This is to certify that the

thesis entitled

A Revision of the Genus Spragueia Grote (Lepidoptera: Noctuidae)

presented by

John H. Wilterding III

has been accepted towards fulfillment
of the requirements for

M.S. degree in Entomology

Major professor

Date 5 August 1992

A REVISION OF THE GENUS *SPRAGUEIA* GROTE (LEPIDOPTERA: NOCTUIDAE)

By

John H. Wilterding III

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

Department of Entomology

1992

The ge
morpho
provide
species
S. llano
and *S.*
elevated
Möschl
perstru
margar
taxonom
phyloge
generic
techniq

ABSTRACT

A REVISION OF THE GENUS
SPRAGUEIA GROTE (LEPIDOPTERA: NOCTUIDAE)

By

John H. Wilterding III

The genus *Spragueia* Grote, 1875 is revised, including the morphology, distribution and systematics. Keys to adults are provided along with illustrations of genitalia and habitus for 29 species of *Spragueia*. Eight species are described as new: *S. xericosa*, *S. llanosa*, *S. cryptomargana*, *S. lukesi*, *S. mexicana*, *S. olmeca*, *S. stehri* and *S. rawlinsi*. Two species are removed from synonomy and elevated to species status: S. *trichostrota* Meyrick and *S. ochracea* Möschler. *S. grana* Dognin is placed in synonomy with *S. perstructana*, and *S. velata* Strecker is placed in synonomy with *S. margana*. The larva of *S. onagrus* is described and illustrated. The taxonomy of the Acontiini and the position of this tribe in noctuid phylogeny is evaluated. Cladistic analysis and justification for the generic limits of *Spragueia* are presented. A new dissection technique for the vesica is described.

To family and friends

S
the co
membe
Fred S
revisio
through
patience
Bush fo
introduc
in whic
thank e
editing
I
numerou
gracious
for sugg
and inte
the Anti
Lafontai
I would
Material

ACKNOWLEDGMENTS

So many people contributed both directly and indirectly during the course of this project. In many important ways, each committee member's service to me was invaluable and deeply appreciated. Fred Stehr served as principal adviser during the course of this revision and wisely encouraged, accompanied, and navigated me through this project. He also intuitively gave me room, time and patience so I could do my best. I am deeply appreciative of Guy L. Bush for recruiting me from my days of collecting in Door Co., and introducing me to MSU. Don Straney provided a comfortable forum in which to eradicate fears and misunderstandings of cladistics. I thank each committee member for enduring the insufferable task of editing a largely systematic work.

I am also indebted to a number of systematists who improved, in numerous ways, my understanding of the Noctuidae and who graciously received me on visits to them. I thank Dr. John Rawlins for suggesting the genus for revision and his continued enthusiasm and interest in this project and to his continued collecting efforts in the Antilles. Drs., Robert W. Poole, John Franclemont, and Don Lafontaine also contributed knowledge and assistance in many ways. I would also like to thank the many curators and institutions (see Materials and Methods) who sent material for use for use in this

study.
work

compa
project
'insecti
travel,
and "M
for arti
Jasinski
Boylan-
more t
in so n
Briggs
supporte
Dr. Mar

Fi
my abs
James A
Jessie,
Laura N
and Mi
encoura
for tota

study. Marc Epstein (USNM) graciously invited me along for field work in Venezuela; I will always remember the experience.

Numerous faculty and friends provided variously their companionship, learning, patience and enthusiasm during this project; Jim Zablotny, for infectious enthusiasm for all thing 'insectiferous', cladistic, and artistic; Adam Peters, for patience in travel, discussions of issues and his giving nature; Dr. Roland Fischer, and "Mo" Nielson for collecting and conversation; Peter Carrington, for artistic advice; Darwin Dale, for photography. I also thank Jim Jasinski, Tony D'Angelo, Maria Davis, Mac Strand, Amy Cole, Walt Boylan-Pett, Beth Bishop, Bob Kreigle, Terry Davis and his lab for more than feigned interest in my project and spontaneous assistance in so many ways. The faculty and staff and students at Lyman Briggs school gave me a wonderful home to teach and learn and supported and tolerated me during waves of stress of ease. I thank Dr. Mark Scriber for seeing that my summers did not go unfunded.

Finally, and with any number of unintentional omissions, I thank my absent friends and family for companionship and understanding: James A. Bess, Tony Roberts, Chuck Cashman, Ted Eggebraaten, Jessie, Tryst, Maggie and James Jankowski, Bill LaVoie, Mac Strand, Laura Mueller, Charlotte and Roy Lukes and everyone at the Ridges, and Michael Rogall. I owe this to my family; their acute encouragement and enthusiasm cannot be overstated. And to Becky, for totally accepting....

TABLE OF CONTENTS

Figure
Venezu
the *dar*
(Brown
membe

Figure
vesica
right l
detail
emerg

Figure
a) aed
mm.

Figure
a) os
abdon

LIST OF FIGURES

Figure
Florid
c) val
corpus

Figure
Louisi
c) valv
abdom
ductus

Figure
a) aede
valves.
abdomi
ductus,

Figure
Sur, M
c) valv
sternite
ostium

Figure
Mexico
c-e (Be

Figure 5. Genitalia of *Spragueia onagrus*. Male, a-c (Dade Co., Florida): a) aedeagus with vesica everted, dorsal; b) ventral; c) valves. d) Female, (Broward Co., Florida): ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

Figure 6. Genitalia of *Spragueia guttata*. Male, a-c (Baton Rouge, Louisiana): a) aedeagus with vesica everted, left lateral; b) ventral; c) valves. Female, d-f (Brownsville, Texas): d) ovipositor and 8th abdominal segment, left lateral; e) 7th abdominal sternite; f) ostium ductus and corpus bursae, ventral. Measure = 1.0 mm.

Figure 7. Genitalia of *Spragueia cleta*. Male, a-c (Huixtla, Mexico): a) aedeagus with vesica everted, left dorso-lateral; b) ventral; c) valves. Female, d-g (Potrerillos, Mexico): d) ovipositor and 8th abdominal segment, left lateral; e) 7th abdominal sternite; f) ostium, ductus, and corpus bursae, ventral. Measure = 1.0 mm.

Figure 8. Genitalia of *Spragueia magnifica*. Male, a-c (Baja California Sur, Mexico): a) aedeagus with vesica everted, dorsal; b) ventral; c) valves. Female, d-g (Graham Co., Arizona): d) 7th abdominal sternite; e) ovipositor and 8th abdominal segment, left lateral; f) ostium and ductus bursae, dorsal; g) ventral. Measure = 1.0 mm.

Figure 9. Genitalia of *Spragueia jaguaralis*. Male, a-b (Guadalajara, Mexico): a) aedeagus with vesica everted, ventral; b) valves. Female, c-e (Bexar Co., Texas): c) ostium, ductus and corpus bursae, dorsal;

d) ost

1.0 m

Figure

Arizon

valves.

abdom

ostium

Figure

Califor

b) dor

lateral;

bursae,

Figure

a) aed

c) valv

corpus

Figure

Venezu

c) valv

bursae,

f) 7th

dorsal.

d) ostium and ductus bursae; e) 7th abdominal segment. Measure = 1.0 mm unless indicated.

Figure 10. Genitalia of *Spragueia funeralis*. Male, a-c (Cochise Co., Arizona): a) aedeagus with vesica everted, dorsal; b) ventral; c) valves. Female, d-f (Chihuahua, Mexico): d) ovipositor and 8th abdominal segment, right lateral; e) 7th abdominal sternite; f) ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

Figure 11. Genitalia of *Spragueia xericosa*. Male and female, (Baja California Sur, Mexico): a) aedeagus with vesica everted, ventral; b) dorsal; c) valves; d) ovipositor and 8th abdominal segment, right lateral; e) 7th abdominal sternite; f) ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

Figure 12. Genitalia of *Spragueia obatra*. Male, a-c (Puebla, Mexico): a) aedeagus with vesica everted, left dorso-lateral; b) ventral; c) valves. Female, d) (Cochise Co., Arizona): ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

Figure 13. Genitalia of *Spragueia dama*. Male, a-c (Guarico, Venezuela): a) aedeagus with vesica everted, dorsal; b) ventral; c) valves. Female, d-g (Nayarit, Mexico): d) ostium bursae and ductus bursae, ventral; e) ovipositor and 8th abdominal segment, left lateral; f) 7th abdominal sternite; g) ostium, ductus and corpus bursae, dorsal. Measure = 1.0 mm.

Figure
Mexic
c-e (A
segme
corpus

Figure
a) aed
Measu

Figure
a) aed
valves.
bursae,
f) 7th

Figure
Costa R
Measur

Figure
Venezu
c) valv
8th ab
bursae,

Figure 14. Genitalia of *Spragueia valena*. Male, a-b (Vera Cruz, Mexico): a) aedeagus with vesica everted, dorsal; b) valves. Female, c-e (Aguascalientes, Mexico): c) ovipositor and 8th abdominal segment, left lateral; d) 7th abdominal sternite; e) ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

Figure 15. Genitalia of *Spragueia pyralidia*. Male (Tehuacan, Mexico): a) aedeagus with vesica everted, left dorso-lateral; b) valves. Measure = 1.0 mm.

Figure 16. Genitalia of *Spragueia margana*. Male, a-c (Jamaica): a) aedeagus with vesica everted, left lateral; b) right lateral; c) valves. Female, d-f (Puerto Rico): d) ostium, ductus and corpus bursae, dorsal; e) ovipositor and 8th abdominal segment, left lateral; f) 7th abdominal sternite. Measure = 1.0 mm.

Figure 17. Genitalia of *Spragueia cryptomargana*, male (Guanacaste, Costa Rica): a) aedeagus with vesica everted, ventral; b) valves. Measure = 1.0 mm.

Figure 18. Genitalia of *Spragueia perstructana*. Male, a-c (Guarico, Venezuela): a) aedeagus with vesica everted, dorsal; b) ventral; c) valves. Female, d-e (St. John Parish, Louisiana): d) ovipositor and 8th abdominal segment, right lateral; e) ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

Figure
Domini
b) right
Republi
bursae,

Figure
a) aede
oviposi
sternite
mm.

Figure
Mexicc
(Oaxac
ovipos
sternit
mm.

Figure
a) aec
ovipo
sterni
mm.

Figu
Mex

Figure 19. Genitalia of *Spragueia ochracea*. Male, a-c (Los Hidalgo, Dominican Republic): a) aedeagus with vesica everted, left lateral; b) right lateral; c) valves. Female, d-e (Convento, Dominican Republic): d) 7th abdominal sternite; e) ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

Figure 20. Genitalia of *Spragueia mexicana*, (Chihuahua, Mexico): a) aedeagus with vesica everted, dorsal; b) ventral; c) valves; d) ovipositor and 8th abdominal segment, left lateral; e) 7th abdominal sternite; f) ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

Figure 20. Genitalia of *Spragueia lukesi*. Male, a-b (Vera Cruz, Mexico): a) aedeagus with vesica everted, dorsal; b) ventral. Male, (Oaxaca, Mexico); c) valves. Female, d-f (Chihuahua, Mexico): d) ovipositor and 8th abdominal segment, left lateral; e) 7th abdominal sternite; f) ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

Figure 21. Genitalia of *Spragueia mexicana*, (Chihuahua, Mexico): a) aedeagus with vesica everted, dorsal; b) ventral; c) valves; d) ovipositor and 8th abdominal segment, left lateral; e) 7th abdominal sternite; f) ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

Figure 22. Genitalia of *Spragueia apicalis*. Male, a-c (Nayarit, Mexico): a) aedeagus with vesica everted, dorsal; b) ventral;

c) valv
abdomi
ductus

Figure
Bolivia
Female
ostium,

Figure
Domini
b) vent

Figure
(Santia
c) ovip
ductus
Measur

Figure
Venezu
valves.

Figure
Venezu
and du
mm.

c) valves. Female, d-f (Baton Rouge, Louisiana): d) ovipositor and 8th abdominal segment, left lateral; e) 7th abdominal sternite; f) ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

Figure 23. Genitalia of *Spragueia trichostrota*. Male, a-c (Santa Cruz, Bolivia); a) aedeagus with vesica everted, dorsal; b) ventral; c) valves. Female, d-f (Minas Geraes, Brazil): d) 7th abdominal sternite; e) ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

Figure 24. Genitalia of *Spragueia stehri*, male (La Vega Prov., Dominican Republic): a) aedeagus with vesica everted, dorsal; b) ventral; c) valves. Measure = 1.0 mm.

Figure 25. Genitalia of *Spragueia pantherula*. Male and female (Santiago, Cuba): a) aedeagus with vesica everted, ventral; b) valves, c) ovipositor and 8th abdominal segment, right lateral; d) ostium, ductus and corpus bursae, ventral; e) 7th abdominal sternite. Measure = 1.0 mm.

Figure 26. Genitalia of *Spragueia marmorea*, male (T.F. Amazonas, Venezuela): a) aedeagus with vesica everted, dorsal; b) ventral; c) valves. Measure = 1.0 mm.

Figure 27. Genitalia of *Spragueia marmorea*, female (T.F. Amazonas, Venezuela): a) ostium, ductus and corpus bursae, dorsal; b) ostium and ductus bursae, ventral; c) 7th abdominal sternite. Measure 1.0 mm.

Figure 2
Surinam
lateral;

Figure 2
a) ostiu
abdomi
lateral.

Figure
a) aede
Measur

Figure
Venezu
c) 7th

Figure
a) aed
mm.

Figure
a) os
segm
Meas

Figure 28. Genitalia of *Spragueia lepus*, male (Moengo Boven, Surinam): a) aedeagus with vesica everted, left lateral; b) right lateral; c) valves. Measure = 1.0 mm.

Figure 29. Genitalia of *Spragueia lepus*, female (Caparo, Trinidad): a) ostium, ductus and corpus bursae, dorsal; b) ventral; c) 7th abdominal sternite; d) ovipositor and 8th abdominal segment, left lateral. Measure = 1.0 mm.

Figure 30. Genitalia of *Spragueia llanosa*, male (Guarico, Venezuela): a) aedeagus with vesica everted, dorsal; b) ventral; c) valves. Measure = 1.0 mm.

Figure 31. Genitalia of *Spragueia llanosa*, female (Guarico, Venezuela): a) ostium, ductus and corpus bursae, dorsal; b) ventral; c) 7th abdominal sternite. Measure = 1.0 mm.

Figure 32. Genitalia of *Spragueia olmeca*, male (Jalisco, Mexico): a) aedeagus with vesica everted, ventral; b) valves. Measure = 1.0 mm.

Figure 33. Genitalia of *Spragueia rawlinsi*, female (Oaxaca, Mexico): a) ostium, ductus and corpus bursae, ventral; b) 8th abdominal segment and ovipositor, left lateral; c) 7th abdominal segment. Measure = 1.0 mm.

Figure 3-

Figure 3

Figure 3

S. xerico

Figure 3

(also see

Figure 4

Figure 3

S. mexic

Figure 3

S. pers

Figure 4

Figure

marmo

Figure

see fig

Figure 4

margan

Figure 4

Figure 4

Habeck

Figure

Figure

Figure

Figure

Figure

Figure

Figure

Figure

Figure

Figure

Figure

Figure

Figure

Figure

Figure

Figure

Figure

Figure

Figure 1

Figure 1

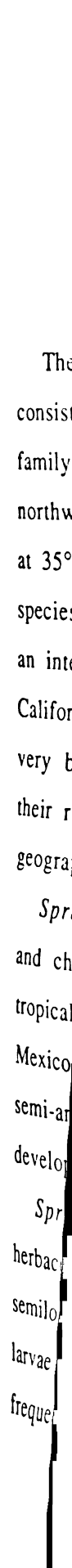
Figure 1

Figure 1

Figure 1

Tabl

LIST OF TABLES



INTRODUCTION

The New World genus *Spragueia* (Noctuidae: Acontiinae: Acontiini) consists of 30 species of small, often brightly colored moths, in the family Noctuidae. *Spragueia* is predominately neotropical, extending northward to 42° N longitude, and southward to northern Argentina at 35° S longitude. The genus is represented by three endemic species from the greater Antilles, one on the Galapagos Islands, and an interesting new species, *xericosa*, from the arid peninsula of Baja California. Many species, such as *margana*, *dama*, and *apicalis* have very broad geographic ranges and show little variation throughout their ranges. However, some species are restricted to limited geographical areas, often inhabiting more xeric habitats.

Spragueia species are rich in the mid-altitude Chihuahuan desert, and chaparral habitats of southwestern United States, in lowland tropical savannah, and in tropical deciduous forests of western Mexico and Costa Rica. The genus appears to be more common in semi-arid habitats with distinct wet/dry periods, and is less developed in more temperate climates.

Spragueia larvae are polyphagous, free-feeding on low woody and herbaceous plants. The larvae in the Acontiini (and other tribes) are semiloopers, with reduction of abdominal prolegs 5 and 6. Acontiini larvae are known to feed on a wide variety of plants, and are frequently reared from families within the Malvales (Rawlins pers.

comm

leaves

(Rawl

Gr

Spragu

membe

superfi

Spragu

and er

accessc

tuft. Tl

species

delimiti

Francle

Spragu

concept

characte

may be

however

lepus).

Hampso

taxonon

The

on the

of the

These

comm. 1991). *Spragueia* larvae of the *apicalis* group pupate in folded leaves (Swainson 1900), or cocoons loosely constructed of debris (Rawlins pers. comm. 1991).

Grote described *Spragueia* in 1875, naming it after William Sprague, a collector and friend of Grote's. He erected the genus from members historically placed in *Agrophila* [*Emmelia*], however, his superficial generic characters did not clearly delimit features of *Spragueia*. Hampson (1910) later removed some taxa from *Spragueia* and erected the genus *Heliocontia* based on the absence of the accessory cell in the forewing and a well developed metathoracic tuft. These characters, however, are variable in many *Spragueia* species (i.e., *pyralidia*, *xericosa*, and *valena*) and are not useful in delimiting the genera. I have reached the same conclusions as did Franclemont and Todd (1983) and Poole (1989); that the limits of *Spragueia* should be much broader than Grote originally conceptualized. It may be argued that the genitalia offer some characters, such as the condition of the clasper and ampulla, that may be useful in splitting *Spragueia* into two or more genera. This, however, would leave some species more poorly characterized (i.e., *lepus*). A cladistic analysis was performed to test the validity of Hampson's Heliocontia; a detailed detailed discusssion follows the taxonomic portion (page 140).

The 30 species in *Spragueia* are placed in the tribe Acontiini based on the presence of an expanded chitonized alula over the tympanum of the metathorax and hair masses on the anal tube in the male. These characters, and others discussed below, appear to be

synapon
that the
distingu
to othe
problen

In a
recogni
arriving
Noctuid
member
noctuid

Com
decade,
North A
higher
remain
treatmen
descripti
nearly a
subfami
Checkli
(1983)
Eublem
Bagisar
and pe
charact
number

synapomorphic for genera in the Acontiini, supporting the hypothesis that the Acontiini are a monophyletic group. Despite these distinguishing characters, the position and relationship of *Spragueia* to other genera within the Acontiini and other noctuids remains problematic.

In an historical review of noctuid classification, Kitching (1984) recognized the importance of the Acontiinae (and the Plusiinae) in arriving at a coherent and stable classification and phylogeny of the Noctuidae because both the Plusiinae and the Acontiinae have members which share characteristics of the trifid and quadrifid noctuid lineages (see page 9).

Comprehensive work on the plusiines has increased in the last decade, culminating in Lafontaine and Poole's (1991) revision of the North American Plusiinae and Kitching's (1987) cladistic analysis and higher classification of the Plusiinae. The Acontiinae, however, remain largely ignored and have received little comprehensive treatment since Hampson's (1910) work which was largely descriptions of numerous genera and species. Generic revisions are nearly absent within the group despite the large size of the subfamily (but see Todd 1966; Todd et al. 1982; Ueda 1984). In the Checklist of the Moths of North America, Franclemont and Todd (1983) recognized five tribes within the Acontiinae: Eustrotiini, Eublemmini, Acontiini and the monobasic Cydosiini (*Cydosia*) and Bagisarini (*Bagisara*). Only the Acontiini, Eustrotiini [Lithacodiini] and perhaps Cydosiini (larvae unknown to me) appear to be well characterized, potentially monophyletic lineages supported by a number of adult and larval synapomorphies (Richards 1932; Crumb

1956; an
to Bagis
the Eubl
serious r
this pape
of the A

Diagn
middle c
sclerotiz
asymmet
sometim
4) vesic
dorsal s
with a
distal re
ostium
processe
accesso

Materi

Near
institut
study a
material
curators
apprec

1956; and Forbes 1954). Poole (1989), rightfully, elevated *Bagisara* to Bagisarinae; future revisionary work is needed to clearly delimit the Eublemmini and the Cydosiini. The Acontiinae *sensu latu* is in serious need of careful revisionery work and cladistic analysis. In this paper I revise *Spragueia*, and discuss additional characteristics of the Acontiini.

Diagnostic features of *Spragueia* include: 1) sacculus divided near middle of the valve on ventral margin into two distinct, heavily sclerotized lobes (Figure 3b); 2) valves, exclusive of tegumen, asymmetric (Figure 3b); 3) valves with ampulla (Figure 16c), sometimes with clasper (Figure 3b), both rarely absent (Figure 28c); 4) vesica of aedeagus bilobed, ventrally decurved (Figure 2a); 5) dorsal surface of the right lobe between the vesica and aedeagus with a condensed patch of cornuti [laminate cornuti] (Figures 2a,b), distal region with patch of long, sclerotized filaments (Figure 2b); 6) ostium of female genitalia usually expanded into paired fan-like processes, never fused (Figures 4a, 10f); 7) venation with or without accessory cell (Figures 1a, b), M2 of hindwing absent (Figure 1a).

Materials and Methods

Nearly 4500 specimens were borrowed from a number of institutions and the curators who kindly provided specimens for study are gratefully acknowledged below. The majority of type material has been examined by me and in some instances other curators have examined this material for me; their assistance is also appreciated.

Specir
several r
alcohol f
size. In
the evers
genitalia
other fe
and a W
have be
sensory

Specimens where macerated in a 20% solution of hot KOH for several minutes. The aedeagus was everted and placed in isopropyl alcohol for hardening which is often difficult to do on moths of this size. In the Appendix I describe a new techinique I developed for the eversion of the male vesica. All structures where stored in genitalia vials containing glycerin for further study. Genitalia and other features were drawn using a Wild stereomicroscope 20X ocular and a Wild camera lucida. Deciduous setae and other sensory setae have been omitted from the drawings of the male genitalia; only sensory structures of the sacculus and ampulla are illustrated.

