorly. Aedeagal fenestra somewhat rounded distally, truncate at posterior border. Orifical plates narrowly-elongate, heavily sclerotized. Aedeagal valve irregular oval, extending nearly to distal margin of aedeagus. Aedeagal chamber truncate posteriorly and extending for one-third length of aedeagal apodemes.

Measurements. The following measurements were taken

from the specimens of the type-series. The measurements of the holotype are also given.

	Holotype Male mm.	Male mm.	
		Mean	Range
Body length	37.00	36.98	36.40-38.00
Body width	14.00	14.27	13.60-14.80
Elytron length	19.00	19.17	18.50-20.00
Elytron width	7.00	7.13	6.80- 7.40
Pronotum length	13.80	13.90	13.20-14.50
Pronotum width	11.00	11.48	10.80-12.00
Rostrum length	10.50	11.15	10.50-12.20
Rostrum length before antennal scrobe	6.50	7.18	6.50- 8.20
Scape length	4.50	4.72	4.50- 4.90
Funicle length	2.40	2.60	2.40- 3.10
Club length	1.10	1.13	1.00- 1.20
Club width	2.00	2.07	2.00- 2.20

Discussion

The female and immature stages are unknown.

Type Locality

British Guiana.

Types and Location

Holotype, male, British Guiana, will be returned and placed in the United States National Museum, Washington, D. C., U. S. A. Type is in excellent condition.

Paratypes, two males same data as holotype (USNM), one male, Rio Napo Watershed, Rio-Jatum Yacu, Oriente, Ecuador, W. C. MacIntyre (USNM); one male, Kalacoon-1916, Bartica Dist., British Guiana, Col. 71, Ac. 5632 (AMNH); one male, W. Robinson, bequest 1929 (USNM).

Distribution

Known only from the specimens of type-series which indicate that this species may be found in British Guiana and Ecuador.

Dynamis coracinus New Species

Figs. 23, 69, 70, 143-144, 219, 233, 274-275, 312-313, 352, 367, 451-453, 526-528, 533-536, 556, 568.

Description

Adult male. Length 25.0 to 28.0 mm.; width 10.0 to 11.9 mm. Body elongate-oval, very shiny, especially on the posterior half of pronotum.

Rostrum stout, strongly compressed; smooth both laterally and ventrally, if punctate less than nitidulus; in general similar to nitidulus but completely black dorsally; space between antennal scrobes smooth; gular suture widely broadened basally, usually obsolete.

Mouthparts as described for nitidulus.

Head shining, sparsely and very minutely punctured; interocular space one-third distance across base of rostrum.

Pronotum very shiny, smooth dorsomedially and ventrolaterally, sparsely punctured dorsolaterally; posterior half strongly convex; posterior three-fourths on both sides strongly curved; thoracic sternum smooth medially and very feebly punctured on episterna and epimera.

Legs as described for nitidulus, except black, sparsely and feebly punctured; front coxa smooth; middle coxa roughly punctured basally; front tibia with lateral row of setae arising from deep punctures, longer than middle or hind tibia; middle tibia shorter than hind tibia.

Scutellum triangular, with feebly lanceolate longitudinal carina.

Elytron very shining, more shining than nitidulus, two and one-half times its own width; posterior border of elytra emarginate and narrowed; first and second striae widely separated anteriorly;

fourth confluent posteriorly with fifth; sixth to ninth almost obsolete except one-third of anterior part of ninth stria strongly indentation; interstices two to five times as wide as striae, brownish-black appearance, smooth, very shining on striae one to five; from six to lateral margin less shining.

Abdomen and pygidium as described for nitidulus, except dorsolateral setae present on third and fourth abdominal sternites, more numerous and dense on the fourth.

Adult female. Length 26.0 to 26.5 mm.; width 11.4 to 11.5 mm. Very similar to male except for thickness and length of setae on front femur and tibia much less thicker and shorter.

Male genitalia. Three males were dissected. Phallobase somewhat smooth without setae dorsolaterally; sparsely but strongly punctured dorsoanteriorly. Dorsal cleft of phallobase very narrowly convergent for two-fifths its length. Sides of cleft very widely divergent posteriorly, forming triangle. Dorsal split short, one-third or less than one-third contiguous area between dorsal cleft and split. Ventral sclerites somewhat rounded distally and truncate proximally, curved on each side, bearing small, short setae anteriorly. Tegminal plate broadly truncate posteriorly and parallel on either side for one-half its length then abruptly narrowed to tegminal apodeme. Dorsal keel extending two-thirds to three-fourths length of plate. Tegminal sclerite broad ventrally, somewhat rectangular

and sinuate laterally; on dorsal side triangular, heavily sclerotized, sharply pointed and almost meeting anteriorly, extending for one-half length of base of tegminal apodeme. Aedeagus oval, almost rounded distally; ventral side with triangular emargination proximally. Aedeagal fenestra spatulate, broadly rounded distally, narrowly concave proximally. Orifical plates elongate-oval, heavily sclerotized. Aedeagal valve triangular. Aedeagal chamber narrowed posteriorly, extending for one-third length of aedeagal apodemes.

Female genitalia. Two females were dissected. Vaginal base covered with brown setae dorso- and ventrolaterally, punctate dorsoanteriorly. Dorsal cleft of vaginal base narrowly convergent for three-fourths of its length then fused, leaving the distal part like dorsal split in the male. Spiculum ventrale slightly shorter than length of vaginal base. Spiculum fenestra triangular, one-fourth length of spiculum ventrale, widely opened distally. Vaginal plate oval, with two pairs of lateral lobes, anterior pair sclerotized. Spermatheca with one distinct ventral lobe, broadly rounded basally and narrowly truncate distally.

Measurements. The following measurements were taken from the specimens of the type-series.

	Holotype Male mm.	Allotype Female mm.	Male		Female	
			mm.		mm.	
			Mean	Range	Mean	Range
Body length	28.00	26.00	26.67	25.00-28.00	26.25	26.00-26.50
Body width	11.90	11.50	11.17	10.00-11.90	11.45	11.40-11.50
Elytron length	14.90	14.50	15.33	14.80-16.00	14.60	14.50-14.70
Elytron width	5.95	5.75	5.59	5.00- 5.95	5.58	5.40- 5.75
Pronotum length	11.20	10.50	11.20	10.50-11.90	10.70	10.50-10.90
Pronotum width	9.50	9.20	9.30	9.00- 9.50	9.25	9.20- 9.30
Rostrum length	10.50	9.00	9.47	8.80-10.50	8.80	8.60- 9.00
Rostrum length before antennal scrobe	6.10	6.00	6.03	5.90- 6.10	5.75	5.50- 6.00
Scape length	3.70	4.00	3.60	3.50- 3.70	3.60	3.20- 4.00
Funicle length	2.20	2.00	2.07	2.00- 2.20	2.05	2.00- 2.10
Club length	1.00	0.60	0.87	0.80- 1.00	0.75	0.60- 0.90
Club width	1.50	1.40	1.43	1.40- 1.50	1.39	1.38- 1.40

Egg. Similar to egg of peropacus and perryi; light brown not shining, elongate, both ends evenly rounded (fig. 219); averaging 1.79 by 5.12 mm; chorion and vitelline membrane usually distinct.

Discussion

The characters for distinguishing from other species are discussed under nitidulus. No biological information, larva, and pupa of this species are presently available for study.

Type Locality

British Guiana.

Types and Location

Holotype, male, "Hold-me-back," clearing, VII-31-25, British Guiana, Car. Mus. Acc. 11988. Allotype, female, Car. Mus. Acc. 11988 (possibly collected with holotype). Both types are in excellent condition and will be returned and placed in the Carnegie Museum, Pittsburgh, U. S. A.

Paratypes, one male, Kartabo, January 17, 1925, Car. Mus. Acc. 11988 (CM), will be retained and placed in the Entomological Museum, Department of Agriculture, Bangkok, Thailand, by the writer; one male, Amazonas, Brazil, Benjamin Constante, Rio Javary, Feb. 1-Mar. 15, 1942 (AMNH); one female, Rio Itecosi,

Benjamin Constante, Amazonas, Brazil, VII-1942, A. Parko,
 Coleção Campos Seabra (CACS); one female, no locality (PANS).

The above data is taken from the labels attached to the
 specimens following the same sequence.

Distribution

Known only from the specimens of type-series. This species
 has been found in British Guiana and Brazil.

Total specimens upon which the description is based	6
Males	3
Females	3

Collecting dates: January 17 to July 31.

Dynamis nitidulus (Guérin-Meneville)

Figs. 22, 73-74, 141-142, 202, 236, 264-265, 316-317, 366, 436-
 438, 512-515, 546, 569, 623-625.

Rhynchophorus nitidulus Guérin-Meneville, 1844, Icon. regn. Anim.,
 7:175, ♂.

Rhynchophorus nitidipennis Boheman in Schoenherr, 1845, Gen.
 Spec. Curc. . . . , 8(2):216-217, ♀.

Dynamis nitidipennis (Boheman), Chevrolat, 1882b, Ann. Soc. Ent.
 France, 6(2):564.

Dynamis nitidulus (Guérin-Meneville), Chevrolat, 1882b, Ann.

Soc. Ent. France, 6(2):564; Wattanapongsiri, 1964, Proc.

Mo. Acad. Sci., 1(2):29.

Description

Adult male. Length 20.5 to 25.0 mm.; width 8.0 to 10.5 mm. Body elongate-oval, shining, usually black with interstices reddish-brown.

Rostrum stout; in profile, strongly compressed, slightly broad at base then straight to apex; viewed dorsally, nearly oval at basal one-third, then abruptly tapering toward apex, becoming dilated at apex, punctate throughout dorsal surface; traces of lateral ridges may be present; epistoma broadly concave distally; viewed ventrally, sometimes reddish-brown, very narrowed medially, broadened towards base and tip, smooth; space between antennal scrobes smooth; submentum broadly oval, concave anteriorly with broad oval, median depression; lateral arm of hyposterma somewhat rectangular basally, narrow to nearly rounded distally.

Mouthparts vary from brown to black; mandible usually dark brown, distal half strongly depressed, laterally bent outward; basal part of mandible strongly convex and dark in color; pleurostoma brownish-black; maxilla brown, small.

Antennal scrobe small, moderately deep, closed ventrally;

scape elongate, broadened distally, longer than funicle and club combined or almost equal to one-half length of rostrum; first funicular segment longer than next two segments combined; second to fourth subequal, conical; fifth as long as sixth but narrower, and broader than second; antennal club triangular, inner side of spongy area with three to four setae.

Head less shiny than thorax; interocular space narrowed, one-third or less than one-third width of rostrum at base; frons diffusely punctured.

Pronotum shining, dorsomedially smooth and convex on posterior half; base strongly produced posteriorly; three-fourths on both sides of its length straight to apex then abruptly constricted anteriolaterally, strongly punctured both dorso- and ventrolaterally; pro-, meso-, and metathoracic sterna smooth; mesepisternum, mesepimeron, metepisternum, and metepimeron sparsely punctured.

Legs sparsely punctured; fore coxa strongly punctured and sometimes brownish-black basally; front femur as long as hind femur, but longer than middle femur; front tibia longer than middle or hind tibia, slightly curved externally, with nearly uniform width to distal end; middle and hind femora subequal; third tarsal segment more rounded distally, one-half of entire area beneath covered with matted brown setae; fourth as long as first three segments combined, with four to five slender setae ventrally, two proximal, the others distal;

setae of front tibia thick, as long as setae on front or middle femur, but thicker and longer than middle, hind tibia or hind femur.

Scutellum triangular, small, without distinct lanceolate longitudinal carina.

Elytra, each three times its own width; narrowed posteriorly with side almost straight; antero- and mediodorsally depressed; posterior border emarginate; sutural striae nearly prolonged to the base; first stria almost confluent anteriorly with second; fourth feebly confluent posteriorly with fifth; sixth feebly confluent both anteriorly and posteriorly with seventh, usually obsolete; interstices three to six times as wide as striae, somewhat sinuate and with few feeble diffuse punctation dorsally.

Abdominal sternites black, usually brownish-black on posterior sternites; lateral side of first abdominal sternite as long as third and fourth combined but shorter than second; fifth fringed with short brownish-black setae dorsolaterally, sometimes extending to fourth sternite.

Pygidium with elevated margins laterally, posterior one-third with thick, brown setae and slightly punctured, usually with distinct longitudinally median elevation.

Adult female. Length 17.5 to 26.0 mm.; width 7.0 to 10.5 mm. Similar to male except pronotum more rounded on anterior half; setae on front femur much fewer and on front tibia much

shorter.

Male genitalia. All four males were dissected. Phallobase smooth to very diffusely punctured anteriodorsally, with fine setae dorsolaterally. Dorsal cleft of phallobase narrowly convergent for three-fourths of its length. Sides of cleft widely divergent posteriorly. Dorsal split of phallobase two to three times longer than contiguous area between dorsal cleft and split. Ventral sclerites broad, nearly rounded in shape, lying slightly diagonal to phallobase, bearing setae anteriorly. Tegminal plate triangular-truncate posteriorly. Dorsal keel extending one-third to one-half length of plate. Tegminal sclerite weakly sclerotized ventrally; narrowed, subtriangular and heavily sclerotized dorsally, somewhat pointed anteriorly and extending for one-half length of tegminal base. Aedeagus suboval distally, on ventral side with sinuate concavity proximally. Aedeagal fenestra spatulate, broadly rounded distally, narrowed and sharply truncate posteriorly; lateral arms slender not joining aedeagal apodemes. Orifical plates heavily sclerotized. Aedeagal valve somewhat rounded distally and broadly triangular basally. Aedeagal chamber broadly oval, extending for one-third length of aedeagal apodemes.

Female genitalia. All four females were dissected. Vaginal base punctate anteriodorsally, covered with brown slender setae. Dorsal cleft of vaginal base narrowly convergent to anterior end of

base. Sides of cleft concave and widely divergent posteriorly. Spiculum ventrale nearly as long as length of vaginal base. Spiculum fenestra triangular, one-seventh length of spiculum ventrale, and widely opened distally. Vaginal chamber oval, with two lateral elliptical sclerites. Spermatheca narrowly elongate distally, without distinct ventral lobe, broadened and rounded posteriorly.

Measurements. The following measurements were taken from three males and four females upon which the description is based.

	Male mm.		Female mm.	
	Mean	Range	Mean	Range
Body length	23.17	20.50-25.00	21.88	17.50-26.00
Body width	9.17	8.00-10.50	8.83	7.00-10.50
Elytron length	12.33	11.00-14.00	12.38	10.00-15.00
Elytron width	4.58	4.00- 5.25	4.41	3.50- 5.25
Pronotum length	9.33	8.50-10.50	8.73	6.50-10.80
Pronotum width	7.67	7.00- 9.00	7.33	5.80- 9.00
Rostrum length	7.83	7.00- 8.50	7.25	6.00- 8.00
Rostrum length before antennal scrobe	5.00	4.50- 5.50	4.68	3.70- 5.50
Scape length	3.13	2.80- 3.30	2.95	2.40- 3.50
Funicle length	2.00	1.80- 2.20	1.73	1.40- 2.20
Club length	0.93	0.70- 1.00	0.68	0.40- 0.90
Club width	1.40	1.30- 1.50	1.23	1.00- 1.50

Discussion

This species was described by Guérin-Meneville in 1844 from at least two specimens from Brazil and Bolivia as Rhynchophorus nitidulus. His description was based on the male specimen since he described the leg as "Pattes assez robustes avec les cuisses et les jambes garnies en dessus de cils bruns très-serrés." In 1845, Boheman described a female of this species from Cayenne as Rhynchophorus nitidipennis. Boheman described the leg as "Pedes breviusculi validi atri, nitidi; femoribus tibiisque subtus atro-ciliatis." The latter was first placed in synonymy with the former by Chevrolat in 1882b.

Dynamis nitidulus is closely related to coracinus but is of smaller size, the pronotum is less convex posteriorly, the dorso-lateral setae all absent on the third abdominal sternite, short and not densely on the fourth abdominal sternite. The male and female genitalia are also very distinctive. Both nitidulus and coracinus can be easily separated from all other species without the use of the genitalia by using the combination of the following characters: pronotum convex posteriorly, elytron smooth, glabrous and very shining, and antennal club triangular and pointed ventrally.

Biological information and immature stages are not available at the present time.

Type Locality

Brazil and Bolivia.

Types and Location

Guérin-Meneville did not designate the holotype, according to his description. One of the males of type-series should be designated as holotype. Location of type is unknown by the writer.

Distribution

Records taken from the material examined and from the literature indicate that nitidulus may range from British Guiana and French Guiana southward into Brazil.

Total specimens examined	8
Males	4
Females	4

Dynamis palmiphilus New Species

Figs. 29, 63-64, 161-162, 199, 230, 252-253, 304-305, 330-331,
347, 398-399, 400-403, 466-468, 542-545, 552, 556, 608-610.

Description

Adult male. Length 40 mm.; width 15 mm. Body

Map 7. Distribution of the specimens examined of the genus Dynamis.

○ callirostris

● coracinus

△ nitidulus

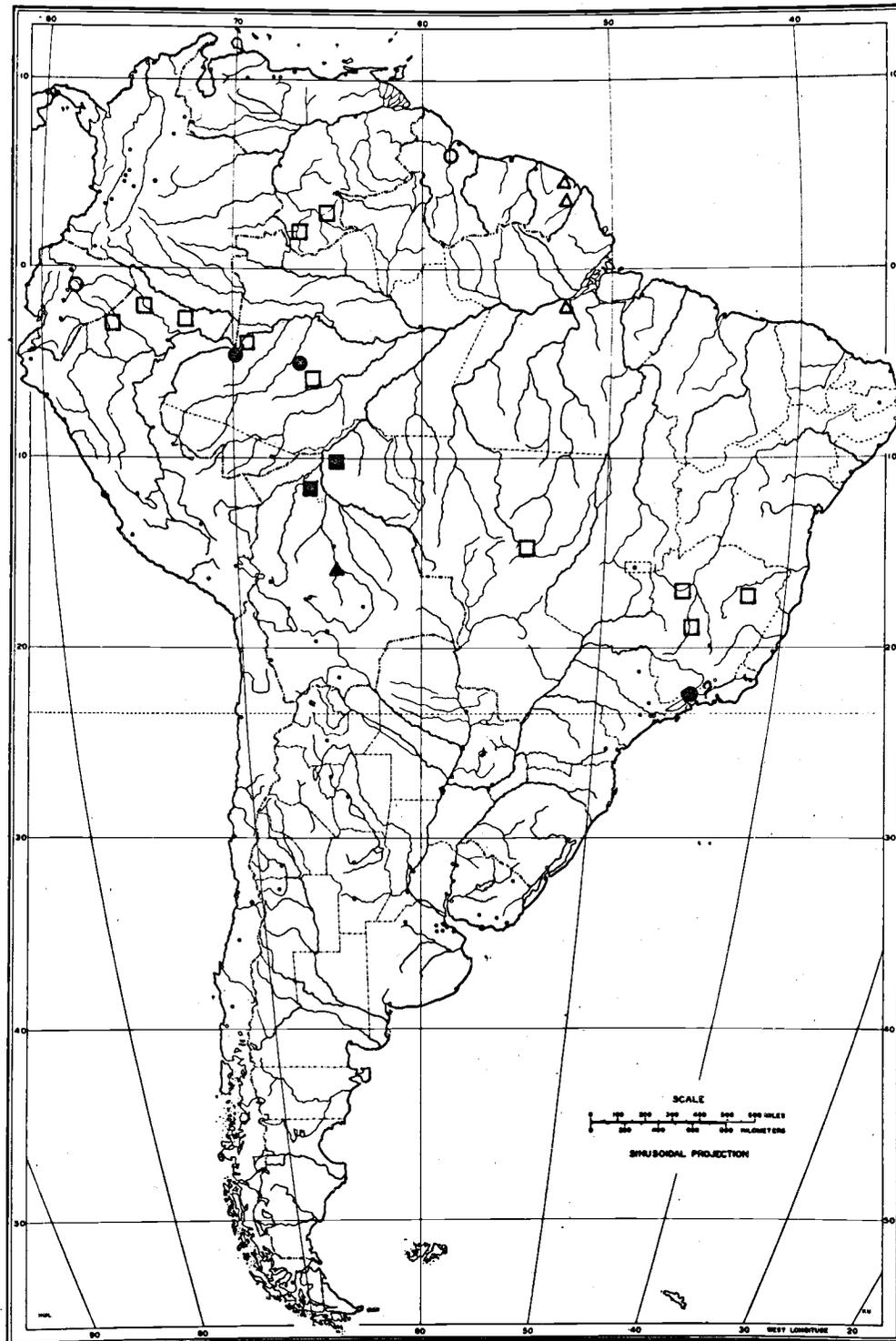
▲ rockefelleri

□ perryi

■ perplexus

SOUTH AMERICA

No. 203



GOODE BASE MAP SERIES
DEPARTMENT OF GEOGRAPHY
THE UNIVERSITY OF CHICAGO
HENRY A. LEPPARD, DIRECTOR

Prepared by Henry A. Leppard
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elongate-oval; only pronotum shining.

Rostrum thick, stout; in profile, strongly compressed, very slightly arcuate at apex and curved ventrally; one-half length from the base slightly punctate; with two distinct carinae extending from base of mandible to two-thirds length of rostrum posteriorly; viewed dorsally, oval for one-fourth distance from base then abruptly narrowed with uniform width to three-fourths length of rostrum, becoming dilated toward apex, with punctation from the base to subapex; epistoma pointed anteriorly with lateral ridges curved posteriorly; ventral side as described for artornitipae; submentum much dilated, sharply concave anteriorly, median depression extending one-third of its length; lateral arm of hypostoma sickle-shaped, narrowed, pointed anteriorly.

Mouthparts black, except pleurostoma and maxilla dark brown; distal half of mandible strongly depressed medially and distally dilated, basal half highly elevated.

Antennal scrobe deep, closed ventrally; scape elongate, much longer than funicle and club combined or slightly less than one-half rostrum; first funicular segment longer than next two segments combined; second to fifth subequal, conical; sixth subrectangular, broader but shorter than fifth, with two dorsal setae; antennal club large, broadly-triangular, inner side of spongy area with five to eleven setae.

Head somewhat shining, sparsely and roughly punctured; interocular space one-third width of rostrum at base.

Pronotum very shiny, widest at base, medially smooth, strongly punctured at sides and more so at apex; gradually curved and strongly depressed dorsolaterally; without median longitudinal carina or any elevation; under side as described for artorntipae, except less shiny.

Legs as described for artorntipae, except stouter, stronger punctation on inner side of femora; all legs less shiny than dorsal surface; front femur more strongly curved; front tibia longer than middle or hind tibia; simple brownish-black setae scattered over inner side of front tibia; third tarsal segment much dilated, subtriangular; setae on ventral side of femora, tibiae, and first three tarsal segments brownish-black; setae on front femur extending for two-thirds of its length; nearly one-half on hind femur; setae on front tibia less dense and shorter than in artorntipae.

Scutellum small, triangular, sharply pointed posteriorly; broadly and shallowly concave anteriorly.

Elytra, each two and one-half its own width, side strongly depressed, more abruptly narrowed posteriorly; posterior border slightly emarginate; sutural striae not prolonged to base; first stria confluent anteriorly with second; third very feeble almost indistinct, confluent posteriorly with eighth; fourth strongly confluent posteriorly

with fifth; sixth feebly confluent both anteriorly and posteriorly with seventh; interstices two to four times as wide as striae, convex with sparse and minute punctures, more densely and strongly punctured posteriorly.

Abdomen similar to artornitipae, except more densely fringed with brownish-black setae on fifth abdominal sternite and extending anteriorly to sides of fourth and third sternites.

Pygidium strongly punctured, without distinct median longitudinal elevation; more rounded at apex; edged with short brownish-black setae.

Adult female. Length 39 to 40 mm. ; width 15 to 16 mm. Similar to male except rostrum shorter, more strongly curved to apex, usually with dorsal depression for two-thirds the distance from the base of rostrum; epistoma less pointed; submentum shallowly concave anteriorly but with large, oval, median depression extending throughout length of submentum; pronotum much strongly narrowed anteriorly; setae on front femur extending from proximal end for one-third its length; setae on hind femur more than two-thirds its length; length of setae on front tibia one-third shorter than in the male.

Male genitalia. The holotype was dissected. Phallobase covered with setae anteriorly and laterally; pointed and punctured distally. Dorsal cleft of phallobase very narrowly convergent for

slightly more than one-half its length. Sides of cleft very abruptly and widely divergent posteriorly. Dorsal split of phallobase slightly longer than contiguous area between dorsal cleft and split. Ventral sclerites broad, subquadrate, lying longitudinally to phallobase, bearing setae anteriorly. Tegminal plate subtriangular. Tegminal apodeme curved to side, dorsal keel not extending into plate. Tegminal sclerite with broad, sinuate plates ventrally, narrowed dorso-laterally, then enlarging to somewhat subrectangular and extending anteriorly for two-thirds distance from base of tegminal apodeme. Aedeagus oval with distinct cleft distally; lateral arms thick and joining aedeagal apodemes. Aedeagal fenestra spatulate, oval distally, narrowly convergent and divergent posteriorly; posterior border concave. Orifical plates heavily sclerotized. Aedeagal valve broadly oval, very distinct from other species, closed to distal end of aedeagus. Aedeagal chamber elongate-oval, extending slightly more than one-half length of aedeagal apodemes.

Female genitalia. The allotype and paratype were dissected. Vaginal base strongly punctured and covered with setae distally. Dorsal cleft of vaginal base narrowly convergent only for one-half its length then fused and extending for two-thirds its length and again split to anterior end. Sides of cleft concave, abruptly and widely divergent posteriorly. Spiculum ventrale distinctive, as long as vaginal base. Two spiculum fenestra present, posterior one enclosed

and longer than anterior fenestra, latter narrow-triangular and opened anteriorly. Vaginal plate with distinct median groove. Spermatheca narrowed distally and without distinct ventral lobe.

Measurements. The following measurements were taken from the specimens of the type-series.

	Holotype Male mm.	Allotype and Paratype Female mm.	
		Mean	Range
Body length	40.00	39.50	*39.00-40.00**
Body width	15.00	15.50	15.00-16.00
Elytron length	19.00	19.50	19.00-20.00
Elytron width	7.50	7.75	7.50- 8.00
Pronotum length	15.00	15.00	14.00-16.00
Pronotum width	12.00	13.00	12.00-14.00
Rostrum length	14.00	13.00	12.00-14.00
Rostrum length before antennal scrobe	10.00	9.00	8.00-10.00
Scape length	5.00	5.75	5.50- 6.50
Funicle length	3.00	2.80	2.80
Club length	1.20	1.30	1.30
Club width	2.20	2.10	2.10

* Measurements of allotype.

** Measurements of paratype, both funicles lacking.

Discussion

This species resembles perplexus but is much larger in size. Other differences are discussed under perplexus. The biology and immature stages are not known by the writer.

Type Locality

Calekoen (?), South America.

Types and Location

Holotype, male, Calekoen (?), Am. Meri., will be returned and placed in the Zoologische Sammlung des Bayerischen Staates, Munchen, West Germany.

Allotype, female, Panama, No. 5592, will be returned and placed at the American Museum of Natural History, New York, U.S.A.

Paratype, female, Field Mus. (F. Psota Coll.) (CNHM).

The above data follows the sequence on the labels attached to the specimens of the type-series.

Distribution

Known only from specimens of type-series. This species may be found in Panama and southward into South America.

Total specimens upon which the description is based	3
Male	1
Females	2

Dynamis peropacus Champion

Figs. 31, 68, 145-146, 220, 231, 269-270, 306-307, 454-456, 529-532, 548, 564, 614-616.

Dynamis peropacus Champion, 1910, Biol. Centr. Amer. Col., 4(7):80; Wattanapongsiri, 1964, Proc. Mo. Acad. Sci., 1(2): 29.

Description

Adult male. Length 31.0 to 35.0 mm.; width 13.5 to 14.5 mm. Body black, broadly oval, opaque and strongly pruinose dorsally, subshining beneath.

Rostrum black, shorter than pronotum, stout, obviously curved, rostrum dorsally broad at base and dilated at apex; sparsely punctate throughout; smooth both laterally and ventrally; viewed laterally, strongly compressed and of uniform width from base to two-thirds length of rostrum then abruptly narrowed and again of uniform width to apex; space between antennal scrobes smooth; gular suture almost obsolete and widely broadened basally.

Mandible dark brown, broadly oval and strongly depressed

to nearly flat distally; proximal half gradually elevated; pleurostoma dark brown, quadrate. Maxilla dark brown.

Head not shining, sparsely and very feebly punctured on frons, interocular space less than one-third of width at base of rostrum.

Pronotum broad, slightly longer than wide; gradually narrowing to apex; base broadly produced posteriorly; smooth and feebly convex mediodorsally; sparsely and feebly punctured dorso-laterally; punctation much smaller ventrolaterally. Prosternum, mesepimeron, metasternum, metepisternum, and metepimeron sparsely and minutely punctured; mesosternum and mesepisternum strongly punctured.

Legs sparsely and minutely punctured; front coxa more or less smooth; middle and hind coxae strongly punctured; front femur thick, curved, broadened distally, nearly as long as hind femur but longer than middle femur; front tibia slightly longer than front femur, and much longer than middle and hind tibiae; first tarsal segment twice as long as second; third subtriangular; fourth elongate, slightly longer than first three segments combined; bearing 9 to 12 ventral setae. Brownish-black setae on ventral side of front tibia as long as the setae on all femora and other tibiae.

Scutellum small, oblong-triangular, and with a smooth lanciform median ridge.

Elytra strongly pruinose, flat at base and feebly convex to

apex; third stria may or may not feebly confluent posteriorly with eighth; fourth usually feebly confluent posteriorly with seventh and sometimes feebly confluent with fifth, if not, with seventh; fifth feebly confluent posteriorly with sixth. Interstices three to seven times as wide as striae, dorsally smooth, flat at base and becoming feebly convex to apex.

Abdominal sternites less shiny than metasternum; medially smooth, sparsely and minutely punctured laterally, more strongly dorsolaterally on the fourth and fifth sternites; setae on lateral sides of fifth sternite very short, almost obsolete.

Pygidium strongly punctured on dorsal surface, with distinct median elevation and short, brownish-black lateral setae.

Adult female. Length 33 to 37 mm.; width 13 to 15 mm.

Similar to male except setae on the ventral sides of front tibia and femur shorter and less densely fringed. One female from British Museum collection, fourth striae with two strong punctations on the right and eight on the left, the latter in an irregular median row.

Male genitalia. Two males were dissected. Phallobase dorsoanteriorly punctured with small, brown setae both dorsoanteriorly and dorsolaterally. Dorsal cleft of phallobase narrowly convergent for about one-half its length. Sides of cleft abruptly divergent posteriorly. Dorsal split of phallobase short, less than one-third of contiguous area between dorsal cleft and split. Ventral

sclerites broad, slightly concave posteriorly and broadly rounded anteriorly, each sclerite bearing simple brown setae and not contiguous anteriorly. Tegminal plate slightly emarginate posteriorly, gradually narrowing to tegminal apodeme. Dorsal keel extending nearly to posterior end of plate and somewhat branched along the edges laterally. Aedeagus oval distally; ventral side curved on either side and deeply concave posteriorly. Aedeagal fenestra broad, and gradually curved for three-fourths its length then abruptly narrowing with uniform width posteriorly; posterior border very slightly and shallowly concave. Orifical plates narrowly elongate, heavily sclerotized; aedeagal valve broadly triangular with pointed end distally. Aedeagal chamber broad oval, pointed posteriorly, extending for one-third length of aedeagal apodemes.

Female genitalia. Three females were dissected. Vaginal base dorsoanteriorly and dorsolaterally punctured, with simple, long, brown setae. Dorsal cleft of vaginal base narrowly convergent to anterior end of base. Sides of cleft widely divergent posteriorly. Spiculum ventrale shorter than vaginal base. Spiculum fenestra triangular, one-fifth its length and widely opened distally. Vaginal plate broadly rounded with two broad sclerites placed anterio-laterally. Spermatheca with three to four distinct ventral lobes and an elevated area at base of spermathecal gland.

Measurements. The following measurements were taken

from the specimens upon which the description is based.

	Male		Female	
	Mean	Range	Mean	Range
Body length	33.00	31.00-35.00	35.00	33.00-37.00
Body width	14.00	13.50-14.50	14.25	13.00-15.00
Elytron length	18.25	17.50-19.00	18.80	17.50-20.20
Elytron width	7.00	6.75- 7.25	7.13	6.50- 7.50
Pronotum length	12.75	12.00-13.50	13.03	12.00-14.10
Pronotum width	11.45	11.00-11.90	11.55	11.00-12.00
Rostrum length	11.40	11.00-11.80	11.65	10.50-12.10
Rostrum length before antennal scrobe	7.60	7.20- 8.20	7.73	6.50- 8.10
Scape length	4.75	4.50- 5.00	4.70	4.20- 5.20
Funicle length	2.75	2.60- 2.90	2.30	2.20- 2.40
Club length	1.10	1.00- 1.20	1.08	1.00- 1.10
Club width	2.15	2.00- 2.30	1.95	1.90- 2.00

Egg. Light brown, not shining, somewhat reticulate, broadest medioposteriorly; ends broadly rounded; averaging 2.02 by 5.29 mm.; chorion and vitelline membrane distinct.

Discussion

This species was described by Champion (1910). His

description was based on two males and one female from Chontales, Nicaragua, collected by Richardson.

Dynamis peropacus Champ. differs from all other species in having a broad pronotum and the body strongly pruinose and not at all shining on the dorsal surface. The male and female genitalia are much different from those of other species, especially in regard to the long setae on the vaginal base, vaginal plate, spermatheca, and aedeagal valve.

Biological information, larvae and pupae were not available at the time of this study.

Type Locality

Chontales, Nicaragua.

Types and Location

No holotype was designated by Champion, therefore, all the specimens of the type-series are "syntypes," according to the International Code of Zoological Nomenclature Article 73(c). These syntypes were collected at Chontales, Nicaragua, by Richardson. Location of types is unknown to the writer. If they are later located then a "lectotype" could be designated.

Distribution

Records taken from the material examined and type locality (Champion, 1910) indicate that peropacus may be found only in eastern Brazil and possibly ranges southward from Nicaragua to Costa Rica.

Total specimens examined	6
Males	2
Females	4

Collecting dates: May to September.

Dynamis perplexus New Species

Figs. 27, 66, 154, 237, 271, 504-507, 551, 570.

Description

Adult female. Length 33 mm.; width 12 mm. Body elongate-oval, somewhat shining.

Rostrum stout, curved, strongly compressed, sparsely punctured laterally; dorsal surface diffusely punctured; ventral side smooth, without punctation; space between antennal scrobes smooth; gular suture almost obsolete, widely broadened basally.

Mouthparts as described for artorntipae.

Head more or less shining, sparsely punctured on the frons;

interocular space one-fourth width of rostrum at base.

Pronotum flat, sides strongly narrowing from base to apex; dorsomedially shining with minute punctation, dorso- and ventro-laterally strongly punctured; pro- and metathoracic sterna sparsely punctured; mesothoracic sternum strongly punctured; episterna and epimera very feebly punctured.

Legs very feebly punctured; outer sides somewhat velvety-pubescent; front coxa smooth; middle coxa sparsely punctured and covered with small brown setae; front femur as long as middle but shorter than hind; hind femur straight, front and middle femora curved; front tibia longer than middle or hind tibia; brownish-black setae on front femur extending for one-half its length and much less thick than setae on middle femur or on hind femur.

Scutellum, pygidium, and abdominal sternites as described for artorntipae.

Elytra velvety-pubescent, somewhat shining dorsally, evenly convex, posterior border shallowly emarginate; third stria feebly confluent posteriorly with eighth; fourth strongly with fifth; sixth feebly with seventh; anterior half of ninth stria without distinct indentation.

Female genitalia. The holotype and paratype were dissected. Vaginal base strongly punctured, with long, slender, brown setae dorsolaterally; tip of vaginal base nearly truncate. Dorsal cleft of

vaginal base narrowly convergent to anterior end of base. Sides of cleft concave and widely divergent posteriorly. Spiculum ventrale shorter than vaginal base. Spiculum fenestra triangular with posterior end very narrow to more than one-half length of spiculum ventrale, widely opened distally. Vaginal plate oval, with two triangular, heavily sclerotized plates, placed anteriolaterally. Distal half of spermatheca with four distinct ventral lobes, somewhat broadly rounded proximally; in front of the spermathecal gland abruptly elevated where gland joining spermatheca.

Measurements. The measurements of the types were as follows:

	Holotype Female mm.	Paratype Female mm.
Body length	33.00	33.00
Body width	12.00	12.00
Elytron length	18.20	18.00
Elytron width	6.00	6.00
Pronotum length	12.00	12.00
Pronotum width	9.70	9.80
Rostrum length	11.00	11.00
Rostrum length before antennal scrobe	7.30	7.10

	Holotype Female mm.	Paratype Female mm.
Scape length	4.20	5.00
Funicle length	2.40	2.50
Club length	0.80	0.80
Club width	1.40	1.50

Discussion

This species resembles artorntipae and palmiphilus in general body shape, scutellum, pygidium, and mouthparts. It differs from artorntipae by having elytra more shiny and pronotum more strongly narrowed to apex; differs from palmiphilus by having less shiny pronotum, posterior border of elytra more deeply emarginate, and is also of much smaller size. It also can be separated conveniently by use of female genitalia and spermatheca which are distinctively different.

At present, the biology, male, and immature stages are not known.

Type Locality

Bolivia.

Types and Location

Holotype, female, Calisaya, Rio Beni, Bolivia, Coll.

G. L. Harrington, will be returned and placed in the United States National Museum, Washington, D. C., U. S. A.

Paratype, female, Brazilia, Fry Coll. 1905-100 (BMNH).

Distribution

Known only from the specimens of the type-series. This species may be found in Bolivia and Brazil.

The description is based on the two females.

Dynamis perryi New Species

Figs. 21, 75-76, 139-140, 221, 235, 262-263, 308-309, 353, 365, 457-459, 537-540, 555, 573, 626-628.

Description

Adult male. Length 23.0 to 26.0 mm.; width 9.0 to 10.2 mm. Body elongate-oval, not shining except pronotum, somewhat velvety-pubescent.

Rostrum stout, strongly compressed; sparsely punctured laterally and ventrally, more densely punctured dorsally; epistoma truncate or with slight median projection; space between antennal

scrobes sparsely punctured; gular suture widely broadened basally, sometimes obsolete.

Mouthparts as described for artorntipae.

Head somewhat shining; sparsely punctured on frons; interocular space less than one-third base of rostrum.

Pronotum flat, feebly shining, often with median carina; minutely punctured dorso- and lateroventrally; for three-fourths distance from posterior on either side almost straight then abruptly narrowed and constricted anteriolaterally; thoracic sterna less shining, minutely and sparsely punctured; episterna and epimera strongly punctured.

Legs sparsely and feebly punctured; front coxa smooth; middle sparsely punctured; front tibia longer than middle or hind tibia; middle shorter than hind.

Scutellum small, triangular, broad at base, usually with feeble lanceolate longitudinal carina.

Elytra velvety-pubescent, slightly convex to posterior end; fourth stria confluent posteriorly with fifth; sixth feebly, sometimes obsolete, with seventh; interstices two to five times as wide as striae; few sparse punctures on striae 1 to 4; from fifth to the margin of elytron strongly punctured.

Abdominal sternites sparsely and finely punctured medially; strongly punctured laterally; setae on lateral sides of fourth and fifth

abdominal sternites very short or absent.

Pygidium without lateral elevation, sparsely punctured; dorsal and lateral setae very short, sometimes absent.

Adult female. Length 19.5 to 25.0 mm.; width 8.0 to 10.1 mm. Similar to male except rostrum longer and setae on front femur and tibia much less and shorter.

Male genitalia. Seven males were dissected. Phallobase punctured dorsoanteriorly with small setae anteriolaterally. Dorsal cleft of phallobase narrowly convergent for about two-thirds of length. Sides of cleft abruptly and widely divergent posteriorly. Dorsal split of phallobase one-half contiguous area between dorsal cleft and split. Ventral sclerites somewhat rounded and slightly diagonal to phallobase, bearing setae anteriorly. Tegminal plate truncate posteriorly and broadened anteriorly for three-fourths its length then abruptly narrowed to tegminal apodeme. Dorsal keel extending to posterior margin of plate. Tegminal sclerite ventrally narrowly transverse and suddenly turned anteriorly; on dorsal side narrowly-elongate and somewhat pointed anteriorly, extending for three-fourths length of tegminal base. Aedeagus oval distally, on ventral side deeply concave proximally. Aedeagal fenestra broadly-oval distally, gradually curved posteriorly for two-thirds of its length then abruptly narrowed, and sharply truncate proximally. Orifical plates heavily sclerotized, elongate, slightly pointed

posteriorly. Aedeagal valve triangular. Two-thirds from anterior end of aedeagal chamber broadly oval, narrowed posteriorly, extending for one-third length of aedeagal apodemes.