AMNH American Museum of Natural History (J. S. Miller)

ANSP Academy of Natural Sciences of Philadelphia (D. Azuma)

BYUC Brigham Young University (R. Baumann)

BMNH British Museum of Natural History (M. R. Honey)

CAS California Academy of Sciences (P. Arnaud Jr.)

CMNH Carnegie Museum of Natural History (J. E. Rawlins)

CNC Canadian National Collection (J. D. Lafontaine)

CDAE California State Collection of Arthropods (T. D. Eichlin)

CSUC Colorado State University (B.C. Knondratieff)

CUEC Clemson University (M. W. Heyn)

CU Cornell University (J. G. Franclemont)

DPI Division of Plant Industry (J. B. Heppner)

FMNH Field Museum of Natural History (R. F. Inger)

KSUC Kansas State University (H. D. Blocker)

LACM Los Angeles County Museum of Natural History (J. P. Donahue)

LSU Lousiana State University (C. B. Barr)

LEMQ Lyman Entomological Museum McGill University (P.M. Sanborne)

INHS Illinois Natural History Survey (G. L. Godfrey)

ISUI Iowa State University (R. E. Lewis)

UWEM University of Wisconsin Madison (S. Krauth)

MCMC Museo de Historia Natural de la Ciudad de Mexico

MEM Mississippi State University (R. L. Brown)

MNHU Museum für Naturkünde der Humboldt-Universität (W. Mey)

MCPM Milwaukee Public Museum (A. M. Young)

MTEC Montana State University (K. Philips)

MSUE Michigan State University (F. W. Stehr)

MZSP Museu de Zoologia, Universidade de São Paulo (F. C. do Val).

NCSU North Carolina State University (R. L. Blinn)

NHSD Natural History Museum San Diego (D. Faulkner)

NYSM New York State Musuem (T. L. McCabe)

OSU Oklahoma State University (W. A. Drew)

PADA Pennsylvania Department of Agriculture (K. Valley)

PURC Purdue (D. W. Bloodgood)

PSUC Pennsylvania State University (D. W. Love)

ROME Royal Ontario Museum (M. Pickles)

RUIC Rutgers, The State University of New Jersey

TAMU Texas A & M (E. G. Riley)

UAIC University of Arizona (C. A. Olson)

UCB University California Berkeley (J. A. Powell)

IZAV Universidad Central de Venezuela (J. DeMarmels)

UCDC University California Davis (L. S. Kimsey)

ULIC University of Kentucky Louisville (C. V. Covell)

UADE University of Arkansas (C. Carlton)

UMMZ University of Michigan (M. F. O'Brian)

USNM United States National Museum (R. W. Poole)

DEFW University of Minnesota (P. J. Clauson)

DEUN University of Nebraska State Museum (B. C. Ratcliffe)

EMUS Utah State University (R. Baumann)

ZMUC Universitets Zoologiske Museum (N. P. Kristensen)

VOB Vitor O. Becker- Planaltina, Brazil

VPIC Virginia Polytechnic Institute (M. Kosztarab)

WSUC Washington State University (R. S. Zack)

Systematics of the Acontiini

It is beyond the scope of this study to perform a detailed cladistic analysis of this tribe, and/or its relationship with other tribes and noctuid phylogeny which is widely accepted to be in a state of disarray. In the following discussion I informally re-characterize the tribe and discuss the phylogenetic position of the Acontiini in noctuid phylogeny. I follow Poole and Lafontaine and Poole's (1991) recent treatment of Noctuid phylogeny in the discussion below.

Fea

For
tympar
paired
often
plate,
number
Aconti
Acontii
with b
extendi
ampull
divided
scleroti
2a), va
scleroti
rows (
monoph
most n

Feat
homolo
plan o
noctuid
arises
scleroti
these

Features of the Acontiini

Forbes (1954) characterized the Acontiini based on a reduced tympanal hood and enlarged chitonized alula of the thorax and paired hair masses on the anal tube. He also noted that members often had an aedeagus with numerous cornuti and a "shagreened plate, or odd plates." In this revision of *Spragueia* I have examined a number of Acontiini taxa including *Tarachidia*, *Fruva*, *Conochares*, *Acontia*, *Emmelia*, *Therasea* and *Ponometia*. I characterize the Acontiini as follows: tympanal hood reduced, alula large, chitonized, with broad scales; anal tube hairy (Figure 3b); valves with sacculus extending to margin of cucullus, usually with clasper, sometimes with ampulla extending obliquely (Figure 3b); sacculus bilobed, nearly divided at ventral margin near the middle of the valve, and heavily sclerotized to cucullus (Figure 3b); vesica of aedeagus bilobed (Figure 2a), variously modified with spines, and/or square to rectangular sclerotized plates in rows, and/or adpressed and shortened cornuti in rows (Figure 5a). The characters above support the hypothesis of monophyly in the Acontiini but the relationship of this taxa to others, most notably the Eustrotiini and Cydosiini is uncertain.

Features of the male genitalia, especially the vesica, can be homologized in the Acontiini. The vesica is modified from a ground plan of two lobes, and is possibly anothere feature of the trifid noctuids (Figure 2a). The lobe from which the primary gonopore arises (right lobe in *Spragueia*) is variously modified with rows of sclerotized plates or adpressed and shortened cornuti (Figure 5a); these plates may be condensed further into a tight series of plates

(some *Acontia*, *Tarachidia* and *Spragueia*), sometimes leaf-like, and termed "laminate cornuti." All *Spragueia* have this condensed series of cornuti in addition to several stout, hair-like sclerotized filaments at the distal end of the right lobe (Figure 2b); this feature appears to be synapomorphic for the group. The left lobe of the vesica is entirely membranous in *Spragueia*; Acontiini genera may have one or several cornuti arising from this lobe and may be a useful generic character (i.e., *Tarachidia*). The genitalic characters of the Acontiini may offer excellent tools for cladistic analysis of the Acontiini, Eustrotiini and the Cydosiini.

Superficial characters such as the modification of the frons, venation, and thoracic and abdominal tufts have been traditionally applied as generic characters; however they are variable and should be carefully applied in acontiine taxa as well as other noctuid taxa. Forbes (1954) noted that modification of the frons is common in taxa which pupate in the soil in more xeric climates and therefore is likely to vary within some genera.

Placement of the Acontiini in Noctuid Phylogeny

Venation, and superficial facies were the primary characters used by many authors in early classifications of the Noctuidae (see Kitching 1984 for review). Most classifications propose two major lineages in noctuid phylogeny based on hindwing venation. In quadrifid noctuids M2 of the hindwing is present, usually arising near M3 and giving the cubital stem a four branched appearance. Conversely, trifids have M2 reduced or absent giving the cubital

ste
hov
eluc
valu
quac
on t
trific
I
prima
exam
There
more
subfan
confirm
are un
tribes
larvae
lineage

Spra

Mos
of mac
required
kept to
salient

stem a three-branched appearance (Figure 1a). These characters, however, are extremely variable and are of questionable value in elucidating phylogeny. Even though this character is of dubious value in accurately defining these lineages, the major trifid/ quadrifid lineages can be delimited by the condition of the SV setae on the first abdominal segment of the larvae; quadrifids with three, trifids usually with two (Lafontaine and Poole 1991).

I associate the Acontiini with the trifid lineage of the Noctuidae, primarily on larval characters. All the Acontiini larvae I have examined have 2 SV setae and a slightly attenuated SD seta on A9. There has been a tendency to place the acontiines and plusiines in a more basal position in the phylogeny of the noctuids since both subfamilies have quadrifid and trifid members; but this needs to be confirmed by rigorous cladistic methods. The Acontiinae, *sensu latu* are undoubtedly para/polyphyletic; it is likely that many of the tribes share only remote relationships with each other. Eublemmini larvae have 3 SV setae and should be placed with the quadrifid lineage of the Noctuidae.

Spragueia Morphology and Taxonomy

Most species of *Spragueia* can be determined by using characters of maculation. In some species, however, study of the genitalia is required for positive identification. In what follows, descriptions are kept to a minimum in taxa previously described; emphasis is on salient features and variation. Locality data for specimens examined

is prese

localitie

Nom

particul

clasper

a taper

any kin

Acontiir

and oth

ampulla

frequen

extensic

sacculu

Key

species

group.

evert t

difficul

Appen

Sprag

is presented for rare taxa, new species and those specimens whose localities could not be located on available maps.

Nomenclature used for describing morphological features, particularly the genitalia, is shown in Figures 1-4. The ampulla and clasper always arise from the distal end of the sacculus; the clasper is a tapered, heavily sclerotized process without sensory apparati of any kind and appears to be homologous with claspers in the Acontiini (i.e., *Tarachidia*, *Acontia*, *Ponometia*, *Emmelia*, *Ponometia*) and other Cucullinae *sensu latu* (Lafontaine and Poole 1991). The ampulla is usually clavate, ringed with minute hairs or more frequently variably covered with minute spines. The saccular extensions are swellings of the basal to median portion of the sacculus and often populated with fine hairs (Figure 3b).

Keys for the species groups are provided, as well as keys to the species of *Spragueia* following the diagnostic features of each species group. In most cases, workers dissecting the male will not care to evert the vesica due to the small size of the structure and the difficulty and specialized tools necessary to accomplish it (see Appendix).

Spragueia Grote 1875

Spragueia Grote, 1875a. Checklist of the Noctuidae of America North of Mexico. I. Bombycinae and Noctuelitae (Nonfasciatae). Buffalo. Reinecke and Zesch. Type species: *Agrophila leo* Guenée by original designation.

Helioc

i

a

c

Mnesip

S

t

Des

fine th

develop

numero

ocelli

third s

proboso

scaled

and p

raised

small

project

mixed

ochreo

series

proxim

metath

Heliocontia Hampson, 1910. Catalogue of the Lepidoptera Phalaenae in the British Musuem. Volume 10, page 662. London. Taylor and Francis. Type species: *Emmelia apicella* Grote by original designation.

Mnesipyrga Meyrick, 1913. Transactions of the Entomological Society of London, p.171. Type species: *Mnesipyrga trichostrota* by monotypy.

Description. Head: frons prominent, nearly round, covered with fine thin scales, somewhat flattened below; clypeal plate weakly developed, producing a slight shelf ventrally; surface of frons with numerous minute protuberances; eyes large, bald, without lashes; ocelli present; palpi developed, porrect, reaching middle of frons, third segment small, less than half the size of the second segment; proboscis present, completely developed; antennae with minute cilia, scaled dorsally and not visibly sexually dimorphic. Thorax: tegula and patagia present, expanded; metathoracic scales depressed or raised into a prominent tuft; vestiture of thorax round, with scales; small clusters of thin, hair-like tufts of scales arising from wing base projecting posterior; thoracic legs pale white to ochreous, variably mixed with brown, tarsi usually alternately banded brown and ochreous; prothoracic tibia without heavy spine, tarsi with a variable series of minute spines; metathoracic tibia with two heavy spines the proximal spine greater than twice the size of the distal spine; metathoracic legs with two pairs of spines, the proximal larger;

tympa
promi
often
dorsal
bande
ventra
dark r
abdom
(Figur
marga
intersp
and co
absent;
genital
or near
side tw
minute
with lo
medial
distinct
two ne
with a
of sma
cucullu
(rarely
decurv
right l

tympanum of metathorax well developed; hood reduced; alula prominent, chitonized, covered with round, expanded ivory scales often mixed with leaden gray. Abdomen stout, slightly curved dorsally from pleurite to sternite and covered with scales, often banded intersegmentally; darker dorsally and often banded, lighter ventrally from pleural border; female 7th sternite with or without dark ring of scales; male with paired, shortened hairpencils on 8th abdominal segment; dorsally without crests. Venation variable (Figures 1a,b): forewing with (*leo* group) or without (*apicalis* and *margana* group) accessory cell, highly variable intra and interspecifically; usually R3+4 when accessory present reaching apex and costa of wing; R3-5 variably branched when accessory cell absent; hindwing with M2 usually absent, rarely degenerate. Male genitalia (Figures 3a,b): valves asymmetric overall, rarely symmetric or nearly so (*lepus* Figure 28c); tegumen usually asymmetric, left side twice the width of right; uncus strong, curved, covered with minute setae and a short sharp point on the apex; anal tube covered with long, fine hairs (Figure 3b); juxta square to rectangular, a small medial point ventrally (Figure 3b), or broadly cleft into nearly two distinct lobes (Figure 18c); sacculus well developed and divided into two nearly distinct lobes (Figure 3b); right and left sacculus usually with ampulla, clasper present or absent; ampulla with variable series of small, stout spines; corona extending along entire length of cucullus (Figure 3b) to greatly reduced (Figure 23c) or absent (rarely); aedeagus straight to slightly curved dorsally; vesica decurved, expanded ventrally and divided into two distinct lobes; right lobe with an oval patch of condensed (laminate) cornuti

(Figures 2a,b) lying on the dorsal surface of the lobe between the base of the aedeagus and the vesica, ventrally with rows of short adpressed cornuti and sclerotized rectangular plates in rows (Figure 5a); right lobe with gonopore arising on distal end; left lobe of vesica, membranous with two to five diverticula, long cornuti absent; terminal and right lateral portion of aedeagus and base of vesica variably sclerotized with or without spines (Figure 3a). Female genitalia (Figures 4a,b); ovipositor present, normal, slightly pointed to flattened at apex and populated with setae; 8th abdominal segment variable in shape, sclerotized laterally and ventrally fringed sparsely with long heavy setae, membranous dorsally; anterior apophysis 1/2 to 2/3 as long as posterior apophysis (Figure 4b); ostium bursae sclerotized ventrally, developed into two lobes of variable shape, tapered (Figure 10f), rounded (Figure 7f) or nearly reduced (Figure 6f); ductus bursae as long as width of ostium bursae or longer; mouth of ductus to corpus bursae membranous and flattened; corpus bursae with a short stout neck leading to body of bursae; body of corpus bursae round to oblong; left posterior edge of bursae with a roughly oval, heavily sclerotized patch corresponding to laminate cornuti of male.

The following key is based on characters useful in placing members in one of three species groups. The groups do not necessarily reflect natural groupings or the phylogeny of the genus; they are structured primarily for ease of determination.

Key to the species groups of *Spragueia*.

1 Forewing nearly unicolorous yellow to dark brown; base of wing with a transverse band of dark brown to black scales meeting posterior margin of wing (Figure 90); a prominent lighter colored transverse band from apex of wing to middle of the outer margin; never a prominent white triangular spot near apex (Figure 84); orbicular and reniform spot absent or indistinct. Clasper of male genitalia absent (Figure 22c), corona 1/3 the length of cucullus, aedeagus long, curved .....*apicalis* group (p. 65)

1' Forewing rufous (Figure 48) to gray-black (Figure 87), when unicolorous, never with a transverse band reaching posterior margin of forewing; orbicular and reniform spot present (Figure 73), sometimes indistinct (Figure 46); male genitalia with corona greater than one-third width of cucullus (Figure 3b)..... 2

2(1) Pectus with light suffusion of gray; right sacculus of male always with clasper and ampulla (Figure 3b); forewing usually orange to rufous coloration (Figure 46), rarely more uniform brown (Figure 57); accessory cell usually present (Figure 1b); costa of forewing usually with a series of equidistant brown dashes (Figure 52); metathorax rarely with a prominent crest of scales.....*leo* group (p. 16)

2' Pectus ochreous, without suffusion of gray; valves with or without clasper and ampulla; forewing dark, usually ochreous

to gray-black, rarely dark rufous (Figure 69); accessory cell present or absent (Figures 1a,b); metathoracic tuft usually present.....3

3(2) Clasper absent, ampulla present; valve rounded at corona, corona biordinal, complete along cucullus (Figure 16c); forewing light brown to rarely orange (Figures 78, 79), apex of wing with a whitish to ochreous triangular spot (Figures 83, 84). Females nearly unicolorous black, lightly suffused with yellow scales (Figure 87), with or without a small triangular white patch of scales near apex of wing (Figures 81, 89); legs uniform ochreous, banding reduced; accessory cell absent (Figure 1a); metathorax usually with a prominent tuft of scales.....*margana* group (p. 46)

3' Right sacculus of male always with clasper and ampulla; corona uniordinal; forewing usually orange to rufous in color, to ochreous (Figure 57) rarely uniform brown; female forewing never uniform dark gray-black; accessory cell usually present (Figure 1b); metathorax rarely with a prominent crest of scales.....*dama* group (p. 31)

Key to the species of the *leo* group:

The leo group is characterized by the following characters: pectus with suffusion of gray; right lobe of aedeagus without ventral diverticulum; metathoracic tuft never present. Ostium bursae reduced.

1 Four to five brown, nearly equidistant dashes along costa of forewing (Figure 53)..... 2

1' Forewing not so marked..... 5

2(1) Brown post medial line anastomosing with reniform spot (Figures 46, 47).....*leo* (p. 17)

2' Postmedial line distinct from reniform spot (Figure 48).....3

3(2) Reniform spot white ringed with black (Figures 50, 51).....*guttata* (p. 23)

3' Forewing not so marked.....4

4(3) Cilia on lower 2/3 of outer margin brown, rufous on remainder (Figures 48, 49).....*onagrus* (p. 20)

4' Cilia on outer margin rufous, a small spot of brown cilia near apex (Figures 52, 53).....*cleta* (p. 26)

5(4) Cilia of entire outer margin of forewing shiny lead gray (Figures 54, 55).....*magnifica* (p. 27)

5' Cilia on outer margin with three brown (male) to black (female) spots on apex, tornus, and middle (Figures 56-58) ..... *jaguaralis* (p. 29)

Spragueia leo (Guenée)

Figures 3a-b, 4a-b, 34, 46, 47

Agrophila leo Guenée, 1852. In Boisduval and Guenée. Noctuélites, Part 2, p 205. Syntype(s): North America. Location of type not known (see remarks below).

Diagnosis. The type species of the genus, *Spragueia leo* is often confused with *onagrus*. Both sexes of *leo* may be distinguished from *onagrus* by the presence in *leo* of alternating black and white stripes at the base of the wing that do not meet in an ellipse and a broad black postmedial line that always anastomoses with the orbicular spot (Figures 46, 47). It appears that where the two species are sympatric there is little or no hybridization; only a single specimen has been found that appears to be intermediate in markings between the two species, the markings being most like *leo* except that the reniform spot does not anastomose with the post medial line. In addition, the right saccular extension reaches the costa of the valve in *leo* (Figure 3b) but not in *onagrus* (Figure 5c).

Description. Wingspan: 13.5-18.4 mm (mean=15.7, n=17). Both sexes. Head: upper half of frons brown, lower half whitish; vertex of head variably mixed with rufous orange to dark brown. Thorax: patagia and tegula rufous orange, the remainder brown dorsally; posterior tip of metathorax rufous orange; pectus ivory, variably mixed with leaden gray. Abdomen: dorsal half black with distinct whitish intersegmental bands; whitish ventrally; 7th sternite of female usually with ring of black scales. Maculation (Figures 46, 47): forewing postmedial line dark brown, distinct and anastomosing with orbicular spot; base of wing with alternating white and black bands; a medial brown stripe usually extending through cell to orbicular spot and postmedial line; hindwing gray, lighter towards base.

Male genitalia (Figure 3a-b): right ampulla thin near middle, expanded apically, spinose surface facing cucullus; juxta nearly

s
c

b

1
a
se
ar
sp
of
as
kn
(F

ge
an
no
tak
Se

E
phy
nor
env
diap

square with small ventral lip; right saccular extension reaching to costal margin of valve.

Female genitalia (Figures 4a,b); ostium bursae narrow; ductus bursae greatly reduced in length, nearly absent.

Biology and foodplant. *Convolvulus* [Convolvulaceae] (Forbes 1954; Kimball 1965). Forbes was the first to indicate the host association and rearing of larvae he found on *Convolvulus*; I have not seen the larvae. Forster and Wholfahrt (1971) described the larvae and host plant of *Emmelia trabealis* Scopoli, a related Old World species that also feeds on *Convolvulous.* The similar plant affinities of the two species might be seen as additional evidence for *Emmelia* as the out-group; however, other Acontiinae *sensu latu* are also known to feed on *Convolvulous* [*Eublemma (Eummicremma)*] (Forbes, 1954).

Distribution and flight period (Figure 34). *Spragueia leo* is generally distributed from northern Illinois, east to Massachusetts, and south to Eastern Texas, southern Mississippi, and west to northern Florida and the Coastal Atlantic States. Adults have been taken as early as April in the South, most commonly June through September.

Material examined. 306 females, 211 males.

Remarks. The markings in *Spragueia leo* are very similar to *Emmelia trabealis*; this may represent a connecting link in the phylogeny of the group (Franclemont pers comm). *S. leo* is the most northerly distributed species in the genus and may share environmental adaptations for more temperate climates (i.e., diapause, cold tolerance) with *Emmelia.*

Th
or th
A[me
handv
(dam
Ho
misde
Et

Agrop
No
An
remark

Dia
disting
anasto
and b
near b
survey
onagr
Florid
these
that

The location of the type of *leo* is not known. It is not in the USNM or the BMNH. The USNM has 2 female specimens of *leo* from A[merica] Sept[entrionali] with the square white labels and "leo gn" handwritten. The locations of other Guenée types are not known (dama, *onagrus* and *lepus*)

Holland (1903) illustrated *leo* on plate 29, figure 27 but misdetermined it as *onagrus*.

Etymology. From the Greek *leontos* = lion (Jaeger 1944).

Spragueia onagrus (Guenée)

Figures 5a-d, 35, 48, 49

Agrophila onagrus Guenée, 1852. *In* Boisduval and Guenée. Noctuélites, Tome 2:205, plate 10 figure 2. Type(s): North America, BMNH [London]. Location of type no known (see remarks for *leo* page 19).

Diagnosis. Very similar to *leo* in markings, *onagrus* may be distinguished from *leo* by the brown postmedial line not anastomizing with the circular orbicular spot. The alternating white and brown lines formed at the base of the wing meet in an ellipse near base of the cell (Figures 48, 49). Many checklists and faunal surveys in the eastern U. S., particularly in the past, have listed *onagrus*; undoubtedly most of these are *leo* when they occur north of Florida and the Costal Southeastern States. Due to the similarity of these two species, the following description is confined to characters that differentiate them.

Description. Wingspan: 14.6-19.6 mm (mean= 17.3 n=21). Both sexes. Thorax dorsally with a continuous thin, rufous line of scales running medially to metathorax. Female 7th abdominal sternite usually with a ring of black scales. Maculation (Figures 48, 49): postmedial line not fusing with orbicular spot; base ovate, with alternating series of white and brown extending into cell; medial brown stripe arising from base of wing, never extending through to postmedial line.

Male genitalia (Figures 5a-c): right saccular extension not reaching costa of valve (Figure 5c).