Female genitalia. Four females were dissected. Vaginal base strongly punctured with long, slender, brown setae dorso-laterally. Dorsal cleft of vaginal base narrowly convergent to anterior end of base. Sides of cleft abruptly divergent, cleft widely open posteriorly. Spiculum ventrale as long as or slightly longer than vaginal base. Spiculum fenestra triangular, one-fourth length of spiculum ventrale, and opened distally. Vaginal plate cordate with two broad longitudinal sclerotized plates anteriolaterally. Spermatheca strongly elevated at base of spermathecal gland with two or three ventral lobes; ridges between lobes more constricted dorso-anteriorly; with small knob-like projection dorsoposteriorly.

Measurements. The following measurements were taken from the specimens of the type-series. Measurements of the holotype and allotype are also given.

	Holotype Male mm.	Allotype Female mm.	Male		Female	
			Male	Range	Mean	Range
			mm.		mm.	
Body length	25.00	25.00	24.58	23.00-26.00	22.88	19.50-25.00
Body width	10.20	10.10	9.72	9.00-10.20	9.28	8.00-10.00
Elytron length	14.40	14.00	13.52	12.50-14.40	12.95	11.50-14.00
Elytron width	5.10	5.05	4.85	4.50- 5.10	4.64	4.00- 5.05
Pronotum length	10.00	9.20	9.38	8.50-10.00	8.63	7.50- 9.50
Pronotum width	8.50	7.90	7.82	7.50- 8.50	7.28	6.20- 8.00
Rostrum length	8.50	9.00	8.30	7.90- 8.50	8.53	7.50- 9.40
Rostrum length before antennal scrobe	6.00	6.10	5.35	5.00- 6.00	5.58	5.00- 6.10
Scape length	3.80	3.50	3.47	3.30- 3.80	3.28	3.00- 3.50
Funicle length	1.80	1.90	1.90	1.80- 2.00	1.75	1.50- 2.00
Club length	0.90	1.00	0.92	0.80- 1.00	0.93	0.80- 1.10
Club width	1.50	1.40	1.52	1.40- 1.70	1.43	1.40- 1.50

Egg. Very similar to peropacus; widest at middle; averaging 1.95 by 4.78 mm., which is larger than the eggs of other known species; chorion and vitelline membrane distinct.

Discussion

This species and nitidulus are the smallest species known of the genus Dynamis. It differs from other species as discussed in artorntipae. The biology, larva, and pupa are unknown.

Type Locality

Holotype, Mishuyacu, Peru, and allotype, Minas Geraes (Minas Gerais), Brazil.

Type and Location

Holotype, male, Mishuyacu, Peru, III-24-30, G. Klug Coll., will be returned and placed in the United States National Museum, Washington, D. C., U.S.A. The type is in excellent condition.

Allotype, female, No. 3963, Minas Geraes, Fry Coll., 1905-100, will be returned and placed in the British Museum of Natural History, London, England. Allotype lacks left front claw.

Paratypes, one male, Venezuela Exp., Territ. Amazonas, Mt. Marahuaca, N. slopes, Benitez Camp, May 1-25, 1950, J. Maldonado, Capriles Coll. (USNM), will be retained and placed in

the Entomological Museum, Department of Agriculture, Bangkok, Thailand; one male, Manaus, Brazil, Miss H. B. Merrill Collector (USNM); one male, Bates Biaz, Bowing 63-47 (BMNH); one female, Fry, Rio San, Fry Coll. 1905-100 (BMNH); one male, Chapada near Cuyaba, Matto Grosso, Brazil, Nov., Klages Coll. Exot. Coleopt., C. M. Acc. 2275 (CM); one male, Middle Rio Ucayali, Peru, VII. 19.28, F. 6174, H. Bassler Collection, Acc. 33591 (AMNH); one male, Iquitos, Peru, F. 6063, H. Bassler Collection, Acc. 33591 (AMNH) will be retained by the writer and placed in the Entomological Museum, Department of Agriculture, Bangkok, Thailand; one female, Tarapoto Region, Peru, I. 6. 26, F. 6042, H. Bassler Collection, Acc. 33591 (AMNH); one female, Colecão Campos Seabra, Benjamin Constante, Amazonas, Brazil, VI-1942, A. Parko (CACS).

Distribution

Records from the material examined indicate that the range of this species may extend from Venezuela southward into Brazil and Peru.

Total specimens upon which the description is based	11
Males	7
Females	4

Collecting dates: January 6 to August 19.

This species is named in honor of Mr. Jesse P. Perry Jr. of the Rockefeller Foundation who made it possible for the writer to study collections at the Chicago Natural History Museum, Carnegie Museum, Philadelphia Academy of Natural Sciences, United States National Museum, American Museum of Natural History, and many other university museums.

Dynamis rebecca New Species

Figs. 26, 67, 149-150, 234, 260-261, 310-311, 460-462, 508-511, 554, 572, 617-619.

Description

Adult male. Length 30 to 32 mm.; width 12 to 13 mm.

Body elongate-oval, more or less shining.

Rostrum strongly compressed; sparsely punctured laterally and ventrally; more strongly dorsally; epistoma with distinct median projection distally; space between antennal scrobes smooth; gular suture widely broadened basally, almost obsolete.

Mouthparts as described for artornitipae, except the distal half of mandible more strongly depressed and dilated.

Head shining, sparsely punctured on the frons, punctation weaker than artornitipae; interocular space less than one-fourth width of rostrum at base.

Pronotum slightly convex on posterior half, shining, very minutely punctured dorsomedially; strongly punctured dorsolaterally and less ventrolaterally; sides gradually narrowing to apex; prothoracic sternum, mesepimeron, metasternum and metepimeron minutely and feebly punctured; mesosternum, mesepisternum and metepisternum more strongly punctured.

Legs, abdominal sternites, scutellum, pygidium, as described for artorntipae, except stronger punctation and scutellum not narrowly elongate-triangular.

Elytra velvety-pubescent, convex dorsoposteriorly and depressed mediolaterally; second and third striae prolonged to the base; third feebly confluent posteriorly with eighth, fourth with seventh, and fifth with sixth; interstices two to five times as wide as striae; first to sixth striae smooth dorsally; seventh to the margin of elytron strongly punctured; ninth stria very distinct on anterior side.

Female adult. Length 27.0 to 31.0 mm.; width 10.5 to 12.0 mm. Similar to male except setae on front femur much less and on front tibia much shorter.

Male genitalia. Two males were dissected. Phallobase strongly punctured dorsoanteriorly, bearing no setae. Dorsal cleft of phallobase narrowly convergent for three-fourths of its length. Sides of cleft abruptly and widely divergent posteriorly. Dorsal split

of phallobase as long as contiguous area between dorsal cleft and split. Ventral sclerites strongly curved at sides to anterior end, lying slightly diagonal to phallobase, bearing minute brown setae both anteriolaterally and anteriorly. Tegminal plate subcordate, with distinct posterior emargination, sides of plate abruptly narrowing to tegminal apodeme. Dorsal keel small, narrowed, extending to posterior margin of plate. Tegminal sclerite ventrally subrectangular, extending for four-fifths length of tegminal base; on dorsal side diagonal trapezoid, extending for two-thirds length of tegminal base. Aedeagus nearly truncate distally; on ventral side, broadly and deeply concave posteriorly. Aedeagal fenestra oval distally, narrowing for one-third distance from posterior end, then broadened and concave posteriorly. Aedeagal valve sharply triangular, extending distally. Orifical plates elongate, heavily sclerotized. Aedeagal chamber broad at base, strongly curved posteriorly, extending more than one-third length of aedeagal apodemes.

Female genitalia. Three females were dissected. Vaginal base feebly punctured and with very minute setae anteriolaterally. Dorsal cleft of vaginal base narrowly convergent for less than one-half then fused and extending for two-thirds its length anteriorly, again split to anterior end of base. Sides of cleft widely divergent posteriorly. Spiculum ventrale shorter than vaginal base. Spiculum

fenestra triangular, less than one-fourth length of spiculum ventrale and opened distally. Vaginal plate broadly oval, with two weakly sclerotized plates lateroanteriorly. Spermatheca narrowed, strongly curved, with one distinct ventral lobe and somewhat flat dorso-anteriorly; abruptly and highly elevated to base of spermathecal gland.

Measurements. The measurements given on the following page were taken from the specimens of the type-series. Measurements of the holotype and allotype are also given.

Discussion

A discussion of the differences between closely related species is discussed under artornitipae. The biology and immature stages are not available during this study.

Type Locality

S. Paulo de Olivenca, Brazil.

Types and Location

Holotype, male, S. Paulo de Olivenca, Brazil, S. Klages, April 1923, Carn. Mus. Acc. 7324, in excellent condition. Allotype same data as holotype; allotype lacks right middle tarsus and left hind claw. Both types will be returned and placed in the Carnegie

	Holotype Male mm.	Allotype Female mm.	Male		Female	
			mm.		mm.	
			Mean	Range	Mean	Range
Body length	32.00	31.00	31.00	30.00-32.00	29.33	27.00-31.00
Body width	13.00	12.00	12.50	12.00-13.00	11.50	10.50-12.00
Elytron length	17.20	16.00	16.85	16.50-17.20	15.77	14.50-16.80
Elytron width	6.50	6.00	6.25	6.00- 6.50	5.75	5.25- 6.00
Pronotum length	12.80	11.60	12.50	11.30-12.80	11.03	10.50-11.60
Pronotum width	10.90	10.00	10.55	10.20-10.90	9.13	8.50-10.00
Rostrum length	11.00	11.00	10.50	10.00-11.00	10.07	9.00-11.00
Rostrum length before antennal scrobe	7.20	7.20	6.85	6.50- 7.20	6.77	6.10- 7.20
Scape length	4.50	4.50	4.40	4.30- 4.50	4.30	4.00- 4.50
Funicle length	2.40	2.60	2.45	2.40- 2.50	2.50	2.40- 2.60
Club length	1.00	1.10	1.05	1.00- 1.10	1.03	1.00- 1.10
Club width	1.70	1.60	1.75	1.70- 1.80	1.50	1.40- 1.60

Museum, Pittsburgh, U. S. A.

Paratypes, one male, same data as holotype except collected in January 1923 (CM), will be retained and placed in the Entomological Museum, Department of Agriculture, Bangkok, Thailand; one female, same data as holotype except collected in March 1923 (CM); one female, Amazonas, Brazil, Benjamin Constante, Rio Javary, March 1942, Augus Rabaut Collector (AMNH).

Distribution

Known only from the specimens of the type-series. This species is found in Brazil.

Total specimens upon which the description is based	5
Males	2
Females	3

Collecting dates: January to April.

This species is named after Miss Rebecca Ann Blickenstaff who has been helpful in the present study.

Dynamis rockefelleri New Species

Figs. 36, 46-47, 159-160, 228, 266-267, 298-299, 325, 348, 448-450, 496-499, 549, 567, 605-607.

Description

Adult male. Length 44.5 to 47.0 mm.; width 17.5 to 19.0 mm. Body black, oval, shining both dorsally and ventrally.

Rostrum shorter than pronotum, stout, strongly compressed; viewed laterally, slightly arcuate at apex, broad at base with almost uniform width to apex, strongly punctured on basal half, diffusely punctured on apical half; two small carinae extending from base of mandible to anterior end of antennal scrobe; rostrum dorsally dilated at apex; epistoma with distinct rounded median projection anteriorly and gradually curved laterally; ventral side of rostrum narrower than dorsal side and strongly punctured; gular suture broadened near the base of rostrum; area between antennal scrobes with several punctures, setae absent; submentum concave anteriorly, gradually curved at side and narrowing posteriorly, median depression oval with small groove extending to join gular suture; lateral arm of hypostoma broadly sickle-shaped, less pointed anteriorly.

Mouthparts black except pleurostoma dark brown; mandible nearly two-thirds width of tip of rostrum, broadened with distal half depressed; base of mandible strongly convex; maxilla usually brownish-black.

Antennal scrobe deep, broad, and widely opened posteriorly; scape slightly more than one-third length of rostrum;

second to fifth funicular segments short, subequal, conical; sixth longer and a little wider than second, with two dorsal and two or three ventral setae; antennal club broad, subtriangular with three to six dorsal and five to seven ventral setae, inner side of spongy area with five to eight setae.

Head shining, strongly punctured, interocular space as described for borassi, frons strongly punctured.

Pronotum black, longer than wide, shining, strongly curved at sides and narrowed to apex; setae beneath the posterior border of pronotum extending to base of scutellum and first striae; minutely punctured dorsally and strongly dorsolaterally from base to apex. Thoracic sternum and legs as described for borassi.

Scutellum small, subtriangular, with a smooth, high and very distinct lanciform median ridge; posterior end covered with setae.

Elytra wider or as long as pronotum; elytron two and one-half times its own width; posterior border of elytron slightly emarginate; sutural striae prolonged to the base except the fifth stria; first stria almost confluent anteriorly with second; third feebly confluent posteriorly with eighth; fourth strongly confluent posteriorly with fifth; sixth feebly confluent both anteriorly and posteriorly with seventh; interstices three to five times as wide as striae, flat at base and gradually convex to apex, sparsely punctured throughout the

length of the interstices dorsally.

Abdomen and pygidium as described for borassi except fifth abdominal sternite without lateral setae; pygidium more strongly punctate and more convex dorsally.

Adult female. Known only from allotype. Length 40 mm.; width 15 mm. Similar to male except rostrum shorter, and less dilated at apex; pronotum much narrower anteriorly; fewer setae on ventral side of front and middle femora, especially on front femur present only proximally; setae on front tibia one-third as long as on the male; pygidium narrowed and more pointed at apex.

Male genitalia. Two male paratypes were dissected. Phallobase strongly punctured at distal end. Dorsal cleft of phallobase narrowly convergent for about two-thirds its length. Sides of cleft gradually divergent. Dorsal split of phallobase three or four times longer than contiguous area between dorsal cleft and split. Ventral sclerites suboval, curved on innersides, lying longitudinally to phallobase, bearing setae anteriorly. Tegminal plate subcordate, shallowly emarginate posteriorly; tegminal apodeme bent laterally; dorsal keel extending to posterior border of plate. Tegminal sclerite narrowly split ventrally; on dorsal side narrowed and extending laterally to near middle then abruptly turned anteriorly to three-fourths length of tegminal base. Aedeagus broadly oval distally; on ventral side widely emarginate proximally; arms joining

aedeagal apodemes. Aedeagal fenestra nearly pointed distally and deeply concave with sides of fenestra strongly curved proximally. Orifical plates heavily sclerotized, between plates with knob-like aedeagal valve. Valve extending to distal end of aedeagus. Aedeagal chamber oval, extending one-third length of aedeagal apodemes.

Female genitalia. The allotype was dissected. Vaginal base strongly punctured both distally and ventrolaterally; with long, slender setae dorsodistally and ventrolaterally. Dorsal cleft of vaginal base gradually narrowing distally. Sides of cleft widely and uniformly divergent forming a triangle. Spiculum ventrale four-fifths length of vaginal base and somewhat truncate posteriorly. Vaginal plate subtriangular with two lateral lobes posteriorly. Spermatheca with four distinct ventral lobes and a pointed projection posteriorly; with distinct sinuate ridge at base of spermathecal gland where joined by spermatheca.

Measurements. The following measurements were taken from the type material. Measurements of the holotype and allotype are given separately.

	Holotype Male mm.	Allotype Female mm.	Male mm.	
			Mean	Range
Body length	44.50	40.00	45.33	44.50-47.50
Body width	17.50	15.00	18.00	17.50-19.00
Elytron length	23.00	20.00	22.83	21.50-24.00
Elytron width	8.75	7.50	9.00	8.75- 9.50
Pronotum length	19.00	16.00	19.00	19.00
Pronotum width	15.00	13.00	15.33	15.00-16.00
Rostrum length	15.50	13.00	15.50	15.00-16.00
Rostrum length before antennal scrobe	10.00	9.00	10.00	10.00
Scape length	6.50	5.00	6.33	6.00- 6.50
Funicle length	3.80	3.00	3.70	3.50- 3.80
Club length	1.50	1.20	1.47	1.40- 1.50
Club width	2.00	1.80	1.80	1.90- 2.00

Discussion

This species resembles borassi but is readily distinguished from borassi by its dorsally dilated rostrum at apex, distal half of the mandible broader and more strongly depressed medially, pronotum more convex, shining; and many differences in both male and female genitalic structures. It also differs from all other species in having antennal scrobe opened ventrally, wider interocular space,

and wider body.

The biology and immature stages are unknown.

Type Locality

Both holotype and allotype from Sara Province, Bolivia.

Types and Location

Holotype, male, Prov. del Sara, Bolivia, Steinbach Coll., C. M. Acc. 5043, Dec. 1912; Allotype, female, Buena Vista, E. Bolivia, J. Steinbach, Acc. 5572. Holotype with left front tarsus lacking; allotype in excellent condition. Both holotype and allotype will be returned and placed in the Carnegie Museum, Pittsburgh, U. S. A.

Paratypes, one male, same locality and collected with holotype, will be retained by the writer and placed in the Entomological Museum, Department of Agriculture, Bangkok, Thailand; one male, Buenavista, Santa Cruz, Bolivia, 1700 ft. Elv., J. Steinbach, III-IV 1923 (PANS).

All the above data followed the sequence on the labels attached to the specimens.

Distribution

Known only from the specimens of the type-series. This

species is found in eastern Bolivia.

Total specimens upon which the description is based	4
Males	3
Females	1

Collecting dates: March to December

Elevation: Up to 1700 feet.

This species is named in honor of the late John D.

Rockefeller.

Genus *Rhynchodynamis* Heller

Rhynchodynamis Heller, 1906, Settin. Ent. Zeit., 67(1):49-50, t. 1,
fig. 11.

Description of the Genus

Adult male. Length 52 mm., width 21 mm. Color black, shining. Rostrum long, one-third longer than pronotum, filiform, polished, compressed; rostral setae absent. Antenna with long, slender scape, nearly one-fifth the length of rostrum; funicular segments slender, elongate. Pronotum narrowly and strongly constricted anteriolaterally; base broad and produced posteriorly. Scutellum small, short, one-eighth length of elytron. Elytra flat, wider than pronotum, length of each elytron two and one-half times

its own width; each with five deep striae and striae at side absent or obsolete. Front and middle femora curved ventrally. Third tarsal segment broadly dilated, four-fifths of entire area beneath covered with soft brown setae. Ratio of width to length of phallobase 1:1.9.

Adult female. Length 52 to 56 mm., width 20 to 23 mm.

Similar to male except rostrum one-half longer than pronotum, setae on front femur absent, on front tibia one-half time shorter than the male. Ratio of width to length of vaginal base 1:2.1. Spermatheca with highly elevated dorsal lobe, where spermathecal gland connects.

Type Locality

Chuchuras, Amazonas, Brazil.

Types and Location

The subgenus Rhynchodynamis is elevated to generic rank at this study. Type hereby designated Dynamis (Rhynchodynamis) filirostris Heller, 1906, as the type species. The type is in the Faust Collection in Dresden Museum, East Germany. Type was collected by Eckhardt in 1888, No. 18409.

Discussion

A single species of this genus has been described from Brazil. Diagnostic characters for the genus are: rostrum filiform,

one-third longer than pronotum; rostrum polished, smooth, rostral setae absent; antennal scape one-fourth to one-fifth length of rostrum; funicular segments slender, elongate; and spermatheca with highly elevated dorsal lobe.

The larva and pupa are unknown and nothing is known about the biology of the genus.

Rhynchodynamis filirostris Heller

Figs. 6, 32, 42, 147-148, 170, 193, 211, 224, 238, 256-257, 296-297, 332-333, 350-351, 374, 463-465, 519-525, 550, 574.

Dynamis (Rhynchodynamis) filirostris Heller, 1906, Stettin. Ent. Zeit., 67(1):49-50, t. 1, fig. 11.

Description

Adult male. Length 52 mm.; width 21 mm. Body broadly oval, flat dorsally, convex ventrally, deep black, both dorsum and venter shining.

Rostrum filiform, slender, one-third longer than pronotum, smooth; in profile straight, strongly compressed, slightly broadened at base and gradually tapering to apex, convex ventrally at tip; viewed dorsally slightly broadened at base and gradually tapering to apex; epistoma depressed posteriorly; ventrally smooth, with small thin subequal lateroanteriorly grooves from base of mandibles and

confluent with gular suture about one-half of rostrum; gular suture narrowly extending to base of rostrum; antennal scrobes widely opened ventrally, area between scrobes smooth and abruptly narrowed posteriorly; submentum spatular, slightly concave anteriorly; lateral arm of hypostoma triangular and sharply pointed anteriorly; mandibular scrobe quadrate and opened anteriorly; maxillary scrobe triangular and opened anteriorly.

Mouthparts black, mandible two-thirds width of tip of rostrum, rounded anteriorly with deep depression medially; pleurostoma quadrate; maxilla black, small.

Antenna arising laterally from scrobe near base of rostrum; scrobe moderately deep, one-third width of rostrum at base, widely opened ventrally; scape slender, elongate, as long as funicle and club combined or equal to one-fourth length of rostrum; funicle with six segments, first funicular segment as long as or slightly longer than next two segments combined; second and third short, subequal, conical; fourth and fifth subequal both in length and size, longer than second or third, but shorter than sixth; sixth conical, broader than first but subequal in length, with two dorsal and four ventral setae; antennal club subtriangular with five dorsal and two ventral setae, inner side of spongy area with three setae.

Head shining, bulbous, smooth, posterior lobe broadly triangular, with small interocular sulcus; interocular space narrowed,

nearly one-third width of rostrum at base; frons smooth, occiput concealed in pronotum, genae smooth, black.

Pronotum black, flat, shining, longer than wide, narrowed to apex and constricted anteriolaterally, base produced posteriorly, beneath posterior edge fringed with dark brown hairs; smooth dorsally, sparsely and finely punctured at sides. In profile, margin convex ventrally; underside black, prosternum and mesosternum smooth; metasternum sparsely and diffusely punctured; prosternum elevated posteriorly; spinasternum extending over one-half of mesosternum with a longitudinal fossula posteriorly. Mesosternum widely emarginate posteriorly, glabrous; sides of prosternum, mesepisternum, and mesepimeron sparsely and diffusely punctured; metasternum subquadrate, large, basal area flat medially, curved upward laterally; metepisternum large, subrectangular, sparsely and diffusely punctured, lateral margin straight and parallel to elytron; metepimeron small, triangular, sparsely and diffusely punctured, outer margin parallel to elytron.

Legs black, with strong punctation; fore coxae separated by distance equal to one-third width of a coxa, bulbous, almost rounded, diffusely punctured, hairs absent; middle coxae subequal in size to front coxae, more strongly punctured; hind coxae elliptical, widely separated. All trochanters triangular, pointed distally; front femur thick, broad distally, strongly curved ventrally; middle femur

curved ventrally but less than front femur; hind femur straight ventrally; all femora subequal in length; front tibia as long as front femur, quite curved, strongly punctured on inner side but diffusely punctured on outer side; middle and hind tibiae subequal both in size and length; both diffusely punctured; all tibiae tapering distally and each with long, thick, recurved uncus; sub-uncus absent; tarsus four segments; first segment elongate, broadened distally, three times as long as second; third segment broadly dilated, four-fifths of entire area beneath covered with matted brown setae distally; fourth segment elongate, shorter than first three tarsal segments combined, with seven to nine slender setae scattered beneath; two simple movable claws. Brownish-black setae ventral side of front and middle femora, tibiae, and first three tarsal segments. Hind femur with few brownish-black setae proximally; setae on first tibia twice as long as setae on other tibiae, but as long as setae on front and middle femora.

Scutellum small, triangular-elongate, smooth, anterior half flat, with median carina posteriorly, one-eighth length of elytron.

Elytra smooth, wider than pronotum; elytron two and one-half times its own width; slightly convex at side basally, gradually concave for about one-half its length and then tapering distally; each with five deep striae, striae at side absent; sutural stria more or less prolonged to base, fourth stria confluent posteriorly with fifth;

interstices two to four times as wide as striae, somewhat convex dorsally.

Abdomen completely black, ventrally convex, with five segments; first abdominal sternite medially fused with and slightly wider than second; the latter as long as third and fourth combined; fifth sternite broad, subtriangular, fringed on each side with a row of thick, long, dark brown setae and without apical emargination, diffusely punctured dorsolaterally.

Pygidium black, triangular; sparsely punctured, without setae laterally; pygidium slightly wider but less pointed than in female.

Adult female. Length 52 to 56 mm.; width 20 to 23 mm.

Similar to male except rostrum one-half longer than pronotum, front femur not strongly curved and setae lacking; setae on front tibia one-half time shorter than the male; pygidium narrowed and more pointed at apex.

Male genitalia. One male was dissected. Dorsal cleft of phallobase triangular medially for about two-thirds its length; dorso-laterally covered with setae. Sides of cleft abruptly diverging. Dorsal split of phallobase absent. Ventral sclerites subrectangular and lying longitudinal to phallobase, bearing few setae anteriorly. Tegminal plate triangular, sinuate at sides; dorsal side of the tegminal apodeme with dorsal keel extending parallel on tegminal

apodeme for about one-half length of plate. Tegminal sclerite broad, nearly triangular ventrally, with sinuate posterior edge; on dorsal side, sclerite irregular in shape and somewhat pointed and extending anteriorly for about two-thirds length of tegminal base. Aedeagus nearly pointed distally and emarginate proximally, lateral arms somewhat cylindrical, not joining aedeagal apodemes. Aedeagal fenestra spatulate, nearly truncate distally then narrowly converging and again diverging proximally. Orifical plates heavily sclerotized. Aedeagal chamber elongate-oval, extending for about one-fourth length of aedeagal apodemes.

Female genitalia. Two females were dissected. Dorsal cleft of vaginal base narrowly convergent to anterior end of vaginal base. Sides of cleft abruptly divergent and widely opened posteriorly. Vaginal base with distinct membranous area along posterior margins. Spiculum ventrale three-fourths as long as length of vaginal base. Spiculum fenestra elliptical, one-seventh as long as its length and closed distally. Spermatheca with base of spermathecal chamber highly elevated; truncate anteriorly, rounded posteriorly, and without distinct ventral lobe.

Egg. Pale yellow, smooth, not shining, slender-cylindrical with rounded ends, broader at the anterior end; averaging 1.1 by 3.5 mm.; chorion and vitelline membrane indistinguishable.

Measurements. The following measurements were taken

from one male from Sara, Bolivia; three females from Buena Vista, Bolivia; and one female from Santa Cruz, Sara, Bolivia.

	Male mm.	Female mm.	
		Mean	Range
Body length	52.00	54.75	52.00-56.00
Body width	21.00	21.75	20.00-23.00
Elytra length	26.00	28.00	27.00-29.00
Elytra width	10.50	10.88	10.00-11.50
Pronotum length	21.00	22.25	20.00-23.00
Pronotum width	18.00	18.88	17.50-20.00
Rostrum length	29.00	31.88	27.50-34.00
Rostrum length before antennal scrobe	20.00	25.25	22.00-27.00
Scape length	6.50	7.78	7.50- 8.00
Funicle length	5.00	5.75	5.00- 6.00
Club length	2.10	2.05	2.00- 2.20
Club width	2.00	2.05	2.00- 2.20

Discussion

In body shape this species is closely related to Dynamis borassi (Fabricius). It is easily distinguished by its rostrum, antenna, and body size. The rostrum is much longer than the pronotum, the funicular segments are elongate and the body is wider

than of D. borassi (Fabr.). Rhynchodynamis filirostris Heller is the largest of all species in the subfamily Rhynchophorinae or possibly the largest weevil in the world.

Except for the egg, no information is available on the immature stages or biology for this species.

Type Locality

Chuchuras, Amazonas, Brazil.

Types and Location

Holotype, sex undetermined, No. 18409, collected in 1888 by Eckhardt, in the collection of Faust, in Dresden Museum, Dresden, East Germany.

Distribution

Records taken from five specimens and from type locality (Heller, 1906) indicate that Rhynchodynamis filirostris Heller is found in western Brazil and eastern Bolivia.

Total specimens examined	5
Male	1
Females	4

Collecting dates: January to April.

Elevation: Up to 1700 feet.

BIBLIOGRAPHY

1. Anderson, W. H. 1947. A terminology of the anatomical characters useful in taxonomy of weevil larvae. *Proceedings of the Entomological Society of Washington* 49(5):123-132.
2. _____ . 1948. Larvae of some genera of Calendrinae (= Rhynchophorinae) and Stromboscerinae (Coleoptera : Curculionidae). *Annals of the Entomological Society of America* 41(4):413-437.
3. Anonymous. 1900. Another enemy of the sugar cane. *Bulletin of Miscellaneous Information, Royal Botanic Gardens, Trinidad* 25:289.
4. Anonymous. 1905. The coconut beetle. *Bulletin of Miscellaneous Information, Royal Botanic Gardens, Trinidad* 45:158-160.
5. Anonymous. 1915. Insect pests of coconuts. *Agricultural News, West Indies* 14(333):42-43.
6. Anonymous. 1933. The red weevil of coconuts. *Tropical Agriculturist, Ceylon* 81(4):261-265.
7. Anonymous. 1939. A handbook of Philippine agriculture. Philippine University. College of Agriculture. Manila. 803 p.
8. Anonymous. 1942a. Plagas y enfermedades de algunos cultivos, por la Seccion de Investigacion y Divulgacion. *Fitofilo* 1(1): 30-37.
9. Anonymous. 1942b. Plagas y enfermedades de algunos cultivos, por la Seccion de Investigacion y Divulgacion. *Fitofilo* 2(3): 104-112.
10. Ashby, S. F. 1921. Some recent observations on red ring disease of the coconut. *Agricultural News, West Indies* 20(508):334; 20(509):350-351.
11. Ashby, S. F. and W. Nowell. 1924. Red ring disease of coconuts. In: *Proceedings of the IXth West Indies Agricultural Conference, Jamaica*. p. 164-172.

12. Bain, F. M. and S. A. Fédon. 1951. Investigations sobre anillio rojo del cocotero. *Agronomia Tropical* 1:103-130.
13. Baker, E. W. and G. W. Wharton. 1950. An introduction to acarology. New York, Macmillan. 465 p.
14. Ballou, H. A. 1912. Insect pests of the Lesser Antilles. Department of Agriculture, West Indies, Pamphlet ser. 71: 103-109.
15. Banks, C. S. 1906. The principal insects injurious to the coconut palm (part I). *Philippine Journal of Science* 1(2): 145-167.
16. Bare, C. O. 1929. Rhynchophorus cruentatus Fabr., the palmetto weevil, attracted to automobile paint. *Journal of Economic Entomology* 22(6):986.
17. Barrett, O. W. and D. B. Mackie. 1912. Coconut pests. *Philippine Agricultural Review* 5(5):254-261.
18. Batista, A. C. 1948. O anel vermelho do coqueiro a fumigação do solo com D-D. *Boletim da Secretaria de Agricultura, Industria e Comercio do Estado de Pernambuco* 15(314): 356-387.
19. Belanger, M. C. 1834. *Voyage aux Indes-Orientales, ...* Paris, M. C. Belanger, 535 p.
20. Beutenmuller, W. 1890a. On the food-habits of North American Rhynchophora. *Canadian Entomologist* 22(1):200-203.
21. _____ . 1890b. On the food-habits of North American Rhynchophora. *Canadian Entomologist* 22(12):258-261.
22. _____ . 1893a. On the food-habits of North American Rhynchophora. *Journal of the New York Entomological Society* 1(1):36-43.
23. _____ . 1893b. On the food-habits of North American Rhynchophora. *Journal of the New York Entomological Society* 1(2):80-88.

24. Bianchi, F. A. 1935. Notes and exhibitions of the 354th meeting of the Hawaiian Entomological Society. Proceedings of the Hawaiian Entomological Society 9(1):133-137.
25. Bissel, T. L. 1937. Structure of the reproductive system of the pecan weevil. Annals of the Entomological Society of America 30(2):242-251.
26. Blackwelder, R. E. 1947. Checklist of the coleopterous insects of Mexico, Central America, the West Indies, and South America. United States National Museum, Smithsonian Institution, Bulletin 185(5):765-925.
27. Blanchard, E. 1845. Histoire naturelle des insectes. Vol. 1, Paris, E. Blanchard. 398 p.
28. Blandford, W. F. H. 1893. Palm weevil in British Honduras. Kew Bulletin 74-75:27-60.
29. Blatchley, W. S. 1925. Notes on the Rhynchophora of Eastern North America with description of new species, III. Journal of the New York Entomological Society 33:87-133.
30. Blatchley, W. S. and C. W. Leng. 1916. Rhynchophora or weevils of North Eastern America. Indianapolis, Nature Publishing Company. 682 p.
31. Boheman, C. H. 1845. Genus 598 - Rhynchophorus on familia Curculionides. In: C. J. Schoenherr's Genera et species Curculionidum. Vol. 8, no. 2. Paris, Fred. Fleicher. p. 216-219.
32. Bondar, G. 1921. Insectos daminhos e molestias do conqueiro (Cocos nucifera) ma Brazil. Brazil Museua Annals, Bahia. p. 2-48.
33. Bondar, G. 1939. O conqueiro (Cocos nucifera L.) no Brazil. Instituto Central de Fomento Economico da Bahia, Boletim 7:1-100.
34. Bondar, G. 1940. Insectos nocivos e molestias do coqueiro (Cocos nucifera) no Brazil. Instituto Central de Fomento Economico da Bahia, Boletim 8:1-160.

35. Bondar, G. 1941. Notes entomologicas da Bahia VII. Revista de Entomologia, Rio de Janeiro 12(1/2):268-303.
36. Bosq, J. M. 1934. Primera lista de los Coleopteros de la Republica Argentina daninos a la Agricultura. Boletin del Ministerio de Agricultura, Buenos Aires 36(4):313-344.
37. Böving, A. G. and F. C. Craighead. 1930. An illustrated synopsis of the principal larval forms of the order Coleoptera. Entomologica Americana 11(1):1-351.
38. Bowdman, C. A. 1888. An enemy to the date palm in Florida. Insect Life 1:14.
39. Box, H. E. 1951. The history and changing status of some neotropical insect pests of sugar cane. In: Transactions of the IXth International Congress of Entomology, Amsterdam, 1951. p. 254-259.
40. Brown, L. C. 1903. Coconut beetles. Agricultural Bulletin, Straits and Federated Malay States 2(2):65-67.
41. Bruhn, A. F. 1947. The external genitalia of some Rhynchophora. Great Basin Naturalist 8(1-4):1-35.
42. Bunting, B. 1928. Division of Agriculture, annual report for 1927. Malayan Agricultural Journal 16(4):92-108.
43. Bunting, B. 1930. Coconut cultivation in Ceylon. Malayan Agricultural Journal 18:378-390.
44. Bunting, B. and C. D. V. Georgi. 1924. Oil palm in Malaya. Malayan Agricultural Journal 12(6-7):145-153.
45. Burkill, I. H. 1913. The coconut beetle, Oryctes rhinoceros and Rhynchophorus ferrugineus. Straits Settlements Garden Bulletin, ser. 3, 1(6):176-189.
46. Burkill, I. H. 1917. Scolia erratica Smith, a parasite of the red coconut weevil, Rhynchophorus ferrugineus. Straits Settlements Garden Bulletin, ser. 3, 1(11-12):399-400.
47. Busck, A. 1902. Report of an investigation of diseased coconut palms in Cuba. U. S. Department of Agriculture, Division of Entomology. Bulletin 38:20-23.

48. Campos, F. 1926. Notas biológicas sobre algunos insectos cautivos. Revista del Colegio Nacional Vicente Rocafuerte Guayaquil 8(23-24):3-13.
49. Candèze, M. E. 1861. Histoire des metamorphoses de quelques coléoptères exotiques. Mémoires de la Société Royale des Sciences de Liège 16:325-410.
50. Castelnau, Le Comte de. 1840. Histoire naturelle des insectes coléoptères. Vol. 2. Paris, P. Dumenil. 563 p.
51. Cater, B. A. R. 1925. Insects on African oil palms. Malayan Agricultural Journal 13(8):250-256.
52. Champion, G. C. 1910. Curculionidae : Calandrinae; appendix Curculioninae. Biologia Centrali Americana 4(7):79-212.
53. Chapuis, M. F. and M. L. Candèze. 1853. Catalogue des larves des coléoptères, connues jusqu'a ce jour avec la description de plusieurs espèces nouvelles. Mémoires de la Société Royale des Sciences de Liège 8:341-622.
54. Chevrolat, L. A. A. 1880. Diagnoses de Rhynchophorides de la Guadeloupe. Le Naturaliste 2(39):315-316.
55. Chevrolat, L. A. A. 1882a. Séance du 23 Aout 1882. Bulletin de la Société Entomologique de France 2:137-140.
56. _____ . 1882b. Calandrides nouveaux genres et nouvelles espèces, observations, synonymies, doubles emplois de noms de genres d'espèces 1^{re} partie. Annales de la Société Entomologique de France, ser. 6, 2:555-582.
57. Chittenden, F. H. 1902. The palm and palmetto weevils. U. S. Department of Agriculture, Division of Entomology. Bulletin 38:23-28.
58. Cobb, N. A. 1919. A newly discovered nematode, Aphelenchus cocophilus n. sp., connected with a serious disease of the coconut palm. West Indian Bulletin 17(4):203-210.
59. Cobb, N. A. 1922. Notes on the coconut nema of Panama. Journal of Parasitology 9:44-45.

60. Copeland, E. B. 1931. The coconut. 3d. ed. London, Macmillan. 233 p.
61. Corbett, G. H. 1923. Annual report of the government entomologist for 1922. *Malayan Agricultural Journal* 11(10):273-284.
62. Corbett, G. H. 1928. Division of Entomology, annual report for 1927. *Malayan Agricultural Journal* 16(4):136-140.
63. Corbett, G. H. 1932. Insects of coconuts in Malaya. Kuala Lumpur. 106 p. (Straits Settlements & Federated Malay States. Department of Agriculture. Bulletin General Series no. 10)
64. Corbett, G. H. and H. T. Pagden. 1941. A review of some recent entomological investigations and observations. *Malayan Agricultural Journal* 29:345-375.
65. Corbett, G. H. and D. Ponniah. 1923. Summary of observation on Rhynchophorus schach Oliv. the "red striped" weevil of coconuts. *Malayan Agricultural Journal* 11(4):79-88.
66. _____ . 1924. "Red stripe" weevil of coconuts (Rhynchophorus schach, Oliv.) Kuala Lumpur 51 p. (Straits Settlement & Federated Malay States. Department of Agriculture, Bulletin no. 36)
67. Cotton, R. T. 1924. A contribution toward the classification of the weevil larvae of the subfamily Calandrinae, occurring in North America. *Proceedings of the United States National Museum* 66(5):1-10.
68. Csiki, E. 1936. Curculionidae: Rhynchophorinae, Cossoninae. 's-Gravenhage, W. Junk. (Coleopterorum Catalogus, ed. by S. Schenkling. Part 149)
69. Dammerman, K. W. 1929. The agricultural zoology of the Malay Archipelago. Amsterdam, J. H. Bussy. 493 p.
70. Delgado, A. M. 1960. Plagas y enfermedades del cocotero. *Fitofilo* 13(28):4-13.
71. Degeer, C. 1775. *Memoiries pour servir a l'histoire des insects*. Vol. 5. Stockholm. 448 p.

72. Deshpande, V. G. and K. K. Karandikar. 1948. Insect pests of fruit and fruit-tree in the Deccan. *Journal of the University of Bombay* 16(5):1-14.
73. Dick, J. 1937. Oviposition in certain Coleoptera. *Annals of applied biology* 24(4):762-796.
74. Emden, F. I. van. 1938. On the taxonomy of Rhynchophora larvae (Coleoptera). *Transactions of the Royal Entomological Society of London* 87:1-37.
75. Erichson, W. F. 1847. *Conspectus insectorum coleopterorum quae in Republica Peruana observata sunt*. *Archiv für Naturgeschichte* 13:67-185.
76. Fabricius, J. C. 1775. *Systema entomologiae, ... Flensburgi et Lipsiae, in Officina Libraria Kortii*. 832 p.
77. _____ . 1781. *Species insectorum... Vol. 1. Hamburgi & Kilonii, C. E. Bohnii*. 522 p.
78. _____ . 1787. *Mantissa insectorum... Vol. 1. Hafniae, C. G. Proft*, 348 p.
79. _____ . 1792. *Entomologia systematica emendata et aucta, ... Vol. 1, part 2. Hafniae, C. G. Proft*. 538 p.
80. _____ . 1801a. *Systema eleutheratorum... Vol. 1. Kiliae, Bibliopolii Academici novi*. 687 p.
81. _____ . 1801b. *Systema eleutheratorum... Vol. 2. Kiliae, Bibliopolii Academici novi*. 506 p.
82. Fähræus, O. I. von. 1845. *Rhynchophorus zimmermanni* (Germar). In: C. J. Schoenherr's *Genera et species Curculionidum*. Vol. 8, no. 2. Paris, Fred. Fleicher. p. 219-220.
83. Fairmaire, L. 1877. Diagnoses de coléoptères de la nouvelle-bretagne. *Petites Nouvelles Entomologiques* 2:185-186.
84. Fairmaire, L. 1879. Descriptions de coléoptères nouveaux ou peu connus du Musée Godeffroy. *Journal des Muséum Godeffroy* 14:80-114.

85. Fairmaire, L. 1883. Essai fur les coléoptères de l'archipel de la nouvelle-bretagne. Annales de la Société Entomologique de Belgique 27:1-58.
86. Falcoz, L. 1926. Materiaux pour l'étude des larves de curculionides. Annales des Epiphyties et de Phyto-géné-tique 12:109-129.
87. Faust, J. 1892. Contributions a la faune Indochinoise, Curculionidae, Brenthidae. Annales de la Société Entomologique de France 61:505-522.
88. Faust, J. 1894. Viaggio di leonardo fea in Birmania e regioni vicine (Curculionidae von Birma). Annali del Museo Civico di Storia Naturale di Genova 14(34):153-370.
89. Faust, J. 1899a. Curculioniden aus dem Congo gebiet in der Sammlung des Brusseler koniglichen museums. Annales de la Société Entomologique de Belgique 43:388-436.
90. Faust, J. 1899b. Viaggio di lamberto loria nella papuasias orientalis (Curculionidae von Neu Guinea). Annali del Museo Civico di Storia Naturale di Genova 20(40):5-130.
91. Fenwick, D. W. 1957. Colonial Office Report No. 40617. Trinidad and Tobago. (quoted from E. A. C. Hagley 1963).
92. Fenwick, D. W. 1958. Red ring of coconuts a problem for the nematologist. Indian Coconut Journal 12(3-4):82-86.
93. Fenwick, D. W. 1962. The entomological aspects of red-ring disease. Journal of the Agricultural Society of Trinidad and Tobago 42(2):265-281.
94. Fenwick, D. W. and S. Mohammed. 1961. The presence of Rhadinaphelenchus cocophilus (Cobb 1919) Goodey, 1960, on the body of the palm weevil Rhynchophorus palmarum (L.). Trinidad and Tobago Coconut Research Ltd., 1961. 10 p.
95. _____ . 1963. Weevil control of red-ring. Journal of the Agricultural Society of Trinidad and Tobago. 43:13-15.
96. Ferguson, J. 1885. All about the coconut palm. Colombo, Ceylon (quoted from W. F. H. Blandford 1893).

97. Ferrira Lima, A. D. and H. M. Da Cruz. 1945. O anel vermelho do coqueiro. Boletim Fitosanitario 2:87-114.
98. Filipjev, I. N. and J. H. Schuurmans-Stekhoven Jr. 1941. Manual of agricultural helminthology. Leiden, E. J. Brill, 878 p.
99. Fletcher, T. B. 1914. Some south Indian Insects and other animals of importance, considered especially from an economic point of view. Madras. 565 p.
100. Forbes, W. T. M. 1922. The wing-venation of the Coleoptera. Annals of the Entomological Society of America 15(4):328-352.
101. _____ . 1926. The wing folding patterns of the Coleoptera. Journal of the New York Entomological Society 34(1):42-68; 34(2):91-140.
102. Froggatt, J. L. 1936a. Entomological notes. New Guinea Agricultural Gazette 2:10.
103. _____ . 1936b. Coconut pest. New Guinea Agricultural Gazette 2:18.
104. Froggatt, W. W. 1914. Pests and diseases of the coconut palm. Sydney. 63 p. (New South Wales. Department of Agriculture. Science Bulletin no. 2)
105. Gerstaecker, A. 1862. Rhynchophorus. In: W. C. H. Peters's Naturwissenschaftliche Reise nach Mossambique... Berlin, 566 p.
106. Ghosh, C. C. 1912. Life-histories of Indian insects - III. The rhinoceros beetle (Oryctes rhinoceros) and the red or palm weevil (Rhynchophorus ferrugineus). Memoires of the Department of Agriculture in India 2(10):193-217.
107. Ghosh, C. C. 1937. The palm beetles in Burma with notes on other pests. Bulletin of the Department of Agriculture, Burma 19:1-40.
108. Ghosh, C. C. 1940. Insect pests of Burma. Rangoon, Superintendent of Government Printing and Stationery. 216 p.

109. Gilbert, E. E. 1952. The homologies of the male genitalia of the Rhynchophora and allied Coleoptera. *Annals of the Entomological Society of America* 45(4):633-637.
110. Gilbert, E. E. 1964. The genus Baris Germar in California. *University of California Publications in Entomology* 34:1-153.
111. Gmelin, J. F. 1790. Curculio palmarum. In: C. Linnaeus's *Systema naturae*. 13th ed., vol. 1, part 4. Holmiae, L. Salvii, p. 1740-1741.
112. Good, H. G. 1925. Wing venation of Buprestidae. *Annals of the Entomological Society of America* 18(2):251-276.
113. Goodey, J. B. 1960. Rhadinaphelenchus cocophilus (Cobb, 1919) n. comb. the nematode associated with "Red-ring" disease of coconut. *Nematologica* 5:98-102.
114. Goonewardena, H. F. and M. S. Velu. 1958. The red palm weevil Rhynchophorus ferrugineus Ol. in Ceylon. I. Introduction, distribution and life history. *Ceylon Coconut Quarterly* 9(1-2):20.
115. Gorkum, N. van. 1916. The palm weevil (Rhynchophorus palmarum). *Boletim do Ministério da Agricultura, Indústria e Comercio, Rio de Janeiro* 5(2):59-75.
116. Gough, L. H. 1911. The palm weevil as a sugar cane pest. *Bulletin of the Department of Agriculture, Trinidad and Tobago* 10(67):59-64.
117. Gowdey, C. C. 1909-1910. Report of the government entomologist for the year 1909-1910. Report of the Government Entomologist, Uganda. 24 p.
118. Graham, S. A. 1922. A study of the wing venation of the Coleoptera. *Annals of the Entomological Society of America* 15(2):191-200.
119. Gronovius, L. T. 1763. *Zoophylacium gronovianum, ... Lugduni Batavorum*, 380 p.

120. Guérin-Méneville, F. E. 1844. Iconographie du règne animal de G. Cubier..., Vol. 7, Insects (1829-1838). Paris. 576 p.
121. Guilding, L. 1828. Insects affecting the sugar cane. Transactions of the Royal Society of Arts, London 46:143-153.
122. Guppy, P. L. 1911. Notes on some coconut pests. Proceedings of the Agricultural Society of Trinidad and Tobago 11(2): 164-171.
123. Gustafson, J. F. 1950. The origin and evolution of the genitalia of the insecta. Microentomology 15(2):35-67.
124. Gyllenhal, L. 1838. Genus 373 - Rhynchophorus in familia Curculionides. In: C. J. Schoenherr's Genera et species Curculionidum. Vol. 4, no. 2. Paris, Fred. Fleicher. p. 816-828.
125. Hagley, E. A. C. 1962. The palm weevil, Rhynchophorus palmarum (L.), a probable vector of red-ring disease of coconuts. Nature 193(4814):499.
126. _____ . 1963. The role of the palm weevil, Rhynchophorus palmarum, as a vector of red ring disease of coconuts. I. Results of preliminary investigations. Journal of the Economic Entomology 56(3): 375-380.
127. _____ . 1965. On the life history and habits of the palm weevil, Rhynchophorus palmarum. Annals of the Entomological Society of America 58(1):22-28.
128. Haller, G. 1885. Entomologische notizen. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 7(4):194-200.
129. Hargreaves, E. 1937. Some insects and their food-plants in Sierra Leone. Bulletin of Entomological Research 28: 505-523.
130. Harris, W. V. 1937. Annotated list of insects injurious to native food crops in Tanganyika. Bulletin of Entomological Research 28:483-488.

131. Heberdey, R. F. 1931. Zur entwicklungs geschichte, vergleichenden anatomie und physiologie der insekten. Zeitschrift für Morphologie und Ökologie der Tiere 22:416-596.
132. Heller, K. M. 1906. Neue rüsselkäfer aus Central-und Südamerika. Stettiner Entomologische Zeitung 67(1):3-50.
133. Henry, G. M. 1917. The coconut Red Weevil (Rhynchophorus ferrugineus). Tropical Agriculturist, Ceylon 48(4):218-219.
134. Herbst, J. F. W. 1784. Curculio palmarum. In: G. H. Borowski's Gemeinüzzige Naturgeschichte des Thierreichs. Vol. 6. p. 106-107.
135. Herbst, J. F. W. 1784-1785. Curculio palmarum. In: J. C. Füessly's Kritisches verzeichniss meiner insecten-sammlung. Archiv der Insectengeschichte. Vol. 5, p. 60.
136. Herbst, J. F. W. 1745. Natursystem aller bekannten in -und ausländischen insekten..., Käfer. Vol. 6. Berlin, K. Pauli. 520 p.
137. Hess, A. J. 1935. Scientific results of the Vernay-Lang Kalahari expedition, March to September 1930. Mutillidae (Hymenoptera), Tenebrionidae (Coleoptera), Hemiptera-Heteroptera, Curculionidae. Annals of the Transvaal Museum 17(1):49-62.
138. Heyne, A. and O. Taschenbert. 1908. Die exotischen Käfer in Wert und Bild. Curculionidae IV. Leipzig, G. Reusche. p. 233.
139. Hickey, J. B. 1891. Notes on the palm weevil. Insect Life 4:136-137.
140. Hicks, E. A. 1958. A new genus and species of diplogyniid from Nicaragua (Order Acarina, family Diplogyniidae). Iowa State College Journal of Science 33(2):103-110.
141. Hoffmann, W. E. 1937. Coleoptera collected by the Lingnan University Fifth Hainan Island Expedition, 1929. Lingnan Science Journal 16(4):631-637.

142. Hoffmann, W. E. 1938. Coleoptera and Hymenoptera from Kwangtung including Hainan Island. *Lingnan Science Journal* 17(3):439-460.
143. Hopkins, A. D. 1911. Contributions toward a monograph of the bark-weevils of the genus *Pissodes*. U. S. Department of Agriculture, Division of Entomology, Technical Series 20(1):1-68.
144. Horn, G. H. 1873. Contributions to a knowledge of the Curculionidae of the United States. *Proceedings of the American Philosophical Society* 13:407-469.
145. Horn, G. H. 1878. Descriptions of the larvae of the North American genera of cicindelidae also of *Dicaelus* with a note on *Rhynchophorus*. *Transactions of the Entomological Society* 7:28-40.
146. Hunger, F. W. T. 1920. *Cocos nucifera*; handbook voor der kennis van den cocos-palm in Nederlandsch-Indie, sijne geschiedenis, beschrijving, cultuur en producten. Tweede veel vermeerde druk. Amsterdam, Schiltema and Holkema's Boekhandel, 1920. 518 p.
147. Hustache, A. 1932. Curculionides de la Guadeloupe. *Faune des Colonies Françaises* 5:1-412.
148. Hustache, A. 1939. Spedizione del Prof. N. Beccari Nella Guiana Inglese (1931-32) Curculionidae. *Memorie del la Società la Entomologica Italiana* 17:39-43.
149. Hutson, J. C. 1930. Report on the work of the Entomological Division. (Ceylon Administration Reports Miscellaneous, Colombo. Section IV, p. D70-D77.)
150. Illiger, J. C. W. 1798. *Rhynchophorus*. In: J. G. Kugelann's Verzeichniss der Käfer Preussens, ausgearbeitet von Illiger. Halle, Johann Jacob. p. 498.
151. _____ . 1805. Zusätze, berichtigungen und bemerkungen zu Fabricii systema eleuthertorum. *Magazin für Insektenkunde* 4:69-174.

152. Iyer, C. S. V. 1940. Two interesting and unrecorded enemies of the palm beetle, Rhynchophorus ferrugineus. Indian Journal of Entomology 2(1):98.
153. Joffily, J. M. 1948. A doença do anel vermelho do coqueiro e sua ocorrência no Brazil. Rio de Janeiro. 64 p. (Boletim do Serviço Nacional de Pesquisas Agrônomicas, no. 3)
154. Jones, C. R. 1913. Entomological notes. Philippine Agricultural Review 6(5):246-250.
155. Kirby, W. and W. Spence. 1843. An introduction to entomology. 6th ed. London, Longman. p. 254.
156. Kirsch, T. F. W. 1877. Beiträg zur Kenntnis der coleopteren Fauna von New Guinea. Mittheilungen Staatliches Museum für Tierkunde und Volkerkunde, Dresden 2:135-161.
157. Knab, F. 1915. The secretions employed by Rhynchophorus larvae in cocoon making. Proceedings of the Entomological Society of Washington 17(3):154-158.
158. Kolbe, H. J. 1887. Beiträge zur Zoogeographie Westafrikas nebst einem Bericht über die Während der Loango-Expedition von Herrn Dr. Falkenstein bei Chinchoxo gesammelten Coleoptern. Nova Acta Acadimiae Caesareae Leopoldino Carolinae Germanicae Natural Curiosorum 1(3):153-364.
159. Kolbe, H. J. 1893. Einführung in die Kenntnis der insecten. Berlin, Ferd. Dummlers Verlagbuch Handlung. 709 p.
160. Krautwig, M. 1930. Untersuchungen am Kornkäfer (Calandra granarius L.). Der Bau der Geschlecht sorgane und ihre gegenseitigen Korrelationen. Zoologische Jahrbücher Abteilung für Anatomie und Ontogenie der Tiere 52:539-596.
161. Kuschel, G. 1955. Nuevas sinonimias y anotaciones sobre Curculionoidea (Coleoptera). Revista Chilena de Entomologia, Santiago 4:261-312.
162. Lacordaire, J. T. 1830. Mémoire sur les habitudes insectes coléoptères de l'Amerique méridionale. Annales des Sciences Naturelles 21:149-194.

163. Lacordaire, J. T. 1866. Histoire naturelle des insectes, genera des coléoptères ou exposé méthodique et critique de tous les genres proposés jusqu'ici dans cet ordre d'insectes. Vol. 7. Paris, A la Librairie Encyclopedique de Roret. 620 p.
164. Lamarck, J. B. P. A. 1801. Histoire naturelle des animaux sans vertebres. Vol. 5. Paris, Verdiere. 355 p.
165. Lamborn, W. A. 1932. The Brenthid beetle Amorphocephalus hospes Kolbe, found in an ants' nest in Nyasaland. Proceedings of the Royal Entomological Society of London 7(1):11-12.
166. Landeiro, R. 1941. Dynamis politus Gyll. (Rhynchophorus politus Gyll.) Una nova praga do coqueiro. Boletim do Ministério da Agricultura, Industria e Comercio, Rio de Janeiro 30(11):1-6.
167. Latreille, P. A. 1804. Histoire naturelle, générale et particulière, des crustacés et des insectes. Vol. 11. Paris, Dufart. 422 p.
168. LeConte, J. L. and G. H. Horn. 1876. The Rhynchophora of America north of Mexico. Proceedings of the American Philosophical Society 15(96):1-455.
169. _____ . 1883. Classification of the Coleoptera of North America. Smithsonian Miscellaneous Collections 26(4):1-567.
170. Leefmans, S. 1920. De palmsnuitkever (Rhynchophorus ferrugineus Oliv.). Mededelingen van het Instituute voor Plantenziekten, Buitenzorg 43:1-90.
171. Lefroy, H. M. 1906. Indian insect pests. Calcutta, Government Printing. 318 p.
172. Leng, C. W. 1920. Catalogue of the Coleoptera of America, north of Mexico. Mount Vernon, J. D. Sherman. 470 p.
173. Leng, C. H. and A. S. Mutchler. 1927. Catalogue of the Coleoptera of America, north of Mexico (Supplement). Mount Vernon, J. D. Sherman. 78 p.

174. Lepesme, P. 1947. Les insectes des palmiers. Paris, P. Lechevalier. 904 p.
175. Lever, R. J. A. W. 1943. Further notes on the fauna of British Soloman Islands. *Tropical Agriculture, Trinidad* 20(2):40-42.
176. Lindroth, C. H. and E. Palmén. 1956. Coleoptera. In: S. L. Tuxen's Taxonomist's glossary of genitalia in insects. Copenhagen, E. Munksgaard. p. 69-76.
177. Linnaeus, C. 1758. *Systema naturae*. 10th ed. Holmiae, L. Salvii. 823 p.
178. Linnaeus, C. 1764. *Museum S. R. M. ludonicae ulricae reginae...* Holmiae. 720 p.
179. Linnaeus, C. 1767. *Systema naturae*. 12th ed. Holmiae. Vol. 1. 1327 p.
180. List, G. M. 1932. A cherry pest in Colorado. Fort Collins. 106 p. (Colorado Agricultural Experimental Station Bulletin 385)
181. Lommel, V. 1925. Über tierische schädlinge der kokospalme. *Zeitschrift für Angewandte Entomologie* 11(2): 255-272.
182. Maharaj, S. 1962. Field studies on the life history of the palm weevil. *Journal of the Agricultural Society of Trinidad and Tobago* 42(2):191-200.
183. Maharaj, S. 1963. Molasses as an attractant for the palm weevil. *Journal of the Agricultural Society of Trinidad and Tobago* 43:11.
184. Mansfield-Aders, W. 1919. Insects injurious to economic crops in the Zanzibar Protectorate. *Bulletin of Entomological Research* 10:145-155.
185. Marshall, G. A. K. 1935. Resultats scientifiques du voyage aux Indes Orientales Neerlandaises de LL. AA. RR. le prince et la princesse Leopold de Belgique. Curculionidae. *Mémoires du Musée royal d'Histoire Naturelle de Belgique*, hors serie 4(11):35-50.

186. Martyn, E. B. 1953. Red-ring disease of coconuts in Trinidad and Tobago. *Tropical Agriculture, Trinidad* 30(1-3): 43-53.
187. Mel, C. N. E. J. de. 1928. Note on coconut pests. *Tropical Agriculturist and Magazine of Ceylon Agricultural Society* 70(2):85-86.
188. Merian, M. S. 1726. *Dissertation sur la generation et les transformations des insectes de surinamensium*. Hague, Petrum Gosse. p. 48.
189. Metcalfe, M. E. 1932. The structure and development of reproductive system in the Coleoptera with notes on its homologies. *Quarterly Journal of Microscopical Science* (n. s.) 75:49-129.
190. Michener, C. D. 1944. A comparative study of the appendages of the eighth and ninth abdominal segments of insects. *Annals of the Entomological Society of America* 37(3): 336-357.
191. Miles, H. W. 1923. Observations on the bionomics of the apple-blossom weevil, *Anthonomus pomorum* Linn. *Annals of Applied Biology* 10(3-4):348-369.
192. Mohammed, S. 1963. The survival of red-ring nematodes during pupation of the palm weevil. *Journal of the Agricultural Society of Trinidad and Tobago* 43:10-11.
193. Montrouzier, P. 1857. *Essai sur la faune de l'ile de Woodlark ou Moiou*. *Annales de la Société d'Agriculture, Sciences et Industrie de Lyon, serie 2*, 7:1-114.
194. Montrouzier, P. 1860. *Essai sur la faune entomologique de la nouvelle-Caledonie*. *Annales de la Société Entomologique de France, ser. 3*, 8:867-916.
195. Morris, D. 1881. Annual report of the public gardens and plantations, Jamaica. (quoted from W. F. H. Blanford, 1893).
196. Muir, F. 1915. Notes on the ontogeny of the genital tubes in Coleoptera. *Psyche* 22(5):147-152.

197. Muir, F. 1918. Notes on the ontogeny and morphology of the male genital tube in Coleoptera. Transactions of the Royal Entomological Society of London 66:223-231.
198. Muir, F. 1919. On the mechanism of the male genital tube in Coleoptera. Transactions of the Royal Entomological Society of London 67:404-414.
199. Muir, F. 1924. The male genitalia of Cupes concolor Westw. (Coleoptera). Journal of the New York Entomological Society 32(4):167-169.
200. Mungia, R. B. 1958. Combata el mayato prieto del cocotero. Tierra 13(8):689, 753-754.
201. Munro, J. W. 1914. Notes on the reproductive organs of the pine weevil (Hylobius abietis). Proceedings of the Royal Physical Society of Edinburgh 19:161-169.
202. Munro, R. W. and L. C. Brown. 1916. A practical guide to coconut planting. London, John Bale & Sons & Danielsson. 186 p.
203. Nirula, K. K. 1956. Investigations on the pests of coconut palm. Part IV. Rhynchophorus ferrugineus F. Indian Coconut Journal 9(4):229-247.
204. Nirula, K. K. and K. P. V. Menon. 1957. Insect pest of coconut palm in India. FAO Plant Protection Bulletin 6(1):1-5.
205. Olivier, A. G. 1790. Encyclopedie methodique, histoire naturelle insectes... Vol. 5. Paris, Chez. Panckoucke. 793 p.
206. Olivier, A. G. 1807. Entomologie, ou histoire naturelle des insectes,... Vol. 5. no. 83. Paris, Chez. Desray. 428 p.
207. Ormerod, E. A. 1880. Cane-borers. Transactions of the Royal Entomological Society of London 28:15-20.
208. Panzer, G. W. F. 1798. Curculio. In: J. E. Voet's Beschreibungen und ubbildungen hart schaalichter insecten Coleoptera Lin... Vol. 4. Erlangen, Johann Jacob. p. 10-11; 60-61.

209. Paul, W. R. C. 1929. The control of red weevil (Rhynchophorus ferrugineus F.) in coconut palms. Tropical Agriculturist and Magazine of Ceylon Agricultural Society 73(3):131-135.
210. Perty, J. A. M. 1830. Insect Brasiliensia. In: Delectus animalium articulorum quae in itinere per Brasilian annis 1817-20... Vol. 1. Monachii. p. 71-124.
211. Petiver, J. 1764. Historian naturalem spectantia, or gazo-phylacium..., London. t. 35.
212. Pierce, W. D. 1925. The history of the Rhynchophorid genera Rhynchophorus, Calendra, Sphenophorus and Sitophilus (Coleoptera). Proceedings of the Entomological Society of Washington 27(5):113-114.
213. Pruthi, H. S. 1924. The development of the ovipositor and efferent ducts of Tenebrio molitor L. (Coleoptera), with remarks on the comparison of the later organs in the two sexes. Proceedings of the Zoological Society of London 92:869-883.
214. Pyenson, L. 1938. The problems of applied entomology in Pernambuco, Brazil. Part II. A survey of some of the pests of the crops of Pernambuco. Revista de Entomologia 9(1-2):16-31.
215. Quedenfeldt, G. 1888. Verzeichniss der von Herrn Major A. D. von Mechow in Angola und am Quango-Strom 1878-1881 gesammelten Curculioniden und Brenthiden. Berliner entomologische Zeitschrift 32:271-308.
216. Ridley, H. N. 1889. Report on the destruction of coconut palms by beetles. Journal of the Royal Asiatic Society of Great Britain and Ireland, Straits Branch 20:1-11.
217. Riley, C. V. and L. O. Howard. 1888. An enemy to the date palm in Florida. Insect Life 1:14.
218. Riley, C. V. and L. O. Howard. 1891. Notes on the palm weevil. Insect Life 4:136-137.
219. Riley, C. V. and L. O. Howard. 1893. The palm weevil in British Honduras. Insect Life 5:537-538.

220. Ritche, P. O. 1944. Dynastinae of north America, with descriptions of the larvae and keys to genera and species (Coleoptera : Scarabaeidae). Lexington. 56 p. (Kentucky Agricultural Experiment Station. Bulletin no. 467)
221. Ritche, P. O. 1949. Larvae of Melolonthinae, with keys tribes, genera, and species (Coleoptera: Scarabaeidae). Lexington. 36 p. (Kentucky Agricultural Experiment Station. Bulletin no. 537)
222. Ritsema, C. Cz. 1882. On three new species of Rhynchophorous coleoptera from Sumatra. Notes from the Leyden Museum 4:177-180.
223. Robles, G. and H. Leonel. 1944. Plagas enfermedades del cocotero de mayor importancia en la costa del edo de Yucatan. Fitofilo 3(2):3-25.
224. Rumpf, G. E. 1750-1755. Herbarium ambionese... Vol. 1. Amsterdam. p. 78-83.
225. Sands, W. R. 1930. Agriculture in Labuan. Malayan Agricultural Journal 18:178-183.
226. Saraiva, A. C. 1939. A preliminary list of the insect pests of crops and fruit tree in Portuguese East Africa. Journal of the Entomological Society of South Africa 2:101-114.
227. Schaufuss, L. W. 1864. Section für zoologie. Sitzungsberichte der Naturwissenschaftlichen Gesellschaft Isis zu Dresden 1-3:15-24.
228. _____ . 1877. Die bisherigen arbeiten des herausgebers. Nunguam Otiosus Dresden 2:425-449.
229. _____ . 1885. Beiträg zur fauna der niederlandischen besitzungen auf den Sunda-Inseln. Russkoe Entomologicheskoe Obshestvo 19:183-209.
230. Schoenherr, C. J. 1826. Curculionidum dispositio methodica cum generum characteribus, descriptionibus atque observationibus variis, seu prodromus ad synonymiae insectorum partem 4. Lipsiae, Fredericum Fleischer. 338 p.

231. _____ . 1838. Genera et species curculionidum, cum synonymia hujus familiae... Vol. 4. Parisei & Lipsiae. 1121 p.
232. Schomburgk, M. R. 1847. Reisen in Britisch Guiana in... Vol. 1. Leipzig. p. 184.
233. Schomburgk, R. H. 1848. The history of Barbados. London, 722 p.
234. Scopoli, J. A. 1772. Historico naturalis. Vol. 5. Lipsiae. 128 p.
235. Sharp, D. 1918a. Studies in Rhynchophora. IV. A preliminary note on the male genitalia. Transactions of the Royal Entomological Society of London 66:209-222.
236. Sharp, D. 1918b. Extract from letter of Dr. David Sharp re Rhynchophorus palmarum. Journal of the New York Entomological Society 26:225-226.
237. Sharp, D. and F. Muir. 1912. The comparative anatomy of the male genital tube in Coleoptera. Transactions of the Royal Entomological Society of London 60:477-642.
238. Short, J. 1888. A monograph of the coconut palm, or Cocos nucifera. Madras. (quoted by W. F. H. Blandford, 1893).
239. Simon, M. F. 1888. Report on beetles injurious to coconut tree, Straits Settlements Government Gazette (1887, May 27). Tropical Agriculturist and Magazine of Ceylon Agricultural Society 7:548-549.
240. Snodgrass, R. E. 1935. Principles of insect morphology. New York, McGraw-Hill. 667 p.
241. _____ . 1957. A revised interpretation of the external reproductive organs of male insects. Smithsonian Miscellaneous Collections 135(6):28-31.
242. South, F. W. 1924. Annual report of the chief agricultural inspector for 1923. Malayan Agricultural Journal 12(8): 219-237.

243. Stoll, N. R. et al. 1961. The international code of zoological nomenclature adopted by the XV International Congress of Zoology. London, International Trust for Zoological Nomenclature. 176 p.
244. Sulzer, J. H. 1761. Die kennzeichen der insekten, nach anleitung des..., Zurich. 270 p.
245. Sulzer, J. H. 1776. Abgekürzte geschichte der insecten nach dem Linnaeischen system. Part 1. Winterthur, H. Steiner. 274 p.
246. Summers, S. V. 1873. Notes on Rhynchophorus zimmermanni, Sch. Canadian Entomologist 5(7):123-124.
247. Tanner, V. M. 1927. A preliminary study of the genitalia of female Coleoptera. Transactions of the American Entomological Society 53:5-50.
248. Thunberg, C. P. 1797. Cordyle et sarskildt insect-slagte beskrifvit. Kungliga Svenska Vetenskapsakademiens Handlingar 18:44-49.
249. Tidman, D. A. 1951. Some agricultural and horticultural problems in Brazil. Plant Protection Overseas Review 2(4).
250. Tidman, D. A. 1959. Agricultural and horticultural problems of Brazil. World Crops 3(9):341-344, 364.
251. Timon-David, J. 1930. Recherches sur les matieres grasses des insectes. Annales de la Faculté des Sciences de Marseille, ser. 2, 4(2):29-207.
252. Torre-Bueno, J. R. de la. 1937. A glossary of entomology. New York, Brooklyn Entomological Society. 366 p.
253. Urich, F. W. 1893. Notes on some insect pests of Trinidad, British West Indies. Insect Life 6(2):196-198.
254. Urich, F. W. 1910. Report of the entomologists. Bulletin of the Department of Agriculture, Trinidad and Tobago 9(65):160-163.

255. Urich, F. W. 1912. Cocoa-nut palm insects in Trinidad. West Indian Bulletin, Barbados 12(4):446-448.
256. Urich, F. W. 1913. Beetles affecting the coconut palm. Proceedings of the Agricultural Society of Trinidad and Tobago 13(4):164-167.
257. Urich, F. W. 1915. Insects affecting the coconut palm in Trinidad. Bulletin of the Department of Agriculture, Trinidad and Tobago 14:200-203.
258. Urich, F. W. and P. L. Guppy. 1911. Preliminary notes on some insects affecting the coconut palm. Port of Spain. 30 p. (Department of Agriculture, Trinidad and Tobago, Circular 5)
259. Vaurie, P. 1951. Revision of the genus Calendra (formerly Sphenophorus) in the United States and Mexico (Coleoptera, Curculionidae). Bulletin of the American Museum of Natural History 98:29-186.
260. Venkatsubba, C. S. 1934. Observations on the palm weevil "Rhynchophorus ferrugineus F. " as a pest of coconuts in Cochin. Poona Agricultural College Magazine 25(4): 147-149.
261. Verano, A. 1940. Rhynchophorus palmarum L. Revista de la Facultad Nacional de Agronomia, Columbia 2(4-5): 393-408.
262. Verhoeff, C. 1893. Vergleichende untersuchungen uber die Abdominalsegmente und die Copulationsorgane der mannlichen Coleoptera. Deutsche Entomologische Zeitschrift 37:113-170.
263. Vestal, E. F. 1956. Control of coconut beetles and weevils in Thailand. FAO Plant Protection Bulletin 5(3):37-44.
264. Viado, G. B. and A. E. Bigornia. 1949. A biological study of the Asiatic palm weevil, Rhynchophorus ferrugineus (Olivier), (Curculionidae, Coleoptera). Philippine Agriculturist 33(1):1-27.

265. Voss, E. von. 1947. Ueber Curculioniden, vorwiegend aus dem Gebiet der Anden (Col. Curc.). III. Beitrag zur Kenntnis der Curculioniden. *Revista de Entomologia, Rio de Janeiro* 18:45-64.
266. Vosseler, J. 1907. The enemies of the coconut palm. *Pflanzer* 3(17-18):275-288; 3(19-20):289-317.
267. Wallace, A. R. 1853. On the insects used for food by the Indians of the Amazon. *Transactions of the Entomological Society of London* 2:241-244.
268. Wattanapongsiri, A. 1959. A key to the Siamese genera and species of coconut beetles. Bangkok. 29 p. (Thailand Department of Agriculture Technical Bulletin)
269. _____ . 1964. A taxonomic revision of the genus Dynamis Chevrolat (abstract). *Proceedings of the Missouri Academy of Science* 1(2):29.
270. Wille, J. 1925. Übersicht der landwirtschaftlich wichtigen Insekten von Rio Grande do Sul (Brasilien). *Zeitschrift für Angewandte Entomologie* 11(2):415-416.
271. Wille, J. E. 1940. Übersicht der landwirtschaftlich Wichtigen Insekten von Peru (Sudamerika). *Zeitschrift für Pflanzenkrankheiten* 50(8):369-388.
272. Wilson, J. W. 1930. The genitalia and wing venation of the Cucujidae and related families. *Annals of the Entomological Society of America* 23(2):305-358.
273. Wilson, M. E. 1963. Investigations into the development of the palm weevil, Rhynchophorus palmarum (L.). *Tropical Agriculture, Trinidad* 40(3):185-196.
274. Wilson, M. E. 1962. Laboratory studies on the life history of the palm weevil. *Journal of the Agricultural Society of Trinidad and Tobago* 42(2):177-190.
275. Wolcott, G. N. 1933. An economic entomology of the West Indies. San Juan, Entomological Society of Porto Rico. 688 p.

276. Wood, S. L. 1952. Observations on the homologies of the copulatory apparatus in male Coleoptera. *Annals of the Entomological Society of America* 45(4):613-617.
277. Woodworth, H. L. 1921. A host index of insects injurious to Philippine crops : I. *Philippine Agriculturist* 10:9-35.
278. Young, F. N. 1959. Fossil beetles from the Vero pleistocene. *Coleopterist's Bulletin* 13(4):103-106.

APPENDIX

ABBREVIATIONS ON THE FIGURES

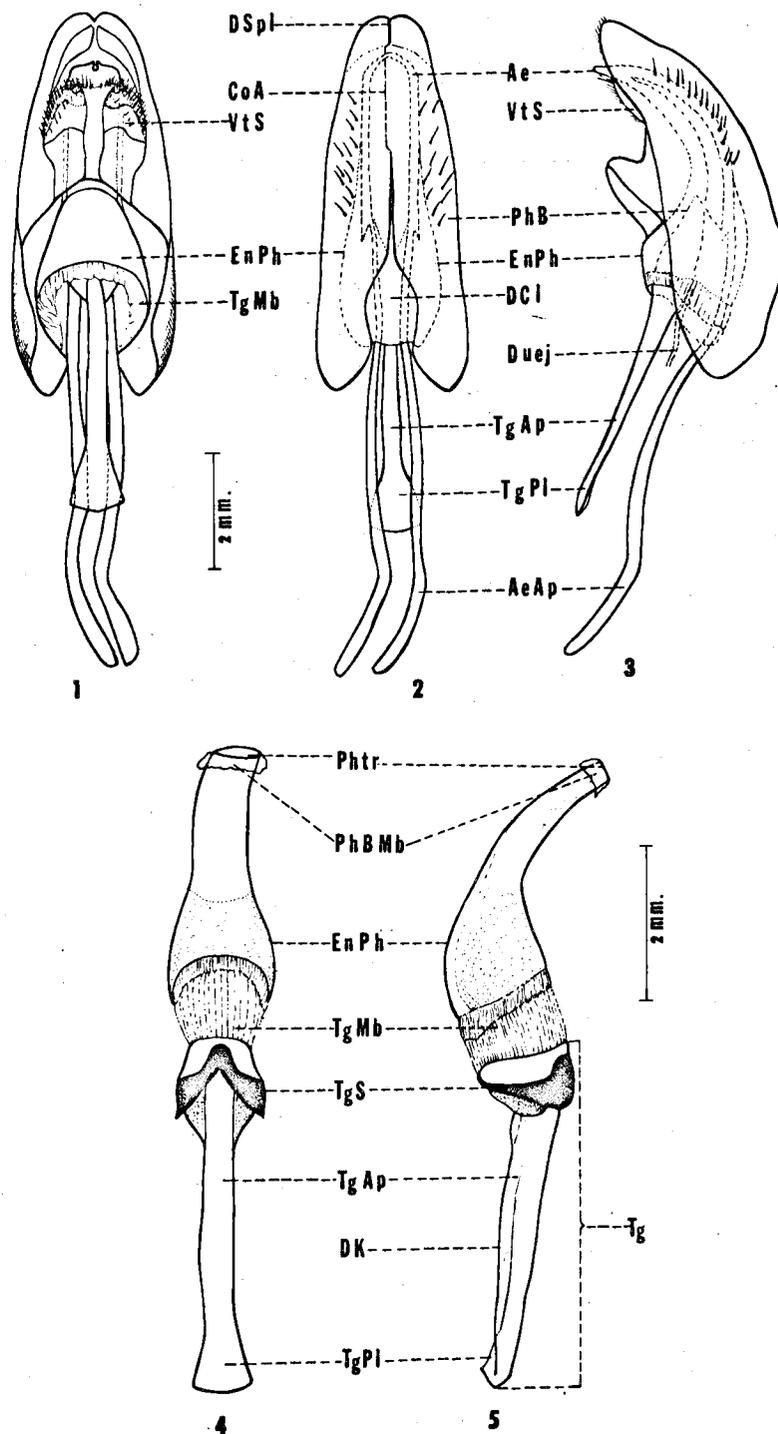
aabsl	anterior abdominal sensillum	Ant	antenna
Ab	abdominal segment	AntS	antennal scrobe
AbSp	abdominal spiracle	AntSp	antennal space
AbSt	abdominal sternum	apt	apical tooth of mandible
Ae	aedeagus	asma	anterior seta of mala
AeAp	aedeagal apodeme	asmxp	anterior sensory spot of maxillary palpus
AeCh	aedeagal chamber	ass	anterior seta of spiracular area
AeFe	aedeagal fenestra	bm ₁₊₂	basal stem of median veins
AeOr	orifical plate of aedeagus	bm _{3+4+Cu}	
aepgsp	anterior epipharyngeal sensory pore	bR	basal stem of radius
aessl	anterior epicranial sensillum	BsCt	bursa copulatrix
afrsl	anterior frontal sensillum	Cad	cardo
alms	anterior labral seta	Cat	cataphysis
almsl	anterior labral sensillum	Cl	clypeus
An	anus	cls	clypeal seta
1st+2nd An	anal veins	CoA	contiguous area between dorsal cleft and dorsal split of phallobase
3rd+4th An		con	condyl

Cos	costa	epis	epipleural seta
cul	cubital lobe	EpS	epipharyngeal sclerite
CxL	coxal lobe	Epx	epipharynx
DC1	dorsal cleft of phallobase	ES	epicranial suture
des	dorsal epicranial seta	es	epicranial seta
DK	dorsal keel of tegmen	EuSt	eusternum
dslm	dorsal seta of labrum	eusts	eusternal seta
dsma	dorsal seta of mala	fos	fossa
DSpl	dorsal split of phallobase	Fr	frons
dspth	dorsal seta of prothorax	FrD	frontal depression
dtr	dorsal tubercle of rostrum	frs	frontal seta
DuBs	ductus bursae	FrS	frontal suture
Duej	ductus ejaculatorius (ejaculatory duct)	GIS	gular suture
DuS	ductus seminalis (seminal duct, ductus spermatheca)	Hp	hypopharynx
EnPh	endophallus	Hyp	hypopleurum
epgs	epipharyngeal seta	Hyst	hypostoma
epgsp	epipharyngeal sensory pore	insf	intersegmental fold
epgss	epipharyngeal sensory spine	InSp	interocular space
		Lal	lateral lobe of anus
		las	lateral seta of anus
		LbP	labial palpus
		Li	ligula

lis	ligulal seta	Mxsc	maxillary scrobe
lisl	ligulal sensillum	Npl	nasal plate
llms	lateral labral seta	Or	orifice of spiracle
Lm	labrum	Ova	ovary
lsma	lateral seta of mala	OvCu	oviductus cummunis
LtAr	lateral arm of aedeagus	OvLt	oviductus lateralis
M ₁₊₂ M _{3+4+Cu}	median veins	pabsl	posterior abdominal sensillum
Ma	mala	pds	postdorsal seta
Md	mandible	pepgsp	posterior epi-pharyngeal sensory pore
mdl	median lobe	pes	posterior epi-cranial seta
Mdlan	median lobe of anus	PES	paraepicranial suture
mds	mandibular seta	pfrsl	posterior frontal sensillum
mdsm	median depression of submentum	PhB	phallobase
mdt	median tooth of mandible	PhBMb	phallobasic membrane
mo	mola	Phtr	phallotreme
MsSp	mesothoracic spiracle	plmsl	posterior labral sensillum
MsSt	mesothoracic sternum	Plf	palpifer
MtSt	metathoracic sternum	pls	pleural seta
MsTh	mesothorax		
MtTh	metathorax		

PMt	postmentum	R ₁ , R ₂	radial veins
pmts	postmental seta	R ₃₊₄₊₅	
		rdl	radial lobe
Pral	preanal lobe	rs	rostral seta
pras	preanal seta	sapt	subapical tooth of mandible
PrD	prodorsum	sc	scutum
prds	prodorsal seta	Scos	subcosta
presc	praescutum	scut	scutellum
PrmS	premental sclerite	sls	sensillum of spiracular area
PrMt	prementum	Smt	submentum
prms	premental seta	Spc	spermatheca
prmsl	premental sensillum	SpcG	spermathecal gland
PrSt	prothoracic sternum	SpFe	spiculum fenestra
PrStD	prothoracic sternal depression	Spi	spine
PrstO	prothoracic sternal opening	Sps	spiculum seta
Prt	peritreme	SpVt	spiculum ventrale
PrTh	prothorax	ss	seta of spiracular area
PsD	postdorsum	Sti	stipe
psds	postdorsal seta	Styl	stylus
psmxp	posterior sensory spot of maxillary palpus	Suc	subuncus
pss	posterior seta of spiracular area	Tg	tegmen
		TgAp	tegmental apodeme

TgMb	tegmina membrane
TgPl	tegmina plate
TgS	tegmina sclerite
Uc	uncus
Vg	vagina
VgB	vaginal base
VgCh	vaginal chamber
VgCl	vaginal cleft
VgPl	vaginal plate
VpAe	ventral plate of aedeagus
vsma	ventral seta of mala
vslma	ventral sensillum of mala
Vts	ventral sclerite of phallobase
Vul	vulva



Figures 1-5. Male genitalia of *Rhynchophorus palmarum* (Linn.): 1, ventral view; 2, dorsal view; 3, lateral view; 4-5, ventral and lateral views of endophallus and tegmen.