Biology and foodplant. Holland (1903) reported larvae on *Solidago* sp., while Kimball (1965) gave records for field corn, and chinquipin; these records I believe are of questionable validity. I have larvae (Figure 45) reared by D. H. Habeck on *Ambrosia* sp. [Asteraceae]. He also indicated collecting adults on *Sida rhombifolia* [Malvaceae], a likely host and also the foodplant of *Acontia marmoralis* (Fab.) (Forster and Wolfardt, 1971).

Larvae (Figure 45). Head 1.4-1.5 mm wide. Body a typical semilooper with A4 and A5 reduced; A8 developed into a broad hump dorsally, base of D setae elevated. Integument smooth, general color not known.

Dorsal to the SD setae with variable series (6-10) of longitudinal stripes; lines often broken, rarely complete along entire length. D1 and D2 often on slightly raised protuberences. Laterally abdominal SD and L setae arising from slightly raised regions of the integument; SD1 setae always arise from small circular melanized regions of the integument, with more extensive melanized areas

below spiracles. Spiracles brown to black, A1 spiracle larger than those of subsequent segments. Ventrally, abdomen with numerous thin, weakly melanized lines. A9 with SD setae long, and slightly attenuated.

Head with extensive melanized areas; spinneret short, cone shaped. P2 arising from vertex of head, P1 and L1 long, greater than half the width of the frons.

The larvae of *Spragueia* are most similar to those of *Acontia*; each have a distinctive swelling of abdominal segments eight and nine. In addition, both *Spragueia* and *Acontia* larvae have long P1 and L1 setae on the head, longer than half the width of the frons. Larvae of *Tarachidia* are similar, but lack the distinctive swelling of A8 and and P1 and L1 are short, less than half the width of the frons.

Distribution and flight period (Figure 35). Mainly Florida, and from coastal Mississippi, Georgia and the Carolinas. Flight all months in Florida, commonly April through October.

Material Examined. 130 females, 110 males.

Remarks. Despite the similarity of *leo* and *onagrus*, their largely parapatric distributions and the absence of convincing intermediates between the two populations suggest that reproductive barriers are complete between the two species.

Etymology: From the Latin *onager*=wild ass (Jaeger 1944).

Spragueia guttata Grote

Figures 6a-f, 35, 50, 51

Spragueia guttata Grote, 1875b. Canadian Entomologist, 7(12): 225.

Holotype: Male, Bastrop Co., Texas, BMNH [London].

Diagnosis. *Spragueia guttata* is unlikely to be confused with other species; it is the only species in the *leo* complex possessing a white orbicular and reniform spot ringed with black, and additional white regions in the cell outlined with black (Figures 50, 51). The postmedial line is most like *onagrus* since is does not reach the costa of the wing and does not anastomose with the reniform spot as in *leo*. Valves of the male similar to *leo*, but the extension of the sacculus is slightly clavate at the apex in *guttata* (Figure 6c).

Description. Wingspan: 15.2-19.6 mm (mean 17.2 mm, n=22). Both sexes. Head: upper half of frons black, lower half whitish; vertex black. Thorax: patagia and tegula rufous orange; metathorax orange, scales not developed into a crest; pectus whitish mixed with gray. Abdomen: banded intersegmentally with black scales on dorsal surface, female 7th sternite (Figure 6e) with black scales. Maculation (Figures 50, 51): reniform and orbicular spot white, ringed in black; variable white areas trimmed in black; hindwing dark brown, cilia ochreous. Forewings usually with accessory cell, frequently not closed entirely on the distal end; radials 3-5 variably branched.

Male genitalia (Figures 6a-c): posterior tip of right sacculus clavate (Figure 6c); posterior tip of aedeagus and junction of vesica with

variable series of heavy spines; right lateral side of vesica with a sclerotized plate and heavy spines (Figures 6a,b).

Female genitalia (Figures 6d-f): left lobe of ostium bursae asymmetrical and nearly reduced (Figure 6f); length of ductus bursae less than twice the width of ostium.

Biology and foodplant. Unknown.

Distribution and flight period (Figure 35). *Guttata* is distributed from northwestern Florida (rarely), west to Coastal Texas and northeastern Mexico, western Coastal Mexico (Jalisco, and Sinaloa), Puebla, and the Yucatan Peninsula. Flight range from March-October.

Material examined. 95 females, 64 males. Material not plotted: 2 females, Texas, Shovel Mountains, RUIC; female, Louisiana, Sunshine 31-V-72, DPI. MEXICO: 3 females, Chuminopolis, Yucatan, 5-VIII-52 AMNH; 2 females, Campeche, San Luis Carpozo, 18-VIII-28, AMNH.

Remarks. *Guttata* appears to be most closely related to *onagrus* in terms of wing maculation, but is divergent in a number of characteristics, see diagnosis.

Etymology. From the Latin *guttatus* = drops, speckles, spotted (Jaeger 1944).

Spragueia cleta Druce

Figures 7a-f, 35, 52, 53

Spragueia cleta Druce, 1889. Biologia Centrali Americana, Lepidoptera, Heterocera. Volume 1: 302, plate 28, figure 7.

Holoty

BMNI

Diag

rufous y

costa, a

52, 53).

Desc

sexes.

cream c

tegula l

pectus

segment

band.

a single

band w

Male

extendir

extensio

tapered,

variable

of prom

junction

Fem

rounde

bursae;

Bio

Holotype: Male, Mexico, Guerrero, Omilteme, H. H. Smith leg., BMNH [London].

Diagnosis. *Spragueia cleta* differs from *onagrus* by its lighter rufous yellow coloration, its more extensive ivory border along the costa, and rufous cilia with a single black spot near the apex (Figures 52, 53).

Description. Wingspan 15.6-18.0 mm (mean=17.0, n=26). Both sexes. Head: upper half of frons and vertex of head black, rufous or cream colored; lower half of frons whitish. Thorax: patagia and tegula light rufous orange; metathorax orange and not in a crest; pectus whitish. Abdomen alternately banded with white along segmental lines; seventh abdominal sternite of female without black band. Maculation (Figures 52, 53): outer margin fringed with rufous, a single brown spot near apex of wing; costa with thick cream white band with five nearly equidistant black dashes.

Male genitalia (Figures 7a-c): clasper variable in orientation, extending to corona or costa of valve (Figure 7c); left saccular extension large, clavate, extending beyond costa; left ampulla long, tapered, nearly reaching corona; base of vesica and aedeagus with a variable collection of spines on the right; an additional variable series of prominent cornuti on the left ventral base of the vesica near the junction with the aedeagus present (Figure 7a) or absent.

Female genitalia (Figure 7d-f): ostium bursae expanded into two rounded lobes; length of the ductus bursae less than width of ostium bursae; corpus bursae nearly round, typical.

Biology and foodplant. Unknown.

Dis

distrib

southv

and P

Octob

Ma

MEXI

VIII-1

VIII-1

Re

popula

Arizon

Mexic

52), th

and th

(contra

yellow

rather

Mexica

distanc

what e

this un

further

Ety

Spartar

Distribution and flight period (Figure 35). *S. cleta* is generally distributed in the mid-altitudues (1800' to 4700') from the southwestern United States, south to Vera Cruz and Jalisco Mexico, and Puebla (Mexico) to El Salvador; the insect flies from mid July to October.

Material examined: 31 males, 33 females. Material not plotted. MEXICO: Nayarit, 49.4 miles NE Venado, Mesa Nayarit, 5800', 18-25-VIII-1987, Norris Bloomfield, SDNH; Nayarit Sta. Barabara micro., 6-VIII-1985 Brown, UCB.

Remarks. Two morphologically and geographically distinct populations of *cleta* have been studied. Populations in southeastern Arizona are unique in a number of characteristics from those in Mexico. The Arizona populations are lighter rufous in color (Figure 52), the ampulla of the valve reaches the costa rather than corona, and the right ventral collection of cornuti on the vesica is absent (contrast Figure 7a). The vertex of the head and the frons is cream yellow and hindwings light gray in the populations from Arizona, rather than deep rufous orange and black respectively in the Mexican populations. Due to a lack of material, and the small distance separating the two populations [<160 km], it is not known to what extent these characters may represent a cline. I make a note of this unusual population in Arizona but refrain from naming it until further material is available for study.

Etymology. From the Greek Kleta. One of the Charities in Spartan mythology, embodying grace and beauty.

Sprag

Di

onag

size a

the fo

genera

De

sexes.

half o

browni

and br

tegula

browni

metath

gray.

scales

female

(Figure

leaden

wing;

Ma

thin, n

Spragueia magnifica Grote

Figures 8a-g, 34, 54, 55

Spragueia magnifica Grote, 1882b. Papilio 2:183. Holotype: Male, Arizona, USA, col E. L. Graef; USNM [Washington]. Type # 340

Diagnosis. *Spragueia magnifica* is nearly identical to *cleta* and *onagrus* in wing pattern, but can be separated readily by its smaller size and differences in coloration (Figures 54, 55). *S. magnifica* lacks the four distinct costal dashes found in *cleta* and *onagrus* and is generally dark rust brown rather than rufous.

Description. Wingspan: 13.3-16.3 mm (mean=15.5, n=22). Both sexes. Head: upper half of frons and vertex of head blackish, lower half of frons ivory. Thorax: tegula cream white on lateral half, brownish gold on medial half; patagia cream white on medial half and brownish gold on the lateral half such that the colors of the tegula and patagia are coincident; meso- and metascutellum brownish gold on dorsal surface with cream white stripes laterally; metathoracic tuft absent, brownish gold; scales of pectus leadeen gray. Abdomen: upper half alternately banded with gray brown scales and white intersegmental lines; 7th abdominal sternite of female (Figure 8d) usually ringed with black scales. Maculation (Figures 54, 55): base of forewing with a series of alternating leaden-gold and whitish bands meeting in an ellipse near center of wing; reniform spot distinct from post medial line.

Male genitalia (Figures 8a-c): right ampulla near clasper; saccus thin, narrow and short; right and left sacculus with a small process at

the d

aedea

varia

becor

lobes

three

Fe

than

B

D

magn

Septe

Mexic

Mts.,

Ma

Mexic

Pass, U

UCB.

Bernar

male, 4

Guadal

Mtns.,

UAZ;

Chihua

Califor

Sur, 2

Arroyo

the distal corner; variable series of spines at the posterior junction of aedeagus and vesica; left lateral junction of aedeagus to vesica with variably spined, sclerotized patch, roughly circular the spining becoming reduced southward (Figure 8b); long axis of left and right lobes of vesica nearly parallel to long axis of aedeagus; left lobe with three diverticula.

Female genitalia (Figures 8d-g): ostium thicker and less tapered than *leo*.

Biology and foodplant. Unknown.

Distribution and flight period (Figure 34). *Spragueia magnifica* flies from April to October, most commonly in July-September. It is distributed from central Texas south to Jalisco Mexico, west to the Baja Peninsula and north to the San Bernardino Mts., California.

Material examined. 141 females, 106 males. Not plotted: New Mexico: male, Dona Ana, Aguirre Springs, 5 miles S. San Augustine Pass, UCDC; male, Hidalgo Co., Guadalupe Cyn., 1 mile E. AZ St Line, UCB. California: female, Riverside Co., Cathedral City, AMNH; San Bernardino UAZ. Arizona: female, Mesa Verde R. at Coon's Bluff UAZ; male, 4 females, Eagle Cr. Canyon, TAMU; 3 females, S.E. Cochise Co, Guadalupe Cyn., McFarland UCB; female,10 miles E. Apache Peloncillo Mtns., Cochise Co., UCDC; male, McCleary Cyn. UAZ; male, Barrel Cyn., UAZ; 5 males, female, Jefferson Davis Co., Limpia Cyn., CNC. MEXICO: Chihuahua, 6 miles upstream from Colonia Juarez, AMNH; male, Baja California Sur 5 miles N. San Isidro San Diego LACM; male, Baja Cal. Sur, 2.3 miles SW San Bartolo NHSD; male, Baja Cal. Sur 27.7 miles NE Arroyo San Miguel NHSD; 6 females, male, Baja Cal. Sur, 7 rd. miles

NW
mal
Sier
Sur,
rd n
Telm
E

Sprag
Ph
Ho

Dia
species
forewi
ochreo
lighter
junctio
alterna
(Figur
and d
De
sexes.
to *bla*

NW 1.1 miles SW of El Clen on Santa Fe rd. 100' LACM; 3 females, male, Baja Cal. Sur Sierra de la Laguna Rd. to San Antonio de la Sierra, 8.5 rd miles S and E of Hwy 1 (kp 148) LACM; male, Baja Cal. Sur, Sierra de la Laguna Rancho San Antonio de la Sierra 3000', 11.6 rd miles, 147.6 LACM; 2 females, Baja Cal. Sur, 11 RD. miles E. San Telmo 500', LACM; male, Sonora, Rancho Tres Rios AMNH.

Etymology. From the Latin *magnificus* = splendid (Brown 1954).

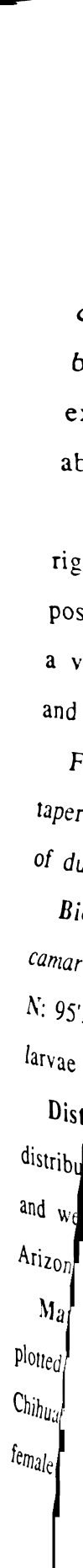
Spragueia jaguaralis Hampson

Figures 9a-e, 36, 56, 57, 58

Spragueia jaguaralis Hampson, 1910. Catalogue of the Lepidoptera Phalaenae in the British Musuem 10:673, plate 169, figure 6. Holotype: Female, San Antonio TX. BMNH [London].

Diagnosis. *Spragueia jaguaralis*, is the only members in the *leo* species group showing pronounced sexual dimorphism of the forewing (Figures 57, 58). Males of *jaguaralis* are generally light ochreous with a slight rufous color, while females are black with lighter regions; aedeagus with 3 regions of small spines on posterior junction of aedeagus and vesica (Figure 9a). Both sexes retain the alternating dark and light banding at the base of the forewing (Figure 56) and are most like *leo* in that these bands are shortened and do not reach into a complete ellipse.

Description. Wingspan: 13.5-19.8 (mean=16.8, n=18). Both sexes. Head: upper half of frons and vertex of head ochreous (males) to black (females) lower half of frons cream white. Thorax: tegula



and patagia variable from ochreous to rufous red (most commonly in females); pectus white, tinged with gray; metascutellum rufous to brown at tip. Maculation (Figures 56-58): male generally variable in color, ochreous to slight rust brown, orbicular and reniform spot brown, prominent (Figures 56, 57); females black, mixed with less extensive areas of rufous, orbicular and reniform spots present or absent (Figure 58).

Male genitalia (Figures 9a,b): valves similar to *leo* and *onagrus*, right clasper more stout than preceeding taxa; junction of vesica and posterior tip of the aedeagus with three patches of spines (Figure 9a); a variable medial series, a single stout spine immediately to right, and a variable series just posterior to spine.

Female genitalia (Figures 9c-e): ostium bursa reduced and tapered, oriented more laterally than others in species group; length of ductus bursae less than 1.5 times the width of ostium (Figure 9d).

Biology and foodplant. Adults have been reared on "*Lantana camara* L. or Hybrid" [Fabaceae]; MEXICO: Vera Cruz, Buen Pais 18.20' N: 95'50" W, 24 July 1987 W.A. Palmer [USNM]. No specimens of the larvae have been examined.

Distribution and flight (Figure 36). *Spragueia jaguaralis* is distributed from north central Texas, south to Guadalajara Mexico and western Mexico and Baja California, and north to southeastern Arizona.

Material Examined. 46 males, 95 females. Specimens not plotted. MEXICO: 2 males, Chihuahua, Timoris, 3 miles S., UCDC; male, Chihuahua, Cuiteco UCDC; male, Vera Cruz, Cotaxtla Exp. Sta., UCDC; female, 2Km San Ignacio Bastida, UCDC; Tlahualila Durango, TAMU.

GUA

Vera

D

Texa

a lon

respe

femal

Et

The *d*

obatra

leo gr

suffusi

diverti

maximu

1

1'

2(1)

2'

3(2)

3'

GUATEMALA: female, Baleu Municipio San Cristobal Verapaz, Alta Verapaz, AMNH.

Discussion. An unusual female specimen from Brownsville, Texas was dissected and found to possess a large ostium bursae and a long ductus bursae typical of *dama* and others but in othere respects similar to other female *jaguaralis* specimens. No other females examined had this condition of the genitalia.

Etymology. Presumably latinized from Jaguar.

The *dama* Species Group

The *dama* species group is composed by *Spragueia dama*, *funeralis*, *obatra*, *valena*, and *pyralidia* and *creton*. Adults are similar to the *leo* group with the following differences: pectus ochreous, without suffusion of gray; right ventral lobe of vesica with a small diverticulum (Figure 10b); length of ductus bursae greater than the maximum width of the ostium bursae.

1 Metathorax with prominent tuft of scales 2

1' Metathoracic scales not raised into tuft.....4

2(1) Forewing nearly uniform rust brown, variably mixed with indistinct silvery white regions (Figure 71). Female unknown.....*pyralidia* (p. 44)

2' Forewing not so marked.....3

3(2) Head and thorax black to dark rust brown.....*valena* (p. 42)

3' Head and thorax light ochreous.....*obatra* (p. 37)

4

5

5'

6(5

6'

Sprag

[Ar

US

Dia

other

an ex

yellow

It is

4(2) Forewing predominately dark lead gray to black suffused with yellow scales and two broad yellow bands at postmedial and medial lines (Figure 59).....*funeralis* (p. 32)

4' Forewing not so marked.....5

5(4) Head and thorax black to dark rufous orange; cilia on outer margin rufous orange with a single brown spot 1/3 from apex of wing (Figures 65, 66).....*dama* (*creton*)(p. 41)

5' Head and thorax ochreous.....6

6(5) Forewing with a broad white band on the costa of wing (Figure 63) .....*obatra* (p. 37)

6' Hindwing dark gray, wing predominately light ochreous to dark brown, without lead gray fringe on outer margin (Figures 61, 62).....*xericosa* (p. 34)

Spragueia funeralis Grote

Figures 10a-f, 36, 59, 60

Spragueia funeralis Grote, 1881a. Papilio 1:158. Holotype: Female [Arizona] USNM [Washington]. Type # 301, Collection J. B Smith, USNM [Washington].

Diagnosis. *Spragueia funeralis* can be differentiated from all other taxa by its overall dark slate gray wings suffused with yellow; an expanded yellow antemedial line; a wide medial line; and two yellow bands variably trimmed with rufous scales (Figures 59, 60). It is not to be confused with any other species.

Description. Wingspan: 14.0- 17.2 (mean = 16.2, n=11). Both sexes. Head: upper half of frons and vertex of head dark gray black, lower half cream white. Thorax: entirely dark gray black suffused with some yellow scales dorsally; metathorax without tuft of scales; pectus of thorax with round white scales without gray suffusion. Abdomen: female 7th sternite ringed with black. Maculation (Figures 59, 60): width of the yellow lines and degree of orange trim variable; orbicular and reniform spots present, leaden gray, obscure; not usually sexually dimorphic, but females may have more extensive area of dark gray.

Male genitalia (Figures 10a-c): right saccular extension reaching beyond costa of valve and bent at a 45' angle from perpendicular (Figure 10c); right lateral junction of aedeagus sclerotized with variable series of spines on the posterior rim.

Female genitalia (Figures 10 d-f): ostium bursae long and tapered to a blunt point.

Biology and foodplant: Unknown

Distribution and flight period (Figure 36): *S. funeralis* is distributed generally from Central Texas, west to southern California, south to Baja California and northern Mexico, and a disjunct population in Peru. *Funeralis* flies from May through September with most common months being July and August.

Material Examined: 121 Males, 252 Females. Specimens not plotted. MEXICO: male, Baja California Sur, mouth of Arroyo Comondú, 400', Sierra de la Gigantea, 16.4 rd miles NE La poza Grande, 17-IX-1985, LACM; female, Baja California Sur, Hwy 1 (Kp 169.3), 2000', 3.5 rd miles NNW Catavina, 2-IX-1985, LACM; female,

estacion Baja California, Hwy 1, ca 10 miles NNW Catavina, 1-2-IX-1983 LACM; male, El Marmol, L. California, 24-IX-1941, CDAE; male, San Domingo, 23-X-1941, CAS; female, San Venancio, 8-X-1941, CAS; 19 males, 22 females, Chihuahua, 6 miles upstream from Colonia Jaurez, 5000', R. Holland, 26-VI-1979, AMNH. Arizona: male, Peppersauce Canyon, 8-VII-1961, UAIC; female, Canelo, 19-VII-1958, at light, UAIC; female, N rim of Salt River Canyon, Gila Co., 15-VII-1958, UAIC. PERU: Matucana, 13-V-1920, CU.

Etymology. Latin root *funer* = burial. Pertaining to a burial (Jaeger 1944).

Spragueia xericosa **sp. nov.**

Figures 11a-f, 36, 61, 62

Spragueia xericosa Wilterding 1992. **Holotype**: Male, MEX: Baja California Sur: Mesa Las Calabazas, 1000', Sierra de San Francisco, 27.29' N, 113.10' W, 14 Sept 1988, #124,705, J.P. K.E.S. Donahue. **Allotype**: Female IBID. Los Angeles County Museum of Natural History [Los Angeles].

Diagnosis. Apparently restricted to desert regions of the Baja peninsula, males have a heavy brown band from the postmedial line to the outer margin of wing and a basal transverse band not quite reaching posterior margin; the disc of wing is ochreous (Figures 61). Females have more extensive brown coloration than the males (Figure 62); antemedial, medial and postmedial lines variably brown, widest at costa narrowing to posterior margin. Right saccular

extension more narrow than other species, reaching beyond costa of valve (Figure 11c).

Description. Wingspan: 13.0-15.4 mm (mean=13.9, n=8). Male. Head: frons and vertex light brown to ochreous. Thorax: patagia and tegula light sand brown to ochreous; metascutellum usually tipped in brown, metathoracic tuft not developed; scales of thorax cream-white laterally; legs more uniform light brown; banding less distinct. Abdomen ochreous, intersegmental banding indistinct. Maculation (Figure 61): ground color ochreous with variable brown shading; postmedial line as a narrow uniform brown band reaching apex of wing, not anastomosing with reniform spot; reniform spot brown with cream white spot in center. Male genitalia (Figures 11a-c): right saccular extension narrow, reaching beyond costa of valve; left saccular extension reduced to swelling medially with fine hairs; additional minute diverticulum arising on ventral portion of right lobe; left lateral sclerotized patch with variable series of thin spines (Figure 11a).