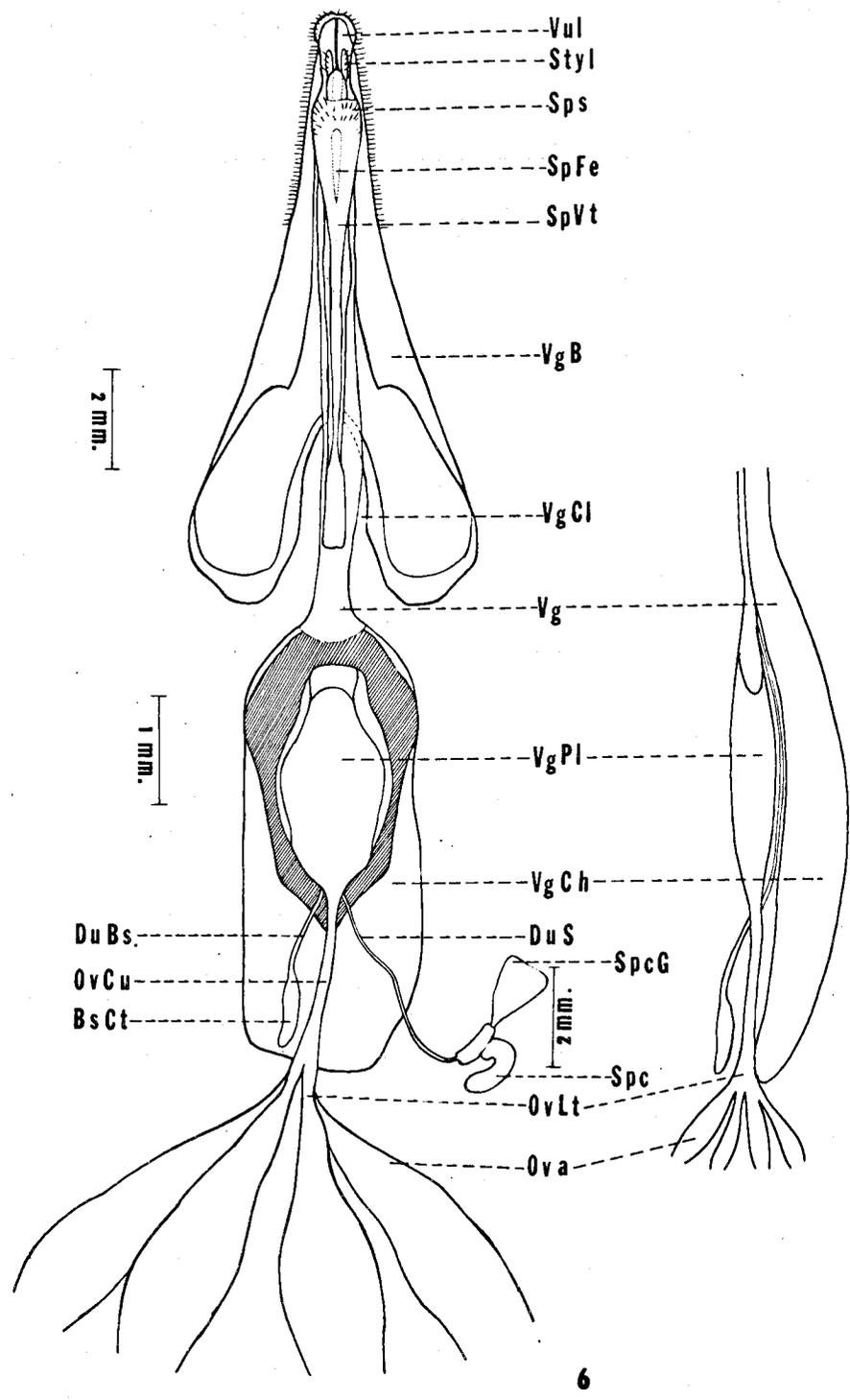
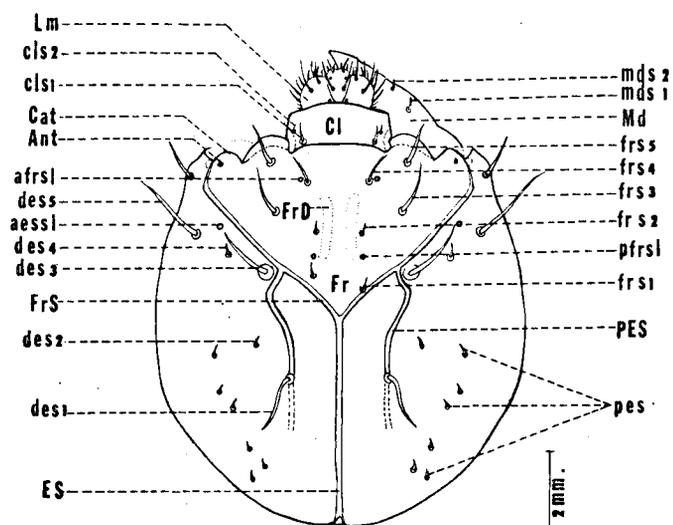
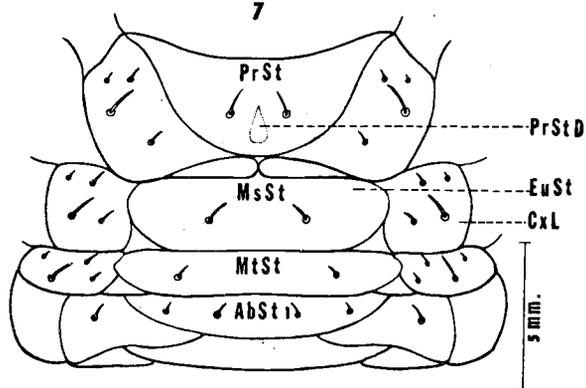


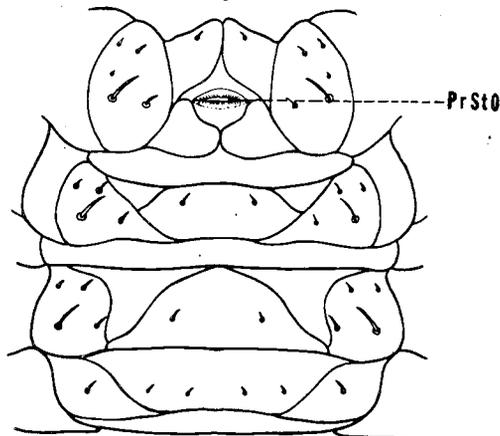
Figure 6. . Ventral and lateral views of female genitalia and reproductive system of Rhynchophorus filirostris Heller.



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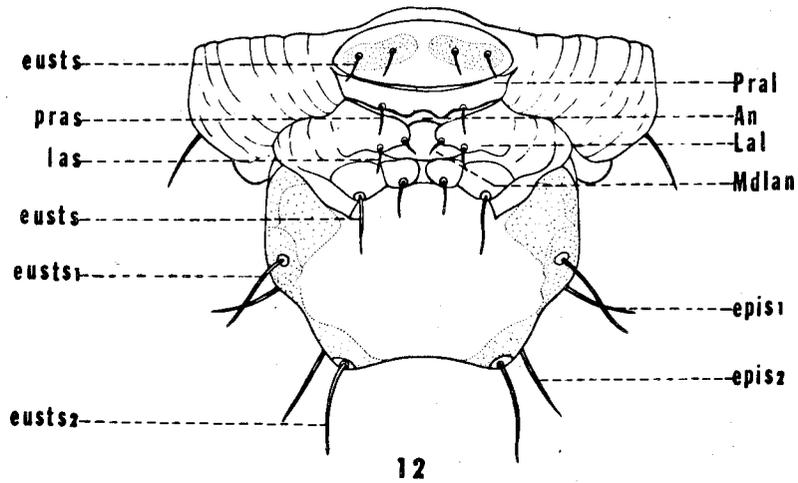
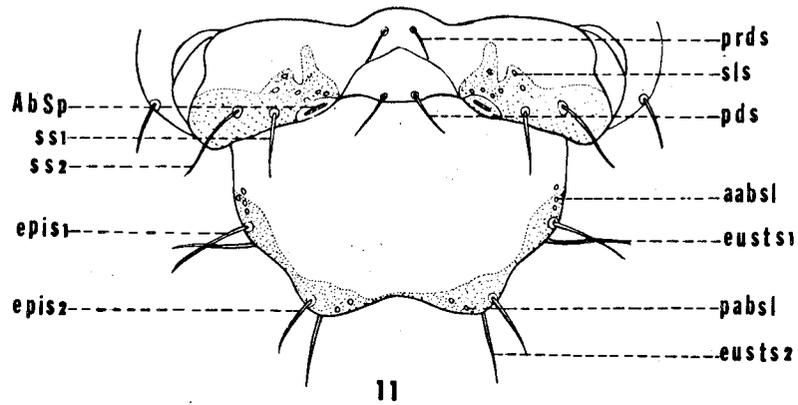
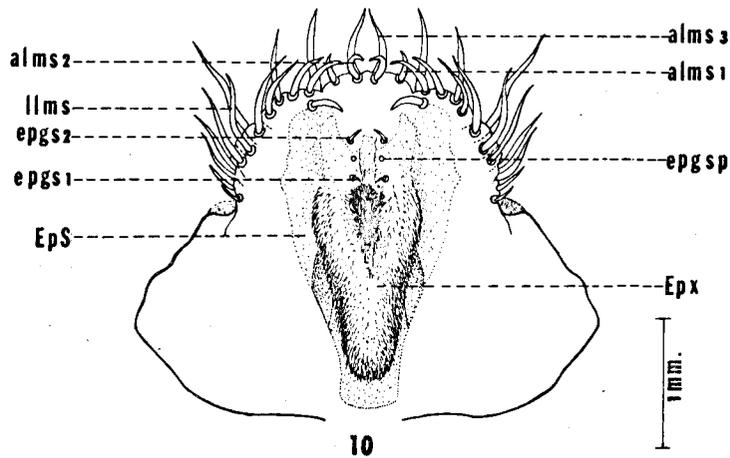


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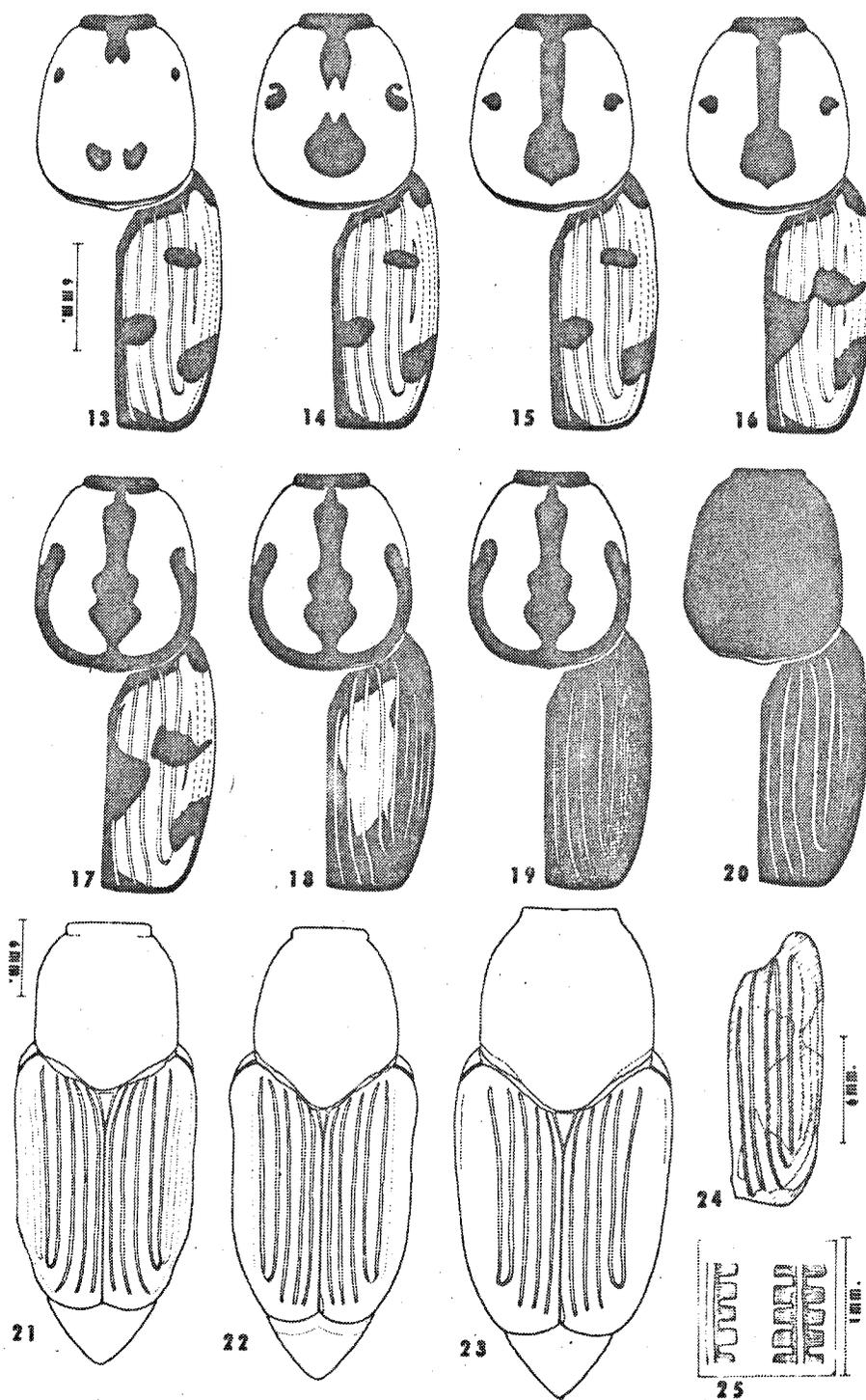


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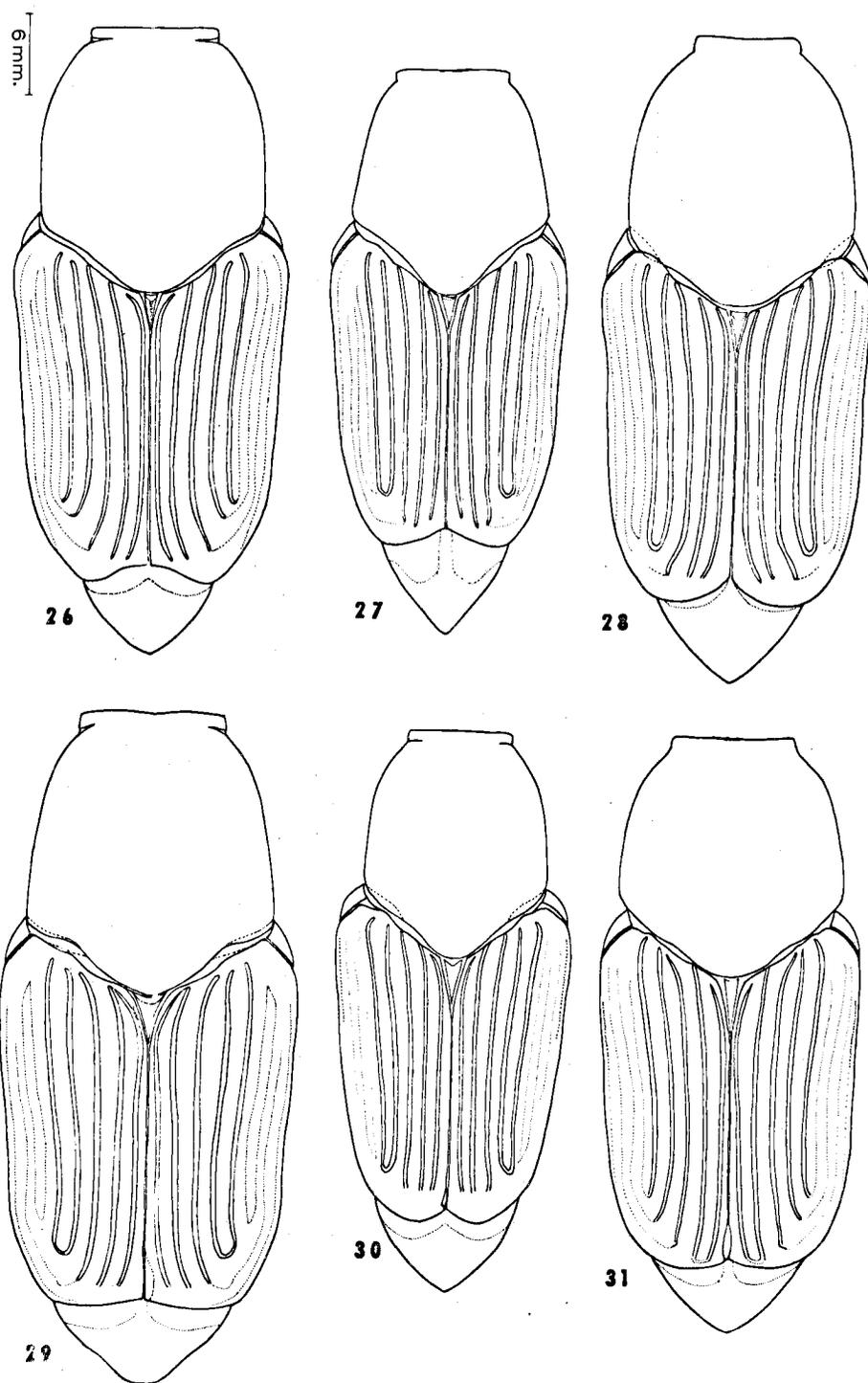
Figures 7 and 8. Larva of *Rhynchophorus palmarum* (Linn.): 7, head, dorsal view; 8, thoracic sternum. 9. Larva of *Dynamis borassi* (Fabr.), thoracic sternum.



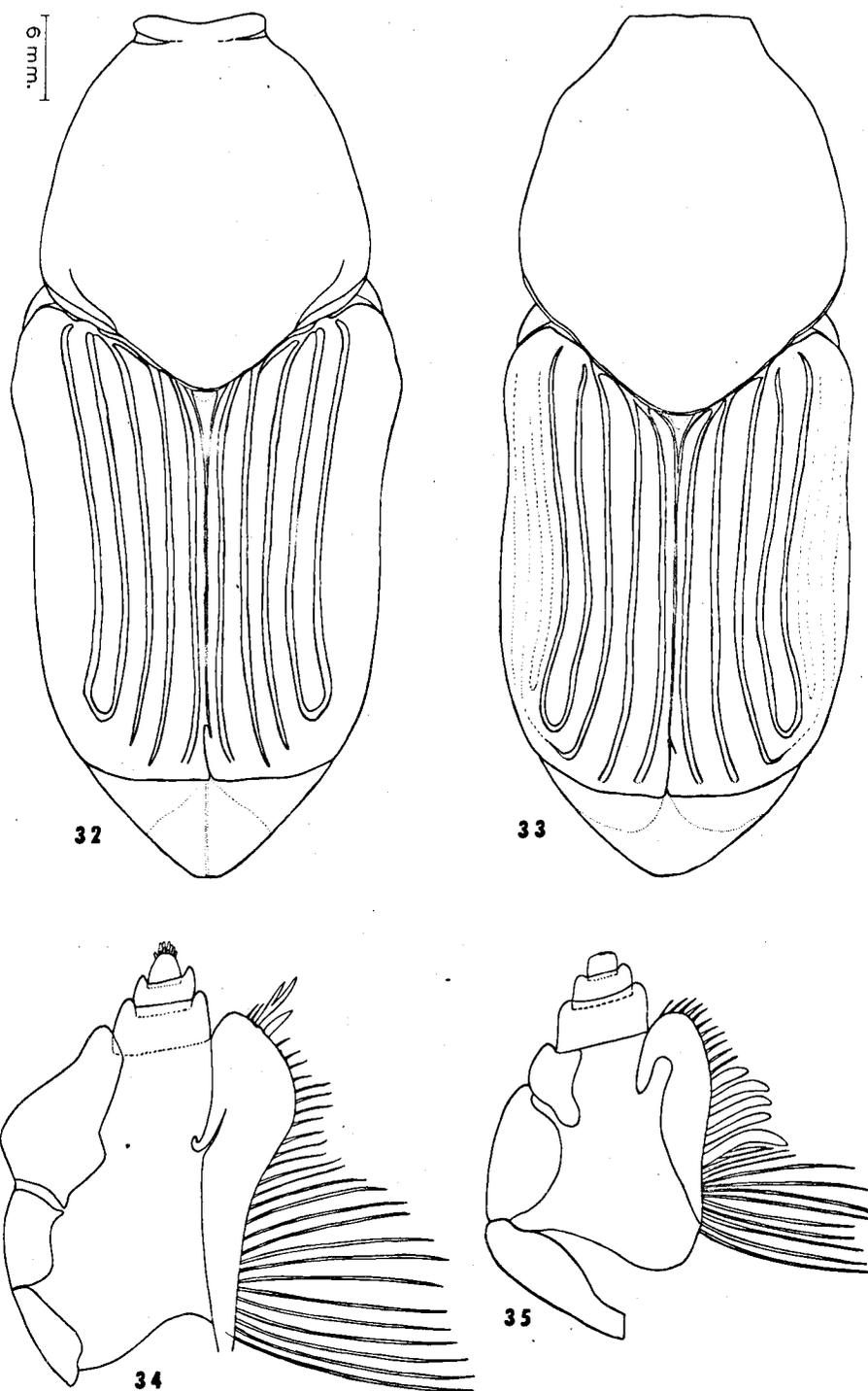
Figures 10-12. Larva of *Rhynchophorus palmarum* (Linn.): 10, epipharynx; 11, eighth and ninth abdominal tergites; 12, ninth and tenth abdominal sternites,



Figures 13-20. *Rhynchophorus cruentatus* (Fabr.), color variation of the body. 21-23. Dorsal view of the body: 21, *Dynamis perryi* n. sp., ♂; 22, *D. nitidulus* (Guér.), ♂; 23, *D. coracinus* n. sp., ♂. 24-25. *R. distinctus* n. sp., ♂; 24, elytral pattern; 25, striae highly magnified.



Figures 26-31. Dorsal view of the body: 26, *Dynamis rebecca* n. sp., ♂; 27, *D. perplexus* n. sp., ♀; 28, *D. callirostris* n. sp., ♂; 29, *D. palmiphilus* n. sp., ♂; 30, *D. artornitipae* n. sp., ♂; 31, *D. peropacus* Champ., ♂.



Figures 32 and 33. Dorsal view of the body: 32, *Rhynchodynamis filirostris* Heller, ♂; 33, *Dynamis borassi* (Fabr.), ♂. 34-35. Ventral view of left maxilla of adult: 34, *Rhynchophorus ritcheri* n. sp., ♂; 35, *R. cruentatus* (Fabr.), ♂.

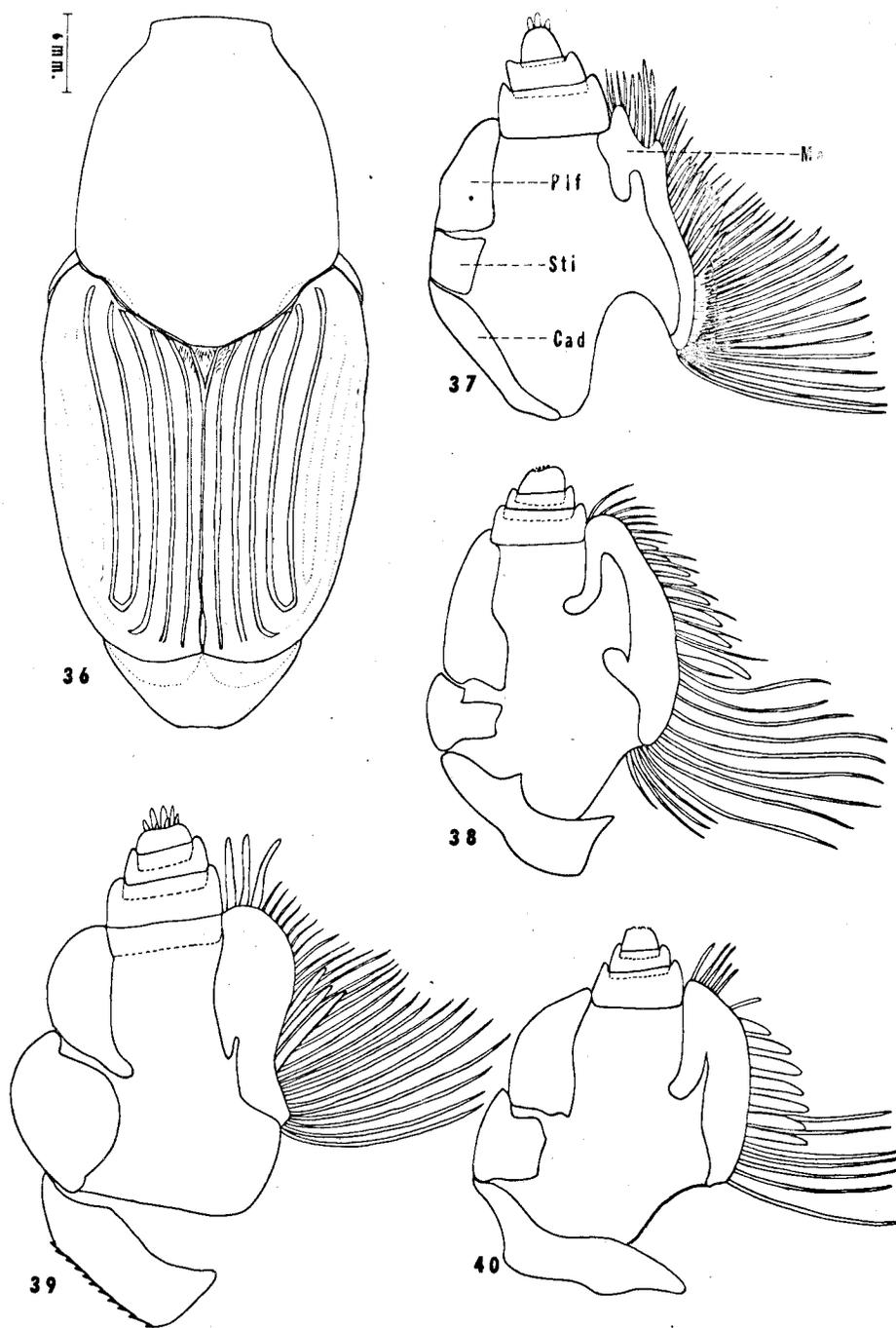


Figure 36. *Dynamis rockefelleri* n. sp., ♂, dorsal view of the body. 37-40. Ventral view of left maxilla of adult: 37, *Rhynchophorus palmarum* (Linn.), ♂; 38, *R. vulneratus* (Panz.), ♂; 39, *R. quadrangulus* Queden., ♂; 40, *R. ferrugineus* (Oliv.), ♂.

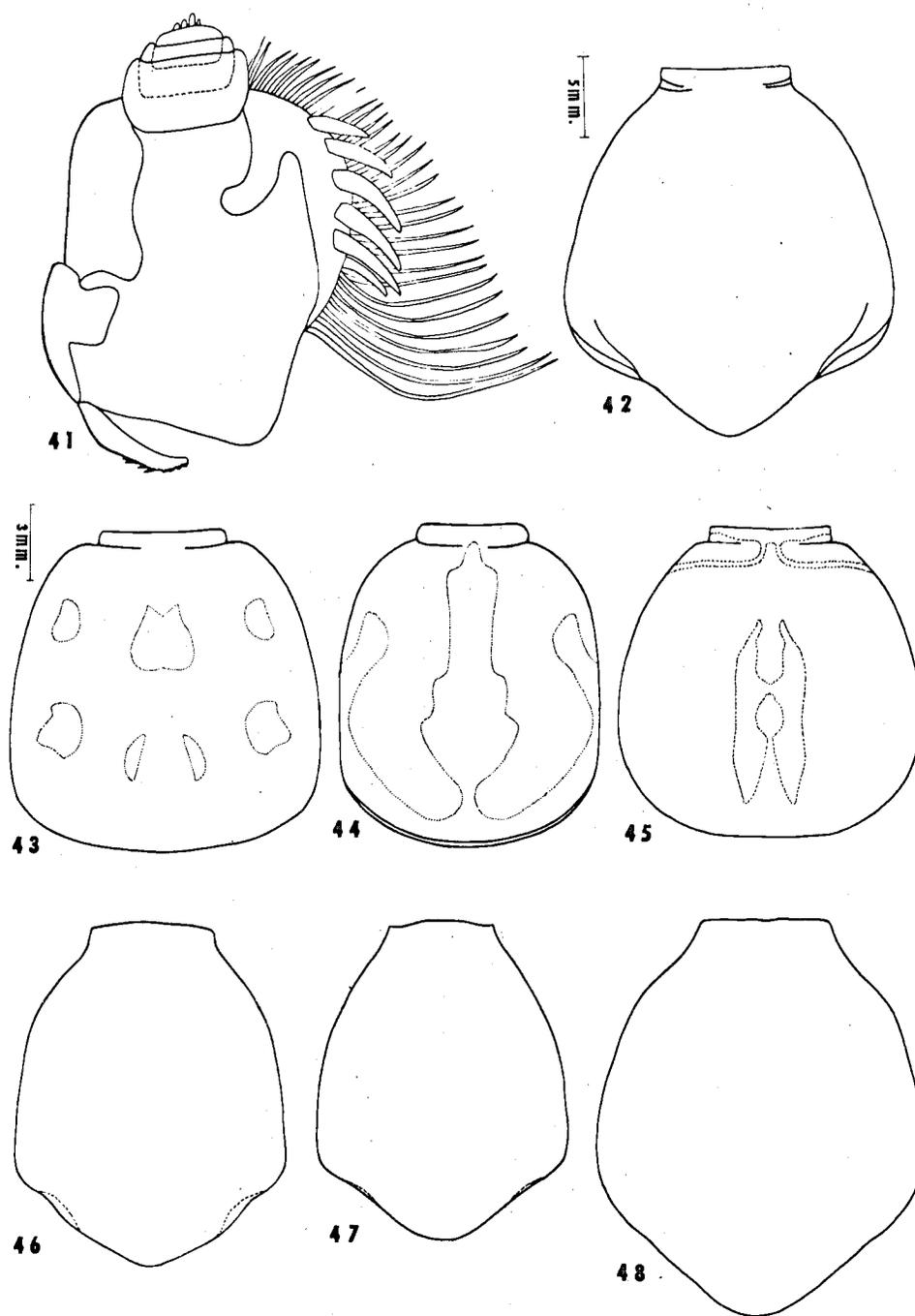
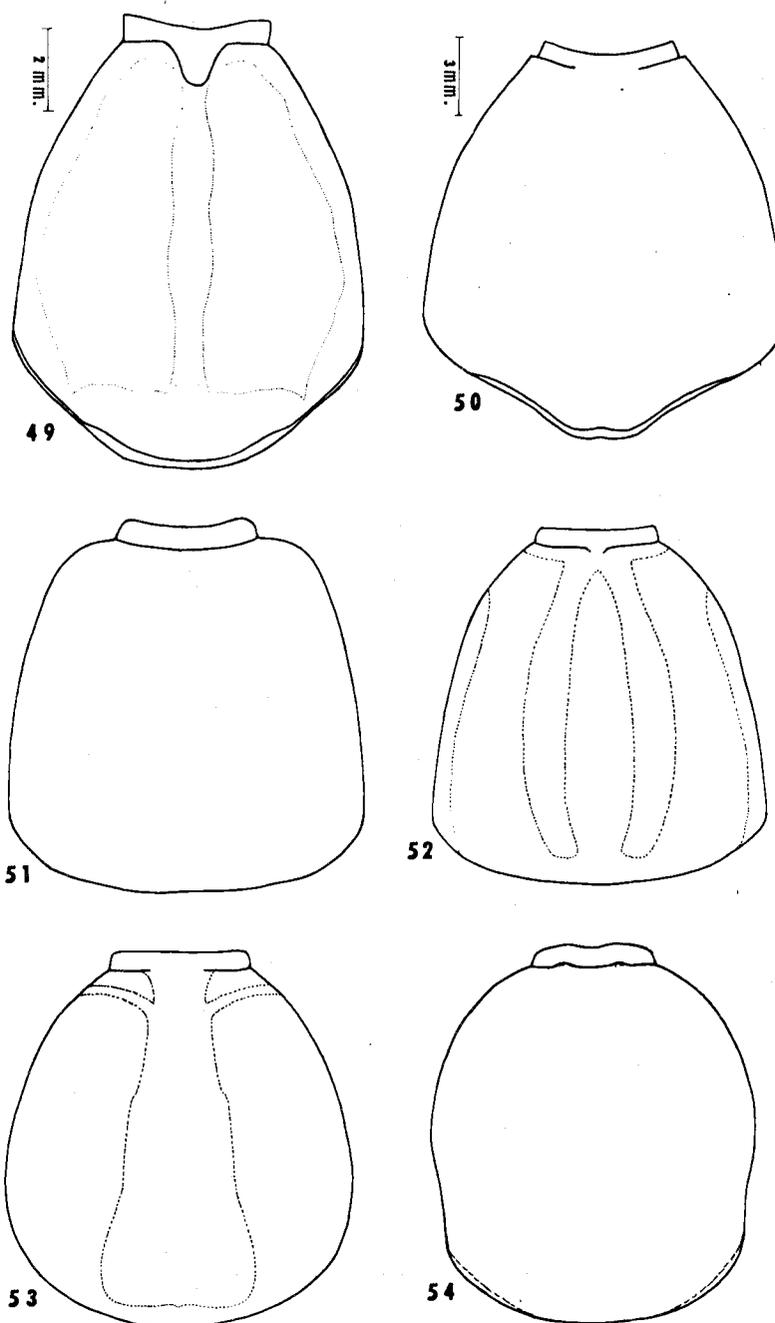
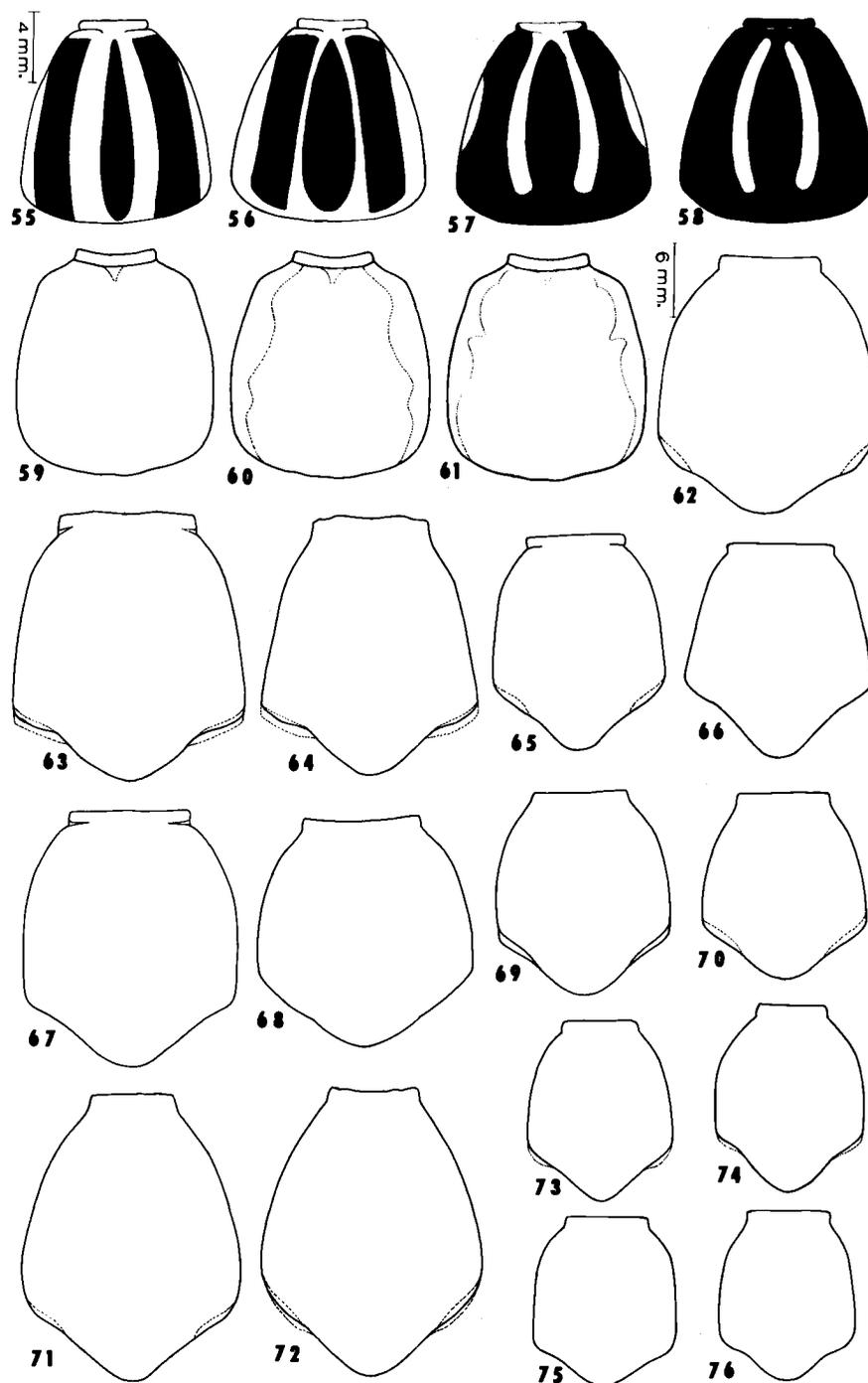


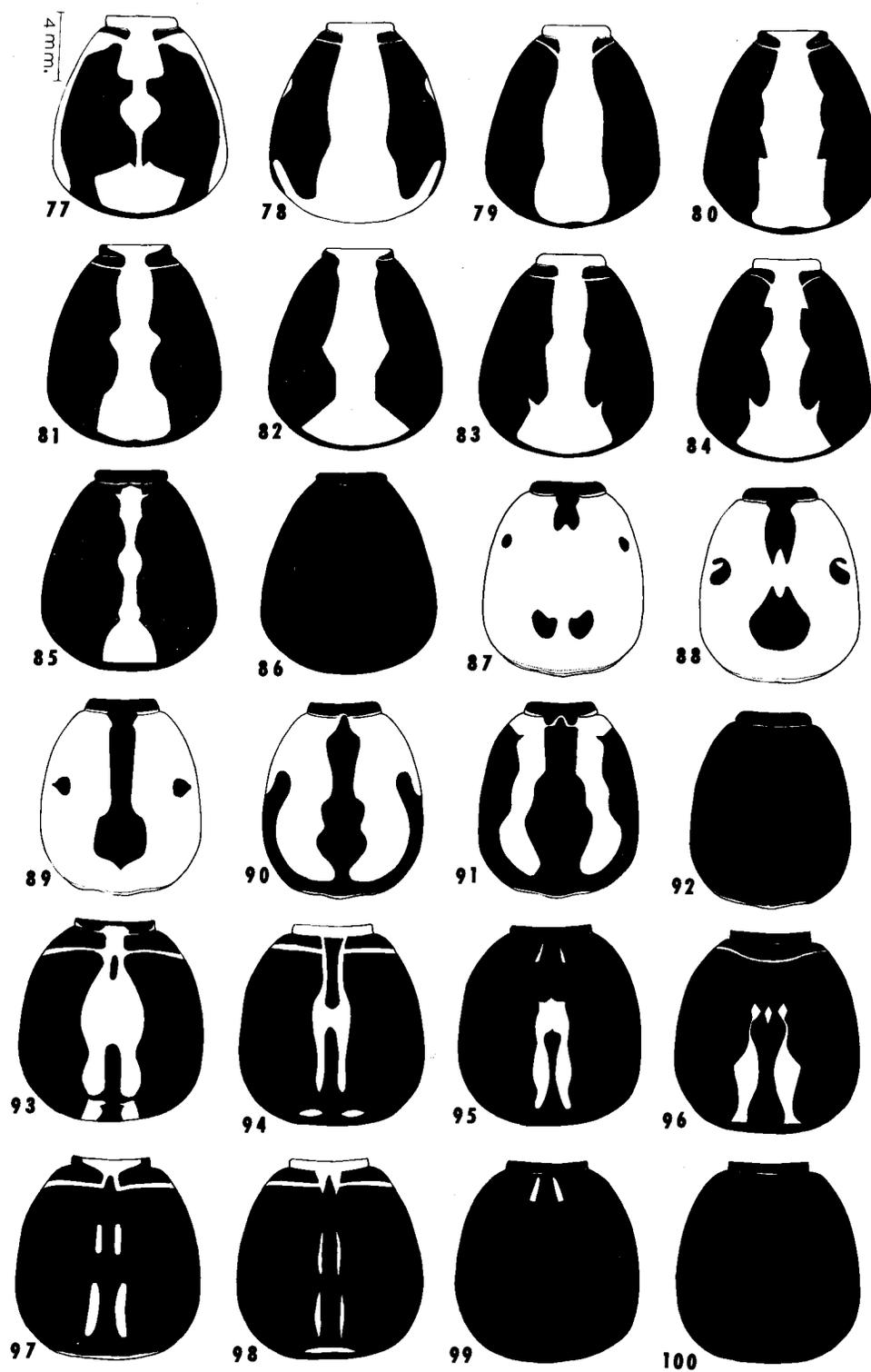
Figure 41. Rhynchophorus bilineatus (Montr.), ♂, ventral view of left maxilla of adult; 42-48: Dorsal view of pronotum: 42, Rhynchodynamis filirostris Heller, ♂; 43, Rhynchophorus ferrugineus (Oliv.), ♂; 44, R. cruentatus (Fabr.), ♂; 45, R. bilineatus (Montr.), ♂; 46, Dynamis rockefelleri n. sp., ♂; 47, D. rockefelleri n. sp., ♀; 48, D. borassi (Fabr.), ♂.



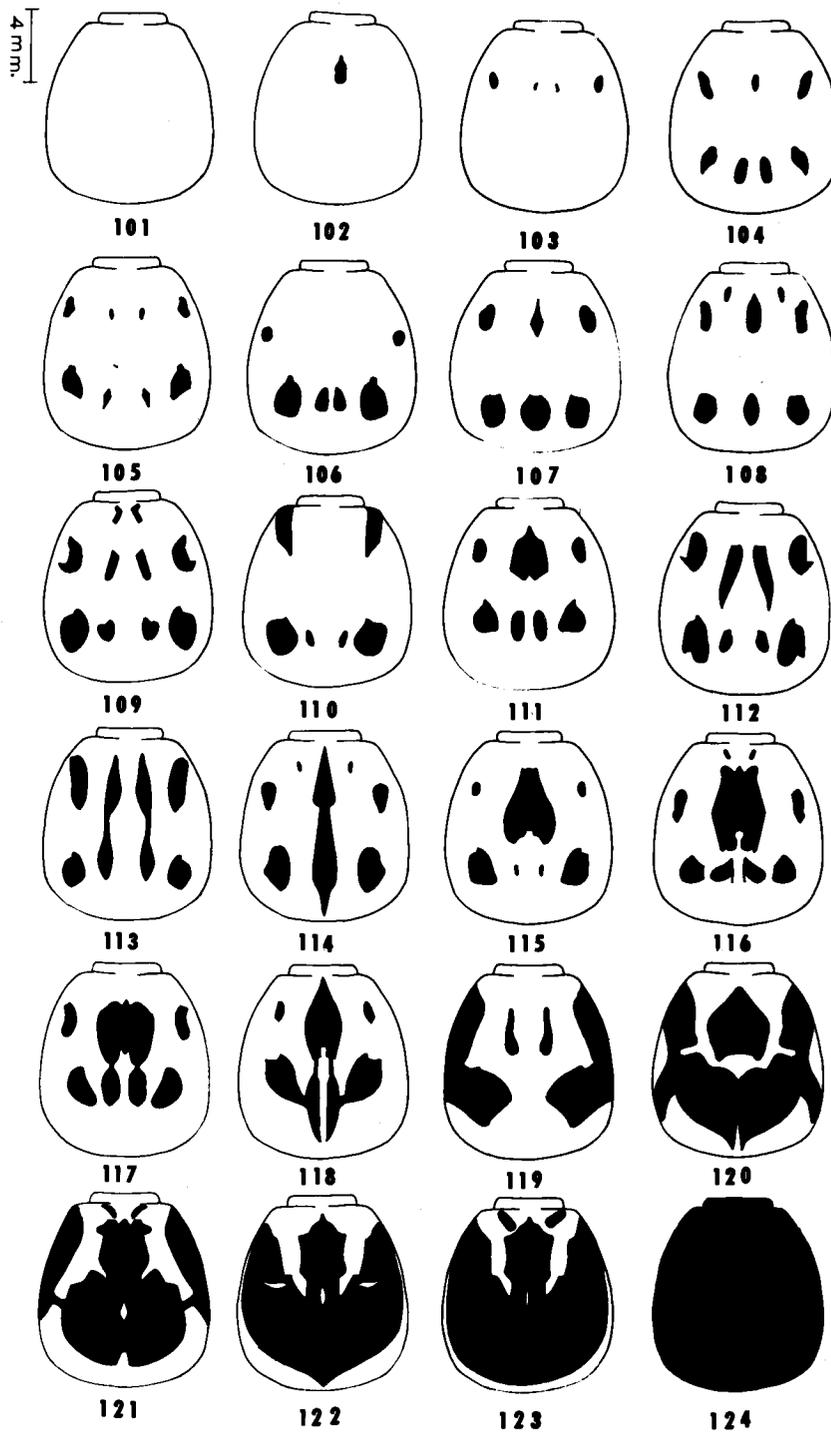
Figures 49-54. Dorsal view of pronotum of male: 49, *Rhynchophorus distinctus* n. sp.;
 50, *R. palmarum* (Linn.); 51, *R. quadrangulus* Queden.; 52, *R. phoenicis* (Fabr.);
 53, *R. vulneratus* (Panz.); 54, *R. ritcheri* n. sp.



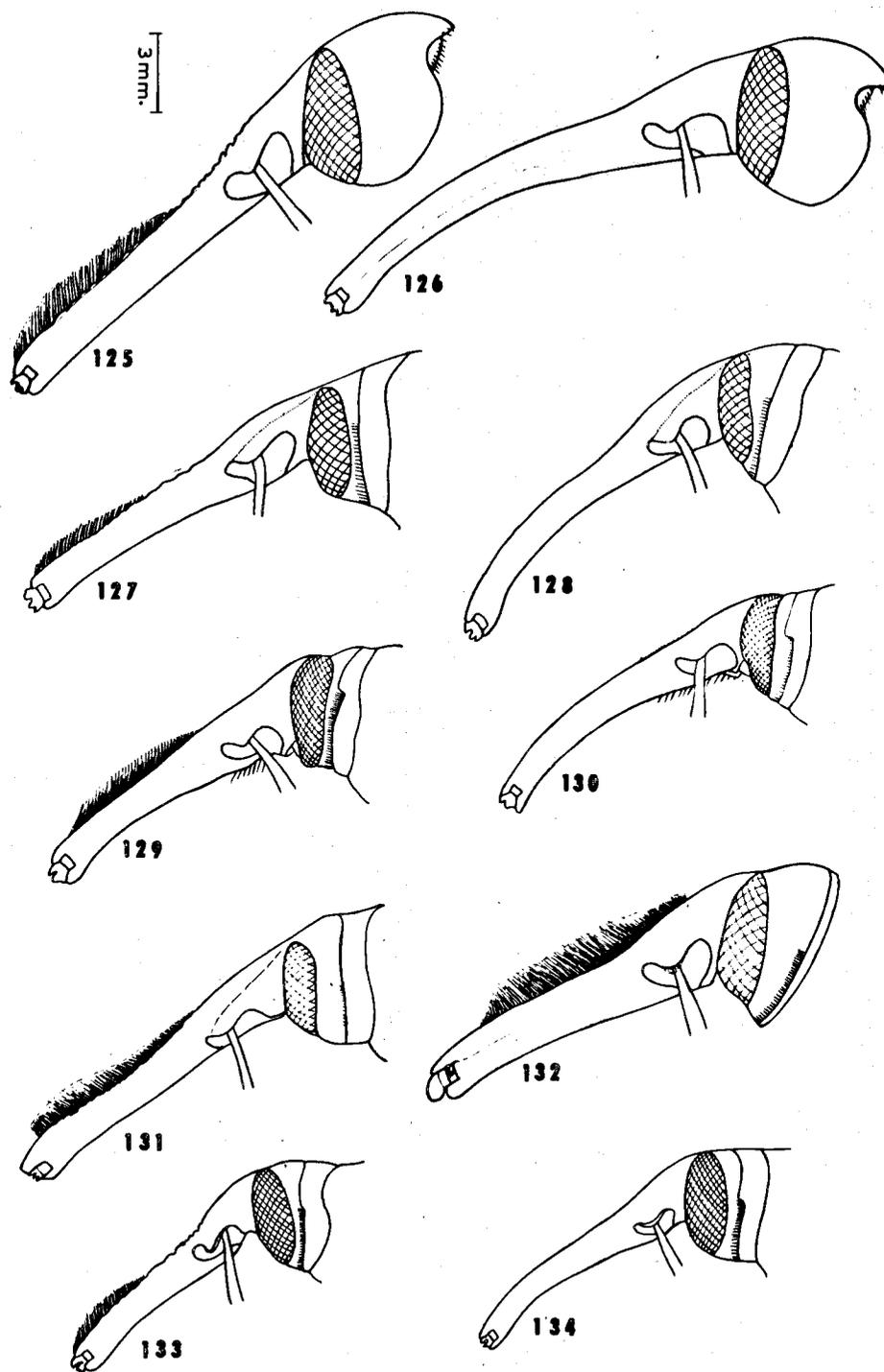
Figures 55-76. Dorsal view of pronotum. 55-58, *Rhynchophorus phoenicis* (Fabr.). 59-61, *R. quadrangulus* Queden. 62, *Dyamis callirostris* n. sp., ♂. 63-64, *D. palmiphilus* n. sp.: 63, ♂; 64, ♀. 65, *D. artoantipae* n. sp., ♂. 66, *D. perplexus* n. sp., ♀. 67, *D. rebecca* n. sp., ♂. 68, *D. peropacus* Champ., ♂. 69-70, *D. coracinus* n. sp.: 69, ♂; 70, ♀. 71-72, *D. borassi* (Fabr.); 71, ♀; 72, ♂. 73-74, *D. nitidulus* (Guer.): 73, ♂; 74, ♀. 75-76, *D. perryi* n. sp.: 75, ♂; 76, ♀.



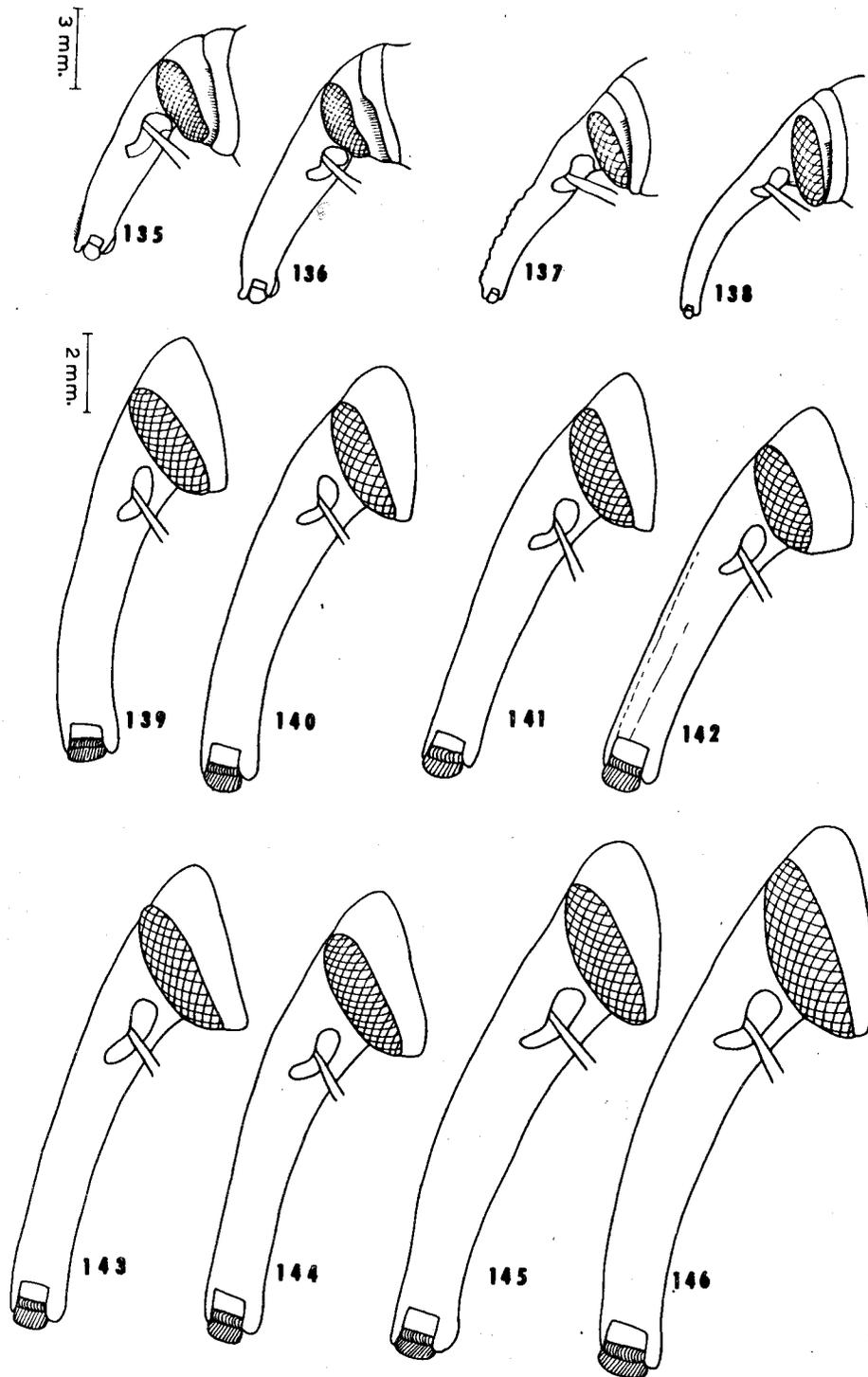
Figures 77-100. Color variation of the pronotum: 77-86, *Rhynchophorus vulneratus* (Panz.); 87-92, *R. cruentatus* (Fabr.); 93-100, *R. bilineatus* (Montr.).



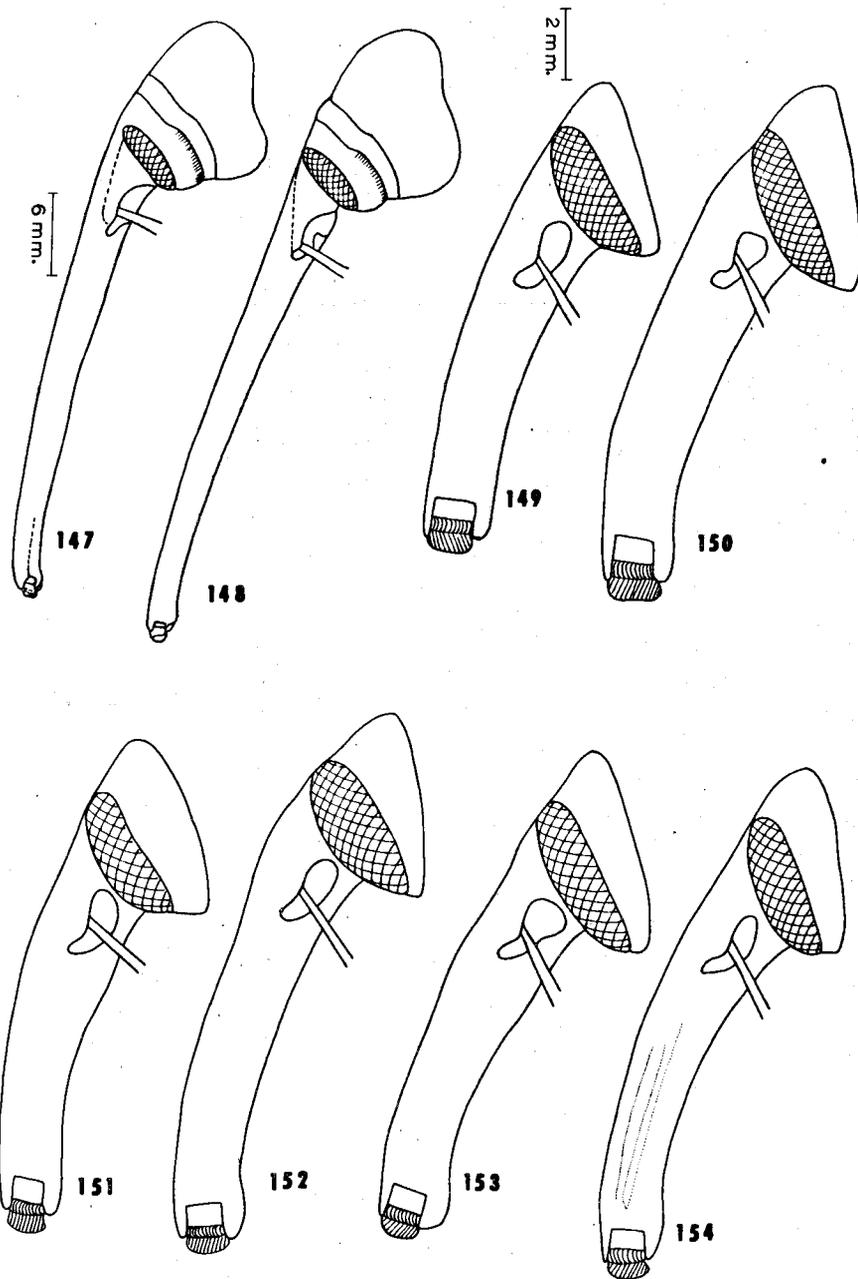
Figures 101-124. *Rhynchophorus ferrugineus* (Oliv.), color variation of pronotum.



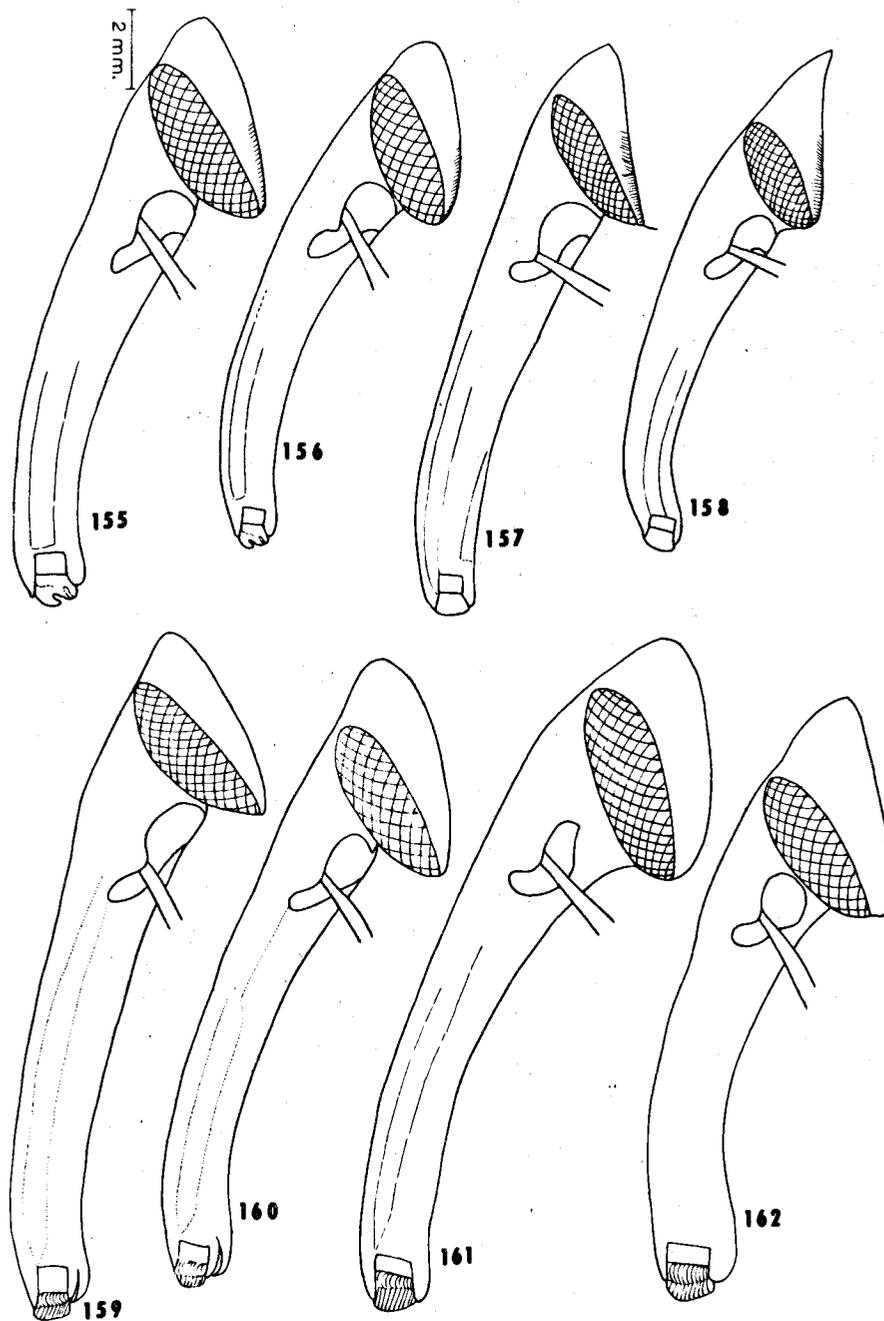
Figures 125-134. Lateral view of rostrum. 125-126, *Rhynchophorus vulneratus* (Panz.) : 125, ♂; 126, ♀. 127-128, *R. bilineatus* (Montr.) : 127, ♂; 128, ♀. 129-130, *R. palmarum* (Linn.) : 129, ♂; 130, ♀. 131, *R. distinctus* n. sp., ♂. 132, *R. ritcheri* n. sp., ♂. 133-134, *R. phoenicis* (Fabr.) : 133, ♂; 134, ♀.



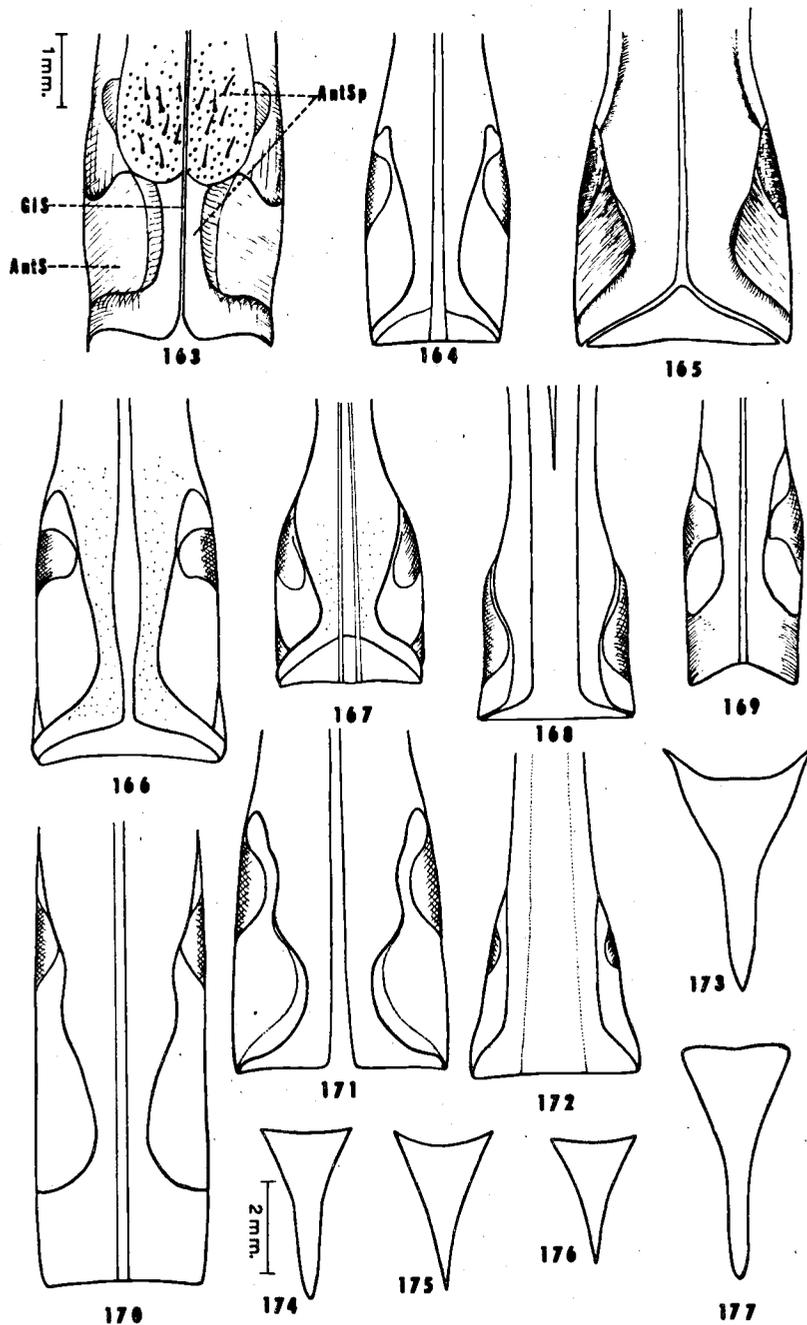
Figures 135-146. Lateral view of rostrum. 135-136, *Rhynchophorus quadrangulus* Queden. : 135, ♂; 136, ♀. 137-138, *R. cruentatus* (Fabr.) : 137, ♂; 138, ♀. 139-140, *Dynamis perryi* n. sp. : 139, ♂; 140, ♀. 141-142, *D. nitidulus* (Guér.) : 141, ♂; 142, ♀. 143-144, *D. coracinus* n. sp. : 143, ♂; 144, ♀. 145-146, *D. peropacus* Champ. : 145, ♂; 146, ♀.



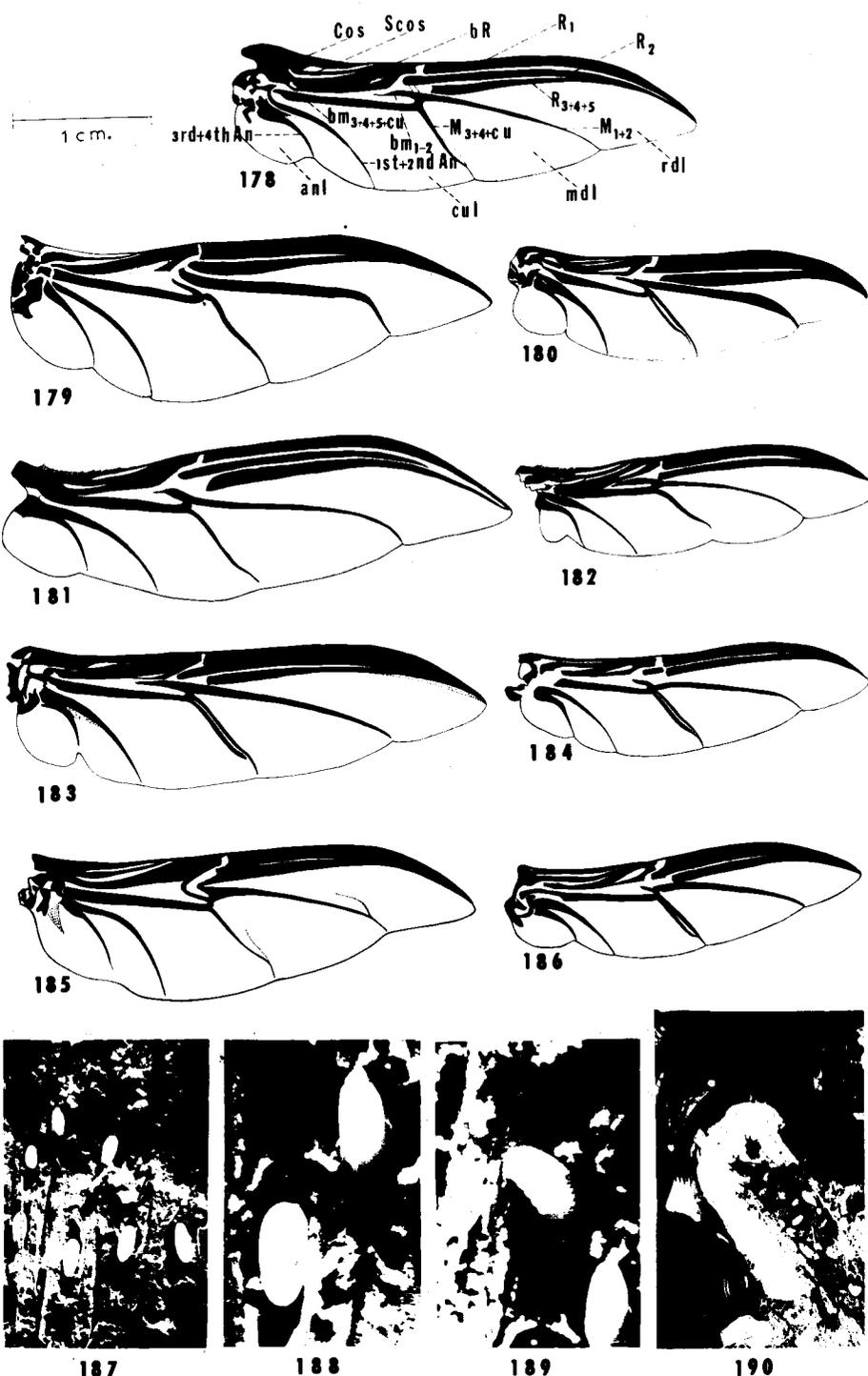
Figures 147-154. Lateral view of rostrum. 147-148, Rhynchodynamis filirostris Heller : 147, ♂; 148, ♀. 149-150, Dynamis rebecca n. sp. : 149, ♂; 150, ♀. 151-152, D. artontipae n. sp. : 151, ♂; 152, ♀. 153, D. callirostris n. sp., ♂. 154, D. perplexus n. sp., ♀.



Figures 155-162. Lateral view of rostrum. 155-158, *Dynamis borassi* (Fabr.) : 155, 157, ♂; 156, 158, ♀. 159-160, *D. rockefelleri* n. sp. : 159, ♂; 160, ♀. 161-162, *D. palmiphilus* n. sp. : 161, ♂; 162, ♀.



Figures 163-172. Ventral view of the space between antennal scrobes; 173-177, Scutellum : 163, 173, *Rhynchophorus palmarum* (Linn.); 164, 174, *R. bilineatus* (Montr.); 165, 177, *R. fitcheri* n. sp.; 166, *R. vulneratus* (Panz.); 167, 175, *R. cruentatus* (Fabr.); 168, *R. quadrangulus* Queden.; 169, 176, *R. distinctus* n. sp.; 170, *Rhynchodynamis filirostris* Heller; 171, *Dynamis borassi* (Fabr.); 172, *D. artornitipae* n. sp.



Figures 178-186. Dorsal view of wing; 178, *Rhynchophorus palmarum* (Linn.); 179, *R. quadrangulus* Queden.; 180, *R. ferrugineus* (Oliv.); 181, *R. ritcheri* n. sp.; 182, *R. distinctus* n. sp.; 183, *R. vulneratus* (Panz.); 184, *R. bilineatus* (Montr.); 185, *R. phoenicis* (Fabr.); 186, *R. cruentatus* (Fabr.). 187-190, *R. vulneratus* (Panz.): 187-188, egg; 189, egg and larva; 190, trunk of coconut palm split to show adult weevils and larvae feeding inside.

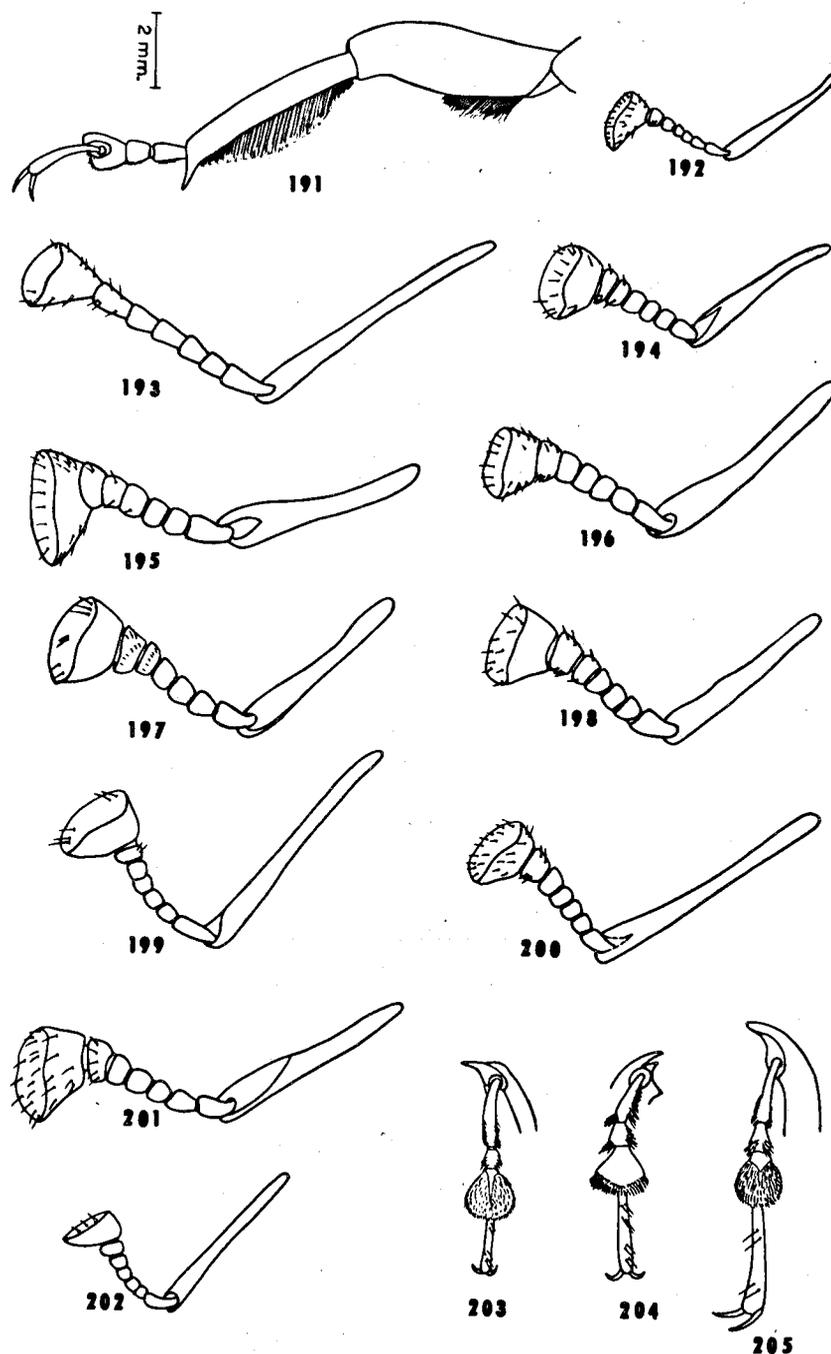
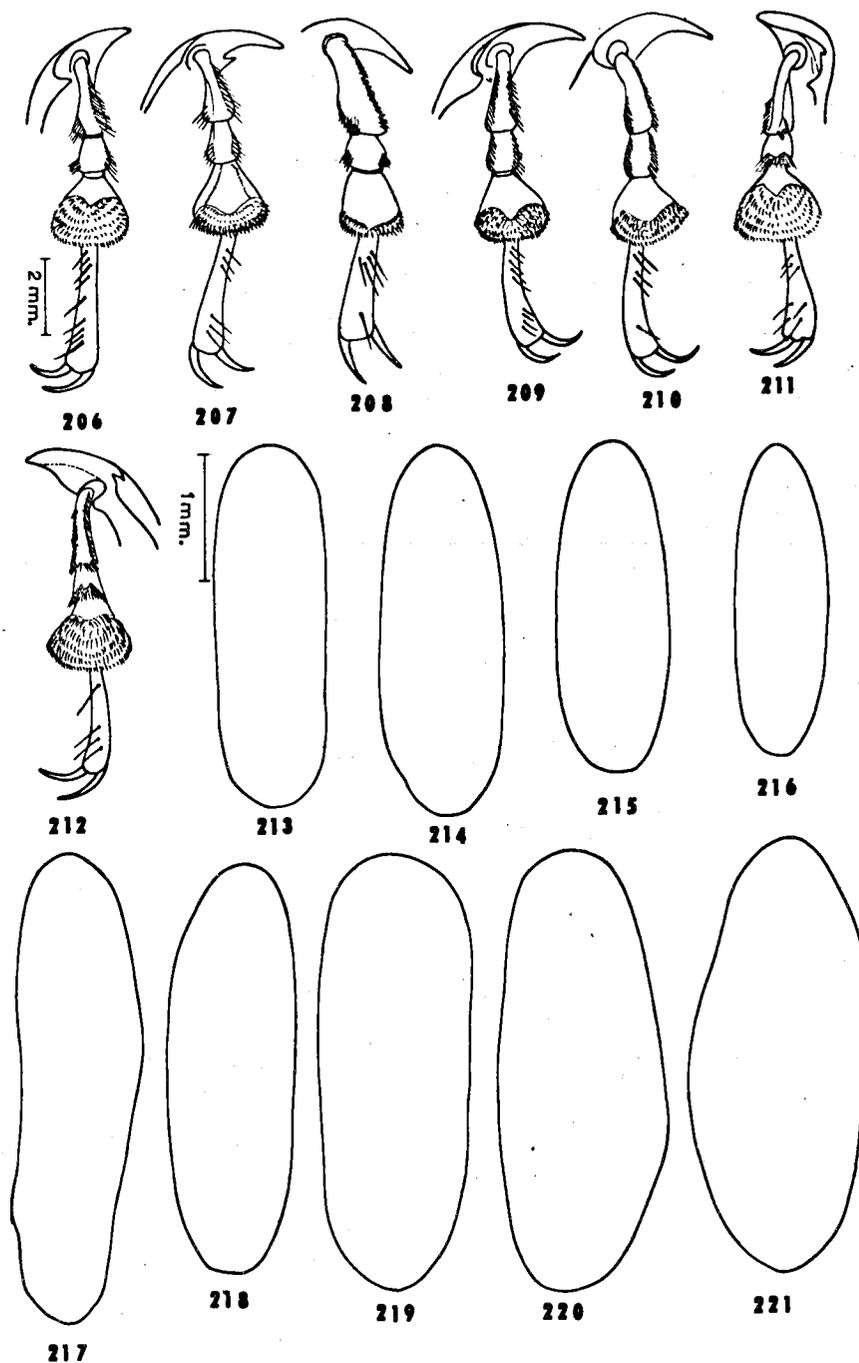
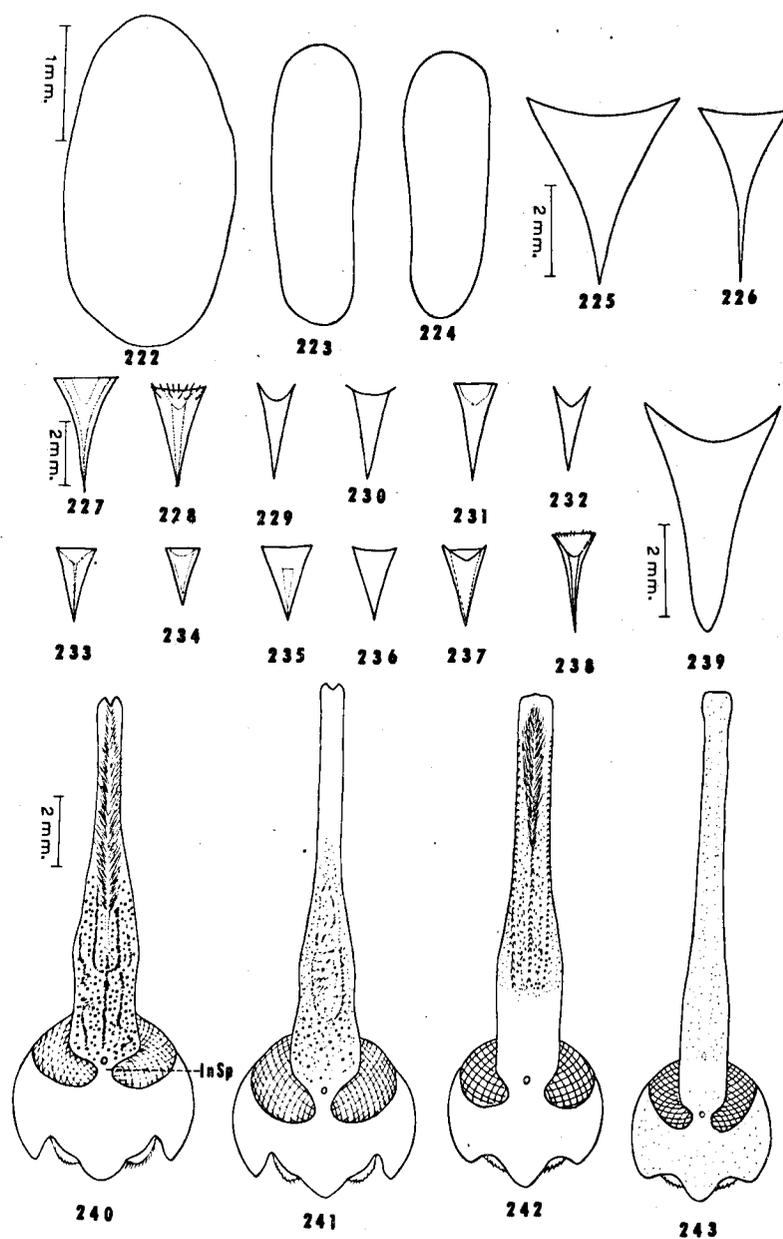


Figure 191. Lateral view of left front leg of male; 192-202. Inner-lateral view of antenna; 203-205.