Female. Head and thorax dark brown, abdomen ochreous. Maculation (Figure 62): ground color dark brown; basal line cream-white, widest at costa, narrowing to posterior margin; a large cream-white patch at medial line, and costa usually tapering to thin line at posterior margin; apex of wing with a cream-white triangular patch; orbicular spot indistinct and reniform spot deep black brown; hindwing gray. Female genitalia (Figures 11d-f): lobes of ostium bursae rounded; ductus bursae longer than the maximum width of ostium (Figure 11f); right lobe of ductus bursae broadly rounded; posterior apophysis less than twice the length of anterior apophysis.

Biology and foodplant. Unknown.

Distribution (Figure 36). *S.xericosa* is restricted to the Baja Peninsula of Mexico, and from very arid locations. The larvae are unknown.

Material examined. 19 males, 14 females; all specimens known to me are at LACM except one specimen at UCB. **Paratypes: MEXICO,** Baja California Sur: 10 females, 14 males, nr. Rancho Esperanza, 8.8 miles E of San Ignacio and 4.3 miles N of KP 59.5, 650', 7-IX-85, J.P. and K.E.S. Donahue; 1 female, Sierra de la Gigantea, Mouth of Arroyo Comondú, 16.4 rd. miles NE La Poza Grande, 400', 17-IX-85, J.P. and K.E.S. Donahue; female, Mesa Las Calabazas, 1000', Sierra de San Francisco, 27.29'N, 113.10' W, 14-IX-88, J.P. and K. E. S. Donahue, LACM; female, 2 mi. NW El Trinufo, 12-VIII-66, Chemsak, Doyen, Powell, UCB; male, Hwy 1, KP 20, 12 rd miles NE Villa Insurgentes, 250' 7-IX-83, J.P. and K.E.S. Donahue, LACM; male, Playa El Coyote, Bahia Concepción, sea level, 17 rd miles S of Mulege, J.P. and K.E.S. Donahue, LACM.

Remarks. *Spragueia xericosa* appears to be confined to arid regions on the Baja Peninsula. Examination of precipitation isolines and collection localities shows the species is restricted to the most arid regions on the peninsula.

Etymology. From the Greek *xeros* = dry and the Latin termination *osus* meaning prone to.

Tarac

Na

La

Sprag

9:

des

Dia

xerico

xerico

margin

typical

extensi

Des

Head:

vertex

patagi

tuft o

Abdo

white

Macul

of le

white

Spragueia obatra (Morrison)

Figures 12a-d, 38, 63, 64

Tarache obatra Morrison, 1875. Proceedings of the Boston Society of Natural History, 18: 124. Holotype: Male Louisiana, MSUE [East Lansing].

Spragueia plumbifimbriata Grote, 1877. Canadian Entomologist, 9: 68-69. Syntypes: 2 females, BMNH [London]. Lectotype to be designated.

Diagnosis. *Spragueia obatra* is a distinctive species allied to *xericosa* in overall habitus. The species can be distinguished from *xericosa* by its larger size and the leaden gray trim of the outer margin of the wing (Figure 64), the lack of sexual dimorphism, and a typically well developed metathoracic tuft. The right saccular extension of valve is clavate (Figure 12c).

Description. Wingspan: range 16.0-20.3 mm (mean=18.2, n=38). Head: frons nearly round, flattened below at junction with clypeus; vertex and frons ochreous mixed with yellow. Thorax: tegula and patagia light brown variably mixed with darker scales; metascutellar tuft of scales present, usually darker brown, than dorsum of thorax. Abdomen: light gray dorsally with faint intersegmental bands, cream white ventrally; female 7th sternite without black ring of scales. Maculation (Figures 63, 64): variably marked with extensive regions of lead-gray to rarely brown; costa of wing usually with a cream-white stripe from basal third of wing to near apex, and sometimes

divide

cream

genita

swell

large

valve

latera

poste

(Figu

Bi

Bi

from

and s

Octob

M

Agro

N

Si

A

un

Agro

Le

divided medially into two parts; basal quarter of wing usually cream-white mixed with brown, rarely completely brown. Male genitalia (Figures 12a,b): left saccular extension reduced to a medial swelling with fine hairs; juxta flask-shaped; right saccular extension large and flattened at apex; right ampulla not reaching the costa of valve; clasper sharp or slightly rounded; vesica with an oval, right lateral, sclerotized patch with a linear row of spines along the posterior rim; stouter and shorter than *xericosa*. Female genitalia (Figure 12d); ostium strongly rounded at posterior end.

Biology and foodplant. Unknown.

Biology and distribution (Figure 38): *Spragueia obatra* ranges from western Colorado, southeastern Arizona, west and central Texas and southward to Chiapas, Mexico. It flies from May through October, most commonly from July to September.

Material Examined: 75 males, 109 females.

Spragueia dama (Guenée)

Figures 13a-g, 37, 42, 65-68

Agrophila dama Guenée, 1852. In Boisduval and Guenée. Histoire Naturelle des Insectes. Species General des Lépidoptéres. Tome Sixiéme Noctuélites. Tome 2 page 205. Syntypes: North America. Type in Oberthür collection (Smith 1893). Type locality unknown (see also remarks, *S. leo* page 19).

Agrophila transmutata Walker, 1865. List of the Specimens of Lepidopterous Insects of the British Museum of Natural

History. Vol 33: 776. Holotype: Female, Santo Domingo, Dominican Republic, Tweedie; BMNH [London].

Agrophila trifariana Walker, 1865. IBID. Vol 33: 777. Holotype: Male, type locality unknown; BMNH [London].

Spragueia pardalis Grote, 1881b. Papilio 1:50. Syntypes: Florida, Thaxter; BMNH [London]. Lectotypes to be designated.

Diagnosis. *Spragueia dama* is a widely distributed, sexually dimorphic species found from southeastern North America to northern Argentina. Females of *dama* can be distinguished from all other *Spragueia* by the nearly uniform black coloration and three cream white patches along the costa of the wing near the basal quarter, middle and apex. Males have similar markings, the ground color dark rufous to brown, usually with more extensive areas of rufous (Figure 65). There are some populations in Mexico and South America that show seasonal polymorphism which results in both sexes losing regions of rufous coloration (Figures 67, 68). The left saccular extension is developed into a heavy knob with fine hairs (Figure 13c).

Description. Wingspan: 14.3-18.5 mm (mean=16.2, n=22). Both sexes. Head: frons and vertex usually dark brown to black, rarely rufous orange or combination. Thorax: patagia and tegula usually black rarely rufous (Antilles); pectus cream white without tinge of gray. Abdomen: dorsally dark brown to black with prominent intersegmental lines; cream-white ventrally; female 7th sternite

without dark dimorphic ring of scales. Maculation (Figures 65-68): both sexes usually with areas of rufous scaling on the outer margin between the three whitish costal areas, and along posterior margin of the wing (Figure 65, 66); a dark basal transverse band rarely reaching posterior margin; band of black-to-brown scaling on outer margin of the wing near the apex; and hindwing uniformly dull black. Males with three costal patches of cream-white scales, the basal white patch tapering, but usually not reaching the posterior margin (Figures 65, 67); postmedial and medial line darker rufous rust, variably marked with regions of rufous in disc and outer margin of wing. Females are usually darker rufous than males (Figure 66); the basal white patch on costa rarely reaches posterior margin (Figures 66, 68), and the abdomen is dark gray with prominent intersegmental ochreous bands (Figures 66, 68).

Male genitalia (Figures 13a-c): right saccular extension absent; left saccular extension elongate, stout, covered with fine hairs (Figure 13c); dorsal junction of vesica and aedeagus with a circular sclerotized patch and a variable series of spines along the posterior rim.

Female genitalia (Figures 13d-g): ostium bursae flattened at posterior tip (Figure 13d); 7th abdominal sternite deeply cleft (Figure 13f).

Biology and foodplant. Unknown

Distribution and flight period (Figures 37, 42). *Spragueia dama* is generally distributed across southeastern North America, throughout Mexico and the Antilles to northern Argentina. The larvae are unknown. Flight period all months throughout range.

Material examined. 331 females, 351 males.

Remarks. Despite its broad range, the species is remarkably homogeneous morphologically. The size of the right lobe of the vesica increases clinally southward. The precise orientation of the left saccular extension and the right clasper is variable. Some populations in Venezuela and Brazil have entirely lost rufous coloration (Figure 67, 68) and the overall color is dull rather than shiny black. This color pattern is indicative of the first brood following onset of the rainy season in Venezuela, since all subsequent generations developing during the rainy season without going through diapause gain back the orange coloration; it appears that this is may be a seasonally polymorphic character.

Spragueia creton Schaus

Spragueia creton Schaus, 1923. Galapogos Heterocera: With Descriptions of New Species. Zoologica, 5(2): 38, plate 1 figure 9. Type: Male, South Seymour, Lectotype designated by Todd 1972, Genitalia on slide # 4601 E. L. Todd, USNM Washington; 1 male Tower Island, Galapagos; USNM [Washington].

Spragueia plumbeata Schaus. 1923. IBID, plate 1 fig 10. Type: Female; USNM [Washington].

Diagnosis. *Spragueia creton* may be separated from *dama* by the absence of the left saccular extension and having the left clasper clavate. Nearly identical to *dama* in coloration, its distribution on the

Galapagos Islands should confirm its identity. Todd (1972) gave a review of the morphology, figured the genitalia, and assigned a lectotype.

Distribution and biology. Known only from the Galapagos Islands. Immature stages unknown.

Material Examined. One male South Seymour Island, Galapagos, 23-IV-23 AMNH; 1 female, Tower Island, Galapagos, 28-IV-1923, AMNH.

Remarks. Female genitalia were not examined due to the lack of material and low resolution of the female genitalia.

Etymology. From the Latin *cretus* = born or to spring from (Jaeger 1944).

Spragueia valena (Druce)

Figures 14a-e, 40, 69, 70

Acontia valena Druce, 1889. Biologia Centrali Americana. Heterocera, p307, plate 28, figure 21. Lectotype: San Geronimo (Champion); BMNH [London].

Diagnosis. Similar in external habitus to *obatra*, this rare species can be differentiated from all other *Spragueia* by the following characters: sexually dimorphic; males red brown in overall habitus (Figure 69); right ampulla more massive than our other species (Figure 14b). Females dull to shiny black (Figure 70). The fringe on the outer margin of the wing is cream-white to rust-brown (Figure 70) and not lead gray as in *obatra* (Figure 64).

Description. Wingspan: 17.6-22.0 mm (mean=19.8, n=9). Male. Head: frons and vertex sand brown (males), third palpi dark brown. Thorax: patagia, tegula and dorsal surfaces sand brown suffused with darker scales. Metathoracic tuft prominent to obscure, usually dark black, suffused with rust in both sexes. Abdomen: dorsally ochreous, ventrally cream-white. Maculation (Figure 69,): male ground color light sandy brown, costa of wing with one or two cream white patches (Figure); a cream-white triangular spot at apex; antemedial and postmedial line distinct; orbicular and reniform spots dark shiny brown. Male genitalia (Figures 14a,b): right ampulla greater than one third wide as it is long, reaching costa of the valve; aedeagus and vesica most similar to *funeralis*.

Female. Head and thorax thorax uniform dark black; abdomen ochreous. Maculation (Figure 70) same as male but dark black replacing brown regions. Female genitalia (Figures 14c-e).

Biology and foodplant. Unknown.

Distribution and flight (Figure 40). This uncommon species is distributed from north-central Mexico to Guatemala.

Material Examined. 10 females, 8 males. MEXICO: male, Chihuahua, 3 miles S. Temoris, 4700', 16-VIII-1968, UCDC; 2 males, Vera Cruz, Rio Motlec Canyon, of Fortin de las Flores, 10-VII-74, UCB; female, Coahuila, Constanza La Muralla, 4000', Hwy 57, 12-VII-1973, LACM; Guerrero, Agua del Obispo, July, AMNH; female, Aguascalientes, 5 miles E. Calvillo, 10-VII-1983 bl., TAMU; Jalisco, Ajijic, 16-18-VII-66, USNM; female, Jalisco, Rt. 9494, 42 km N. Chapala, 16-18-VII-1966, USNM; 2 females, male, Jalisco, 20.3 miles S Yahualica, 5800,' 11-IX-1986, NHSD; male, Jalisco, Rio Verde, 17

miles S. Yahuaica, Hwy 116, 14-IX-1986 NHSD; female, Sinaloa, 28.2 miles W. Concordia, 24-28-VII-1987, SDNH; male, Orizaba, ELT slide #1447, AMNH; female, Sinaloa, 2m W. Potrerillos, 7-12-VIII-1986, bl. 4200', UCB. GUATEMALA: male, Dept Alto V.P. Fla Holandia, NR Santa Cruz V.P. 23-24-VI-66, USNM.

Etymology. Possibly from the Latin *valens* = strong (Brown 1954).

Spragueia pyralidia (Schaus)

Figures 15a-b, 41, 71

Tarache pyralidia Schaus, 1898. Journal of the New York Entomological Society, 6: 117. Holotype: Male, Mexico, Oaxaca; USNM [Washington].

Diagnosis. *Spragueia pyralidia* is the only uniformly colored species in the *dama* group. The ground color of the wing is more generally rust brown like the males of *valena*, with light silver gray scales suffused throughout disc of forewing (Figure 71). The shape of the left ampulla is distinctive (Figure 15b) as well as the right ampulla that extends over the right sacculus far from the clasper. The female is not known.

Description. Wingspan 18mm, 21mm (2 specimens). Head: frons and vertex rufous to gray brown. Thorax: patagia, tegula and dorsum rufous to gray brown; metathoracic tuft well developed, rarely absent, predominately rust-brown. Abdomen brown dorsally, cream white ventrally, without intersegmental banding. Maculation (Figure

71):
gray
15a,
right
sacc
direc
vesi
and
dive
F
B
D
pyra
but
Sept
M
Jalisc
IBID
Todd
2-VII
VIII-
500n
E
of b

71): nearly unicolorous rust brown variably suffused with silvery gray between medial and postmedial line. Male genitalia (Figures 15a,b): tegumen weekly asymmetric; juxta short, tapered dorsally; right ampulla broad at base and developed into a point apically; right sacculus as a slight swelling; right ampulla of post sacculus long and directed basally rising over sacculus; dorsal junction of aedeagus and vesica with a variable patch of microspines or denticles (Figure 15a), and a sclerotized spine arising on right lateral side; left lobe with two diverticula, distal portion rounded, not tapered.

Female unknown.

Biology and foodplant. Unknown.

Distribution and flight period (Figure 41). *Spragueia pyralidia* appears to occur from Central Mexico to the Coastal Belize but is rarely collected. Specimens have been collected in August and September.

Material examined. MEXICO: male, Lagos de Monero, 6300', Jalisco, 25-VIII-1954, CNC; male, Puebla, Tehuacan, IX-1937 AMNH; IBID, male VIII-1911 AMNH; male Tehuacan, IX-1910, Mueller, E.L. Todd Slide #1445 USNM; male, Oaxaca, 5 miles W. Santos Riaz Papalo, 2-VII-1975, T. W. Taylor LACM; male, Oaxaca, Ruinas Dainzu, 11-VIII-1988, J.T. Doyen UCB; BELIZE: male, Augustine Mt. Pine Ridge, 500m, 24-25-IX-1973, VOB.

Etymology. Perhaps derived from pyralid + *ia* = state or quality of being like a moth in the Pyralidae.

Key to the species of the *margana* group:

The *margana* group is characterized by the following: pectus ochreous without gray; valves rounded at corona, corona biordinal with two rows of stout spines; valves without clasper, right ampulla always present; aedeagus straight. .

NOTE: The condition of the female 7th abdominal sternite can be observed by removing the scales from the abdomen with a fine brush.

1 Female.....2

1' Male.....7

2(1) Forewing with four equidistant costal dashes (Figure 78).....*perstructana* (p. 53)

2' Forewing without, or with fewer than three costal dashes.....3

3(2) Forewing nearly uniform dull black suffused with yellow scales (Figures 87, 89), without pronounced whitish triangular patch at apex.....4

3' Forewing black to brown with whitish triangular spot at apex (Figures 74, 81, 84.....5

4(3) Seventh abdominal sternite deeply cleft (Figure 20e) .....*lukesi* (p. 59)

4' Seventh abdominal sternite not deeply cleft (Figure 21e) .....*mexicana* (p. 62)

5(3) Forewing dark brown, hindwing uniform dark brown to dark

5' gray (Figure 77)..... *cryptomargana* (p. 51)

Hindwing lighter near base (Figure 74).....6

6(5) Forewing pale black, antemedial and postmedial lines indistinct (Figures 74, 75)..... *margana* (p. 48)

6' Forewing brown, antemedial and postmedial lines yellow, thin (Figure 84).....*ochracea* (p. 57)

7(1) Forewing with four brown, equidistant spots along costa; ground color orange to yellow, cilia of outer margin entirely black (Figures 78-80).....*perstructana* (p. 53)

7' Forewing not so marked.....8

8(7) Forewing with a distinct triangular white to brown patch near apex along costa (Figures 72, 76, 83) 9

8' Forewing not as above.....11

9(8) Ground color brown; apex, mid-costal and base of wing with variable degrees of white.....10

9' Forewing ochreous, never with ivory white patches; post-medial line thin, lighter ochreous (Figure 83); valves (Figure19c) .....*ochracea* (p. 57)

10(9) Hindwing light brown, lighter near base.....*margana* (p. 48)

10' Hindwing uniform dark brown to gray..*cryptomargana* (p. 51)

11(9) Hindwing uniform dark brown to gray.....*mexicana* (p. 62)

11' Hindwing light brown to ochreous, lighter near base .....*lukesi* (p. 59)

Spragueia margana (Fabricius)

Figures 16a-f, 36, 43, 72-75

Pyralis margana Fabricius, 1794. Entomologiae Systematica Emendata et Aucta. Volume 3: 257. Holotype: Male, Ex. Ins[ulis] Am[erican], Schmidt; UZM [Copenhagen].

Grapholita subapicana Walker, 1863. List of Lepidopterous Insects of the British Museum. Volume 28: 387. Holotype: Female, Santo Domingo [Dominican Republic]; BMNH [London].

Agrophila rudisana Walker, 1865. IBID, Volume 33: 776. Syntype(s): Male, Santo Domingo [Dominican Republic]; BMNH [London]. Lectotype to be designated.

Spragueia sordida Grote, 1882a. Canadian Entomologist. 14(11): 217. Holotype: Male, Texas; BMNH [London]

Spragueia inornata Grote, 1882b. Papilio. 2: 183. Holotype: Male, Arizona, Slide #ELT 1450; USNM [Washington].

Heliocontia variegata Möschler, 1890. Abhandlungen der Senkenbergischen Naturforschenden Gesellschaft, 16:156. Syntypes: 4 males and 2 females, Puerto Rico; ZMHB [Berlin]. Lectotype to be designated.

Spra

F

H

Spra

E

H

Spra

E

S

D

numb

distir

on th

72, 7

(Figu

color

apex

scale

D

Head

verte

tegu

not

whit

Spragueia velata Strecker, 1898. **NEW SYNONYMY.** Lepidoptera, Rhopaloceres and Heteroceres, Indigenous and Exotic. 1:11. Holotype: Female, near Dallas, Texas; FMNH [Chicago].

Spragueia canofusa Hampson, 1898. Transactions of the Entomological Society of London, p. 247, plate 17 figure 4. Holotype: Female; BMNH [London].

Spragueia tarasca Schaus, 1904. Transactions of the American Entomological Society of Washington. 30:164. Holotype: Female, Sao Paulo, S. E. Brazil; USNM [Washington].

Diagnosis. *Spragueia margana* may be easily confused with a number of related species in the *margana* group. Males may be distinguished from others in the *margana* group by the dark fringe on the lower 2/3 of outer margin and light gray hindwings (Figures 72, 73); ampulla on the left valves reduced to a series of microspines (Figure 16c). Females are variable but have a general dull black color with a distinct whitish triangular spot on the costa near the apex, and variably expressed, but rather indistinct white suffusion of scales from middle of costa through the disc (Figures 74, 75).

Description. Wingspan: 12.0-16.5 mm (mean=14.5, n=57). Male. Head: frons round, slightly flattened below, brown on dorsal half; vertex light brown, mixed with darker scales. Thorax: patagia, tegula, and dorsum as in vertex; metathoracic tuft usually present, not prominent, often flattened. Abdomen: light brown dorsally, whitish ventrally. Maculation (Figures 72, 73): Generally ochreous,

to brown; postmedial and antemedial lines weak; hindwing light brown, fading more basally. Genitalia (Figures 16a-c): left sacculus without ampulla and a variable series of heavy spines, becoming larger distally; juxta deeply cleft at anterior base, not obviously fused (Figure 16c); dorsal juncture of aedeagus and vesica with one at the northern part of distribution to several spines in a series on southern part; five diverticula on left lobe, the large diverticulum at base of aedeagus (Figure 16a,b) with a corresponding pouch in female ductus bursae (Figures 16d).

Female. Marked as in male but dull black mixed with whitish scales replacing brown, and a whitish triangular spot on costa near apex of fore wing (Figures 74, 75), and additional indistinct suffusion of whitish scales. Genitalia (Figures 16d-f): ostium bursae in two prominent lobes, flattened at apex; ductus bursae with a left lateral notch near ostium; an expanded membranous diverticulum at the junction of ductus bursae and corpus bursae (Figure 16d).

Biology and foodplant. *Melochia carihosifolia* [Bittneraceae] (Crumb 1956); "leaves and buds of *Malvastrum americanum* [Malvaceae] (male, USNM specimen [reared?]). Larval description Crumb (1956). I have been unable to locate the larvae at USNM. Also specimens: "on cotton." (*Glossypium*) [Malvaceae] USNM.

Distribution and flight period (Figure 36, 43): *Spragueia margana* is widely distributed from southeastern costal U.S., south through Mexico and Antilles to Northern Argentina and West to Galapogos. All months.

Material examined. 199 males, 132 females. Specimens not plotted. GALPAGOS: female, South Seymour, 23-V-1923, USNM.

MEX

Lago

Vasq

Real,

R

mex

dash

whiti

fema

gene

bursa

of *c*

the

exam

possi

fema

genit

E

Spra

E

D

G

F

MEXICO: male, Vera Cruz, Probole State, USNM; 4 males, Chiapas, Lagos de Colores, Rt 17, 13-VI-69, CNC. ARGENTINA 2 female, Los Vasquez, CMNH. PUERTO RICO: male, CU; 3 males, 2 females, Puerto Real, Viequez Island, CU; 2 males, female, Constant Springs, CMNH.

Remarks. Females may be confused with, *ochracea*, *lukesi* and *mexicana*. Female *margana* never have a distinct series of costal dashes. *S. mexicana* and *lukesi* do not possess a distinct triangular whitish patch on the costa of the wing near the apex (Figures 87, 89); females of *ochracea* have an additional mid-costal patch and is more generally mixed with brown (Figure 84) and a tapering ostium bursae (Figure 19e). Males of *margana* may be separated from those of *cryptomargana* by a lighter hindwing and a smaller ampulla on the left sacculus. Positive identification should be made by examination of male and female genitalia (Figure 16a-f). It is possible to study the left ampulla of the male and the ostium of the female by brushing the terminal abdominal scales away from the genitalia with a fine brush.

Etymology. Not known.

Spragueia cryptomargana **sp. nov.**

Figures 17a-b, 37, 76, 77

Spragueia crytomargana Wilterding 1991. **Holotype**: MEXICO: Jalisco Estacion Biologia Chamela, 28-VII-2-VIII-84, J. A. Chemsak, J. T. Doyen, at lights UCB [Berkeley]. **Allotype**: Mexico, female, Chiapas, Yaxoquintela, 16.58°N 91.47°W, 560 m, 14-Aug-78, Rawlins, CMNH [Pittsburgh].

Diagnosis. Known from three localities in Central America and Mexico, females are similar to *margana* but have an additional ochreous spot midway on the costa of the wing and are variably suffused with dark brown (Figure 77). Males have dark gray to black hindwings (Figure 76) and a long thin right ampulla extending beyond the costa of the right valve (Figure 17a).

Description. Wingspan: 13.0-15.8 (14.7 mm, n=4). Male. Head: frons, vertex, and palpi light cream-brown. Thorax: patagia and tegula light cream brown; metascutellum with prominent dark brown tuft. Abdomen: gray to brown dorsally, ochreous ventrally. Male genitalia (Figures 17a,b): juxta with a small cleft producing two rounded lobes; left ampulla spined, slightly raised; right ampulla long and tapered, slightly expanded at apex and reaching costa of valve or nearly so; right lobe of vesica with five diverticula, basal diverticulum of left lobe long and prominent. Maculation (Figure 76): light to dark brown, lighter ochreous along costa; reniform and orbicular spot dark; hindwings dark gray to black.

Female. Head and thorax nearly uniform dark brown, lightly mixed with yellow scales. Abdomen dark brown, intersegmental lines indistinct. Maculation (Figure 77): forewing nearly uniform dark brown to black, variable; antemedial and postmedial line black, indistinct; two small triangular white spots on costa near apex and the middle of wing; fringe on outer margin of wing light brown on upper 1/3; dark brown below; hindwing black throughout.

Biology and foodplant. Unknown.

Di

taken

M

Biolo

VII-1

light,

same

91.47

Guan

UCB.

R

but c

E

1944

Agro

Le

Vo

Emm

In

V

H

Distribution (Figure 37). Distribution uncertain; specimens taken in west central and southern Mexico, and western Costa Rica.

Material examined. Paratypes. MEXICO: male, Jalisco, Estacion Biologia Chamela, 13-23-X-1986, Chemsak, at light, UCB; male, 7-13-VII-1987, UCB; same data, male 20-27-VII-1984, Chemsak, Doyen, at light, UCB; same data, male, 16-19-X-1987, Chemsak, Powell, UCB; same data, female, 27-28, UCB; female, Chiapas, Yaxoquintela, 16.58'N 91.47'W, 560 m, 14-Aug-1978, Rawlins, CMNH. COSTA RICA, male, Guanacaste, Santa Rosa National Park, HQ area, 280m 14-VI-1988, UCB.

Remarks. Specimens of *cryptomargana* should reliably key out but care should be taken due to many similarities with *margana*.

Etymology. From the Greek *kryptos* = hidden, secret (Jaeger 1944) and *margana*.

Spragueia perstructana (Walker)

Figures 18a-e, 39, 42, 78-82

Agrophila perstructana Walker, 1865. List of the Specimens of Lepidopterous Insects in the collection of the British Museum. Volume 33: 774. Holotype: Male, JAMAICA, in BMNH London.

Emmelia felina Herrich-Schaffer, 1868. Die Schmetterlinge der Insel Cuba. Correspondenz-Blatt des Zoologisch-Mineralogischen Vereines in Regensburg, 22: 151. Holotype: Female, CUBA, MZC [Havana]. In poor condition.

Emmet

Ma

Agrop

Ce

1:

Cu

Agrop

No

En

Eq

Agrop

Ce

49

Gu

Di

may

mark

basal

black

costa

marg

mark

Emmelia trigridula Herrich-Schaffer, 1868. ibid. Syntypes: Two Males, CUBA, MZC [Havana]. One destroyed, one recognizable.

Agrophila phaenna Druce, 1889. *In* Godman and Salvin. Biologia Centrali Americana. Zoology, Lepidoptera, Heterocera Volume 1: 303, plate 28, figure 8. Syntypes: Females, Mexico, Cuernavaca, Morelos; BMNH [London]. Lectotypes to be designated.

Agrophila grana Dognin, 1897. **NEW SYNONOMY.** Lepidoptérès Nouveaux de Loja et Environs (Equatuer). Annales de la Société Entomologiqué de Belgique, 44: 414. Holotype: Male, Loja, Equatuer (Equador); USNM [Washington].

Agrophila mata Druce, 1898. *In* Godman and Salvin. Biologia Centrali Americana. Zoology, Lepidoptera, Heterocera Volume 2: 491, plate 94, figure 27. Lectotype: Female; Mexico, Amula, Guerrero; Mexico, Cuernavaca, Morelos; BMNH [London].

Diagnosis. *Spragueia perstructana* is a polymorphic species that may be separated from other species by the following: males are marked very similarly to *onagrus* and *cleta* but lack the alternating basal area of brown, orange and white; females are nearly uniform black, suffused with yellow scales and with four whitish dashes along costa (Figures 81, 82) often faintly extending in lines to posterior margin. Males are uniform orange to pale yellow coloration with marking very similar to *cleta* and *leo* (Figures 78-80). Females of

perstr

group

De

Head:

orange

dark b

more

not ra

interse

very s

costal

filled

basally

valves

not ob

longer

diverti

rounde

series

Fer

orange

than

costal

indist

ductu

obov

perstructana are the most distinctive of any species in the *margana* group.

Description. Wingspan: 13.3-17.7 mm (mean=15.0, n=21). Male. Head: variably marked, upper half of frons and vertex usually rufous orange to yellow. Thorax: patagia and tegula same as head, rarely dark brown; dorsal meso- and metathorax orange to yellow mixed more extensively with black; scales of metathorax black, elongate but not raised into a prominent tuft. Abdomen: pale gray dorsally with intersegmental banding; ivory ventrally. Maculation (Figures 78-80): very simlar to *cleta*, orange to yellow-brown; four brown to black costal dashes present; orbicular and reniform spot distinct, reniform filled with lighter scales; hindwing darker brown near border lighter basally in both sexes. Male genitalia (Figures 18a-c): tegumen of valves symmetric; juxta squarish with a broadly cleft invagination not obviously fused (Figure 18c); right ampulla slightly recurved and longer than left ampulla; left lobe of vesica with three distinct diverticula, two distally and one basally; right lobe more greatly rounded; dorsal junction of aedeagus and vesica with a variable series on spines clinally increasing in number and size southward.

Female. Head and thorax usually darker black rarely rufous orange. Female maculation (Figures 81, 82); more variably marked than male; always with four prominent to weakly defined ivory costal dashes; postmedial and medial lines yellow, prominent to indistinct. Genitalia (Figures 18d,e): ostium bursae long and tapered; ductus bursae at least twice as long as ostium is wide; corpus bursae obovate.

Bi

Aechy

preser

Di

gener

Mexi

M

plotte

CNC;

Leon,

Maria

Tuxpa

12-VI

IX-19

AMN

Re

descri

valve

perst

males

comb

some

dimor

and

first

typic

E

Biology and foodplant. Wild collected larvae reared on *Aechylaneus americana* [Fabaceae] wild caught larvae, not preserved. Constant St. George, [USNM].

Distribution and flight (Figures 39, 42). This species is generally distributed from Florida and Louisiana (rare), the Antilles, Mexico and Central America south to Southern Brazil.

Material Examined. 152 females, 129 males. Specimens not plotted. MEXICO: female, 3 males, Chiapas, nr. Ixtapa, 11-VI-1969, CNC; 2 males, Guerrero, Agua del Obispo, July, AMNH; female, Neuvo Leon, 40 miles S. San Roberto, 6000', UCB; female, Nayarit, Jesus Maria, 18-VII-1955, UCDC; female, Nayarit, Micro. Penitas, nr Tuxpan, 17-VIII-1985, NHSD; male, Sinaloa, 8 miles W. El Palmito, 12-VIII-1972, 6400' UCB; male, Jalisco, 20 miles NW Magdalena, 9-IX-1970, EM and JL Fisher, LACM; male, female, Chiapas, La Granja, AMNH; male, Nayarit, Pantanal, X-1936, AMNH.

Remarks. The new synonym *Agrophila grana* Dognin was described from a single male from Ecuador. I have examined the valves of the type and they appear not to vary significantly from *perstructana*. The male is darker orange (Figure 79) in contrast to males from Venezuela (Figure 80) and slightly larger; this combination of characters is not unusual however, and is seen in some populations from Mexico near Guadalajara. Seasonal dimorphism occurs in a populations in the llanos of Venezuela, Brazil, and Cuba, (Figure 80), the males appearing lighter ochreous in the first brood following a period of dormancy (dry season), more typically orange in subsequent broods.

Etymology. Not Known.

Spragueia ochracea (Möschler) **new status**

Figures 19a-e, 39, 42, 83, 84

Emmelia variegata ab. [var.] *ochracea*, Möschler, 1890. Abhandlungen der Senkenbergischen Naturforschenden. Holotype: Male, PUERTO RICO, muo. Krug [18]89 [small green label]; ZMHB Berlin.

Diagnosis. Möschler originally recognized *ochracea* as a variety of *variegata* [=*margana*] . It is, however, distinct in a number of characteristics. Known only from the Dominican Republic and Puerto Rico, males of *ochracea* may be separated from *margana* by their more uniform ochreous coloration, variably marked darker regions (Figure 83) and features of the male genitalia (Figures 19a-c). In females the ostium of *ochracea* is tapered to a blunt point (Figure 19e) while in the apex in *margana* is broad and flattened (Figure 16d) and the forewing is more variably mixed with brown (Figure 84).

Description. Wingspan: 4 measures: 15.0, 15.7, 14.8, 14.6. Male. Head: palpi cream-brown, darker toward apex; upper half of frons and vertex ochreous. Thorax: patagia and tegula ochreous; metathoracic tuft present, slightly raised, usually with darker brown scales. Maculation (Figure 83): generally light ochreous brown; lower 2/3 of outer margin dark, upper third light ochreous; orbicular and reniform spots darker brown; posterior margin variably mixed with brown to center; postmedial and antemedial lines present or absent;

hindwing light gray. Male genitalia (Figures 19a-c); valves only slightly expanded at cucullus; juxta rectangular with slight mid-ventral invagination; margin of left and right post sacculus long, tapered to a narrow point; junction of aedeagus and vesica with a linear series of small spines (Figures 19a,b); left lateral base of vesica without distinct diverticulum; left lobe with four diverticula; right lobe round.

Female. Maculation (Figure 84): uniform shiny brown to black, base of wing and outer 1/3 of posterior margin mixed with light olive to yellow; whitish triangular spot on costa near apex; cilia on upper third of outer margin of forewing yellowish. Genitalia (Figures 19d-e): ostium bursae large, expanded toward middle and drawn to a blunt point near terminus (Figure 19e); left ventral ductus bursae with invagination near ostium.

Biology and foodplant. Unknown.

Distribution and flight period (Figure 39). Endemic to the Greater Antilles. Flight in May-August.

Material examined. 8 females, 5 males. DOMINICAN REPUBLIC: 2 females, Convento, 12 km S. of Constanza, 6-13-VI-69, USNM; 1 male, 1 female, Constanza, 2-6-VI-69, Flint and Gomez USNM; 2 males, Los Hidalgos, 4-5-VI-69, Flint, Gomez, USNM; female, Dajabon Prov., Rio Massacre, 40m, Balneario Don Miguel, 7 km SW Dajabon, 26-V-73, D. and M. Davis, USNM; 3 females, 1 male, Azua, 8 km NE Padre Las Casas, Rio Las Cuevas, 18.46 N, 70.53 W, 580M, 7-VIII-1990, Rawlins and Thompson, CMNH. PUERTO RICO, male, USNM.

Remarks. Closely related to *mexicana* and *lukesi*, *ochracea* is probably restricted to the Greater Antilles. Female *ochracea* are

m
m
to
st
1
19
Sp
luk
an
20
tap
cle
Fro
scal
ligh

most likely to be confused with females of *margana* with which it may be sympatric in the Dominican Republic; brushing the scales off to reveal the ostium bursae extending beyond the margin of the 7th sternite will distinguish *ochracea* (Figure 19e) from *margana* (Figure 16d)

I thank Dr. Mey, ZMHB [Berlin] for examining the type material.

Eytmology. From the Latin *ochraceus* = pale yellow (Jaeger 1944).

Spragueia lukesi **sp. nov.**

Figures 20a-f, 38, 85-87

Spragueia lukesi Wilterding, 1992. **Holotype**: Male, MEXICO, Puebla, 4 km, S Tulcingo, 1190 m, 14-VIII-1986, J. Rawlins, R. Davidson. **Allotype**: Female, MEXICO, Yucatan, Chichen-Itza, 11-20-V-1954, E. C. Welling, CMNH [Pittsburgh].

Diagnosis. Closely related to *Spragueia mexicana*, males of *S. lukesi* can be distinguished from the former by the lighter hindwings and the position of the left ampulla arising below the corona (Figure 20c). The ostium bursae of the female is broad at the middle, tapering toward the apex and the 7th abdominal sternite is deeply cleft (Figure 20e).

Description. Wingspan: 13.2-14.3 mm (mean=13.6, n=8). Male. Frons and vertex of head light tan, rarely suffused with darker scales. Thorax: patagia and tegula same as head; metathoracic tuft light yellow mixed with brown and not significantly raised.

Ab
int
dul
ren
fou
bec
20a
ver
fro
am
wit

ste
(Fig
narr
7th
apic
narr

D
arid
spec

Abdomen light gray dorsally, lighter ventrally with faint intersegmental banding. Maculation (Figures 85, 86): forewing light dull yellow, variably mixed with brown; orbicular spot brown, reniform spot brown filled with yellow scales; a variable series of four equidistant brown dashes along costa; hindwing lighter basally, becoming darker toward margin, cilia light gray. Genitalia (Figures 20a-c): juxta elongate, tapered to middle, and apex with a deep cleft ventrally; right and left valve nearly symmetrical, left ampulla rising from middle of sacculus, right ampulla, stout, shaped like the left ampulla (Figure 20c); right lateral junction of aedeagus and vesica with a small series of spines, right lobe of vesica long and tapering.

Female. Head and thorax black mixed with light yellow scales; 7th sternite with or without dimorphic ring of black scales. Maculation (Figure 87): apical costal dash usually present; am and pm lines narrow, yellow, usually present. Female genitalia (Figures 20d-f): 7th abdominal sternite deeply cleft. Maculation (Figure 87): a slight apical costal dash usually present; antemedial and postmedial lines narrow, yellow, usually present.

Biology and foodplant. Unknown.

Distribution and flight period (Figure 38). Confined to semi-arid tropical and deciduous habitats of Mexico and Central America; specimens have been collected from July through September.

Material examined. Paratypes. COSTA RICA: 2 males, Guanacaste Prov., La Pacifica, 4 km NW Canas, 15-20-IX-73, Opler, UCB; female, Canas, 6-XII-72, Becker, VOB; female, Guanacaste, Las Canas, Rio Corobici, 26-VII-67, Flint, USNM. HONDURAS 2 females, male, Pespire, 1-VIII-67, Flint, USNM. MEXICO: 4 females, male,

Tam
Gue
mi
Mez
11
TA
Gar
fem
69,
Ric
Cru
Pot
20
Sta
VII
119

Nat
gav
aca
my
ack

Tamalipas, El Ensino, 250m 4-13-VIII-88, Becker, VOB; 2 males, Guerrero, Yaxhi, 3-8-25, CNC; male, CNC; female, Guerrero, Iguala, 33 mi S. 1450', 5-VIII-54, Chillcott, CNC; male, Guerrero, Xalitla, 8km, N. Mezcala, 580 m, 17-23-IX-82, Powell, Chemsak, UCB; male, Oaxaca, 11 mi W Tehuantepec, 15-VII-81, Bogar, Schaffner, Friedlander, TAMU; 1 male, 3 females, Chihuahua, Cuiteco, 29-VIII-69, Sears, Gardner, Glaser, UCDC; same data, male, 20-VII-69, UCDC; same data, female, 15-VIII-69, UCDC; 2 females, Chihuahua, Santo Nino, 8-VIII-69, Sears, Gardner, Glaser, UCDC; female, Vera Cruz, 7 mi. SW Poza Rica, 200', 20-22-VII-63, Duckworth, Davidson, USNM; male, Vera Cruz, 1-6-VIII-61, R & K Dreisbach, MSUE; 2 males, Sinaloa, 2 mi SW Potrerillos, bl.,7-VIII-86, Brown and Powell, UCB; 2 females, Sinaloa, 20 mi E. Guasave, 21-VIII-69, Haddock, Janzen, UCB; male, Nayarit, Sta. Barbara micro., 6-VIII-85, Brown, UCB; male, Chiapas, Arriaga, 3-VIII-69, L. A. Kelton, CNC; male, Mexico, Puebla, 4 km S Tulcingo, 1190m 14-VIII-1986, Rawlins, Davidson, CMNH.

Etymology. *Spragueia lukesi* is named after friend and Door Co., Naturalist, Roy Lukes. His unending support and encouragement gave the required impetus to follow the study of Lepidoptera academically, and whose accomplishments in the enlightenment of myself and the public to the wonders of nature are duly acknowledged.

Spragueia mexicana sp. nov.

Figures 21a-f, 38, 88, 89

Spragueia mexicana Wilterding, 1992. **Holotype**: Male, MEXICO: Baja California Sur Rancho. San Antonio de la Sierra, 3000', Sierra de la Laguna, 11.6 rd mi SE KP 147.6, 11-12-IX-85, #97169, J. P. and K. E. S. Donahue. **Allotype**: Same data. In LACM [Los Angeles].

Diagnosis. This species and the preceeding one are (*lukesi*) difficult species to separate. Both sexes may be positively identified by examination of the genitalia. Males of *mexicana* have dark hindwings (Figure 88), and the left ampulla of the valves extends nearly to the costa, arising beyond the corona (Figure 21c). In addition, there is a series of fine spines clustered into a loose collection on the dorsal end of the aedeagus. Females are unicolorous black with only very faint white marks on costa (Figure 89); the ostium bursae is long, rounded posteriorly (Figure 21f) and the 7th sternite is not deeply cleft (Figure 21e).

Description. Wingspan 10.1-15.0 mm (mean=13.5, n=15). Male. Head: frons and vertex tan, variably mixed with darker brown. Thorax: patagia and tegula light tan, variably mixed with brown; dorsal surface dark brown; metathoracic tuft present, but rarely greatly raised and prominant, often darker brown. Abdomen dark gray-brown on dorsal half, ivory on ventral half. Maculation (Figures 88,): generally darker than head and thorax, variably mixed with indistinct lighter regions; markings obscure; cilia of forewing grayish

brown, a faint triangular patch on costa near apex; orbicular and reniform spots present, filled with dark scales; reniform spot dark brown, usually with light scales in center and outlined with lighter scales; cilia on outer margin tan, usually with small areas of brown scales near middle; hindwing black, rarely light brown. Male genitalia (Figures 21a-c): similar to *margana*; juxta tapered dorsally; right ampulla facing slightly outward to corona, left ampulla reaching to edge of valve, arising beyond corona (Figure 21c); right lateral junction of aedeagus and vesica with a series of spines grouped into a loose cluster (Figure 21a); vesica typical, base of left lobe with two prominent diverticula, right lobe rectangular (Figure 21ab.

Female. Head and thorax black, variably suffused with light yellow to white scales. Abdomen with ventral 7th abdominal segment with or without dark dimorphic ring. Maculation (Figure 89): forewings nearly unicolorous black, variably suffused with yellow-white scales; lines usually absent, costal dashes reduced to thin white patches on costa or absent. Female genitalia (Figures 21d-f): ostium large, developed into two rounded lobes usually overlapping medially (Figure 21f); 7th abdominal sternite continuous on posterior edge without prominent invagination (Figure 21e).

Biology and foodplant. Unknown.

Distribution and flight (Figure 38). This species is distributed from the Baja peninsula of California, south to Oaxaca; one male is known from Venezuela (not plotted).

Type Material. Paratypes. MEXICO: Same data as Holotype, 21 males, 3 females, LACM; male, Jalisco, Estacion Biologia Chamela, 27-28-IX-1988, P. A. Opler, bl., UCB; same data, male, 16-19-X-1987, bl.

Chemsak, Powell, UCB; same data, male 15-23-1986, Chemsak at lites, UCB; same data, male 21-22-X-1987, Chemsak, Powell, UCB; male, Jalisco, 5 km N El Tuito (800m), 23-X-1987, Chemsak, Powell at lite, UCB; Tamalipas, male, 12 miles, SW Cuidad Victoria, 4000', 17-IX-1976, Chemsak, Powell, at lights, UCB; male, Tamalipas, Gomez Farias, 1000m, 29-31-VII-1988, Becker, Solis, VOB; male, 4 mi S.W. C. Victoria, 5-VIII-1963, Duckworth, Davis, USNM; same data, female, 6 mi. S., USNM; 2 females, Guererro, 33 mi S. Iguala, 1450', Chillcott, 5-VIII-1954, CNC; 2 females, Chihuahua, Cuiteco, Sears, Gardner, Glaser, 29-VIII-1969, UCDC; same data, 2 males, 2-IX-1969, UCDC; MEX, same data, male, 1-IX-1969, UCDC; same data, 3 males, 9-IX-1969 UCDC; female, Chihuahua, Santo Nino, 8-VIII-1968, Sears, Gardner, Glaser, UCDC; male, Sinaloa, 3 mi NW Choix, 12-IX-1969, Sears, Gardner, Glaser, UCDC; male, Sinaloa, 16 mi N. Mazatlan, 28-X.5-1961, Cary-Carnegie Exp, 1961, CMNH; male, Sinaloa, 2.5 mi N., 10-VIII-1970, Chemsak, UCB; male, Nuevo Leon, 18 mi W. Linares, 2700' 24-IX-1975, Powell, Chemsak, UCB; male, Nuevo Leon, Chipinque Mesa 4300', 19-IX-1975, Powell, Chemsak, Friedlander, at light, UCB; male, Oaxaca, Pte. Tlacotepec, S. Tehuantepic, 8-VI-1966, Flint, Ortiz, USNM; male, Nayarit, Santa Barbara micro., 16-VIII-1988, Bloomfield, NHSD; male, Nayarit, 49.4 mi NE Venado Mesa Nayar 5800',18-25-VIII-1987, Bloomfield, NHSD; male, Nayarit, Sta. Barbara, micro., 6-VIII-1985, UCB. VENEZUELA, male, Lara, El Cuji, 7 mi. N. Barquisimeto, 29-VI-1967, Poole, USNM.