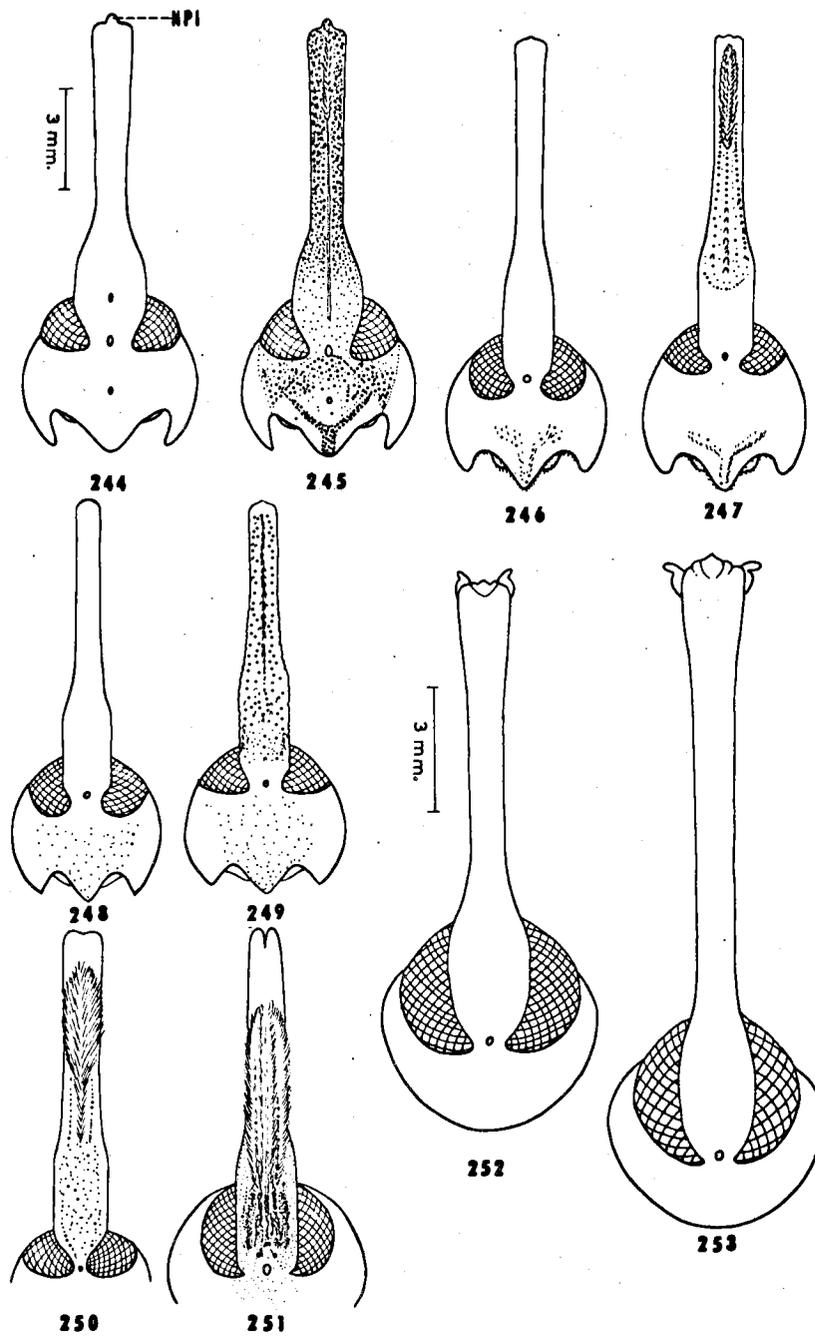
Ventral view of tarsal segment of left prothoracic leg. 191, 192, 203, *Rhynchophorus distinctus* n. sp.; 193, *Rhynchodynamis filirostris* Heller; 194, 204, *Rhynchophorus cruentatus* (Fabr.); 195, *R. palmarum* (Linn.); 196, *R. ritcheri* n. sp.; 197, *R. phoenicis* (Fabr.); 198, *R. quadrangulus* Qued.; 199, *Dynamis palmiphilus* n. sp.; 200, *D. borassi* (Fabr.); 201, *R. bilineatus* (Montr.); 202, *D. nitidulus* (Guér.); 205, *D. artoantipae* n. sp.



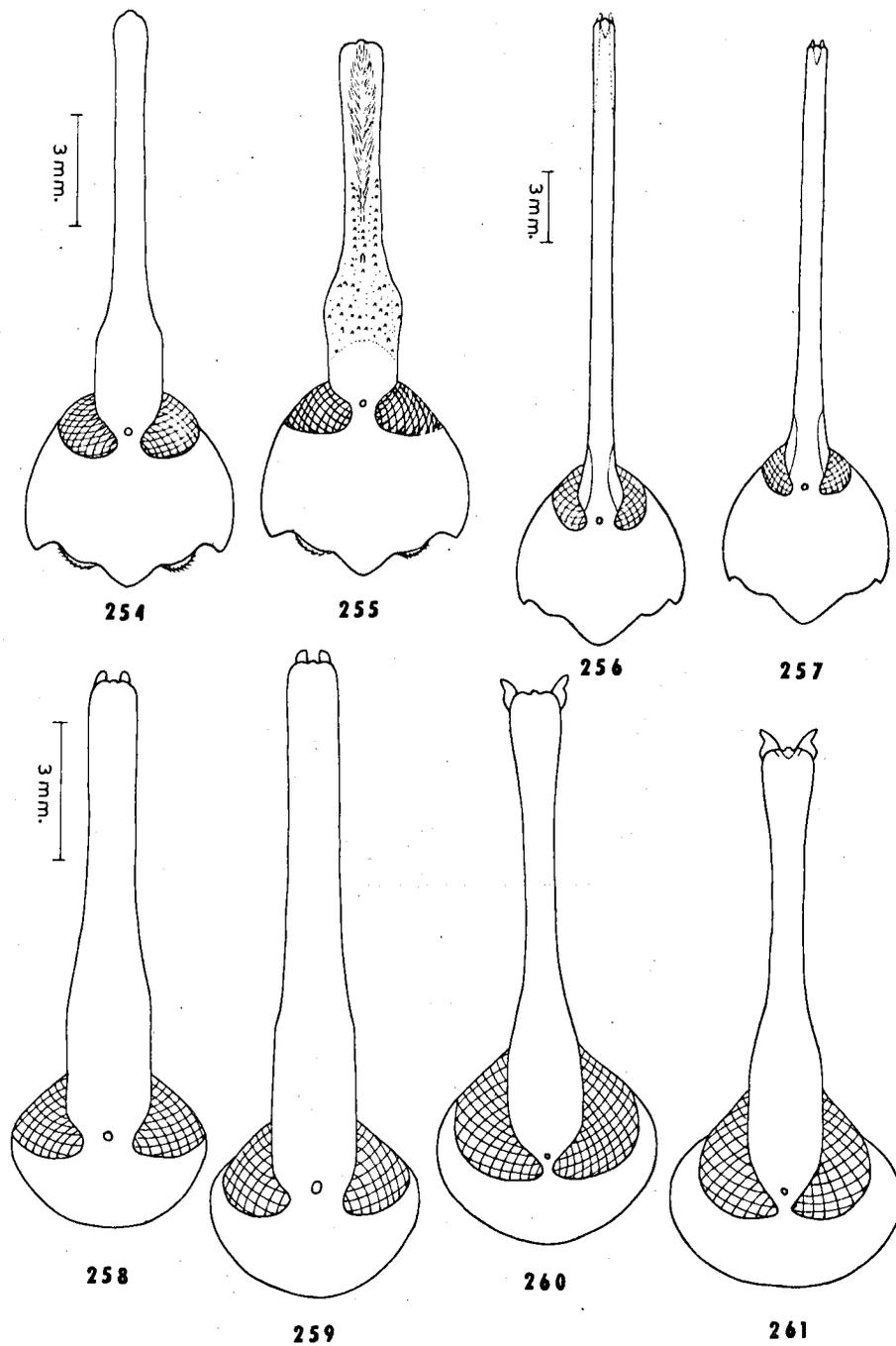
Figures 206-212. Ventral view of tarsal segment of left prothoracic leg; 213-221. Egg: 206, *Rhynchophorus quadrangulus* Queden.; 207, 215, *R. bilineatus* (Montr.); 208, *R. ritcheri* n. sp.; 209, 217, *R. phoenicis* (Fabr.); 210, 213, *R. palmarum* (Linn.); 211, *Rhynchodynamis filirostris* Heller; 212, *Dynamis borassi* (Fabr.); 214, *R. ferrugineus* (Oliv.); 216, *R. cruentatus* (Fabr.); 218, *R. vulneratus* (Panz.); 219, *D. coracinus* n. sp.; 220, *D. peropacus* Champ.; 221, *D. perryi* n. sp.



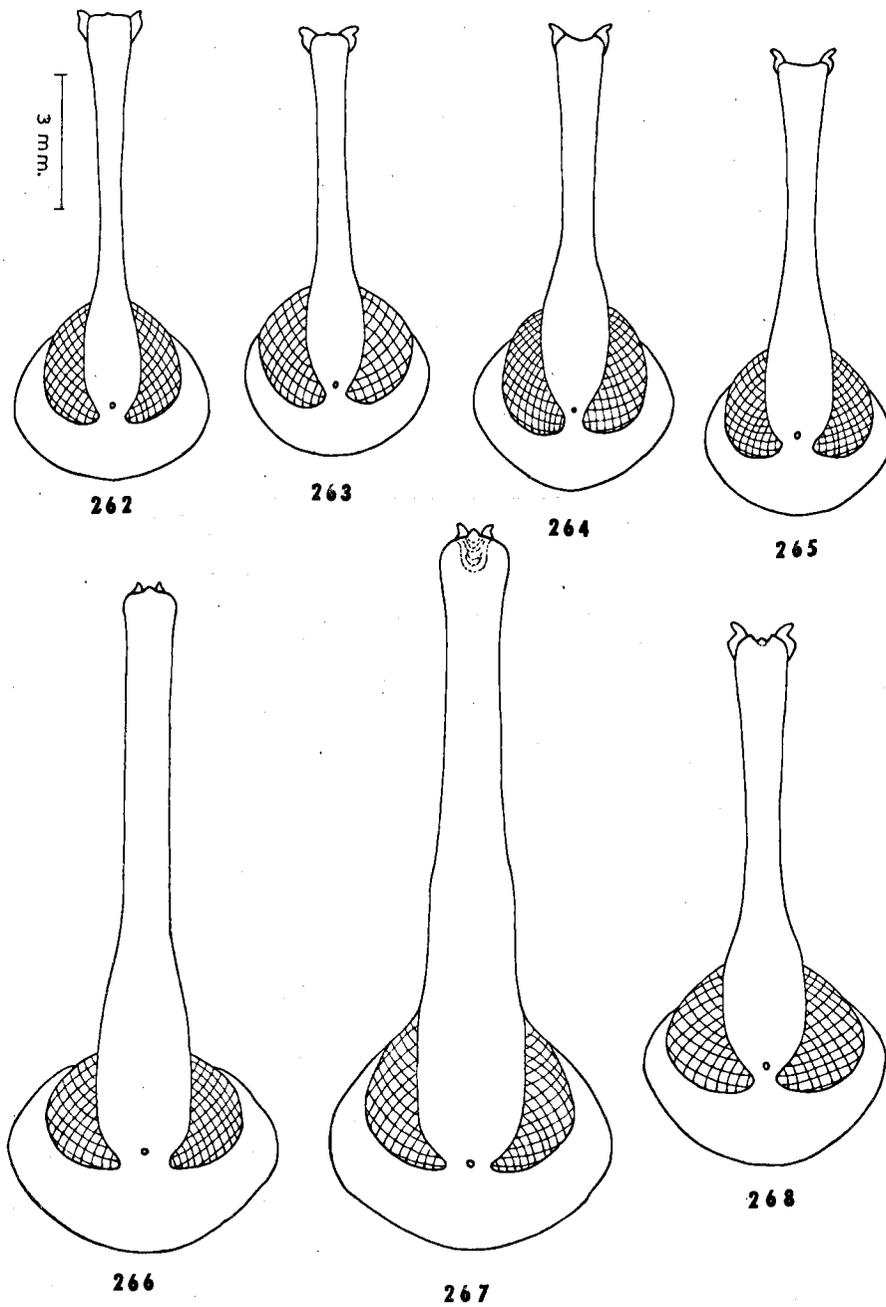
Figures 222-224. Egg; 225-239. Scutellum; 240-243. Dorsal view of rostrum: 222, 225, *Rhynchophorus quadrangulus* Queden. ; 223, 227, *Dynamis borassi* (Fabr.); 224, 238, *Rhynchodynamis filirostris* Heller; 226, *R. phoenicis* (Fabr.); 228, *D. rockefelleri* n. sp. ; 229, *D. artortipae* n. sp.; 230, *D. palmiphilus* n. sp. ; 231, *D. peropacus* Champ. ; 232, *D. callirostris* n. sp. ; 233, *D. coracinus* n. sp. ; 234, *D. rebecca* n. sp. ; 235, *D. perryi* n. sp. ; 236, *D. nitidulus* (Guér.); 237, *D. perplexus* n. sp. ; 239, *R. vulneratus* (Panz.); 240-241, *R. palmarum* (Linn.): 240, ♂; 241, ♀; 242-243, *R. vulneratus* (Panz.): 242, ♂; 243, ♀.



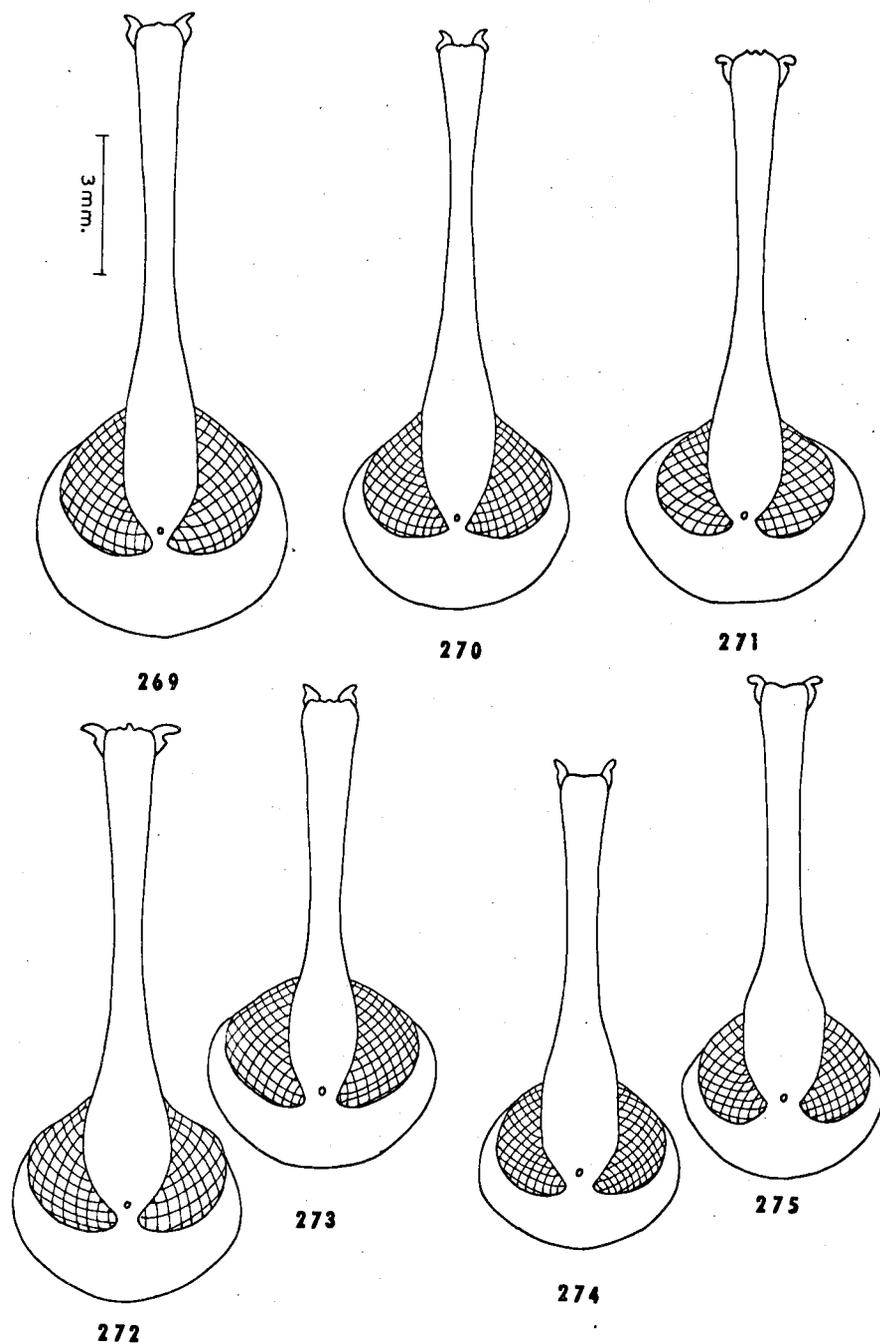
Figures 244-253. Dorsal view of rostrum. 244-245, Rhynchophorus quadrangulus Queden. : 244, ♀; 245, ♂. 246-247, R. bilineatus (Montr.): 246, ♀; 247, ♂. 248-249, R. cruentatus (Fabr.): 248, ♀; 249, ♂. 250, R. distinctus n. sp., ♂; 251, R. ritcheri n. sp. ♂; 252-253, Dynamis palmiphilus n. sp. : 252, ♂; 253, ♀.



Figures 254-261. Dorsal view of rostrum. 254-255, *Rhynchophorus phoenicis* (Fabr.): 254, ♀; 255, ♂. 256-257, *Rhynchodynamis filirostris* Heller: 256, ♀; 257, ♂. 258-259, *Dynamis borassi* (Fabr.): 258, ♀; 259, ♂. 260-261, *D. rebecca* n. sp.: 260, ♀; 261, ♂.



Figures 262-268. Dorsal view of rostrum. 262-263, *Dynamis perryi* n. sp. : 262, ♀; 263, ♂
 264-265, *D. nitidulus* (Guér.) : 264, ♀; 265, ♂ 266-267, *D. rockefelleri* n. sp. : 266, ♀;
 267, ♂ 268, *D. callirostris* n. sp., ♂



Figures 269-275. Dorsal view of rostrum. 269-270, *Dynamis peropacus* Champ. ; 269, ♀; 270, ♂. 271, *D. perplexus* n. sp., ♀. 272-273, *D. artornitipae* n. sp. : 272, ♀; 273, ♂. 274-275, *D. coracinus* n. sp. : 274, ♀; 275, ♂.

Figures 276-317. Ventral and dorsal views of tegmen (from left to right).

Figs. 276-277. Rhynchophorus cruentatus (Fabricius).

278-279. Rhynchophorus distinctus New Species.

280-281. Rhynchophorus bilineatus (Montrouzier).

282-283. Rhynchophorus quadrangulus Quedenfeldt.

284-287. Rhynchophorus ferrugineus (Olivier).

288-289. Rhynchophorus phoenicis (Fabricius).

290-291. Rhynchophorus vulneratus (Panzer).

292-293. Rhynchophorus ritcheri New Species.

294-295. Rhynchophorus palmarum (Linnaeus).

296-297. Rhynchodynamis filirostris Heller.

298-299. Dynamis rockefelleri New Species.

300-301. Dynamis callirostris New Species.

302-303. Dynamis borassi (Fabricius).

304-305. Dynamis palmiphilus New Species.

306-307. Dynamis peropacus Champion.

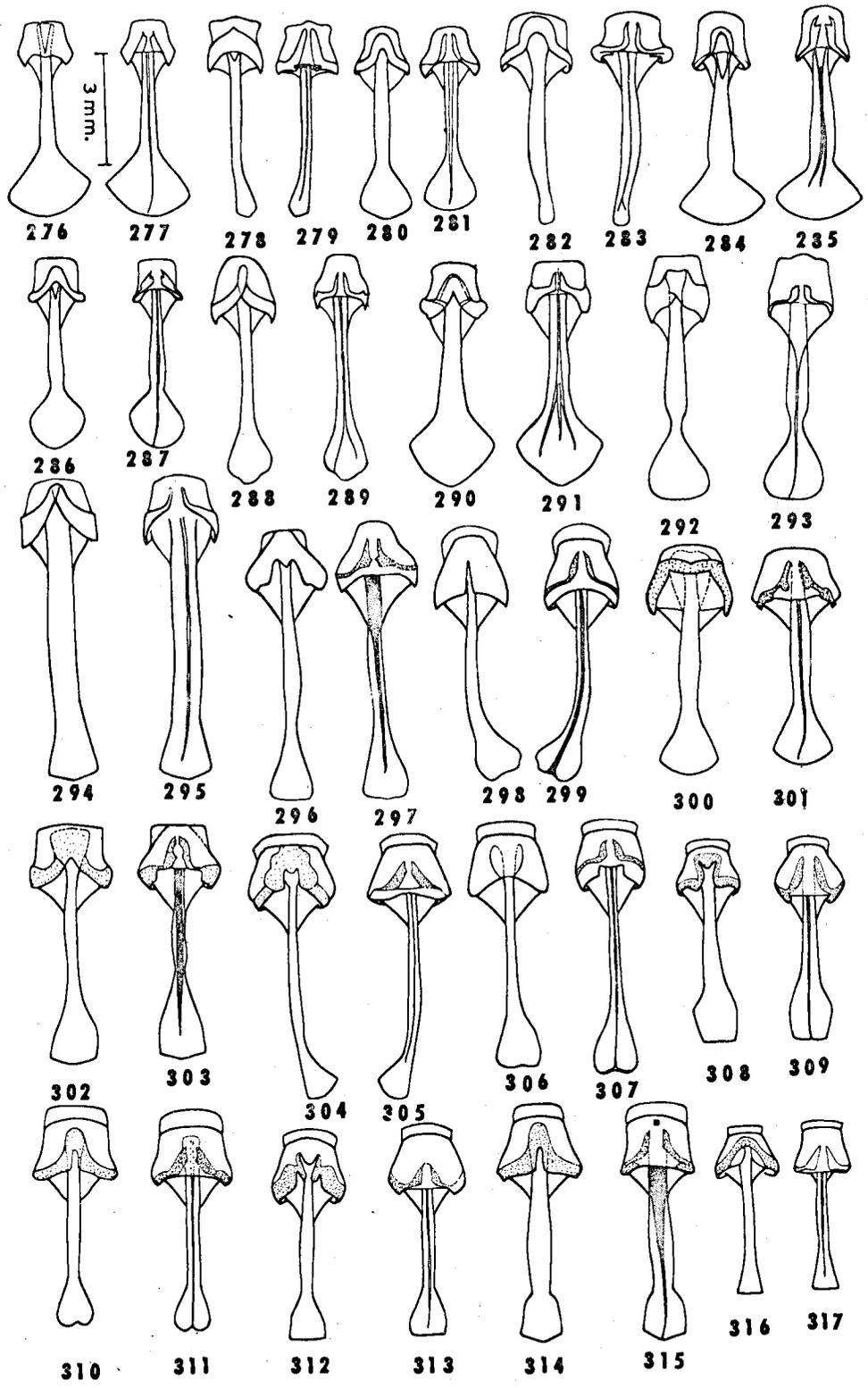
308-309. Dynamis perryi New Species.

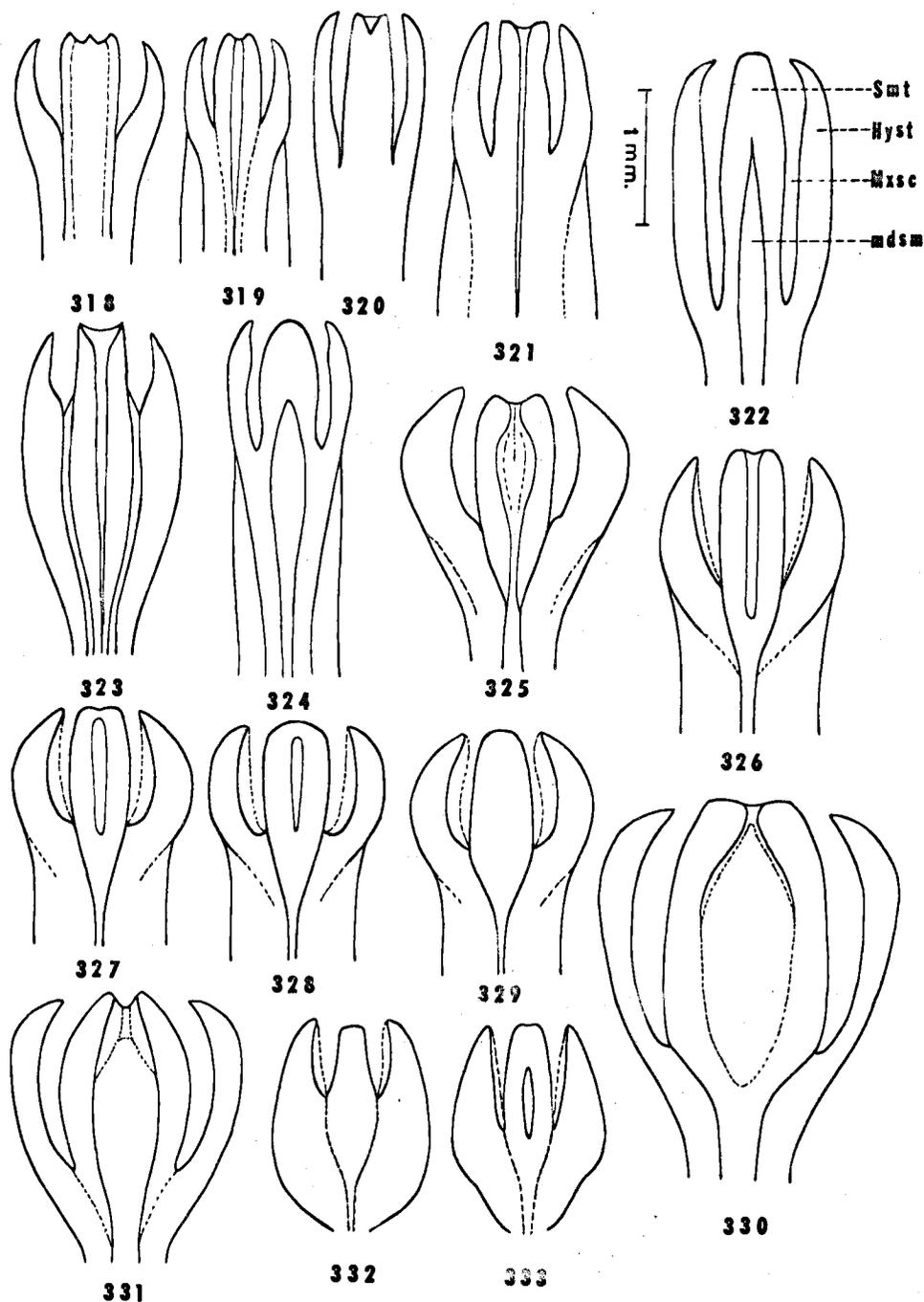
310-311. Dynamis rebecca New Species.

312-313. Dynamis coracinus New Species.

314-315. Dynamis artorntipae New Species.

316-317. Dynamis nitidulus (Guérin).

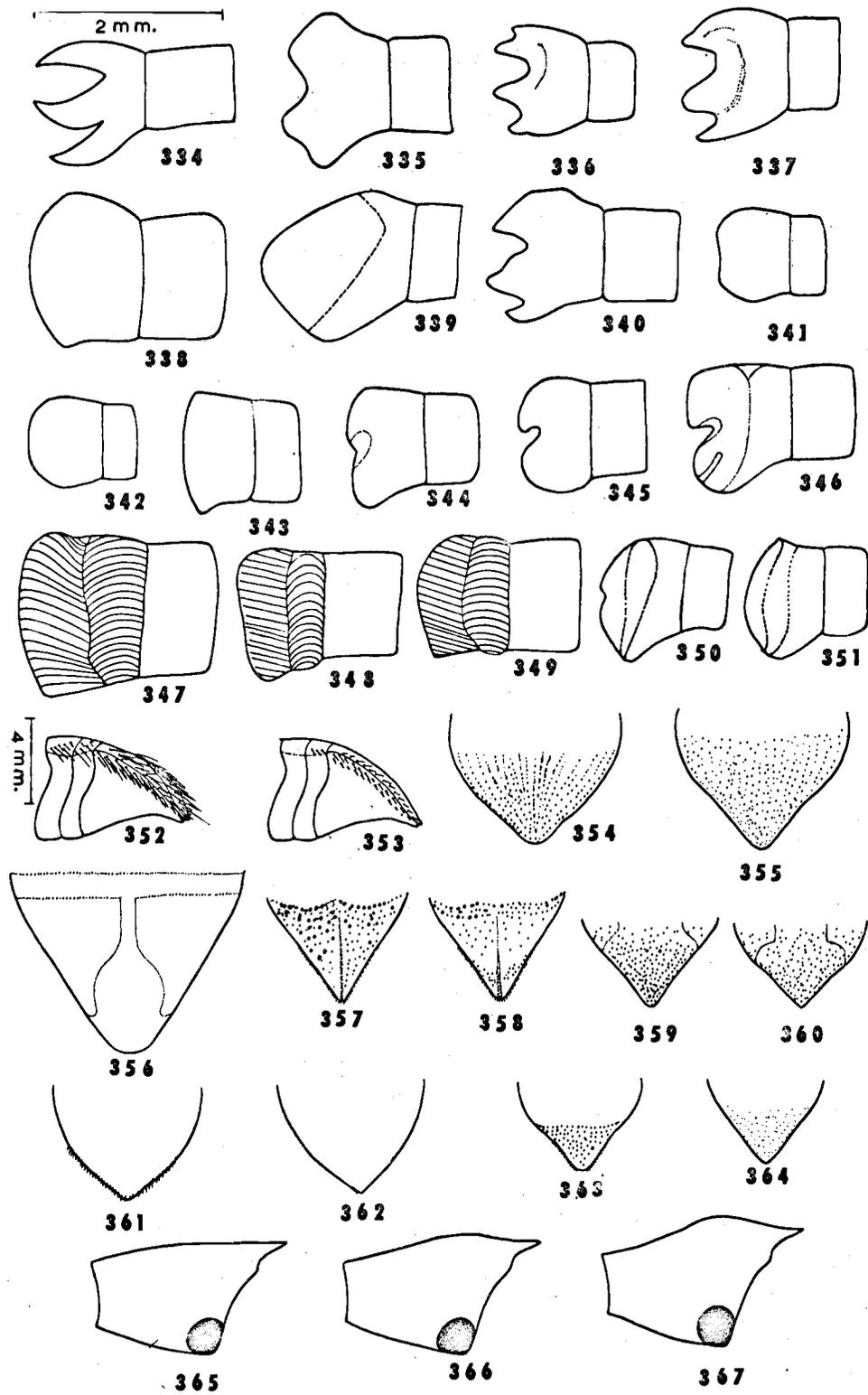




Figures 318-333. Ventral view of hypostoma : 318, *Rhynchophorus distinctus* n. sp. ; 319, *R. cruentatus* (Fabr.) ; 320, *R. bilineatus* (Montr.) ; 321, *R. vulneratus* (Panz.) ; 322, *R. palmarum* (Linn.) ; 323, *R. ritcheri* n. sp. ; 324, *R. quadrangulus* Queden. ; 325, *D. rockefelleri* n. sp. ; 326-329, *D. borassi* (Fabr.) ; 330-331, *D. palmiphilus* n. sp. : 330, ♀ ; 331, ♂ ; 332-333, *Rhynchodynamis filirostris* Heller : 332, ♀ ; 333, ♂.

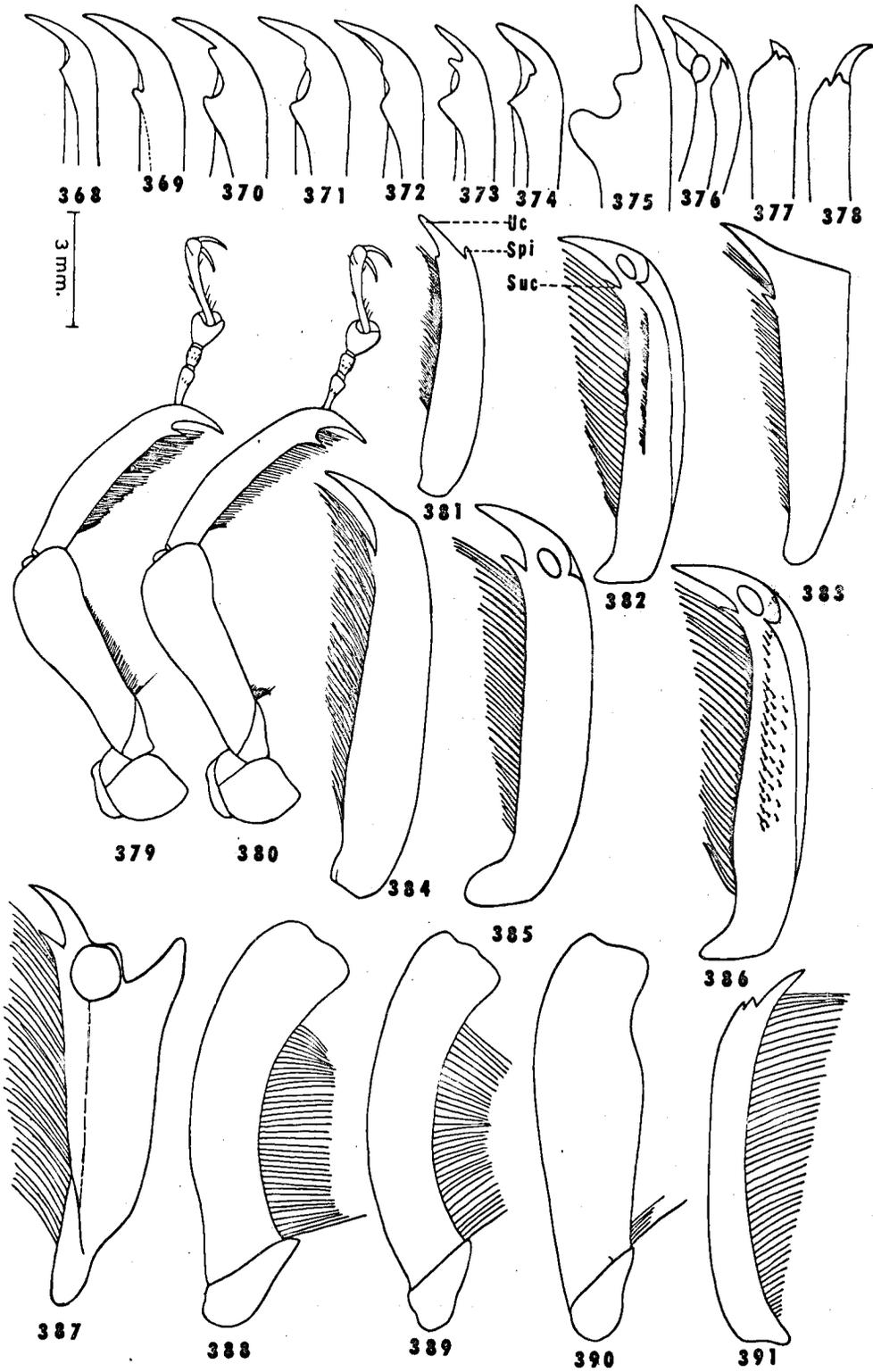
Figures 334-351. Lateral view of right mandible; 352-353. Lateral view of pygidium;
354-364. Dorsal view of pygidium; 365-367. Lateral view of pronotum.

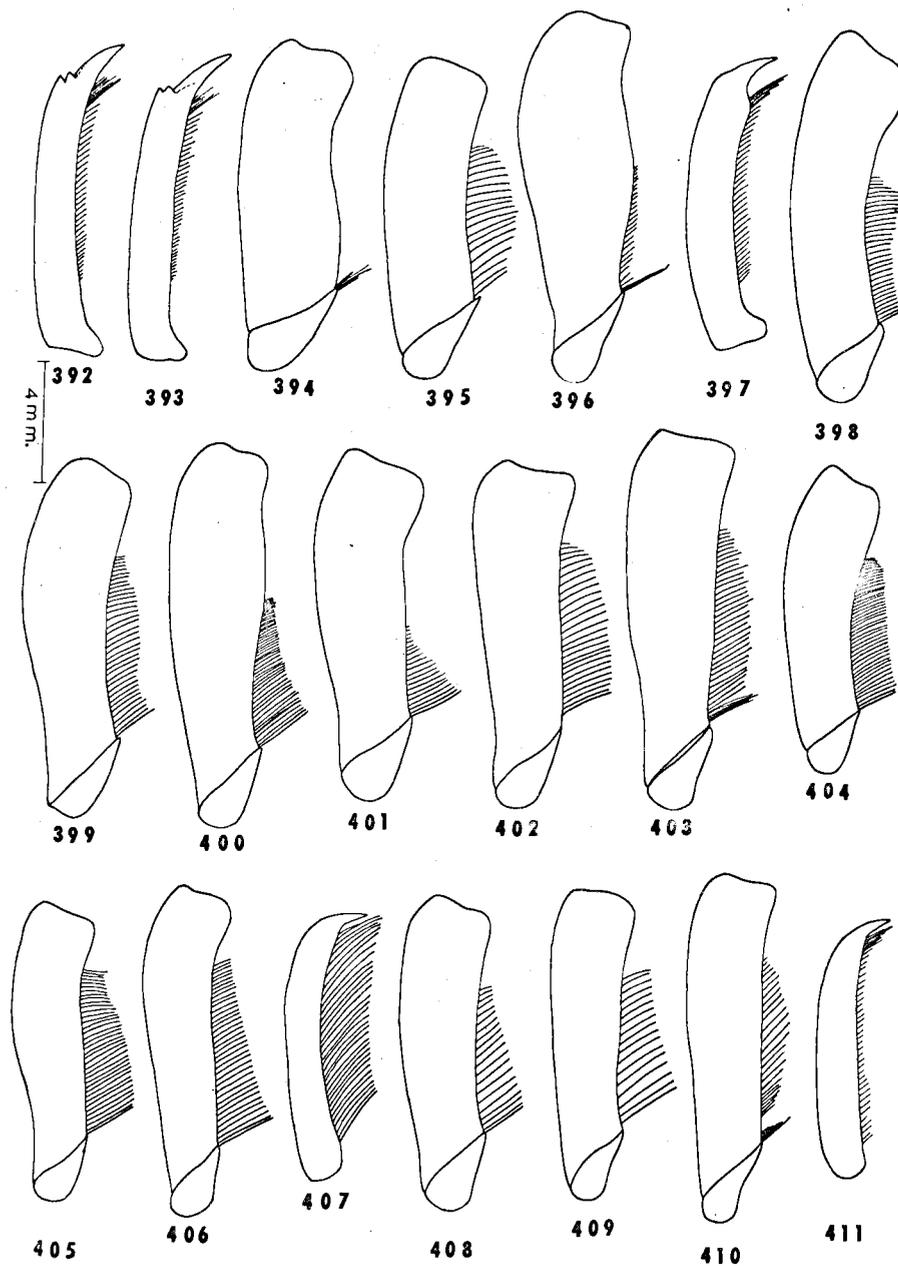
- Fig. 334. Rhynchophorus distinctus New Species.
335. Rhynchophorus palmarum (Linnaeus).
336. Rhynchophorus bilineatus (Montrouzier).
337. Rhynchophorus vulneratus (Panzer).
338. Rhynchophorus quadrangulus Quedenfeldt.
339. Rhynchophorus ritcheri New Species.
340. Rhynchophorus phoenicis (Fabricius).
341-342. Rhynchophorus cruentatus (Fabricius).
343-346. Dynamis borassi (Fabricius).
347. Dynamis palmiphilus New Species.
348. Dynamis rockefelleri New Species.
349. Dynamis artornitipae New Species.
350-351. Rhynchodynamis filirostris Heller.
352. Dynamis coracinus New Species.
353. Dynamis perryi New Species.
354. Rhynchophorus quadrangulus Quedenfeldt, male.
355. Rhynchophorus quadrangulus Quedenfeldt, female.
356. Rhynchophorus distinctus New Species, male.
357. Rhynchophorus palmarum (Linnaeus), male.
358. Rhynchophorus palmarum (Linnaeus), female.
359. Rhynchophorus cruentatus (Fabricius), male.
360. Rhynchophorus cruentatus (Fabricius), female.
361. Rhynchophorus phoenicis (Fabricius), male.
362. Rhynchophorus phoenicis (Fabricius), female.
363. Rhynchophorus bilineatus (Montrouzier), male.
364. Rhynchophorus bilineatus (Montrouzier), female.
365. Dynamis perryi New Species.
366. Dynamis nitidulus (Guérin).
367. Dynamis coracinus New Species



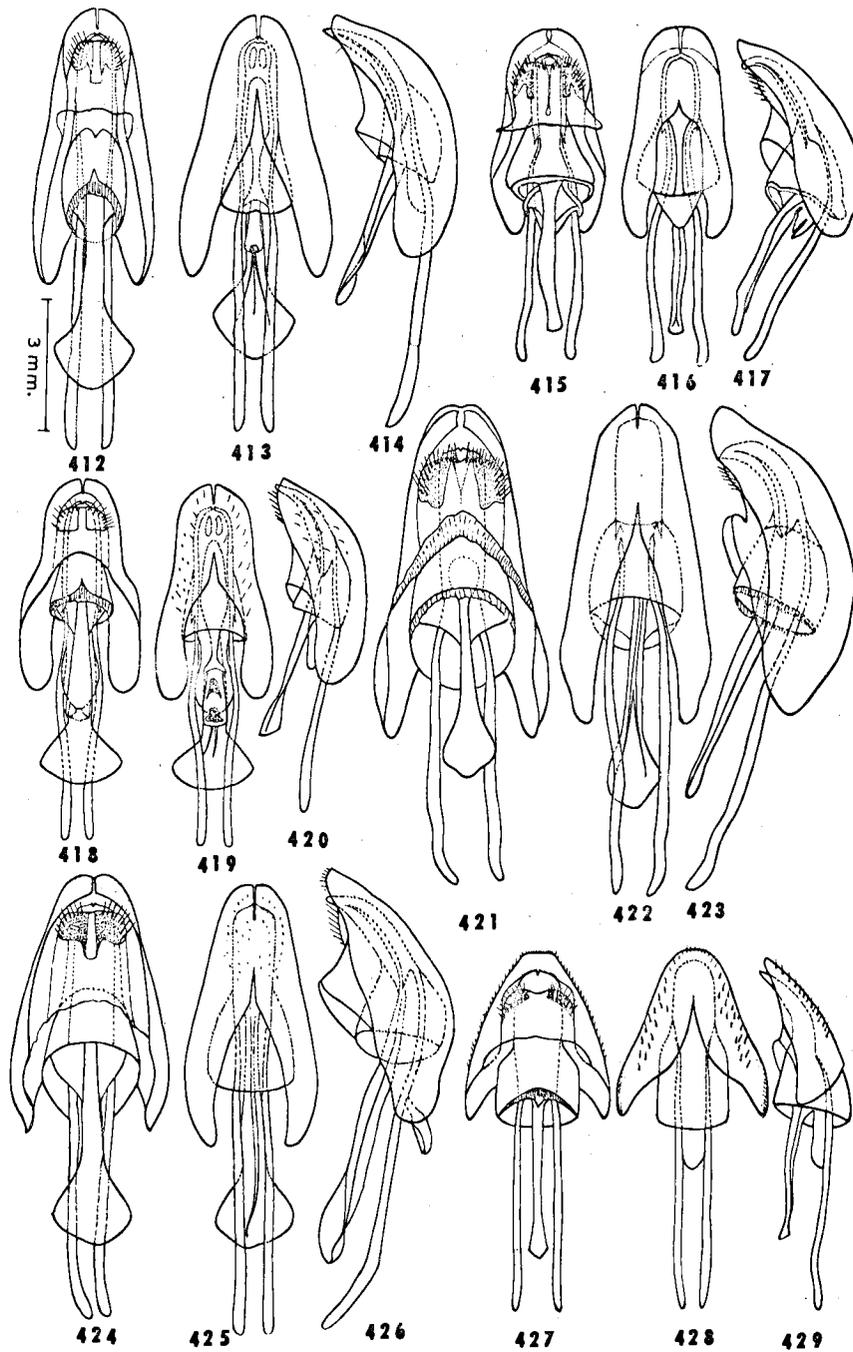
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369. Rhynchophorus palmarum (Linnaeus).
370. Rhynchophorus quadrangulus Quedenfeldt.
371. Rhynchophorus phoenicis (Fabricius).
372. Rhynchophorus bilineatus (Montrouzier).
373. Rhynchophorus cruentatus (Fabricius).
374. Rhynchodynamis filirostris Heller.
375. Rhynchophorus ritcheri New Species.
376. Dynamis borassi (Fabricius).
377. Rhynchophorus bilineatus (Montrouzier).
378. Dynamis borassi (Fabricius).
379. Rhynchophorus palmarum (Linnaeus), male.
380. Rhynchophorus palmarum (Linnaeus), female.
381. Rhynchophorus distinctus New Species.
382. Rhynchophorus cruentatus (Fabricius), male.
383. Rhynchophorus ritcheri New Species.
384. Rhynchophorus palmarum (Linnaeus).
385. Rhynchophorus palmarum (Linnaeus).
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387. Rhynchophorus ritcheri New Species.
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389. Dynamis borassi (Fabricius), male, left middle femur.
390. Dynamis borassi (Fabricius), male, left hind femur.
391. Dynamis borassi (Fabricius), male, left front tibia.