Remarks. *Spragueia mexicana* is sympatric with *Spragueia lukesi* in a number of locations and they are easily confused; where the two occur there appears to be no hybridization. Both species are distinct

in a number of characters. The valves of the male are often extruded enough to observe the condition of the ampulla (Figure 21c); a fine brush should be used to brush away the scales to observe the state of the left ampulla which arises beyond the corona in *mexicana*. In the same way the condition of the female 7th sternite may be examined- the absence of a deeply invaginated sternite (Figure 21e) distinguishes *mexicana* from *lukesi*.

Keys to a species of the *apicalis* group:

The *apicalis* group is characterized by the following: male valve with corona reduced to nearly absent (Figure 22c); ampulla present (Figure 22c) or reduced (Figure 24c), rarely absent (Figure 28c); aedeagus long, curved; 7th abdominal sternite of females deeply cleft, usually with circular to elongate pockets found laterally to near pleurite (Figures 22e, 29c); pectus of thorax strongly suffused with leaden gray.

1 Forewing nearly uniform black mixed with yellow, female (Figures 91, 93, 96).....2

1' Forewing brown to yellow, male or female(Figures 90, 98)....4

2(1) Forewing with whitish spots near the middle of the costa and one near the apex (Figure 96)..... *pantherula* (p. 75)

2' Forewing with a brown or black transverse band at wing base, apex with a whitish transverse band from near apex of wing to middle of outer margin (Figures 91, 93).....3

3(2) Forewing with brown transverse band trimmed by a heavy yellow band (Figure 91)..... *apicalis* (p. 67)

3' Forewing with transverse band of forewing dark brown to black without a strong trim of yellow along band (Figure 93) ..... *trichostrota* (p. 71)

4(2) Forewing with brownish transverse band on base of forewing with broad, adjacent regions of ivory scales from antemedial line near base of wing (Figure 95) ..... (male) *pantherula* (p. 75)

4' Forewing not as above; basal transverse band usually trimmed by a thin band of whitish scales (Figure 97).....5

5(4) Forewing predominately yellow mixed with brown regions ..6

Forewing ochreous, without extensive regions of brown scales.....8

6(5) Forewing with a pale brown streak running through middle of wing to middle of outer margin (Figure 90) . .....*apicalis* (p. 67)

6' Forewing without a pale streak from middle of wing to outer margin (Figures 92, 94).....7

7(6) Hindwing uniform gray to black (Figure 94).....*stehri* (p. 73)

Hindwing gray near outer margin, lighter near

7' base (Figure 92).....*trichostrota* (p. 71)

8(6) Cilia on lower half on outer margin of forewing black (Figures 97, 98, 104).....9

8' Cilia on outer margin yellow to ochreous with a small black to brown dash on middle of outer margin (Figures 100, 101, 102, 103).....10

9(8) Saccular extensions of male valve absent (Figure 26c); 7th abdominal segment of female with lateral depression lateral, near pleuron (Figure 27c).....*marmorea* (p.77)

9' Saccular extensions of male valve prominent, tapered (Figure 32b), female unknown.....*olmeca* (p. 85)

10(8) Costa without white to yellow band on middle of wing near costa (Figure 102).....*llanosa* (p. 82)

10' Costa of forewing with a long yellow to white band along middle of costa (Figure 101).....*lepus* (p. 79)

Spragueia apicalis (Herrich-Schäffer)

Figures 22a-f, 40, 90, 91

Emmelia apicalis Herrich-Schäffer, 1868. Correspondenz-Blatt des Zoologisch-Mineralogischen Vereines in Regensburg, 22:157. Type(s): Apparently not in MZC [Havana]. Type(s) lost (see remarks below)?

Emmelia apicella Grote, 1872. Transactions of the American Entomological Society, 4:21. Syntypes: Females, Central Alabama, BMNH [London]. Lectotype to be designated.

Agrophila truncatula Zeller, 1873. Verhandlungen der Kaiserlich-Koniglischen Zoologisch-Botanischen Gesellschaft in Wein, 23:203, plate 3, figure 1. Holotype: Female, Texas, MCZ [Cambridge].

Fruva accepta H. Edwards, 1881. Papilio, 1:24. Syntypes: 3 Males, 2 Females, Tallahassee Fla, AMNH [New York]. Lectotype to be designated.

Diagnosis. *Spragueia apicalis* is the most widely distributed member of the *apicalis* group. Males are distinguished from all other species of *Spragueia* by the nearly unicolorous yellow forewing and a brown basal transverse streak from near the base of the wing, through the center of the cell, to near the outer margin (Figure 90). Females have a brown basal transverse band outlined with yellow and a variable yellow apical transverse band (Figure 91).

Description. Wingspan 14.0-18.8 mm (mean=16.3, n=29). Male. Head: 1st and 2nd palpal segments ochreous interspersed with darker rufous brown, 3rd segment darker rufous to black; frons and vertex uniform rufous-red to rust-brown. Thorax: tegula and patagia and thorax rufous to rust; metathoracic tuft prominent; pectus shiny gray; alular scales gray. Abdomen brownish dorsally, ochreous ventrally. Maculation (Figure 90): forewing uniform yellow; a rufous brown transverse band near base of wing usually the same color as the patagia; a light brown band extending from near base of wing to outer margin; hindwing ranging from entirely gray to light brown trimmed with gray. Male genitalia (Figures 22a-c): juxta flask shaped, invaginated into two rounded lobes ventrally; right ampulla curved inward to tegumen, perpendicular to length of sacculus; right saccular extension prominent, nearly perpendicular or slightly recurved toward tegumen; posterior spine of vesica single, another

spine(s) just immediately ventral and a variable patch of small denticles just left of spines (Figure 22c).

Female. Head and thorax dark rust brown, metathoracic tuft well developed. Maculation (Figure 91): forewing uniform black mixed with yellow; transverse rufous band near base of wing usually trimmed by a thin yellow line, rarely absent; apex of wing with a transverse yellow band variably mixed with yellow. Abdomen: 7th abdominal sternite with or without black ring of scales. Female genitalia (Figures 22d-f); ostium bursae large, flangelike, expanded near middle and rounded; ductus bursae with a slight gradual curve, and elongate; 7th abdominal sternite deeply cleft posteriorly with a pair of rectangualar to round heavily sclerotized depressions laterally (Figure 22f).

Biology and foodplant. Swainson (1900) described the larvae from Jamaica feeding on "broom weed" *Gutierrizia* sp. [Asteracea] The determination of the adult was made by G. F. Hampson as *H. apicella.*

Distribution and flight period (Figure 40). Generally distributed from southern United States, south through Mexico, Central America, the Antilles [Cuba], to northern Venezuela and Columbia. April through October in the north, all months in Central America.

Material Examined. 142 males, 140 females. Specimens not plotted: MEXICO: male, Jalisco, 20 mi NW Magdalena, 9-IX-70, LACM; 2 females, Chiapas, La Granja, 10-13-X-1929, AMNH; male, Yucatan, Chuminopolis, 5-VIII-1952, CNC; male, Chiapas, Santa Anita, 12-VII-

1930, CNC; 9 females, 17 males, Chiapas, Finca La Violeta, Soconusco, 850 m, CNC. GUATEMALA: female, Quirigua, May, CMNH.

Remarks. The application of the Herrich-Schäffer name remains dubious due to uncertainty of the location of the type. Mr. Vitor Becker has studied the type material at MZC [Havava] and through his cooperation I have been able to establish that the type material of *apicalis* is not in MZC [Havana] although the majority of the Gundlach collection, from which *apicalis* was described, was deposited there. Apparently no material in the collection fits the description of, or is labeled as, *apicalis*. It is assumed at this time to be lost or destroyed by psocids since all the other *Spragueia* types described by H-S in the same paper are in Havana. However, the type could be at ZMHB Berlin where the majority of H-S's material is deposited. The description of H-S's *apicalis* fits well with Grote's *apicella*- the former having priority.

Taxa north of Mexico are recognized by some as *apicalis apicella* (Grote) and the southern taxa as *apicalis apicalis* (H-S) (Franclemont and Todd 1983). Apparently slight differences in the orientation of the right ampulla and clasper, right saccular extension, and the predominately dark gray hindwings separate the subspecies. Though rare, a number of specimens in North America (particularly Florida, and Texas) have these characteristics; distinctive characters for the two populations can not be established. Therefore, I recommend that the subspecies not be recognized.

Etymology. From the Latin *apiculus* = tip or point (Jaeger 1944).

Spragueia trichostrota (Meyrick) **new status**

Figures 23a-e, 44, 92, 93

Mnesipygra trichostrota Meyrick, 1913. Transaction of the Entomological Society of London, 170-200. Holotype: Female, Chanchamayo Peru, genitalia slide # 6285 J.F.G. Clarke, BMNH [London].

Diagnosis. Related to S. *apicalis*, *S. trichostrota* replaces it in South America. Males may be separated from *apicalis* by the light brown transverse band near apex of the wing (Figure 92); similar to *stehri*, *trichostrota* is restricted to South America except for a single male taken in Jalisco, Mexico. Females of *trichostrota* usually lack a distinct basal transverse band, and have a smaller transverse band at the apex of the wing (Figure 93). In northern South America, *trichostrota* and *apicalis* may be sympatric, in these cases the genitalia should be examined. Females of *trichostrota* have less distinct depressions on the 7th abdominal sternite which are near the pleurite (Figure 23d), the left ampulla of the valve is reduced (Figure 23c).

Description. Wingspan: 13.3-16.8 mm (mean=15.1, n=12). Male. Head and thorax variably brown to nearly black; pectus of thorax with gray scales; dorsal thorax mixed with black scales; metathoracic tuft prominent; alular scales whitish. Abdomen uniformly ochreous, rarely lighter ochreous below. Maculation (Figure 92): forewing overall light yellow, base of wing with transverse band usually the same color as abdomen; apex with a light brown transverse band;

hindwing dark gray to light brown toward base, darker near edge. Genitalia (Figures 23a-c): juxta elongate, flask shaped, often constricted near middle, slightly invaginated ventrally (Figure 23c); left ampulla reduced to a small knob; right sacculus with a long process perpendicular to long axis of sacculus; right ampulla reduced to a small knob; dorsal posterior junction of aedeagus and vesica with three distinct regions of spines, variable in number (Figure 23a); left basal diverticulum present (Figures 23a,b).

Female. Head, thorax and abdomen dark black, rarely lightly suffused with yellow scales; alular scales light gray; intersegmental banding usually indistinct. Maculation (Figure 93): overall dark black mixed with yellow scales; basal transverse band indistinct, dark black, rarely brown; apex of wing with a small yellow transverse band; hindwing dark gray to black. Genitalia (Figures 23d,e): ostium bursae developed into two large, rounded lobes (Figure 23e); ductus bursae with a small membranous pouch near junction of corpus bursae, corpus bursae elongate (Figure 23e); 7th sternite with two small pockets on anterior-most membrane near pleurite (Figure 23d).

Biology and foodplant. Unknown.

Distribution (Figure 44). South America, to northern Argentina, and Bolivia and one specimen from Mexico.

Material examined. 18 females, 34 males. Specimens not plotted: Male, MEXICO; Jalisco, 20 mi NW Magdalena, 9-IX-1970, UCD.

Remarks. While *trichostrota* is similar in overall habitus to *stehri*, the two species should not be confused since they are not sympatric; the later is known only from the Dominican Republic.

I thank Mr. Martin Honey for his location of the Meyrick type at the BMNH.

Etymology. From the Greek *trichos* = hair, and greek *strotos* = laid (Jaeger 1944).

Spragueia stehri **sp. nov.**

Figures 24a-c, 39, 94

Spragueia stehri Wilterding, 1992. **Holotype**: Male, Dominican Republic, La Vega, Bamboo Hole Canyon, Rio Baiquote, 5 km SE Jarabacoa. 580m, 22 July 1987, Davidson and Rawlins; CMNH [Pittsburgh].

Diagnosis. Restricted to the greater Antilles, males are identical to *trichostrota*, but differ by having more extensive brown throughout the forewing (Figure 94), and having the right saccular extension curved and facing the costa (Figure 24c). The female is not known.

Description. Wingspan: 15.5 mm. Male. Head entirely black to deep brown. Thorax black to dark brown; metathoracic tuft well developed to slightly reduced, black mixed with brown; pectus dark gray, particularly prothoracic segment. Abdomen: gray on upper half, ochreous below; intersegmental banding usually present. Male genitalia (Figures 24a-c): juxta strongly vase shaped, narrow from

middle to posterior (dorsal) end (Figure 24c); ventral portion with small lip; right sacculus with extension long, bent toward cucullus. Maculation (Figure 94): uniform yellow mixed variably with light brown along middle and base of the costa; basal transverse band black to deep brown; cilia of lower half of outer margin brown; hindwing dark gray.

Female unknown.

Biology and foodplant. Unknown.

Distribution (Figure 39). Restricted to the Dominican Republic.

Material examined. Paratypes: DOMINICAN REPUBLIC: 2 males, La Vega Prov., Hotel Montana, ca. 520m, 10 km NE Jarabacoa, 28 May 1973, USNM; 2 males, La Vega Prov., Constanza, 1164m, Hotel Neuva Suiza 29 May, 1973, USNM; 1 male, same data as Holotype, CMNH.

Remarks. The female is not known at this time. I expect the female to look more like those of *S. apicalis* and *trichostrota*; the female should retain the light transverse band at the apex of the wing.

Etymology. The species is named after Fred W. Stehr for his contribution in our understanding of Lepidoptera and immature insects in general, and for the many ways he contributed to my professional development over the course of this degree.

Spragueia basipunctata (Schaus)

Heliocontia basipunctata Schaus, 1914. Proceedings of the United States National Museum, 46: 504. Holotype: Male, St. Jean Maroni River, French Guiana, USNM. Type No. 16567.

Diagnosis. The status of *basipunctata* is uncertain; known only from the type, the valves on the ELT slide are destroyed about midway such that the posterior half of the valve is missing. The appearance of the aedeagus and the habitus of the adult (not everted) suggests that it is *Spragueia*.

Description. Wingspan 20 mm (measured by Schaus 1914). Head, and thorax yellow to light brown; thoracic tuft present. Male genitalia essentially destroyed. Maculation: overall color pale orangish-yellow; a rufous orange transverse band basally with a blackish spot at the center; hindwings gray.

Etymology. From the Greek *basis* = base, foundation, and Latin *punctatus* = spotted (Jaeger 1944).

Spragueia pantherula (Herrich-Schäffer)

Figures 25a-e, 41, 95, 96

Heliocontia pantherula Herrich-Schäffer, 1868. Correspondenz-Blatt des Zoologisch-Mineralogischen Vereines in Regensburg, 22:151. Holotype: Male, CUBA; MZC [Havana]. One male of the original type series has been destroyed (see remarks).

Heliocontia uncinula Herrich-Schäffer, 1868. IBID. Type(s);

Female(s), CUBA; Type not in MCZ [Havana], presumed destroyed.

Diagnosis. Restricted to Cuba, *Spragueia pantherula* is not easily confused with other species. Males are similar to *stehri* but differ in the more extensive brown coloration toward apex of the wing, and cream-white coloration above the basal transverse band (Figure 95). Females are unicolorous black (Figure 96) with a triangular spot along costa of wing and a smaller spot near apex.

Description. Wingspan: 13.8-15.9 mm (mean=14.7, n=13). Male. Head and thorax uniform black to dark brown; metathoracic tuft weakly developed; pectus of thorax gray. Abdomen darker gray dorsally, with distinct intersegmental banding; ochreous ventrally. Maculation (Figure 95): forewing with dark basal transverse band black to dark brown; pale yellow over remainder of wing, mixed with darker brown to near apex and outer margin of wing; hindwing gray, darker to edge. Male genitalia (Figures 25a,b): right valve with ampulla (Figure 25b); sacculus twice as long as width of valve; right lobe of vesica with a large ventral diverticulum (Figure 25a), left lobe membranous with two large diverticulum.

Female. Thorax uniform rufous brown. Maculation (Figure 96): forewing overall dull black, suffused with yellow scales; basal area dark rufous brown to black; whitish triangular spot along costa toward middle, and a smaller spot near apex of the wing; lower half of cilia on outer margin of forewing dark brown. Genitalia (Figures 25c-e): ostium bursae large, rounded (Figure 25d).

Biology and foodplant. Unknown

Distribution (Figure 41). Known only from Cuba.

Material examined: 8 females, 6 males. CUBA: female, Pinar, Rio Sierra Rosaria, 400 m 4-6-X-1989, VOB; 4 males, 5 females, Santiago, USNM; Isle of Pines [Los Indies], Nov 1912, CMNH; female, HAYTI [sic], CMNH.

Etymology. From the Greek *panther* = a panther (Jaeger 1944).

Spragueia marmorea (Butler) **new status**

Figures 26a-c, 27a-c, 41, 43, 97-99

Aphusia marmorea Butler, 1879. Transactions of the Entomological Society of London, 1879:27. Holotype: Female, Rio Jutahi BRAZIL, 31-I-1875, Trial, BMNH [London].

Heliocontia lepus concordens Dyar, 1914. Proceedings of the United States National Museum, 47:198. Holotype: Male, Trinidad River, Panama, August 1912 (Busck), Type #15863, USNM [Washington].

Diagnosis. *S. marmorea* differs from *lepus* by the more extensive dark rufous-brown regions at the base of the wing, and the deep yellow color toward the outer margin of the wing; ivory costal streak roughly 1/3 as long as the wing, and the transverse band near the apex is absent to indistinct (Figures 97-99). The sexes are not dimorphic.

Description. Wingspan: 16.3-19.1 mm (mean=18.4, n=14). Both sexes. Head: frons and vertex rust-rufous to brown. Thorax: patagia and tegula rufous brown; metathoracic tuft well developed; pectus

suffused with gray. Abdomen: dark gray dorsally, whitish ventrally; female 7th sternite with or without ventral dimorphic band; intersegmental lines indistinct. Maculation (Figures 97-99): forewing overall dark brown with basal brown to rufous transverse band, outlined with thin yellow band; pale yellow to outer margin, brown near apex; apical transverse band present or indistinct; cilia on lower 2/3 of margin black to dark brown, the remainder ochreous (Figures 98). Male genitalia (Figures 26a-c); left ampulla reduced to a small knob with few small hairs; right ampulla short, reduced in size; right sacculus with broad to rarely elongate extension (Figure 26c); laminate cornuti of right lobe of vesica long (Figure 26b); right lateral junction of aedeagus and vesica with a long, basal cornuti arising from a small, sclerotized diverticulum (Figure 26a).

Female genitalia (Figures 27a-c): 7th sternite deeply cleft with small pockets laterally on pleuron (Figure 27c); ostium and ductus bursae well developed and expanded (Figure 27b); ductus bursae twice as long as width of ostium and extending into a rounded lobe below the junction of the ductus to corpus bursae (Figure 27a); corpus bursae oblong; left dorsal edge of corpus bursae with a long thin heavily sclerotized band; 7th sternite deeply cleft with small pockets laterally on pleuron (Figure 27c).

Biology and foodplant. Unknown.

Distribution and flight period (Figure 41, 43): Found from central Mexico south through Central America, Ecuador, southern Venezuela and northeastern Brazil. Specimens collected all months.

Material Examined. 25 males, 41 females. Specimens not plotted: MEXICO: San Luis Potosi, Palitla, 5-VI-1966, USNM; male

Chiapas, El Bosque, 10-VI-1969, CNC; female, Chiapas, Hiquidanubar, 1100 m, VIII-1937; 2 females, Chiapas, Cordoba, 13-X-1929/ 23-IX-1929, CNC.

Remarks. The genitalia of *marmorea* exhibit some geographic variation in the number of spines on the aedeagus, but all populations have remarkably similar valves throughout its range. The size and condition of the single lateral spine on the aedeagus is variable; specimens from Cerro de Neblina (Venezuela) have a long knife-shaped spine, while populations west and north usually have a single tapered spine. The degree of development of the right saccular extension is quite variable within and/or between populations.

Specimens of this species collected by Vitor Becker continue an elaboration of the terminal aedeagal spine; those from southeastern Brazil (Parana) have two, rather than one, terminal cornuti. I refrain from naming this population at this time due to a lack of material and the poor degree of character displacement between it and populations to the north.

Etymology. From the Greek *marmoros* = marble (Brown 1954).

Spragueia lepus (Guenée)

Figures 28a-c, 29a-d, 44, 100, 101

Agrophila lepus Guenée, 1852. Species Général des Lepidoptérès. Tome Cinquiéme. Noctuilétes. Tome 2:204. Type(s): Brazil, BMNH [London]. Lectotype to be designated.

Spragueia inversa Schaus, 1904. Transactions of the American Entomological Society, 30:163. Holotype: Female, Aroa, Venezuela, USNM [Washington].

Spragueia taragma Schaus, 1904. IBID, 164. Holotype: Male, Sao Paulo, SE Brazil, genitalia slide, E.L.T. #1427, USNM [Washington].

Diagnosis. *Spragueia lepus* is sexually dimorphic and closely related to *marmorea* and *llanosa*; males may be distinguished from these taxa by the absence of ampulla and clasper (Figure 28c), overall lighter coloration, and a distinct transverse band near the apex of the wing (Figure 100). Females are darker brown to black in coloration with a distinct transverse band on the apex of the wing, and a smaller, nearly square ivory spot on the costa of the forewing near the middle (Figure 101). Females of *llanosa* lack the whitish medial costal dash common in *marmorea* and *lepus*. Positive identification requires examination of the genitalia.

Description. Wingspan 15.0-19.0 mm (mean = 17.1 n=15). Male: head and thorax ochreous; metathoracic tuft prominent, often slightly darker than head; pectus of abdomen and legs ochreous, tarsi banded with darker brown. Abdomen dark ochreous dorsally, lighter ventrally. Maculation (Figure 100): forewings generally light ochreous brown; a dark ochreous to rufous transverse band at base of wing; costa with a rectangular light tan patch near middle; a lighter transverse band from middle of outer margin to apex of the wing; cilia brown to black at middle outer margin. Hindwings gray, darker near margin. Genitalia (Figures 28a-c): juxta long,

rectangular, narrow with a slight lip ventrally; ampulla and claspers absent (Figure 28c); right saccular extension broadly swollen with fine hairs (Figure 28c); posterior tip of aedeagus with round diverticulum, a basal cornuti arising left ventrad (Figure 28b); a small diverticulum on ventral junction of aedeagus and vesica (Figures 28a-b).