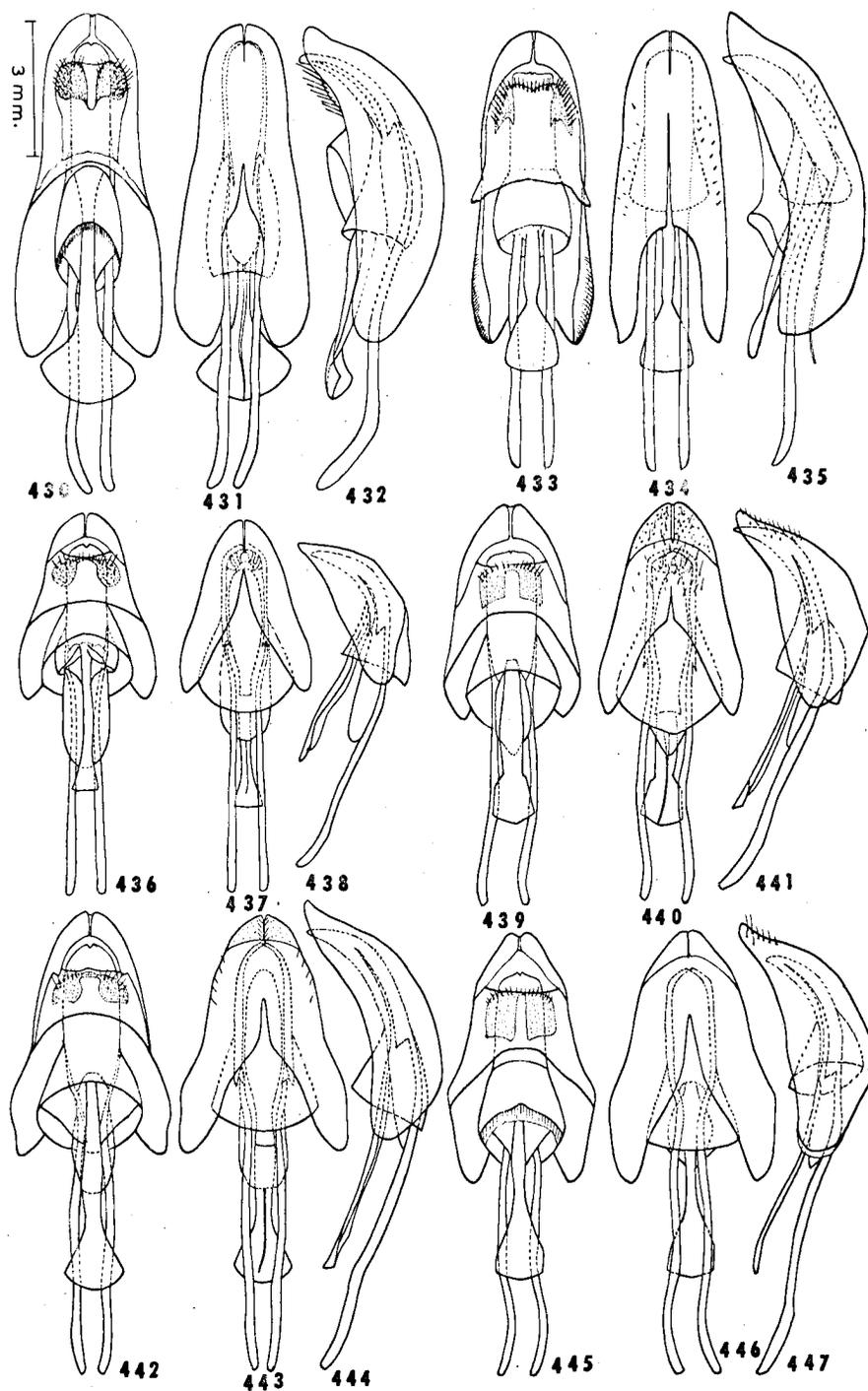




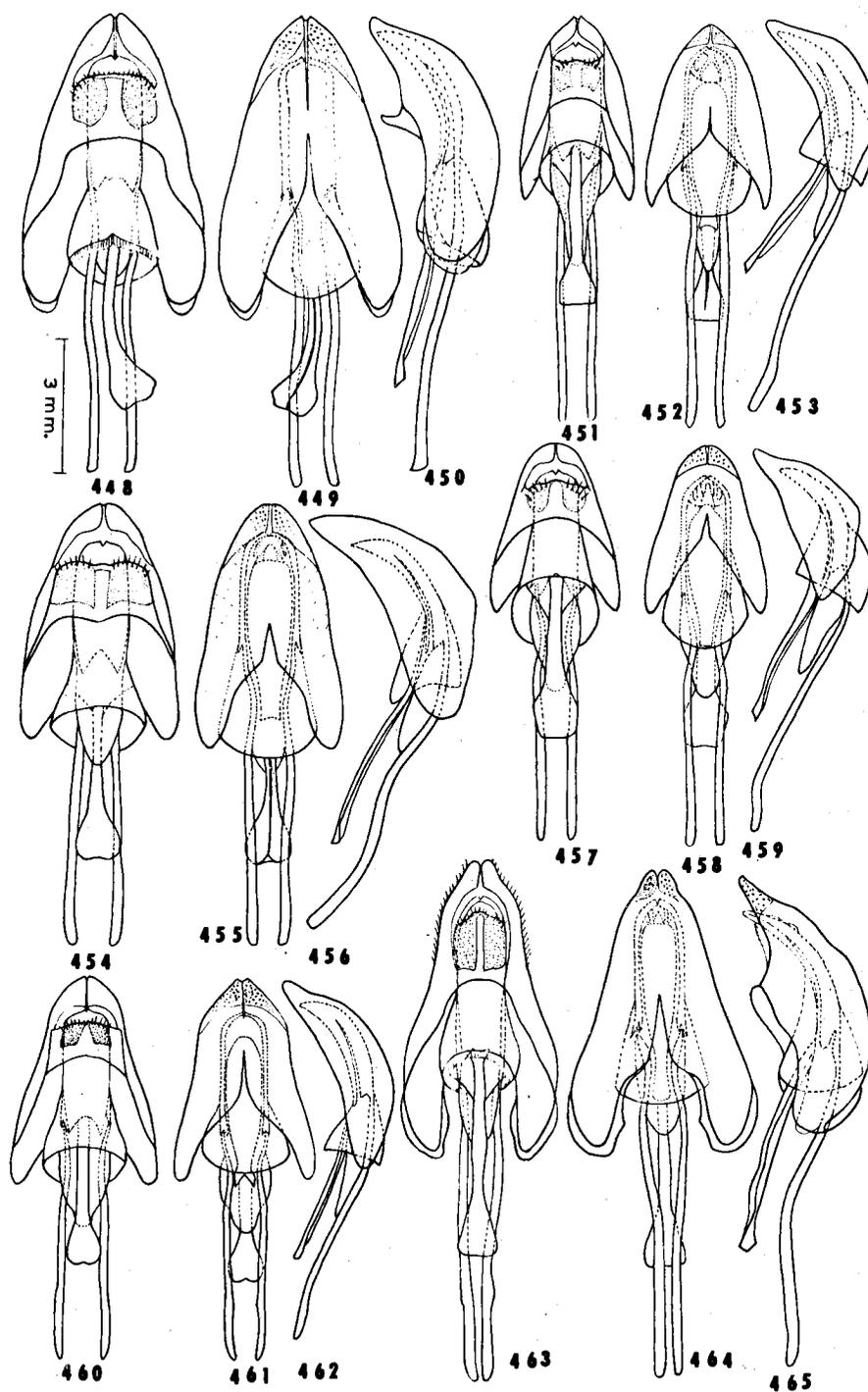
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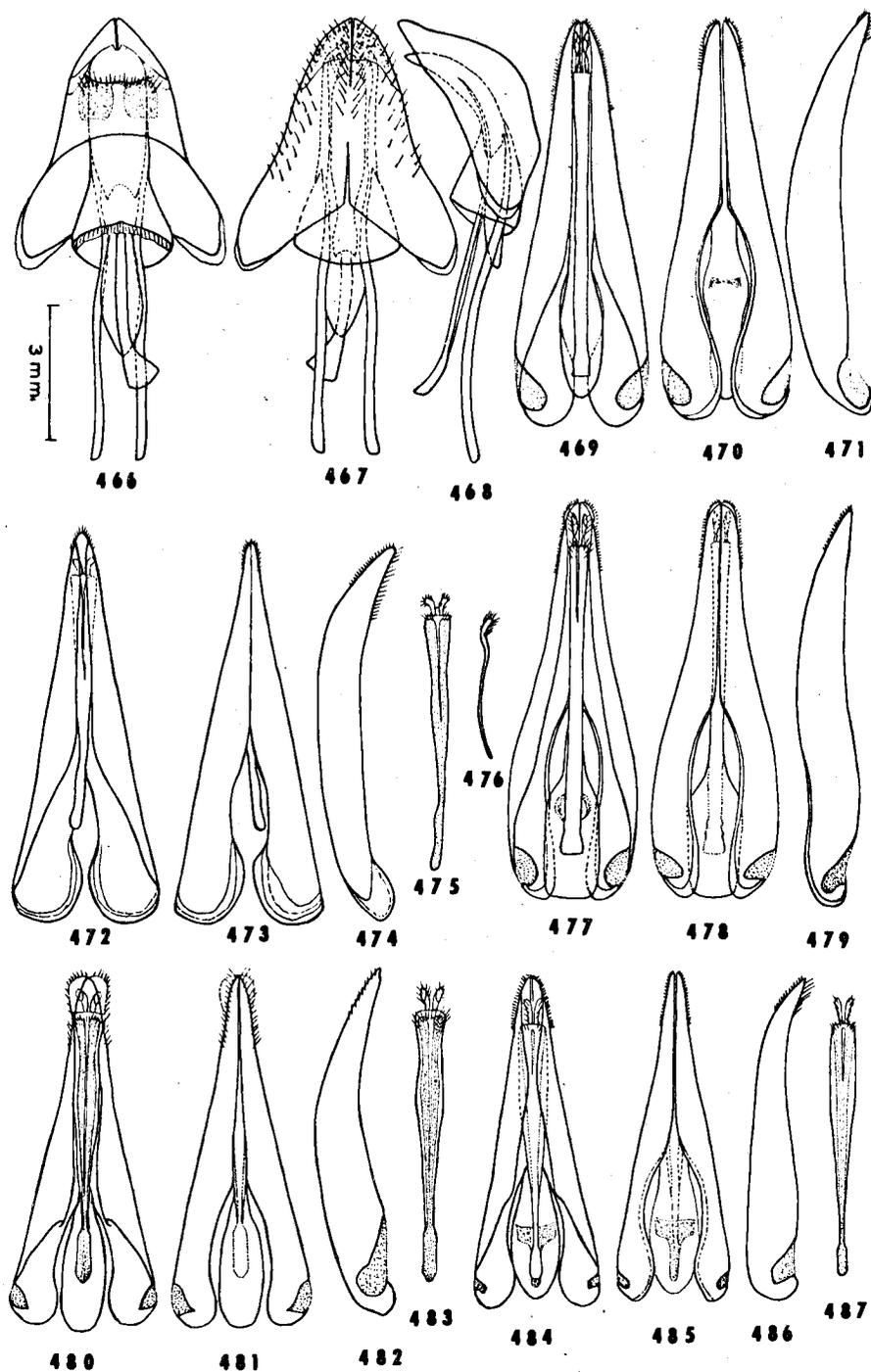
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 427-429, *R. distinctus* n. sp.



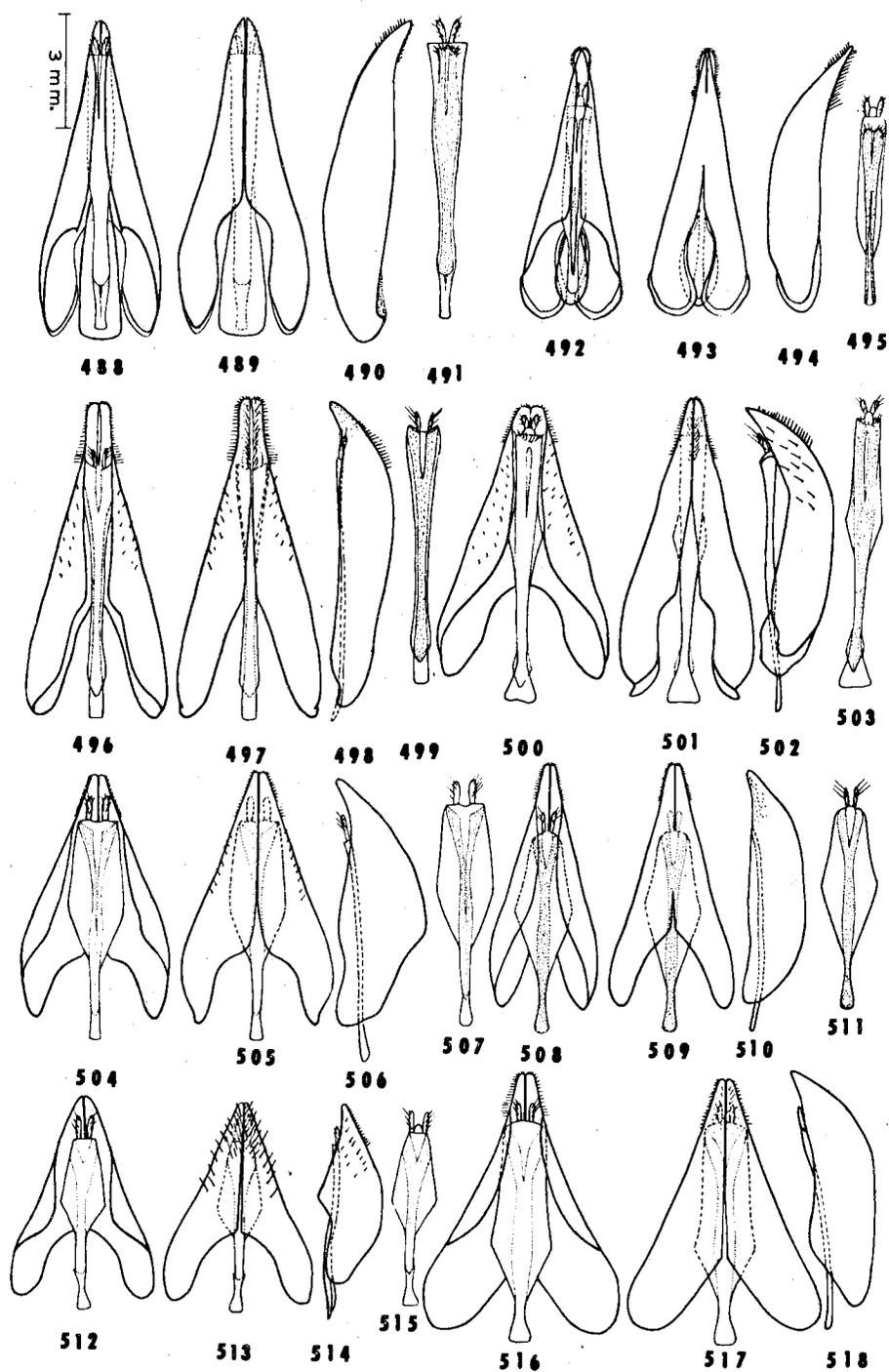
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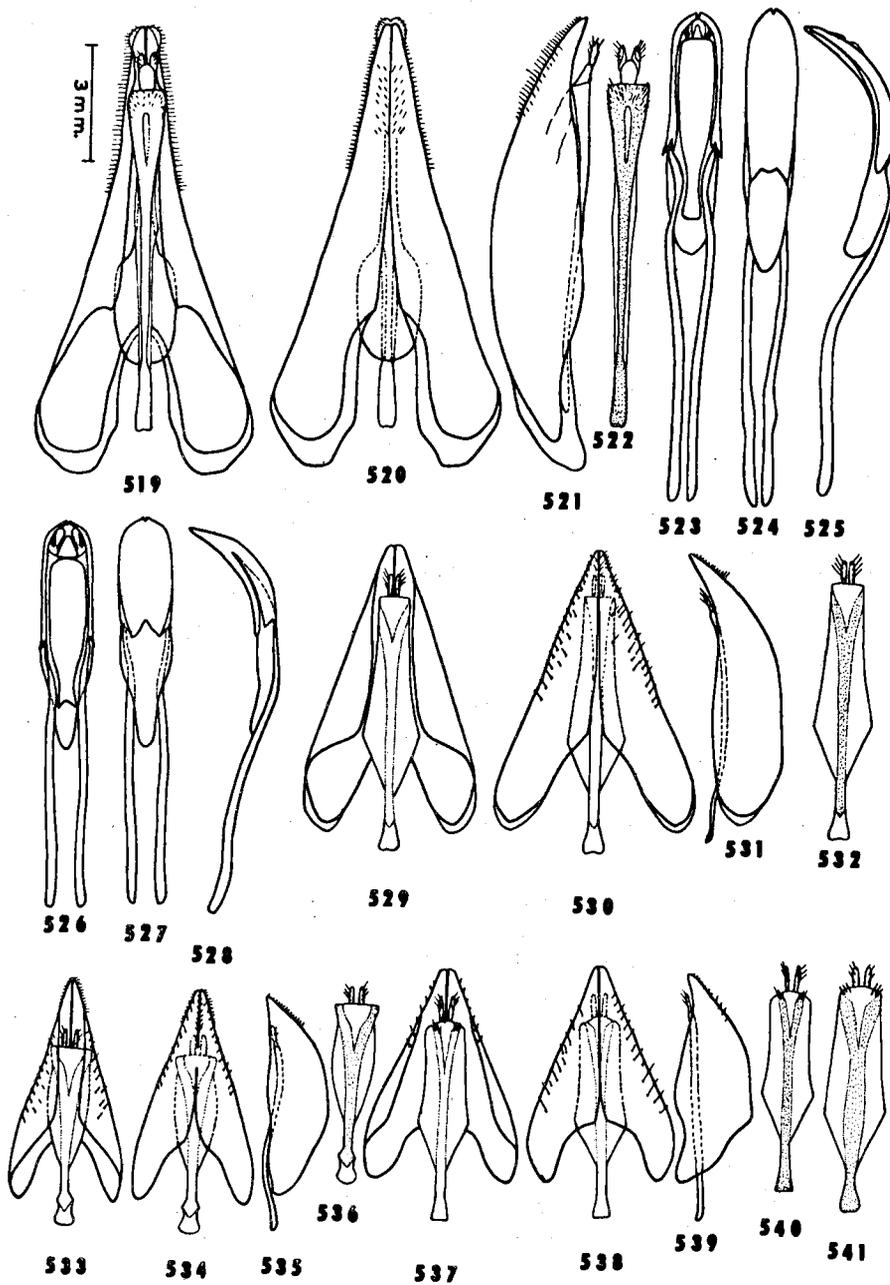
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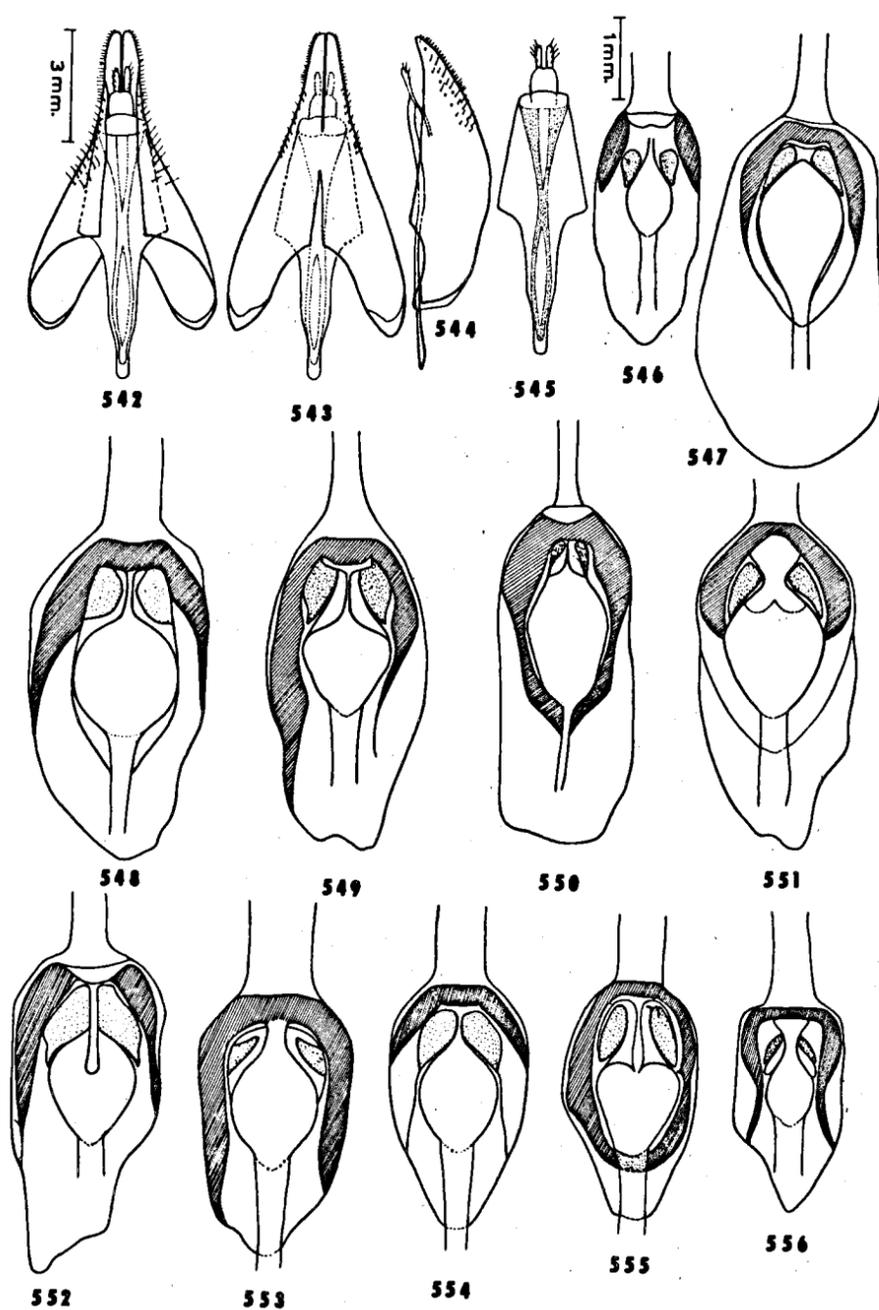
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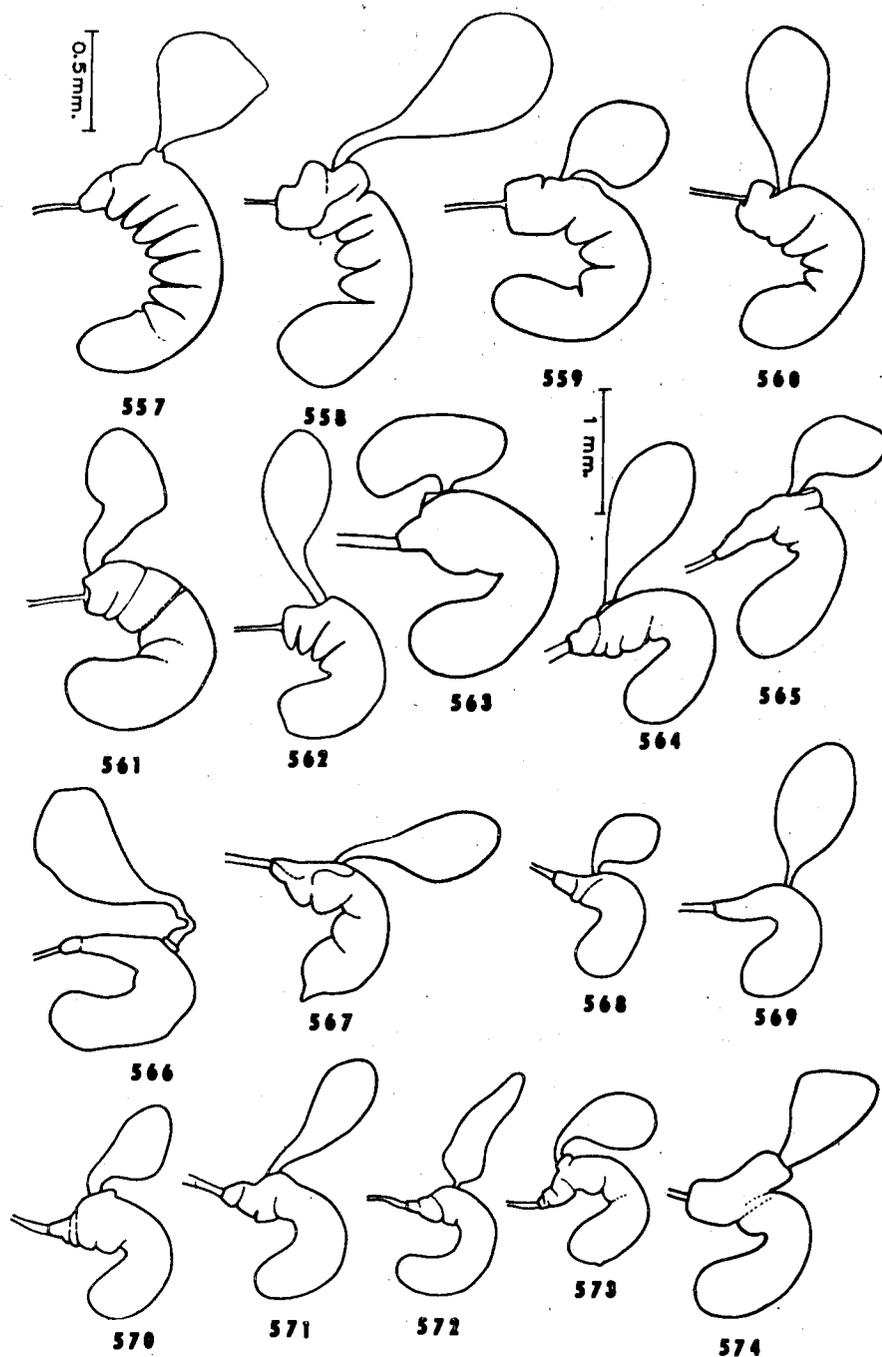
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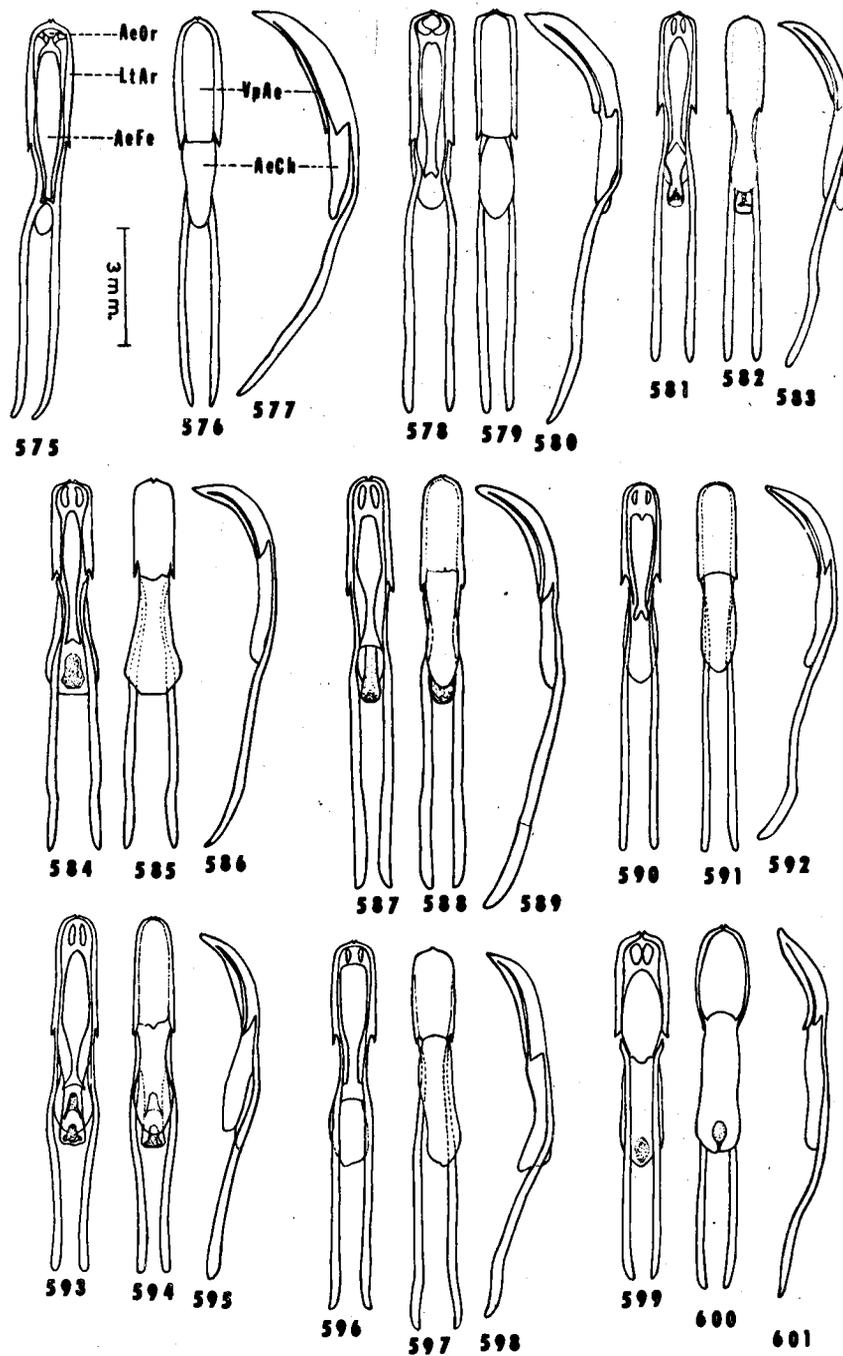
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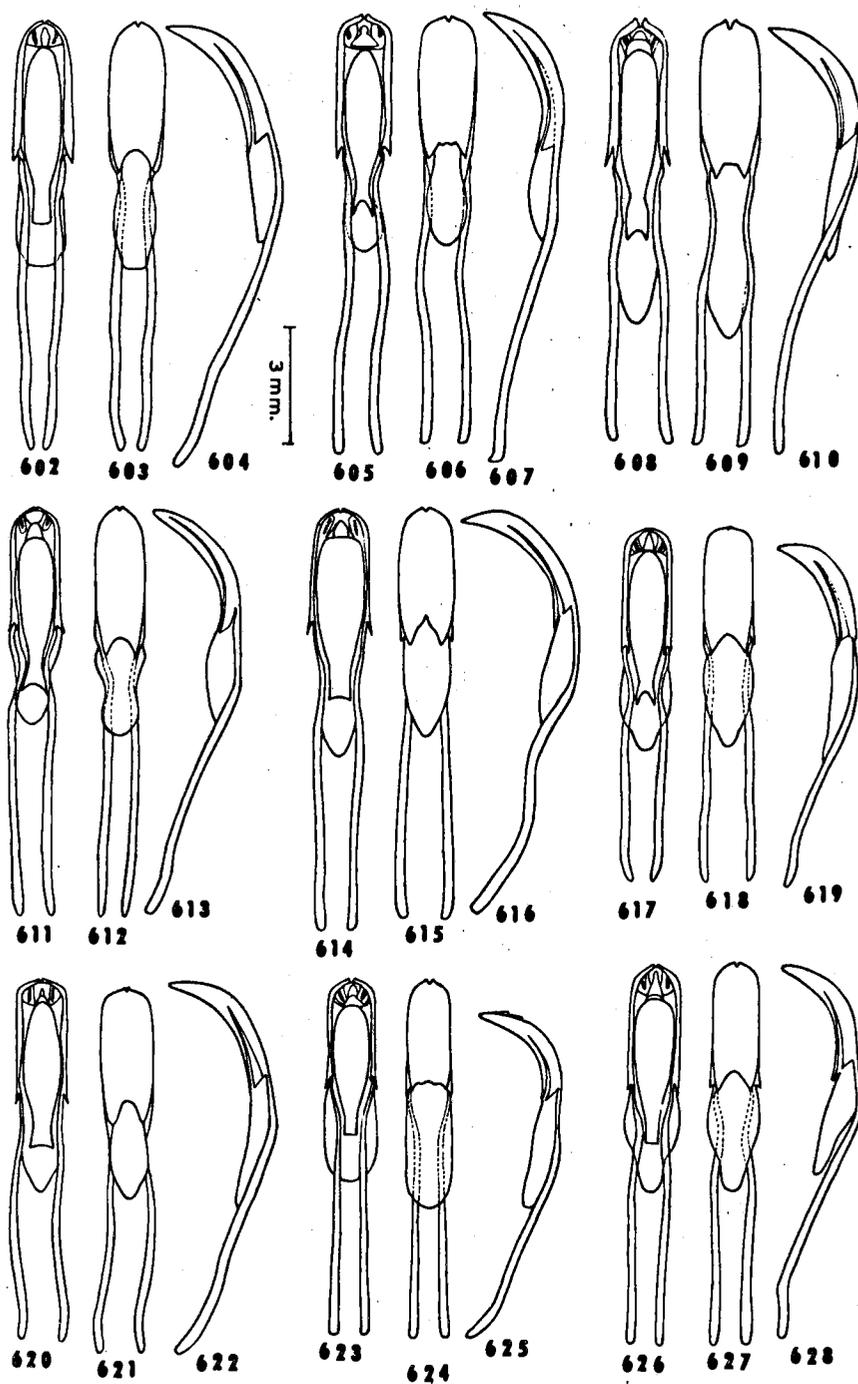
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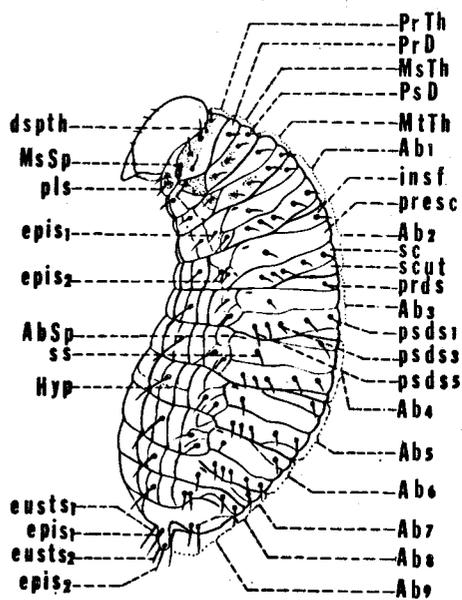
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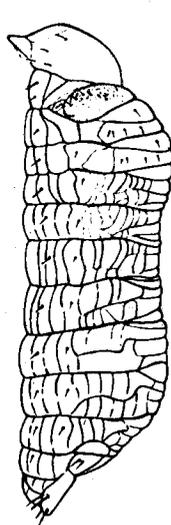
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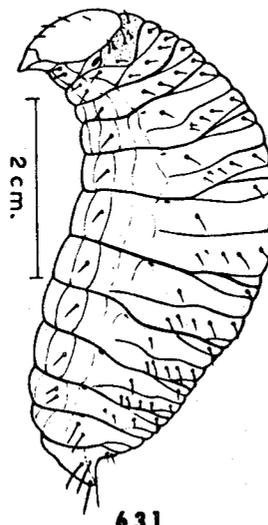
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631. Rhynchophorus vulneratus (Panzer).
632. Rhynchophorus bilineatus (Montrouzier).
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634. Rhynchophorus cruentatus (Fabricius).
635. Rhynchophorus cruentatus (Fabricius).
636. Dynamis borassi (Fabricius).
637. Dynamis borassi (Fabricius).
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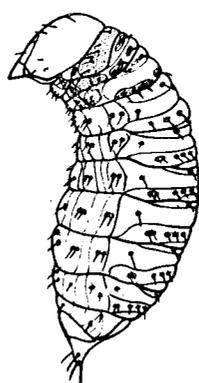
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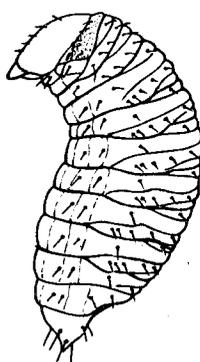
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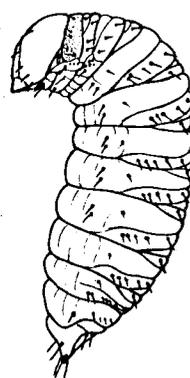
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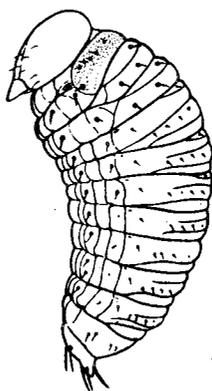
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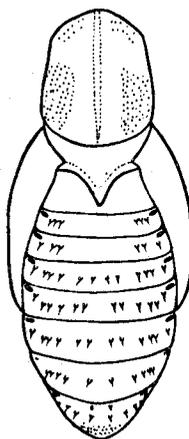
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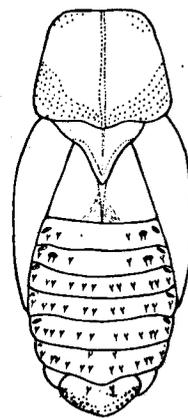
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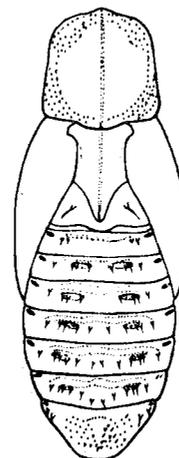
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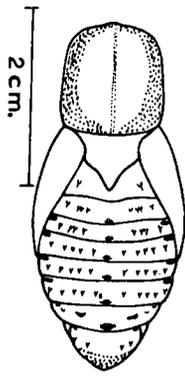
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Fig. 646. Rhynchophorus ferrugineus (Olivier).