Female. Head and thorax darker rufous to dark ochreous. Abdomen dark gray dorsally, whitish ventrally; 7th abdominal sternite usually without dimorphic ring of scales. Maculation (Figure 101): forewing dark brown to black mixed with yellow scales; base of wing with a rufous transverse band lined with a fine yellow band of scales; middle of costa with a whitish square patch; apex of wing with a prominent transverse band mixed with yellowish scales; cilia of outer margin brown with a small black patch near middle; hindwings uniform gray. Female genitalia (Figure 29a-d): ostium bursae large, prominent; ductus bursae sclerotized midway to corpus bursae, rather than entire length (Figure 29b) the remainder membranous; anterior ductus bursae with a sclerotized diverticulum on left side (Figure 29b); neck of corpus bursae with an extended foot-like process; corpus bursae oblong (Figure 29a); 7th abdominal sternite deeply cleft with small invaginated pockets along pleural margin (Figure 29c).

Distribution and flight period (Figure 44). *Lepus* is found at the edges of the Amazon Basin from Peru to Ecuador, and Northern Venezuela, southeastern Brazil, and northern Argentina. The insect flies throughout the year.

Biology and foodplant. Reared on *Sida setosa* Mart. [Malvaceae] ex. coll. det. S. A. Thompson, Confirmed by P. Fryzell, 1983, Thompson and Rawlins 963, Carnegie Museum [hostplant voucher]. From wild caught larvae, ECUADOR: Carchi. Chical. 1250 m. 00.56N, 78-11W, July-August 1983, J.E. Rawlins. "Larvae pupated in debris in a very slight cocoon on July 16, 1983" (Rawlins pers. comm.)."

Material examined: 77 males, 71 females. Specimens not plotted: VENEZUELA: male, Cuenca del Rio Borborata, Caraboba, 675m Virgin Forest, 4-IX-1943, R. Lichy, COR. PERU: female, Rio Curaryar Napo, 21-VI-1930, HS Papfifu COR. BOLIVIA, 5 females, Provincia del Sara, NOV 1912, Steinbach, CMNH. ARGENTINA: female, Provincia Oran, N. Argentina, 300 m Jan 1916, CMNH. BRAZIL: male, Bela Horizonte, Mato Grosso, 10-12-IV-1975, VOB.

Etymology. *Lepus* is Latin for hare (Brown 1954).

Spragueia llanosa **sp. nov.**

Figures 30a-c, 31a-c, 43, 102, 103

Spragueia llanosa Wilterding, 1992. **Holotype**: Male, Venezuela, Guarico, Hato Masaguaral, 45 km S Calabozo, 8.57N 67.58W, 75 m, 3-VII-89, Epstein and Deza, USNM [Washington]. Allotype: Same data, female, 12-13-IV-1988, USNM [Washington].

Diagnosis. Most easily confused with *S. lepus*, *Spragueia llanosa* may be separated from it by the absence of the white costal mark on the middle of the forewing (Figure 102, 103). This sexually

dimorphic species is known only from the type locality where it is apparently allopatric from populations of *lepus* slightly to the north. Examination of the male genitalia is required for positive identification; the male valve has both a right and left ampulla, the right tapered and long (Figure 30c).

Description. Wingspan 14.8-17.2mm (mean 15.9, n=8). Male. Head and thorax light ochreous to light brown; 3rd segment of palpi usually darker; pectus of thorax ochreous; tarsal segments banded with light brown; legs ochreous to light brown; metathoracic tuft present. Abdomen ochreous dorsally, whitish ventrally. Maculation (Figure 102): forewing generally rust-brown; darker rufous transverse band basally lined with a fine line of lighter scales; postmedial line deeply curved inward near middle, rarely indistinct; cilia on lower half of outer margin dark brown; apex of wing with a light transverse band. Hindwing gray, darker near border. Genitalia (Figures 30a-c): juxta rectangular, narrow near middle, with a slight lip at anterior end; right ampulla very narrow, tapering, bald, extending beyond costa of valve; right saccular extension prominent, reaching beyond costa; left ampulla thin, narrow and arising from near middle of sacculus, without spines or hairs (Figure 30c); left posterior junction of aedeagus with a slight diverticulum and a basal cornuti arising from it (Figure 30a); dorsal junction of aedeagus and vesica with a variable series of small spines (Figure 30a).

Female. Head and thorax generally rufous to rust-colored; pectus and legs ochreous to darker brown, particularly on tarsi and femur. Abdomen dark gray above, light ochreous ventrally; 7th abdominal sternite without dark ring of scales. Maculation (Figure 103):

forewing generally dull black to brown, mixed with yellow scales; basal transverse band rufous, lined with whitish scales; apical transverse band prominent with lighter yellow and ochreous scales; postmedial line distinct, deeply incurved, nearly reaching middle of outer margin of wing; hindwing dark gray. Genitalia (Figures 31a-c): ostium bursae broadly lobed, posterior rim with minute teeth (Figure 31a); ductus bursae same length as maximum width of ostium bursae; 7th abdominal sternite deeply invaginated with sternal pockets near middle (Figure 31c).

Material examined. Paratypes: Male, Venezuela, Guarico, Hato Masaguaral, 45 km S Calabozo, 8.57N 67.57W, 75m, 19-21-IV-88, Epstein and Blahnik, USNM; same data, 2 males 23-24-IV-88, USNM; same data female 12-13-IV-88 USNM; same data, female 9-11-V-88, USNM; same data, female, male, 13-16-V-88, USNM; same data male 18-V-88, USNM [Washington].

Biology and foodplant. Unknown.

Distribution and flight period (Figure 43): Known only from the type locality; adult flies during the rainy season, April and May.

Remarks. Of all the members of the *lepus* group, *llanosa* shares the strongest affinities of genitalia with *apicalis*, particularly in the female abdominal sternite (Figure 22e). The type locality is tropical savannah and lowland gallery forest.

Etymology. Spanish for flat; name for tropical savannah where this species is found.

Spragueia olmeca **sp. nov.**

Figures 32a-b, 40, 104

Spragueia olmeca Wilterding, 1992. Holotype: Male, Mexico, Jalisco, Estacion Biologia Chamela, 16-19-X-87, Chemsak and Powell, UCB [Berkeley].

Diagnosis. *Spragueia olmeca* is an anomalous species known only from two sites in Mexico, from which a number of other rare *Spragueia* are known. Known only from four males, *olmeca* may be separated from the more common *marmorea* by the presence of a thin whitish line of scales arising near the middle of the costa through the cell (Figure 104), and curving outward to the apex of the wing, nearly bisecting the apical transverse band. In addition to a slightly darker olive-brown tinge of the forewing, the processes of the right and left sacculus valve are distinct and may be seen simply by brushing away scales from the abdomen (Figure 32c).

Description. Male. Head and thorax rufous to rust; frons round, slightly invaginated below at clypeal plate; metathoracic tuft prominent, with many decumbent scales; pectus nearly ochreous tinged with gray; legs ochreous to brown, tarsi banded brown. Abdomen gray above, ochreous below. Maculation (Figure 104): base of wing with a transverse patch of rufous scales outlined in yellowish white; a thin whitish line arising from middle of costa and extending to tranverse band at apex; apical tranverse band yellow; lines indistinct; hindwing dark gray. Genitalia (Figures 32a,b): juxta rectangular, cleft dorsally, a slight lip ventrally (Figure 32b); right

and left sacculus each with a long extension reaching beyond costa of the wing; left ampulla reduced, a small protruberance medially; margin of sacculus reaching well beyond corona and following margin of cucullus; right ampulla extending well beyond costa of valve; right lateral junction of aedeagus and vesica with a variable patch of fine denticles (Figure 32a).

Material examined. Paratypes: MEXICO: male, Jalisco, Estacion Biologia Chamela, 18-19-X-1987, Chemsak and Powell, UCB; male, Yucatan, Chichen Itza, 1-10-V-1954, E.C. Welling, CMNH; same data male, 21-31-V-1954, CMNH.

Biology and foodplant. Unknown.

Distribution and flight (Figure 40). Two populations: Yucatan Peninsula, and Jalisco, Mexico.

Etymology. Latinized from the Olmec Indians of the Yucatan Peninsula.

Incertae Sedis

Spragueia rawlinsi **sp. nov.**

Figures 33a-c, 105

Spragueia rawlinsi Wilterding, 1992. Holotype: Female, Mexico, Puebla 4 km S. Tulcingo, 1190 m 14 Aug, 1986, Rawlins, Davidson. CMNH [Pittsburgh].

Diagnosis. Known from only five females, *Spragueia rawlinsi* may be distinguished from all species by the nearly complete lead-

black coloration, four brown dashes along the cream yellow costal margin (Figure 105) and the large expanded ostium bursae (Figure 33a).

Description. Wingspan: 11.2-13.0 mm (mean=12.0 n=3). Female. Head: palpi, frons, and vertex of head ochreous. Thorax: patagia and tegula ochreous, variably mixed with dark brown, meso and metathorax dark brown; metathoracic tuft present, weakly developed, brown; pectus ochreous. Abdomen, typical, light brown on upper half, no terminal female dimorphism of 7th sternite. Maculation (Figure 105): forewing overall dark black, suffused with yellow scales from base along posterior margin to tornal angle, then to apex, and along costal margin to base; orbicular and reniform spots brown, distinct, faintly traced by yellow scales; costal margin yellow from base to apex, with series of four brown marks. Genitalia (Figures 33a,b): ostium bursae large, bilobed, expanded laterally and rounded near apex; length of ostium and ductus bursae slightly greater than the maximum width of ostium (Figure 33a); ductus bursae short, stout.

Biology and foodplant. Unknown.

Distribution. Southern Mexico (Puebla, Oaxaca).

Material examined. Paratypes: 4 females, MEXICO, Oaxaca, 12.4 miles west of Tehuantepec, 4-Aug-1980, Schaffner, Weaver, Friedlander, [TAMU].

Remarks. The female retains many of the generic characters of *Spragueia*, but departs in the broad, round ostium, and the long neck of the corpus bursae connecting the ductus bursae - characters autapomorphic for *Spragueia*. This may be *speciosa* Draudt, but due

to many problems in establishing type identity the name has been dropped (see discussion of *speciosa* p.87, below). Males of *rawlinsi* are expected to have a general habitus like that of the females; the genitalia of the male should be most similar to those of *cleta* and related forms.

Etymology. Named after CMNH curator John E. Rawlins, acknowledging his contributions to our knowledge of the Noctuoidea. His suggestion of the genus for revision, and his continued support, advice and enthusiasm for my efforts in this project is greatly appreciated.

Names not treated in this revision:

Spragueia speciosa Draudt 1936 **Nomen dubium**

Heliocontia speciosa Draudt, 1936. In Seitz, A., 1936. Die Gross-Schmetterlinge des Amerikanischen Faunengebietes. Volume 6. Die Amerikanischen Spinner und Schwarmer. Stuttgart. Alfred Kernen. p. 387. Plate never issued. Type Locality: Guerrero [MEXICO]: Type destroyed (Poole 1989).

In his treatment of *Heliocontia* and *Spragueia*, Draudt largely adhered to the classification of the genus as proposed by Hampson. In the text he described, but did not figure, a new species following the description of *Heliocontia [Spragueia] perstructana* (Wlk), stating that it was "very similar to the preceding." From his description it is clear that he is describing a species very near to male of

perstructana (Figures 78, 79) in overall coloration and markings; females of *perstructana* are dark black. However, *speciosa* could be from the *leo* group, and its identity becomes uncertain with the absence of any reference to the sex of the material he had before him. If Draudt had both sexes before him, then it would be apparent that *speciosa* is not dimorphic and that it probably would be placed in the *leo* group. This would mean that the species is distantly, rather than closely, related to *perstructana*. Since the sex of his specimen(s) is uncertain, the identity of *speciosa* becomes questionable. A plate was not issued and the type is presumed destroyed (Poole 1989).

In this paper I describe *Spragueia rawlinsi* **sp. nov.** (Figure 105) from southern Mexico near the type locality of *speciosa*. Known only from five females, this could be Draudt's *speciosa*, but without the males it is uncertain whether this species should be placed in the *margana* or *leo* species groups. *S. rawlinsi* clearly could fall in the *leo* group *sensu latu*, therefore I would expect the males to be similar to the females in overall coloration and most closely related to *cleta*. Because the type series of *speciosa* is destroyed, and Draudt's description is quite poor, the identity of *speciosa* remains uncertain. I therefore do not treat the name as valid.

Spragueia turca Köhler

Spragueira [sic] *turca*, Köhler. Zoologica Lilloana. 1979: 50 male genitalia fig 22. Syntypes, Argentina: Cordoba, Tacanto; Villa Dolores. ZSBS [Munich].

I have been unable to locate specimens that match the descriptions of *turca*. Köhler illustrated the valve, and it appears most similar to *mexicana*. In the type description the female is described as being very similar in overall coloration as the male; both *lukesi* and *mexicana* are sexually dimorphic. I have not seen the type series of this species.

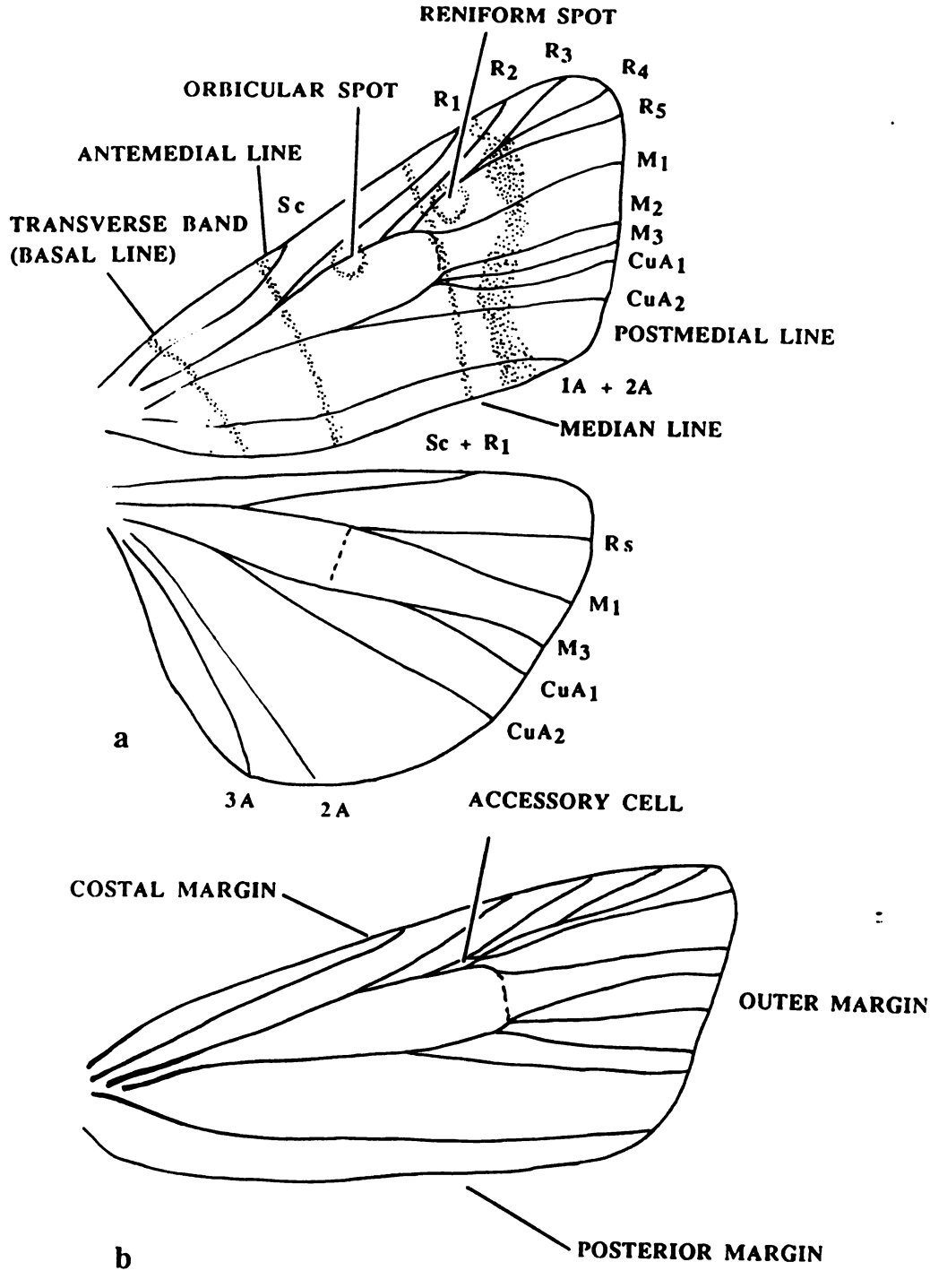


Figure 1. a) Wing venation of *Spragueia margana* (Guarico, Venezuela), typical for the *margana*, *apicalis* and some members of the *dama* species groups. b) Wing venation of *Spragueia guttata* (Brownsville, Texas), indicative of the *leo* species group and some members of the *dama* group.

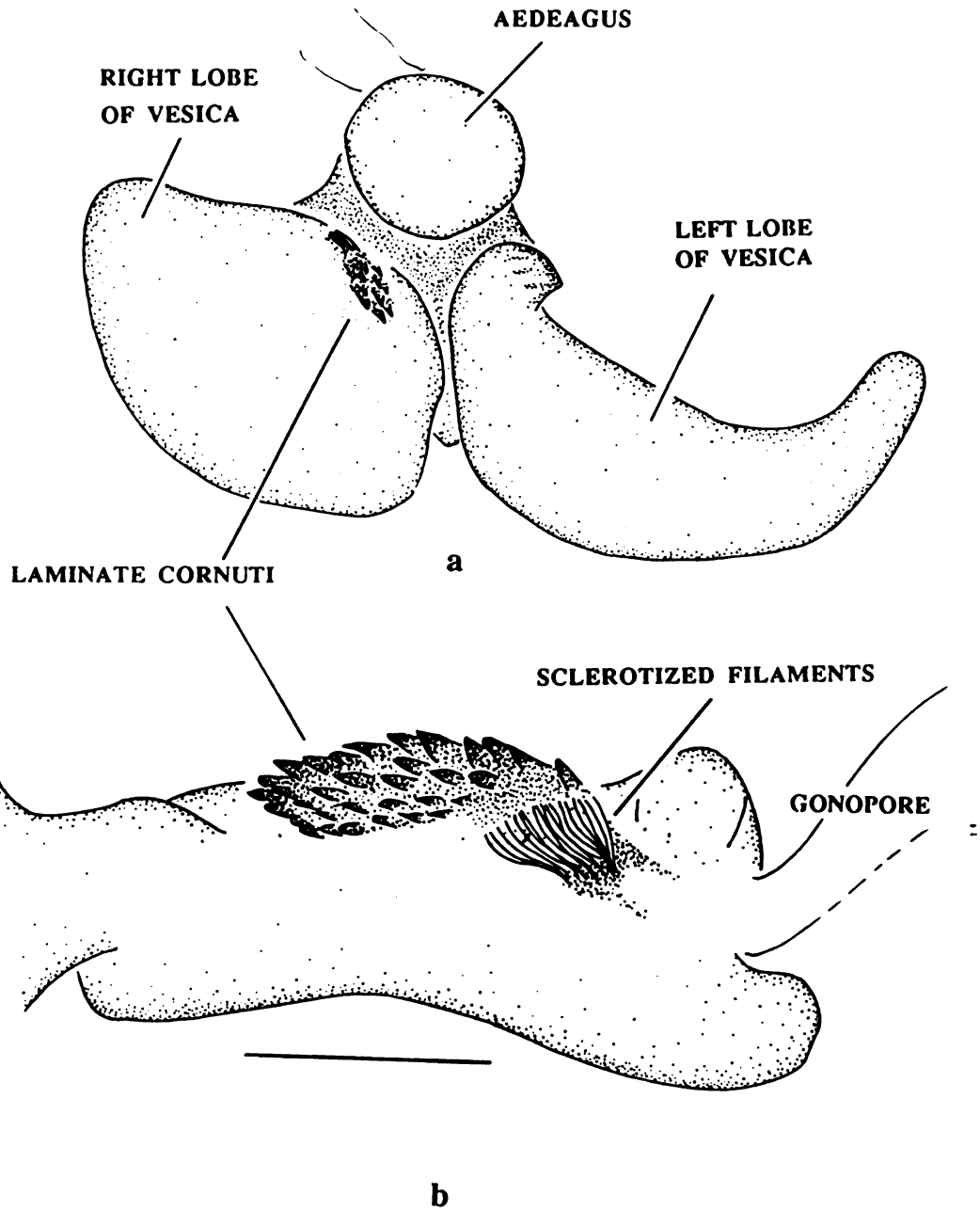


Figure 2. a) *Spragueia onagrus* (Dade Co., Florida) aedeagus with vesica everted, posterior aspect. Note position of laminate cornuti on right lobe. b) *Spragueia lepus* (Moengo Boven, Surinam) showing detail of laminate cornuti on right lobe of vesica. The gonopore emerges laterally from the right lobe. Measure = 0.5 mm.