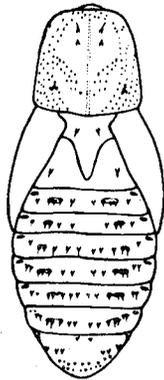
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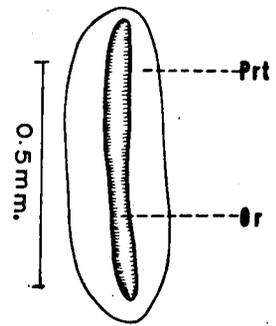
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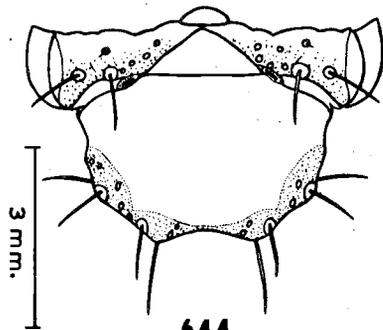
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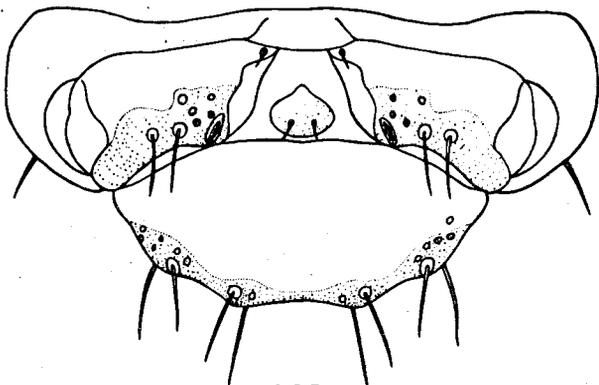
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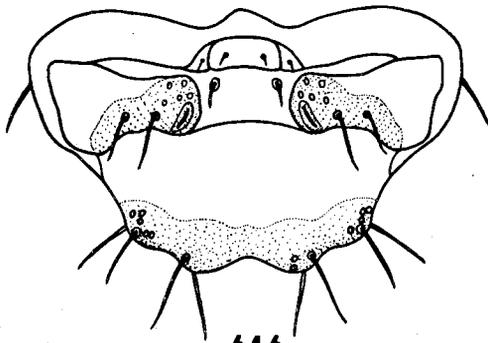
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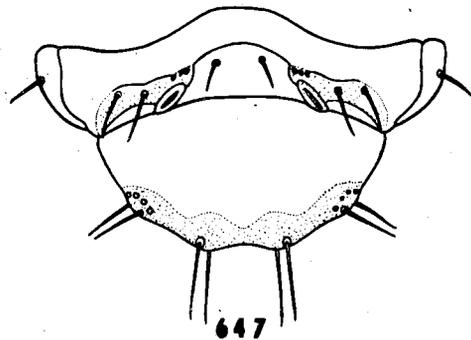
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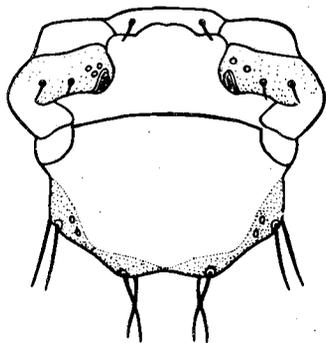
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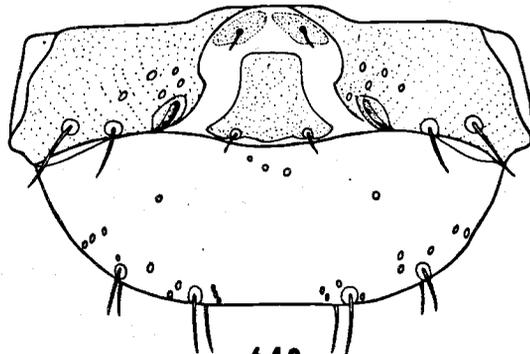
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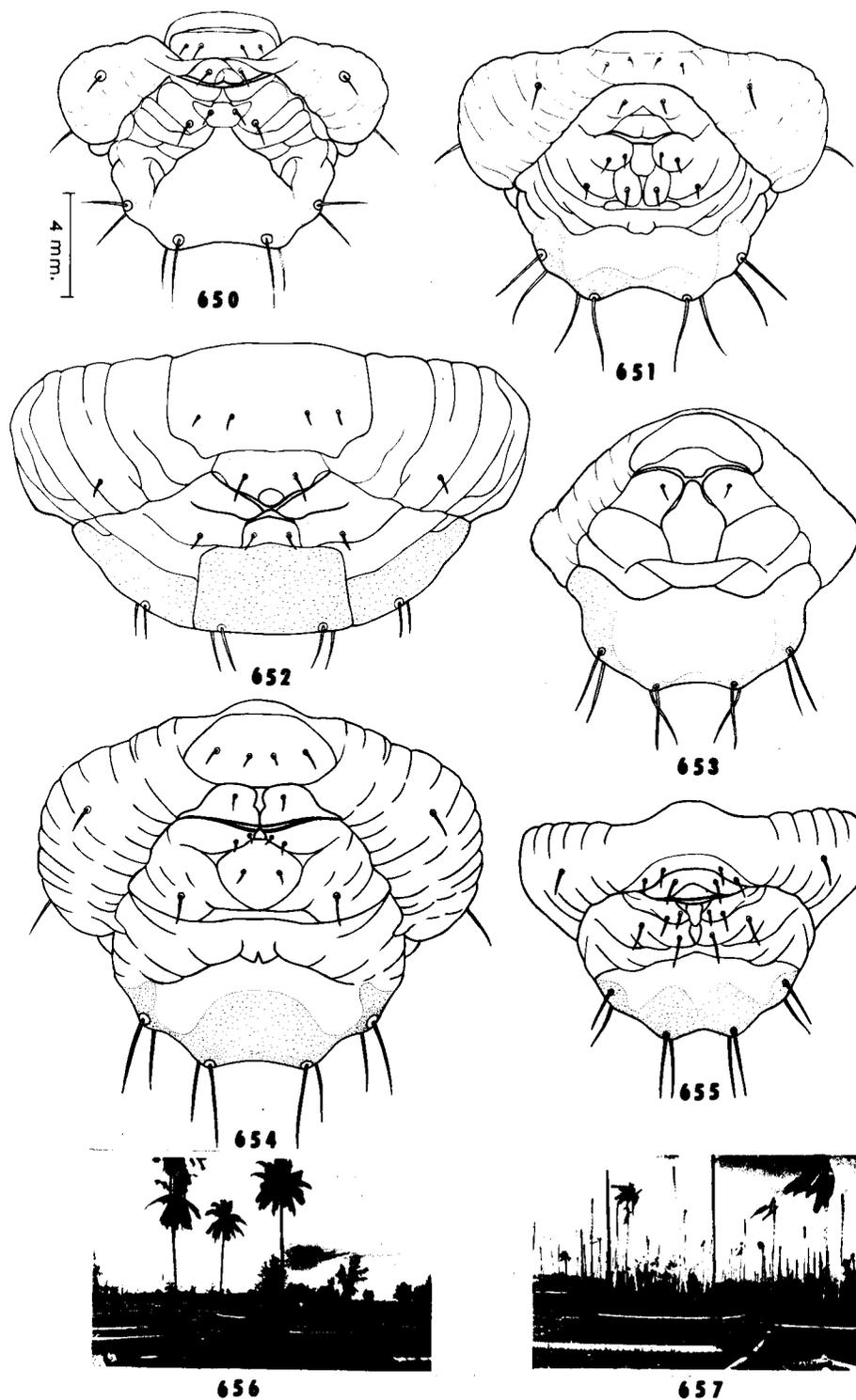
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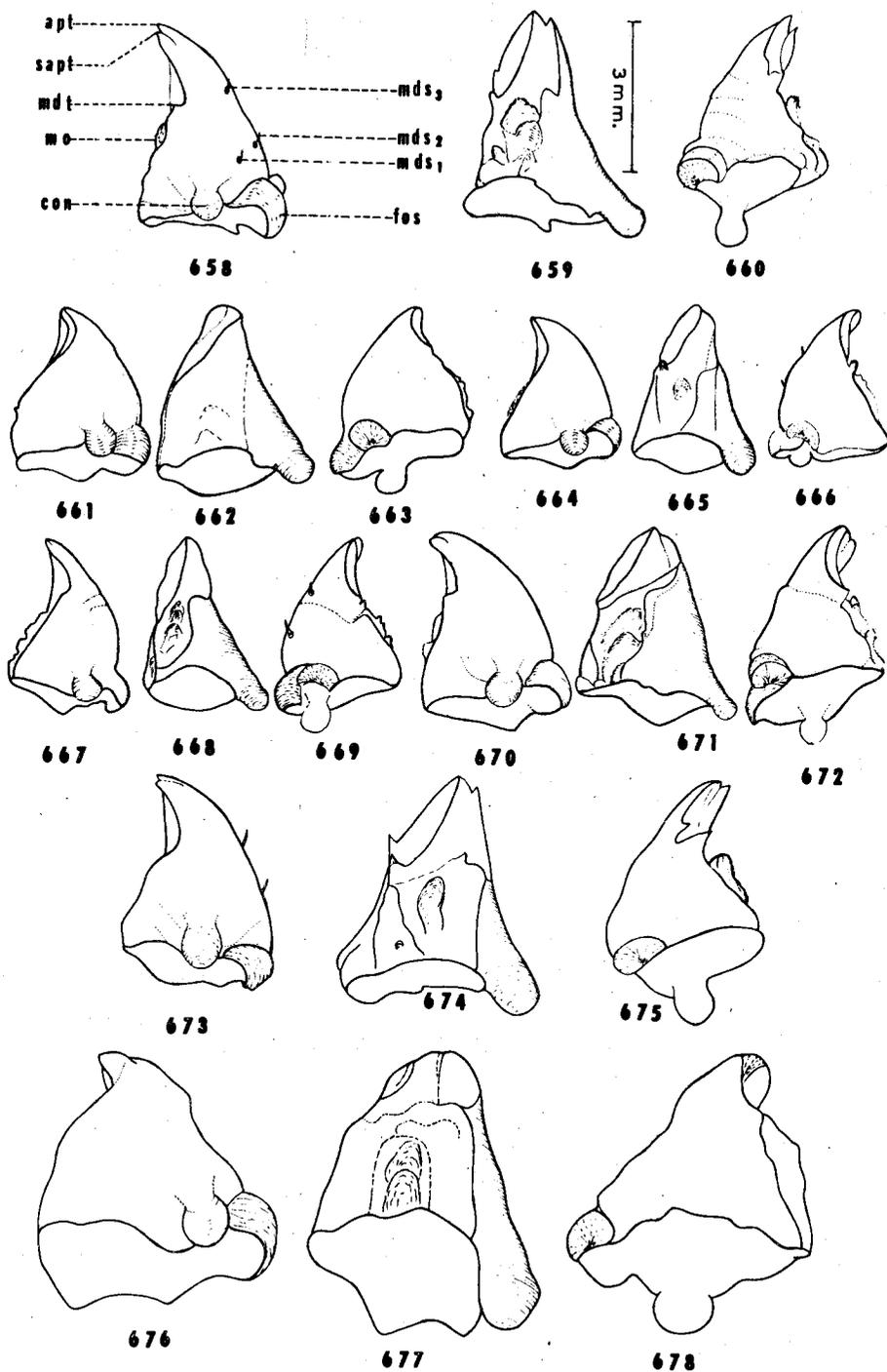
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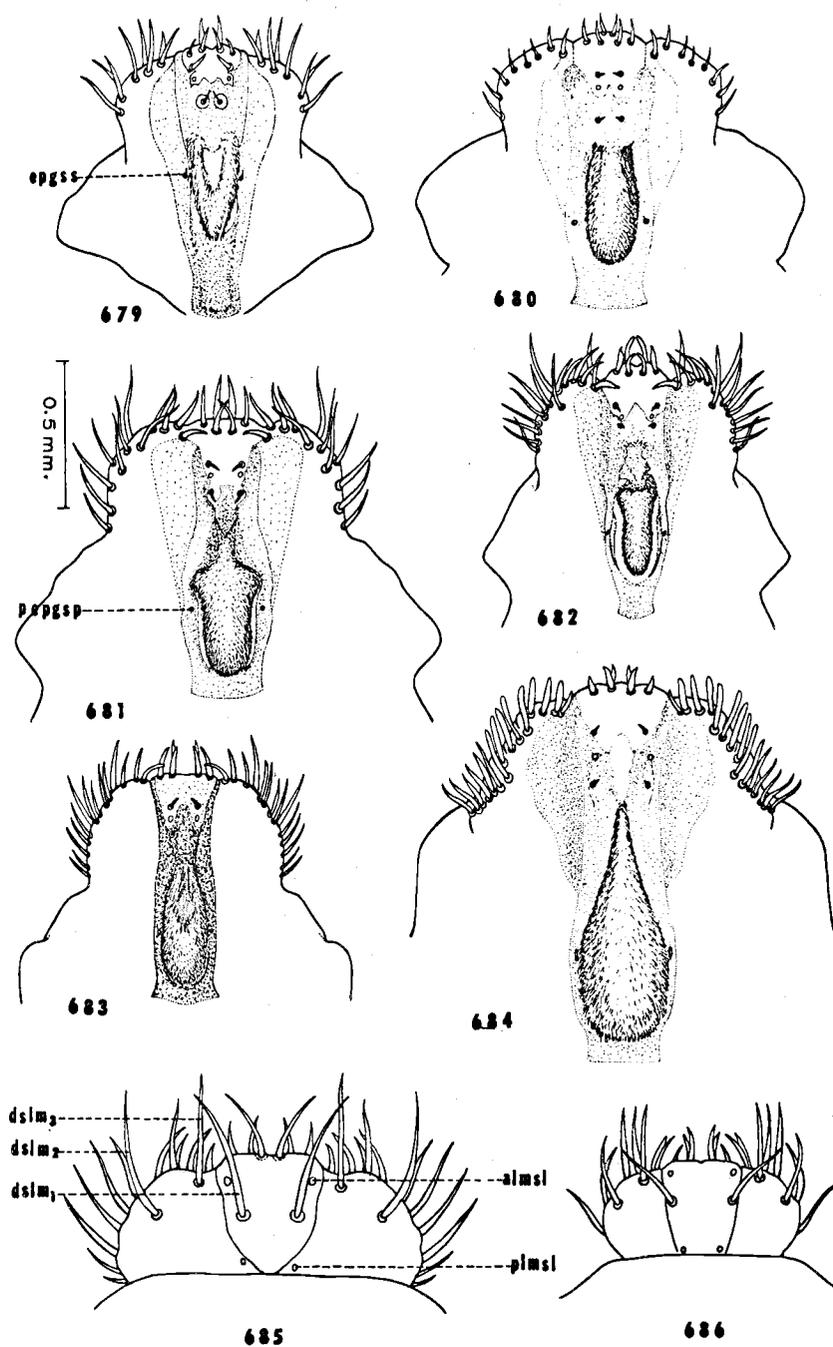
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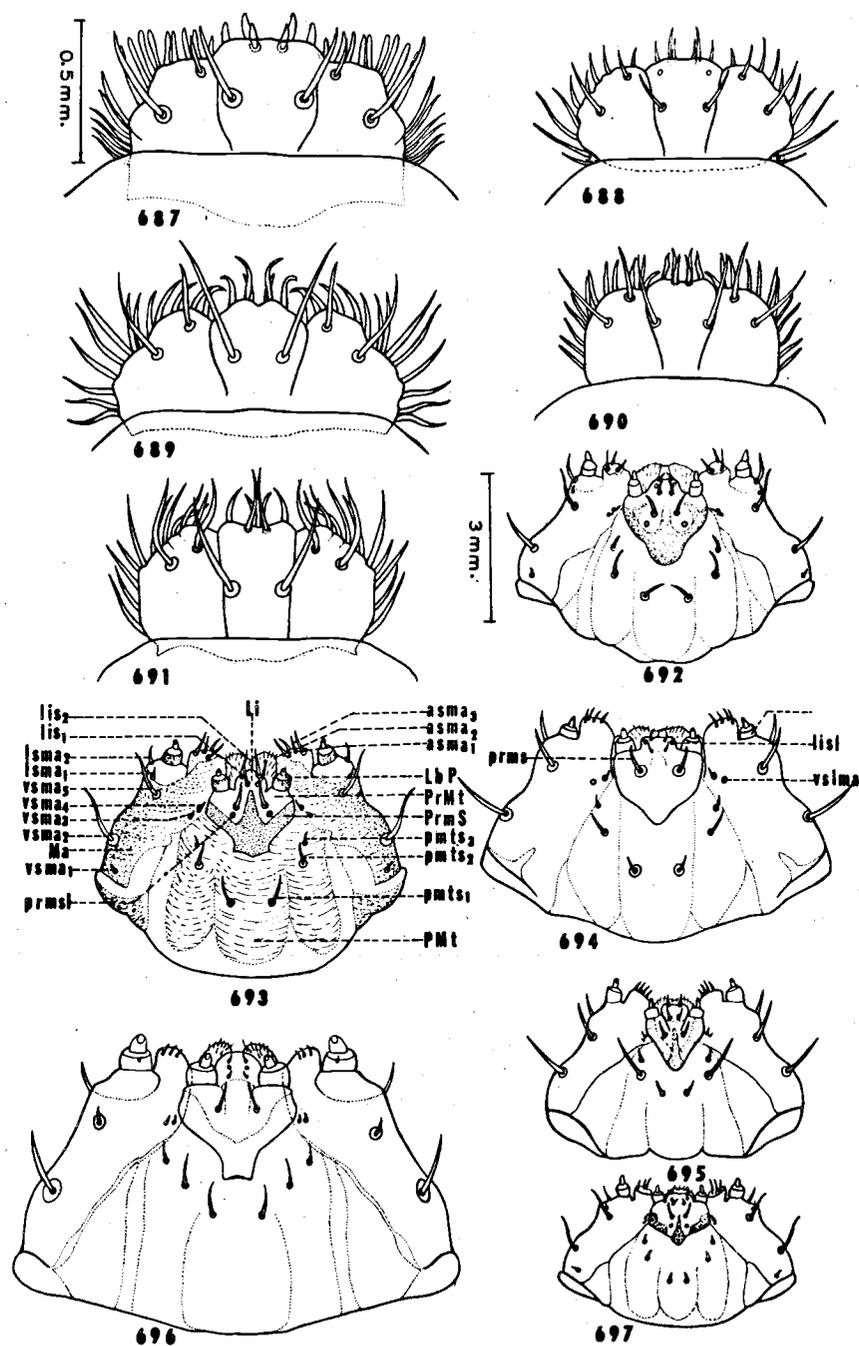
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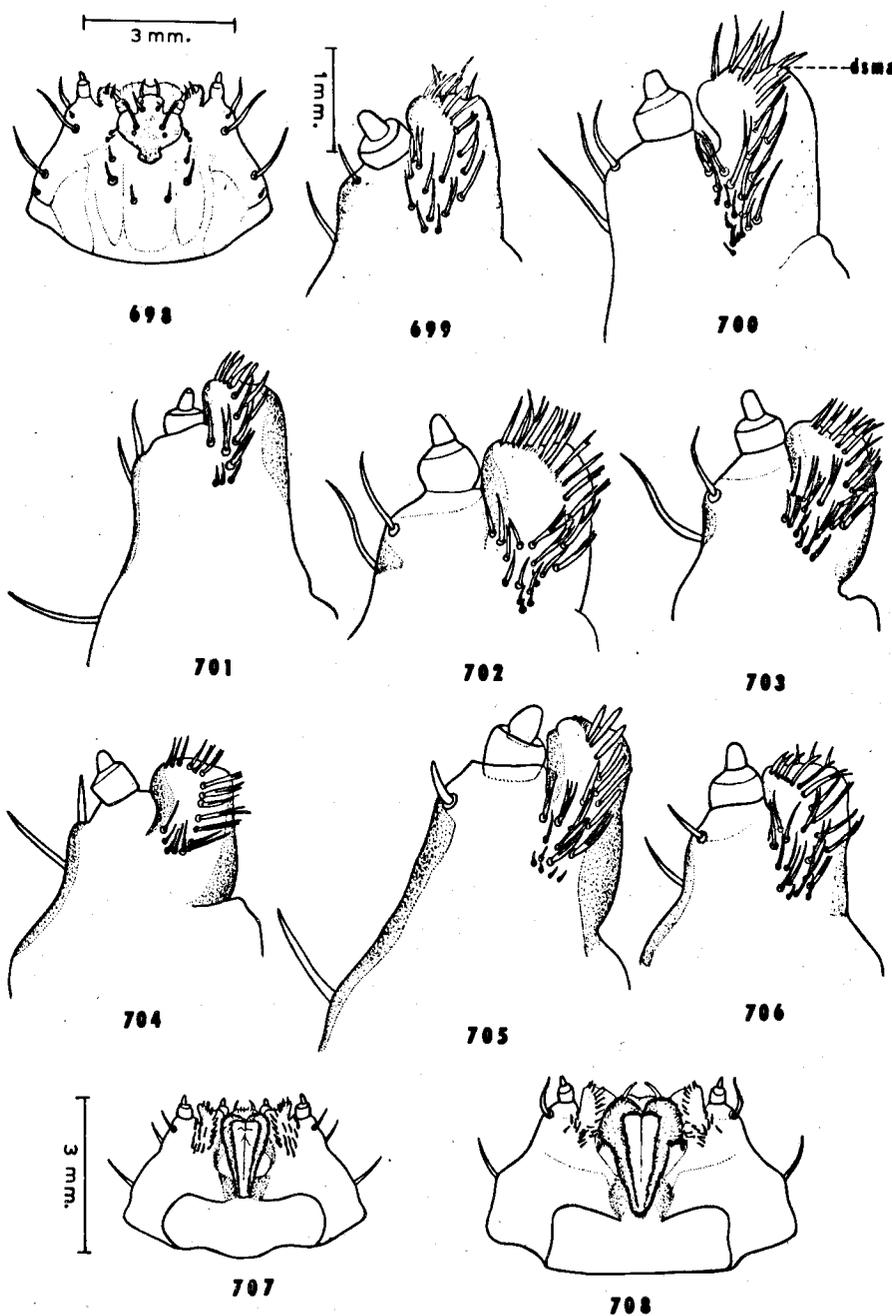
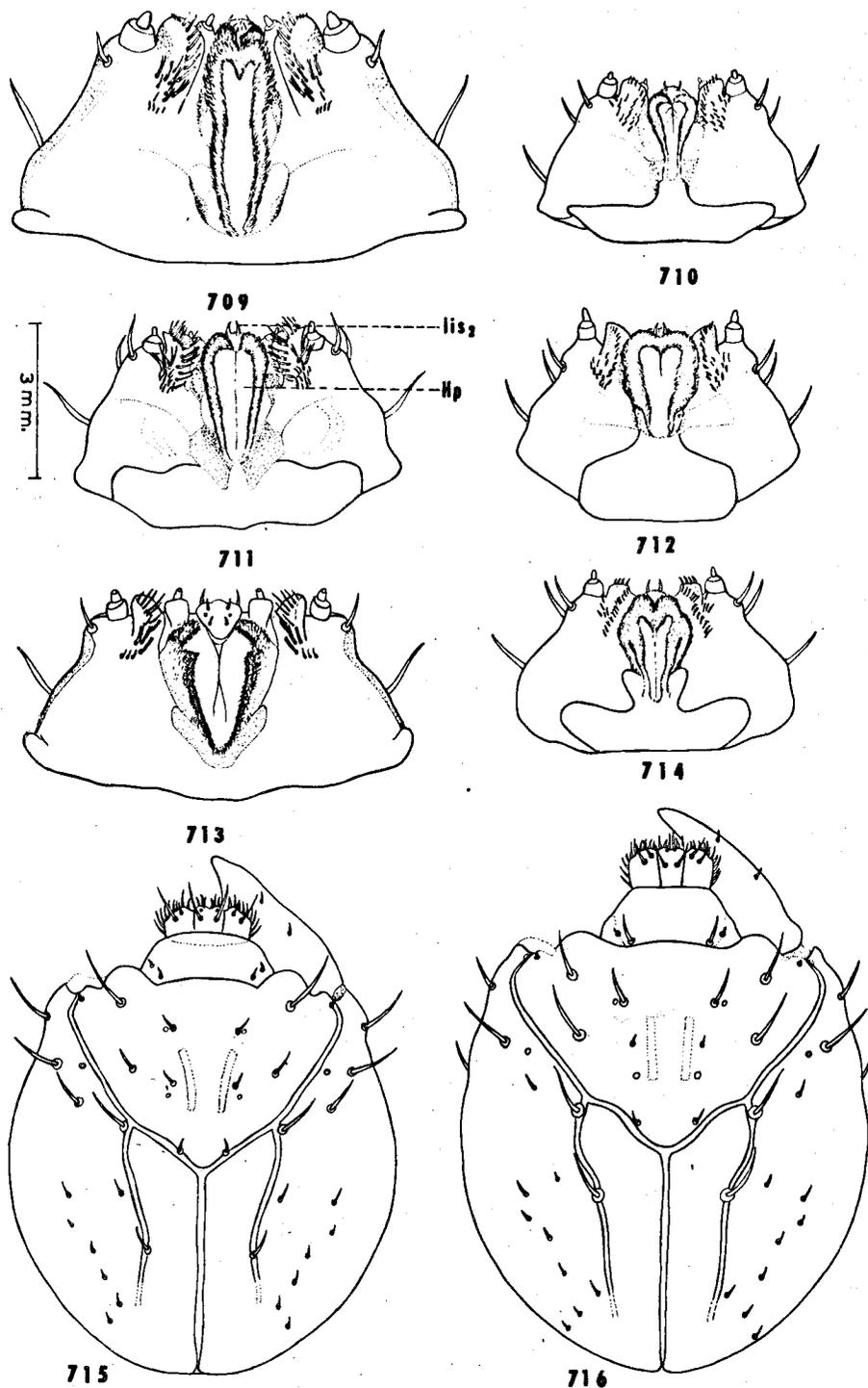
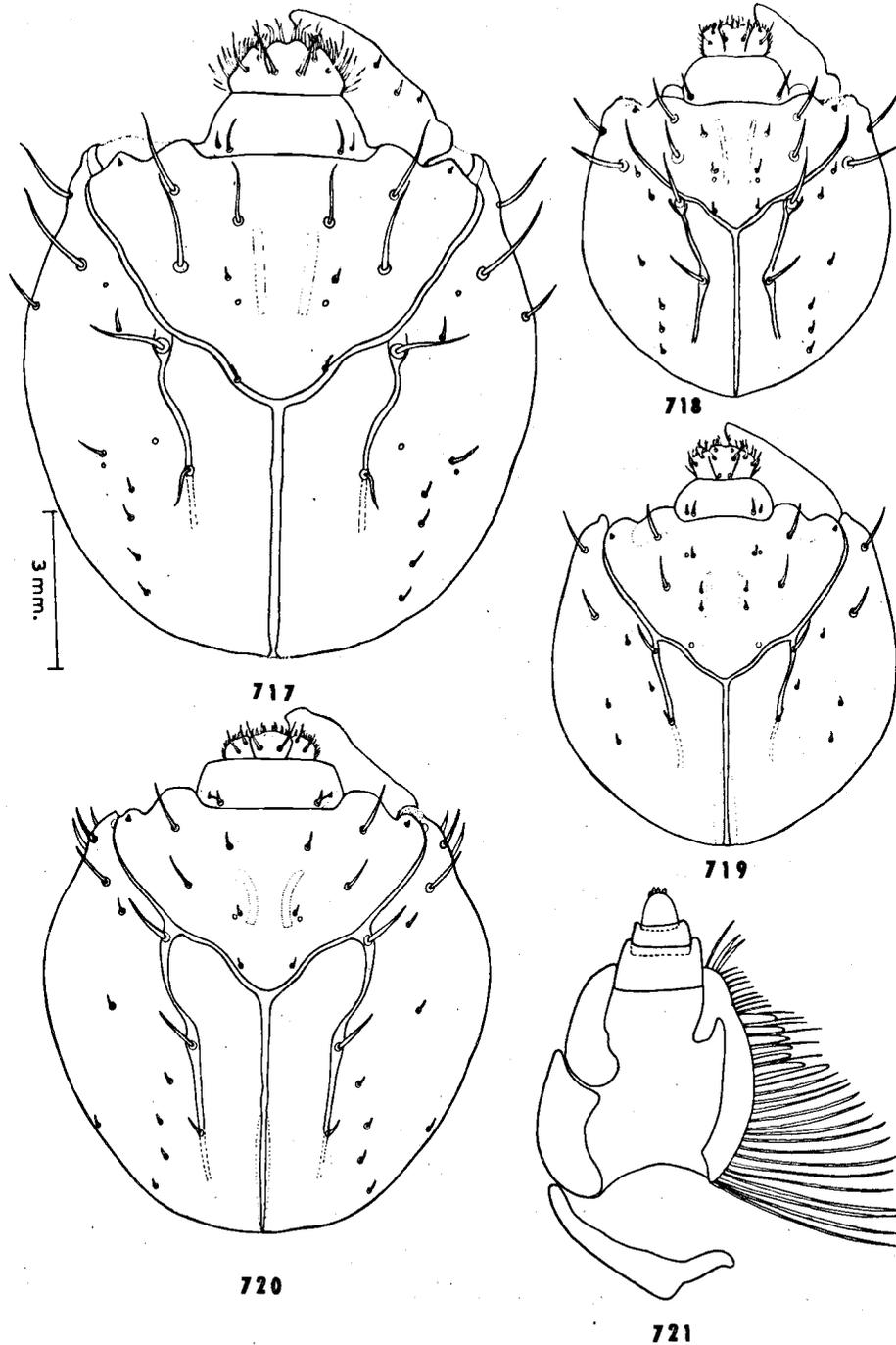


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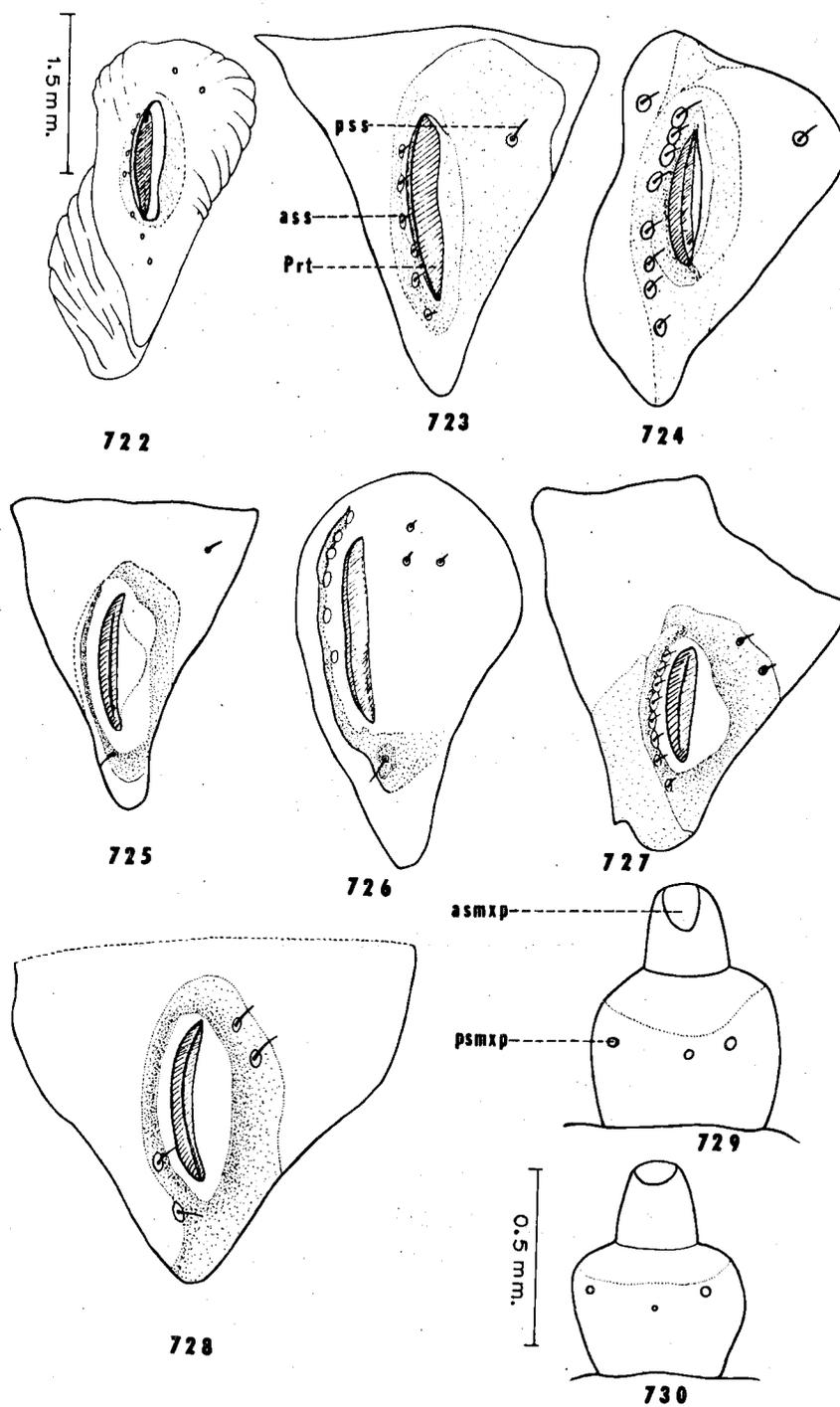
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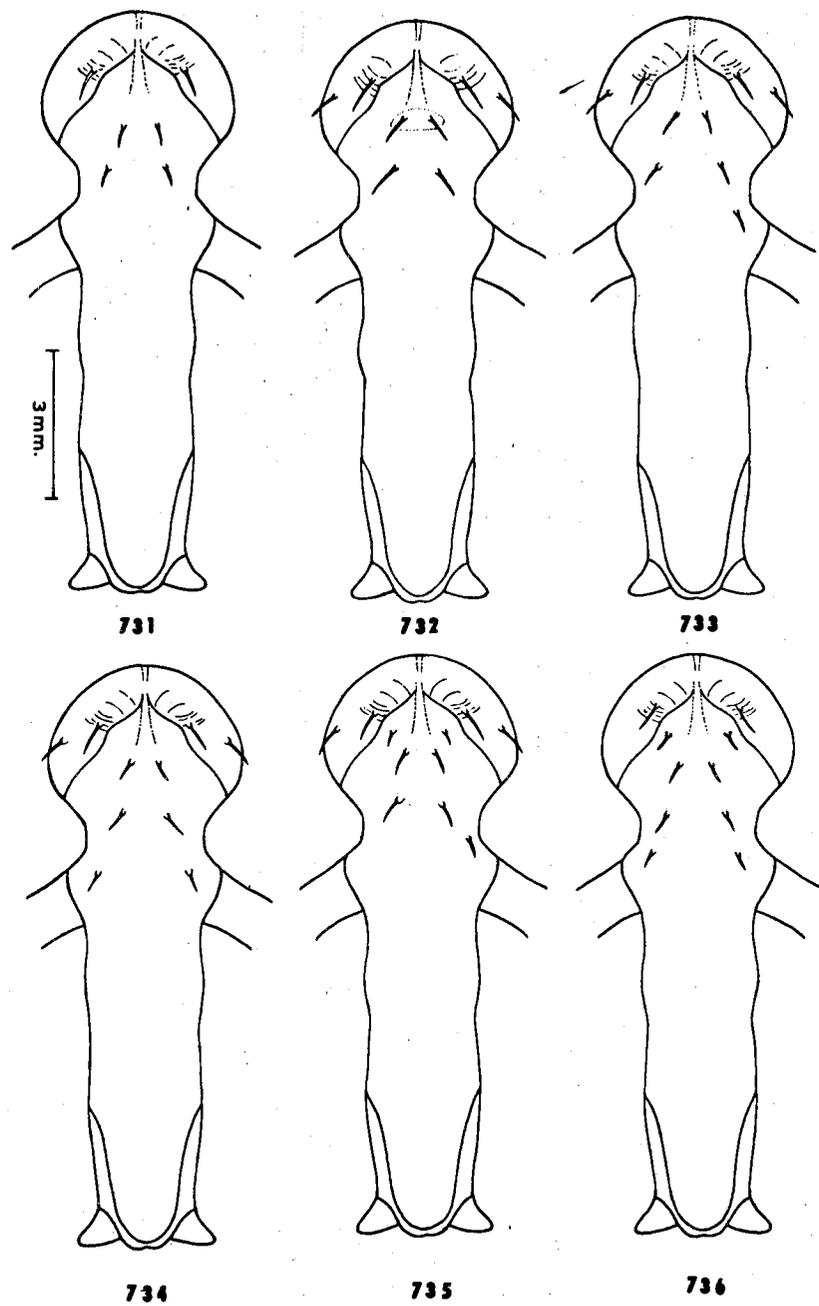
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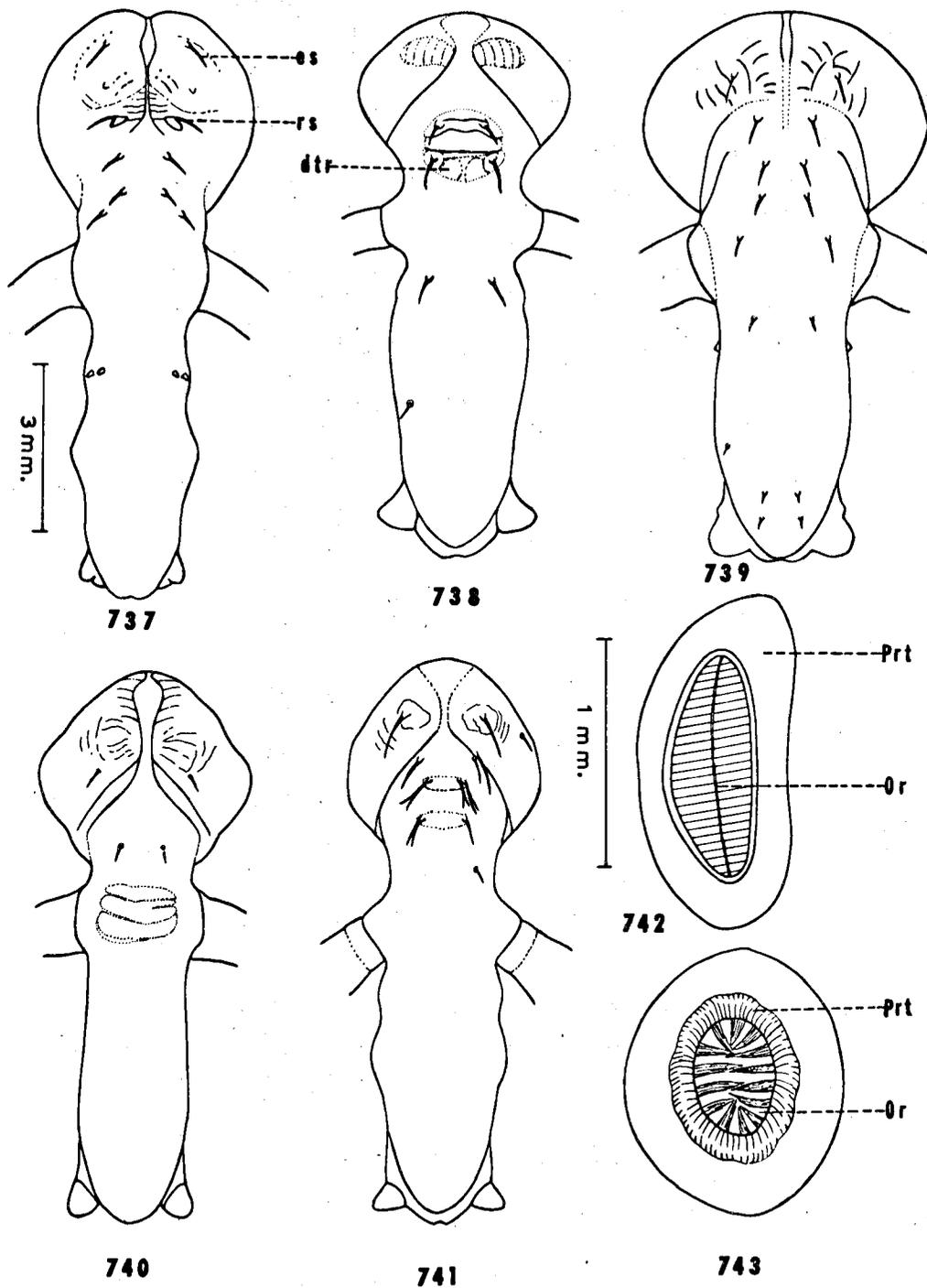
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