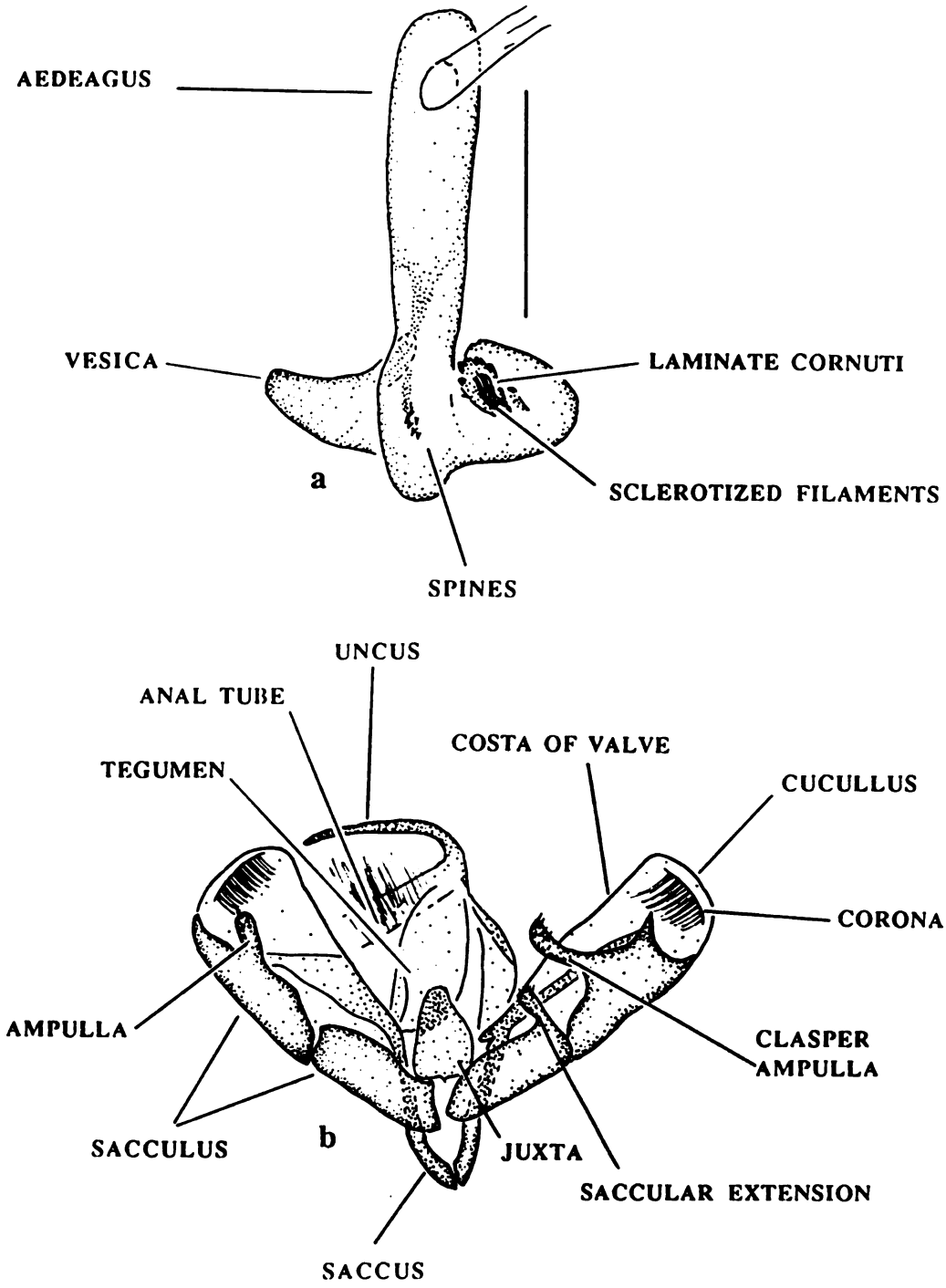


Figure 3. Male genitalia of *Spragueia leo* (Rockcastle, Kentucky). a) aedeagus with vesica everted, dorsal; b) valves. Measure = 1.0 mm.

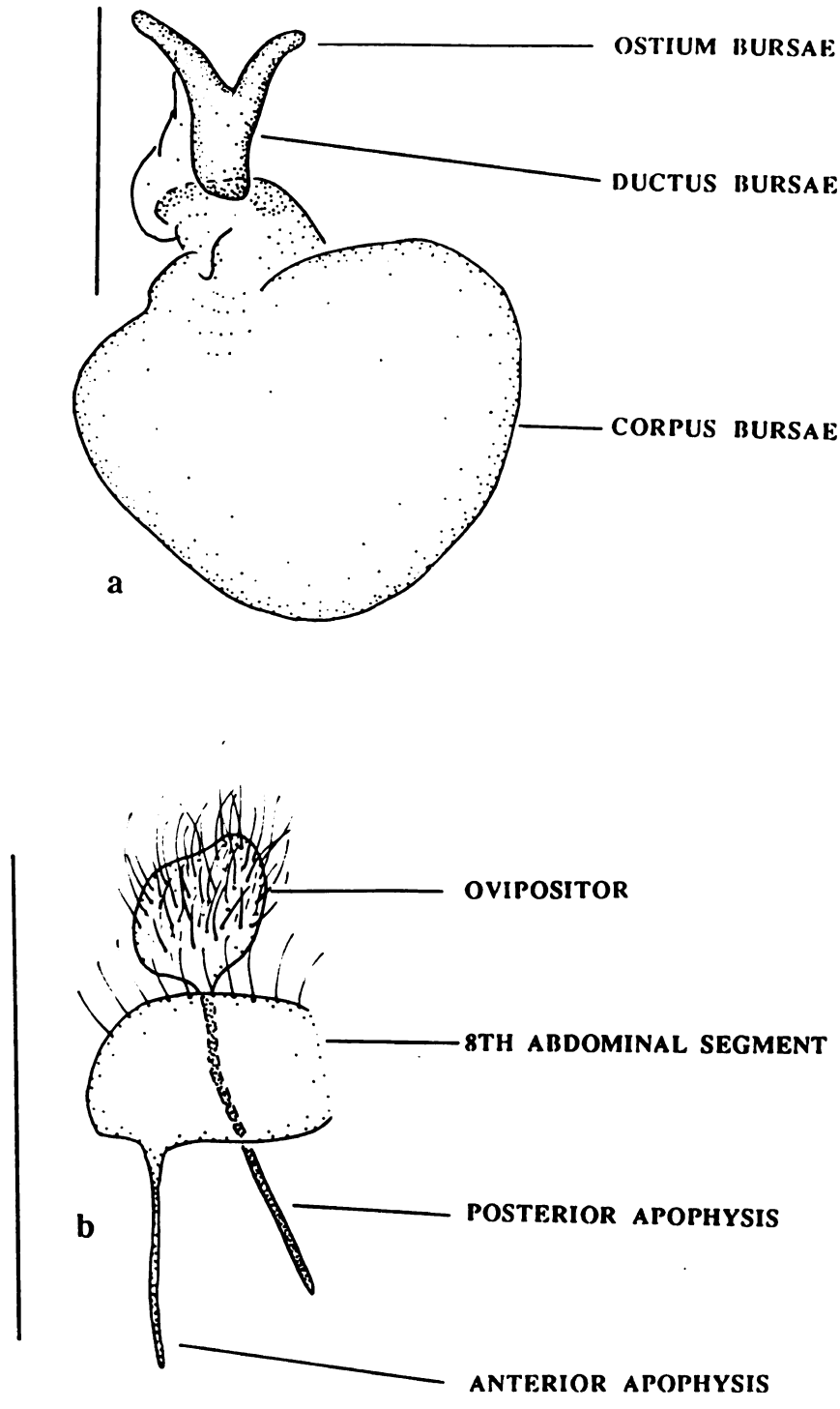


Figure 4. Female genitalia of *Spragueia leo* (Warren Co., Mississippi). a) ostium, ductus and corpus bursae, ventral; b) ovipositor and 8th abdominal segment, left lateral. Measure = 1.0 mm.

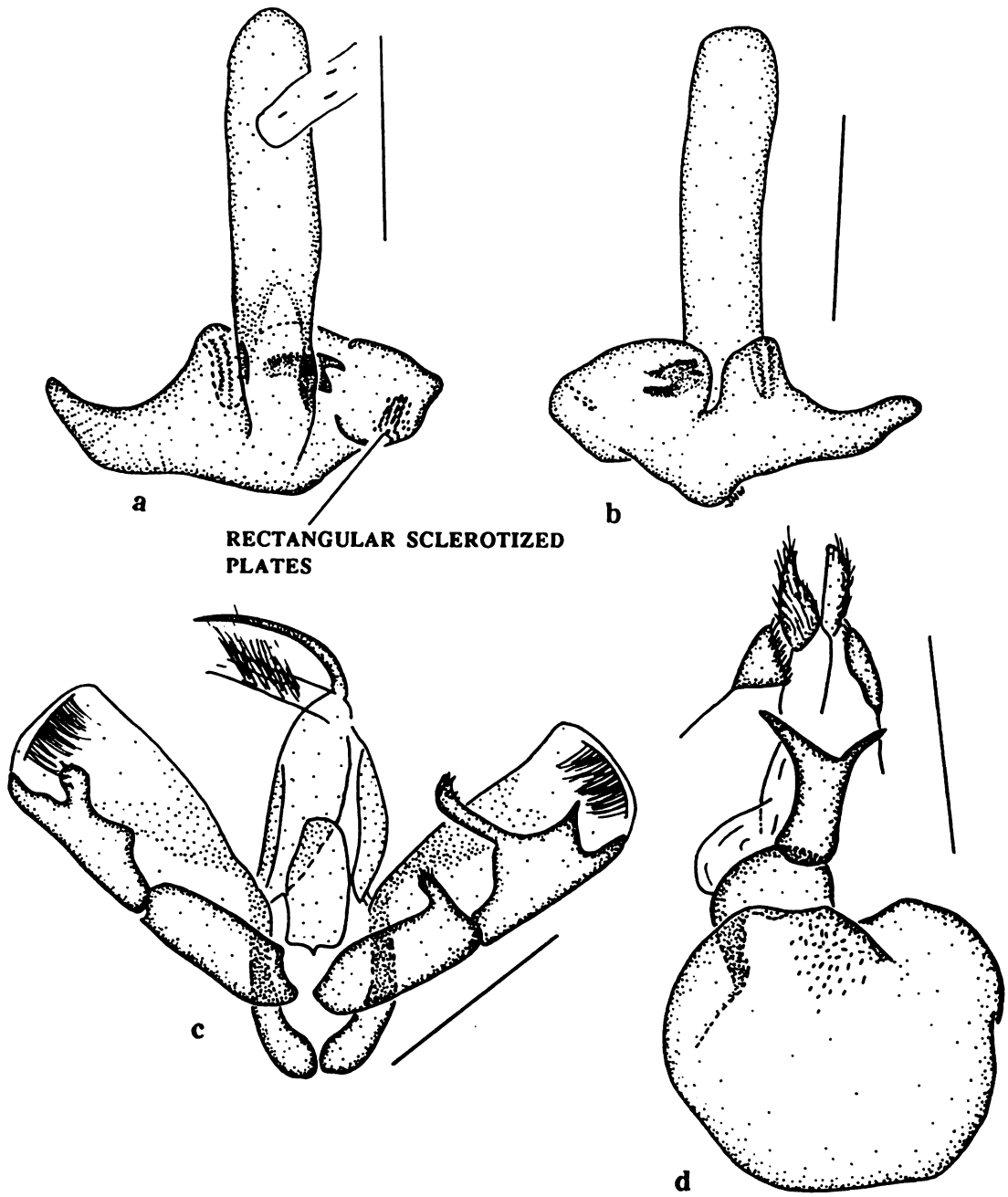


Figure 5. Genitalia of *Spragueia onagrus*. Male, a-c (Dade Co., Florida): a) aedeagus with vesica everted, dorsal; b) ventral; c) valves. d) Female, (Broward Co., Florida): ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

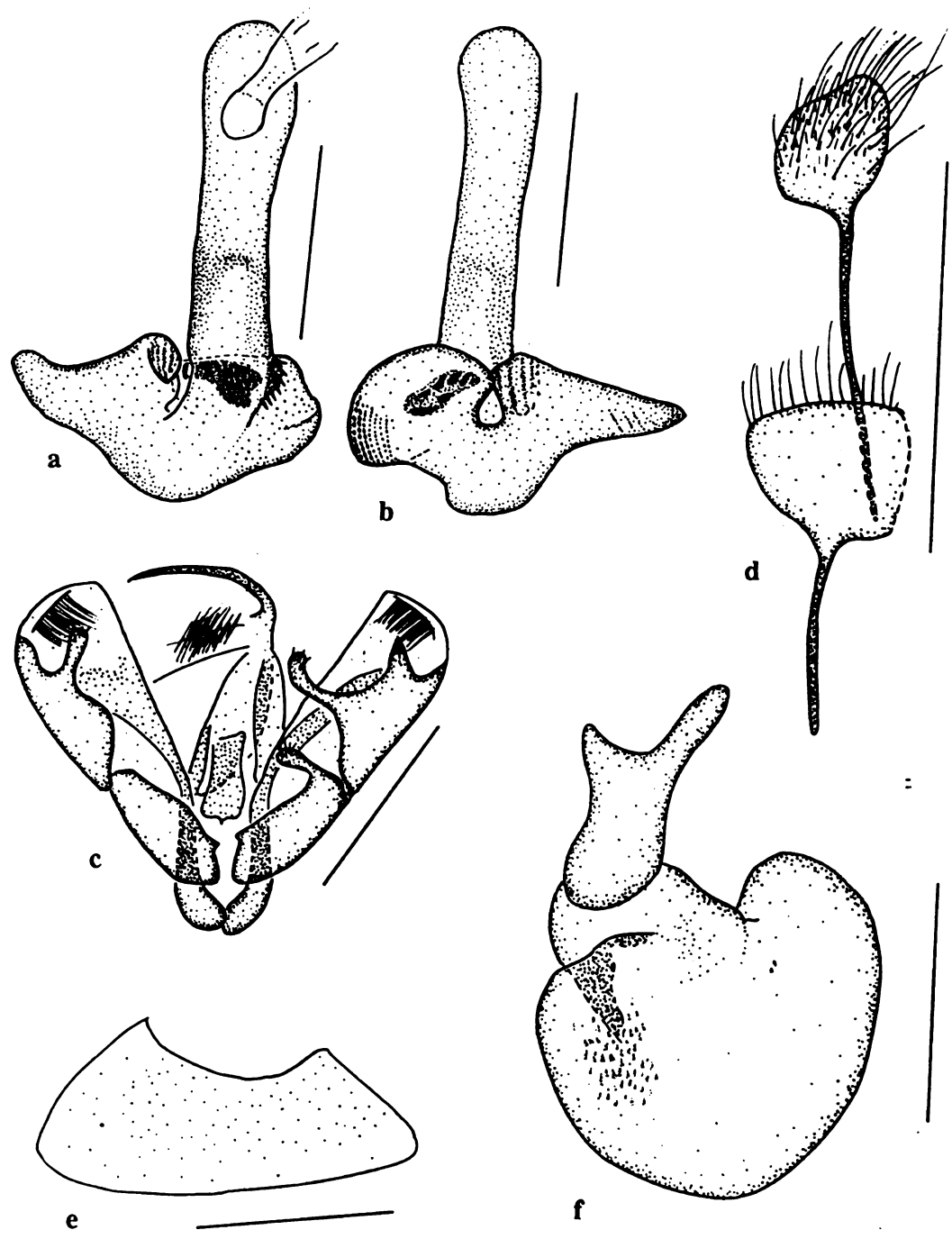


Figure 6. Genitalia of *Spragueia guttata*. Male, a-c (Baton Rouge, Louisiana): a) aedeagus with vesica everted, left lateral; b) ventral; c) valves. Female, d-f (Brownsville, Texas): d) ovipositor and 8th abdominal segment, left lateral; e) 7th abdominal sternite; f) ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

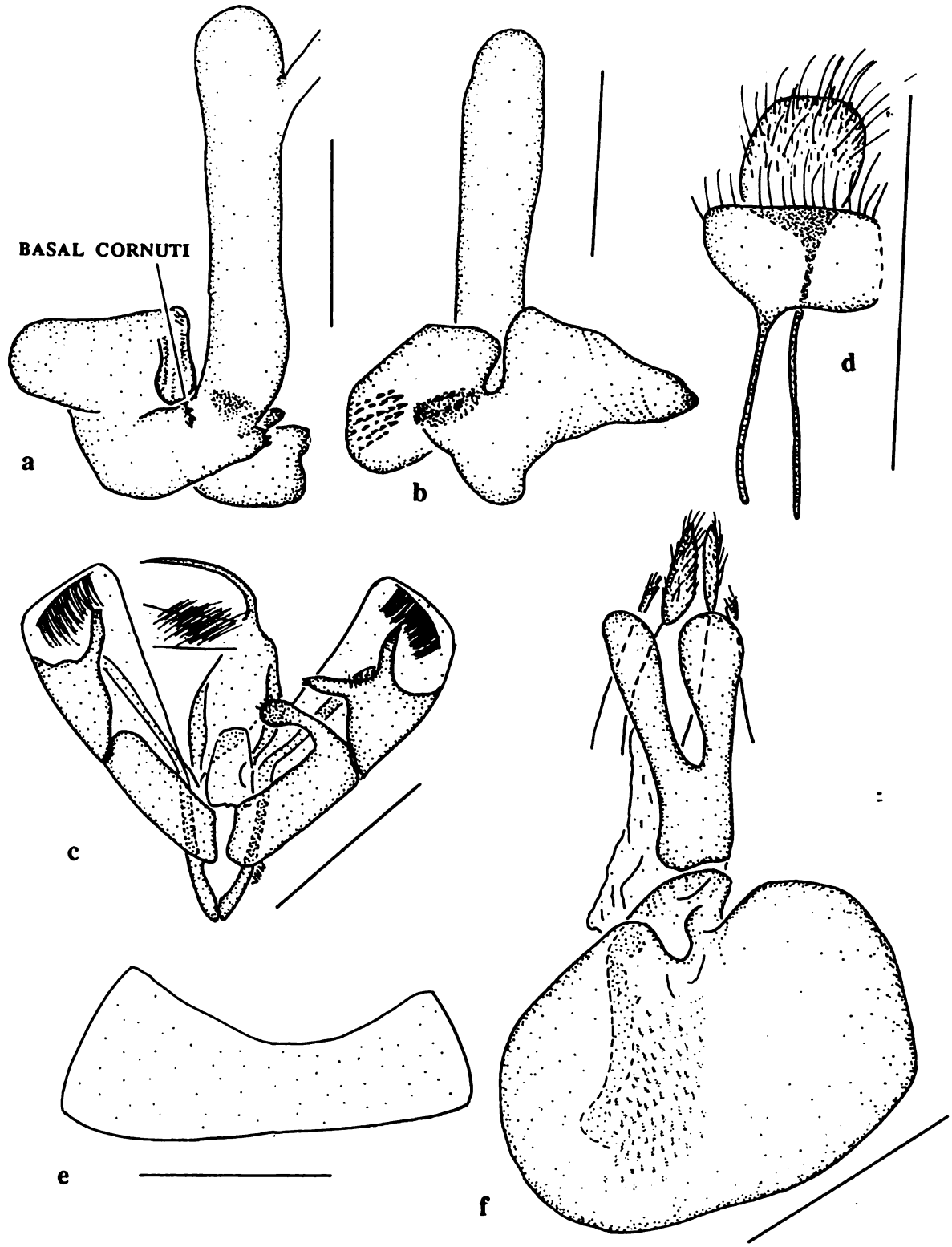


Figure 7. Genitalia of *Spragueia cleta*. Male, a-c (Huixtla, Mexico): a) aedeagus with vesica everted, left dorso-lateral; b) ventral; c) valves. Female, d-g (Potrerillos, Mexico): d) ovipositor and 8th abdominal segment, left lateral; e) 7th abdominal sternite; f) ostium, ductus, and corpus bursae, ventral. Measure = 1.0 mm.

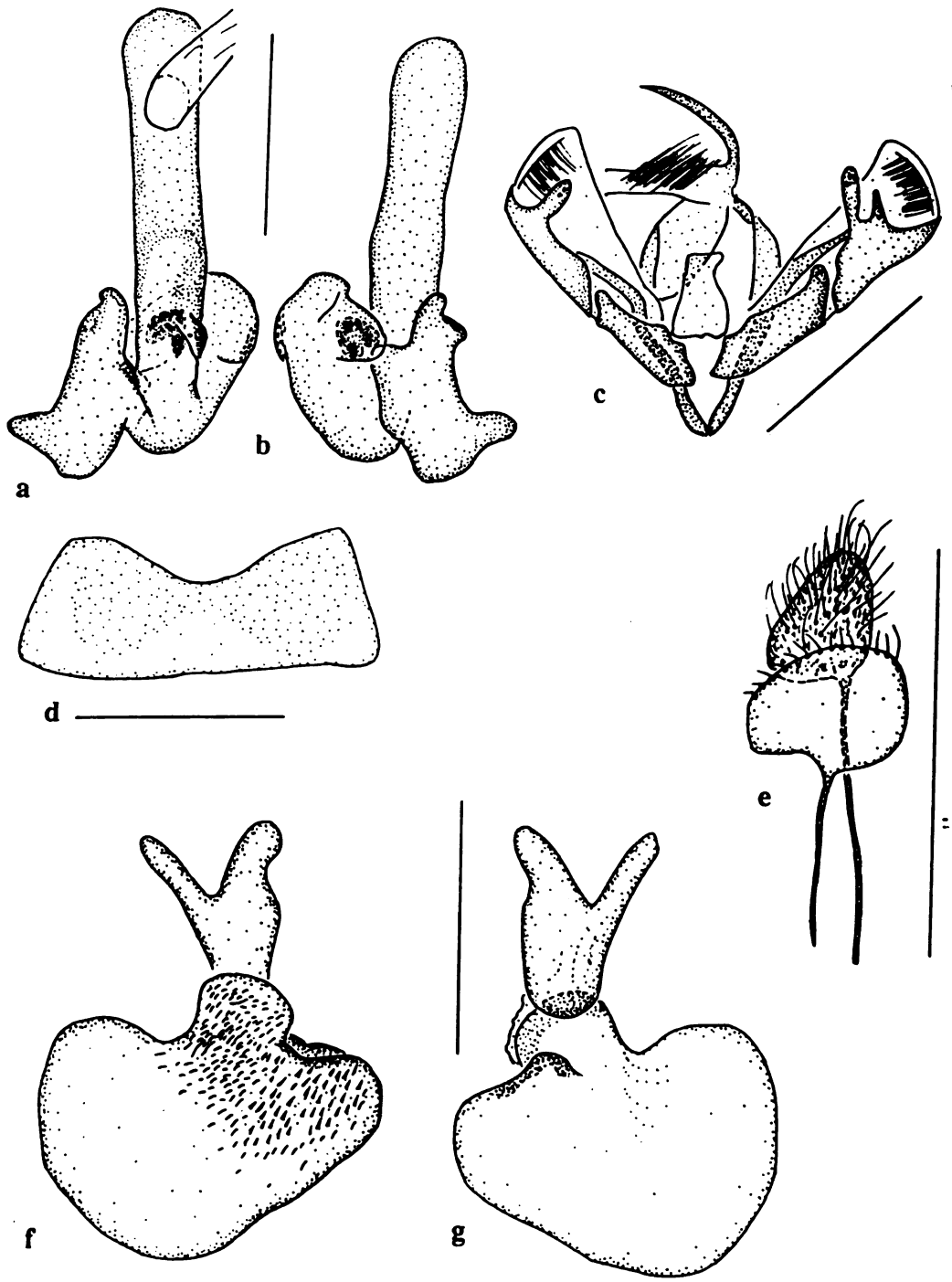


Figure 8. Genitalia of *Spragueia magnifica*. Male, a-c (Baja California Sur, Mexico): a) aedeagus with vesica everted, dorsal; b) ventral; c) valves. Female, d-g (Graham Co., Arizona): d) 7th abdominal sternite; e) ovipositor and 8th abdominal segment, left lateral; f) ostium and ductus bursae, dorsal; g) ventral. Measure = 1.0 mm.

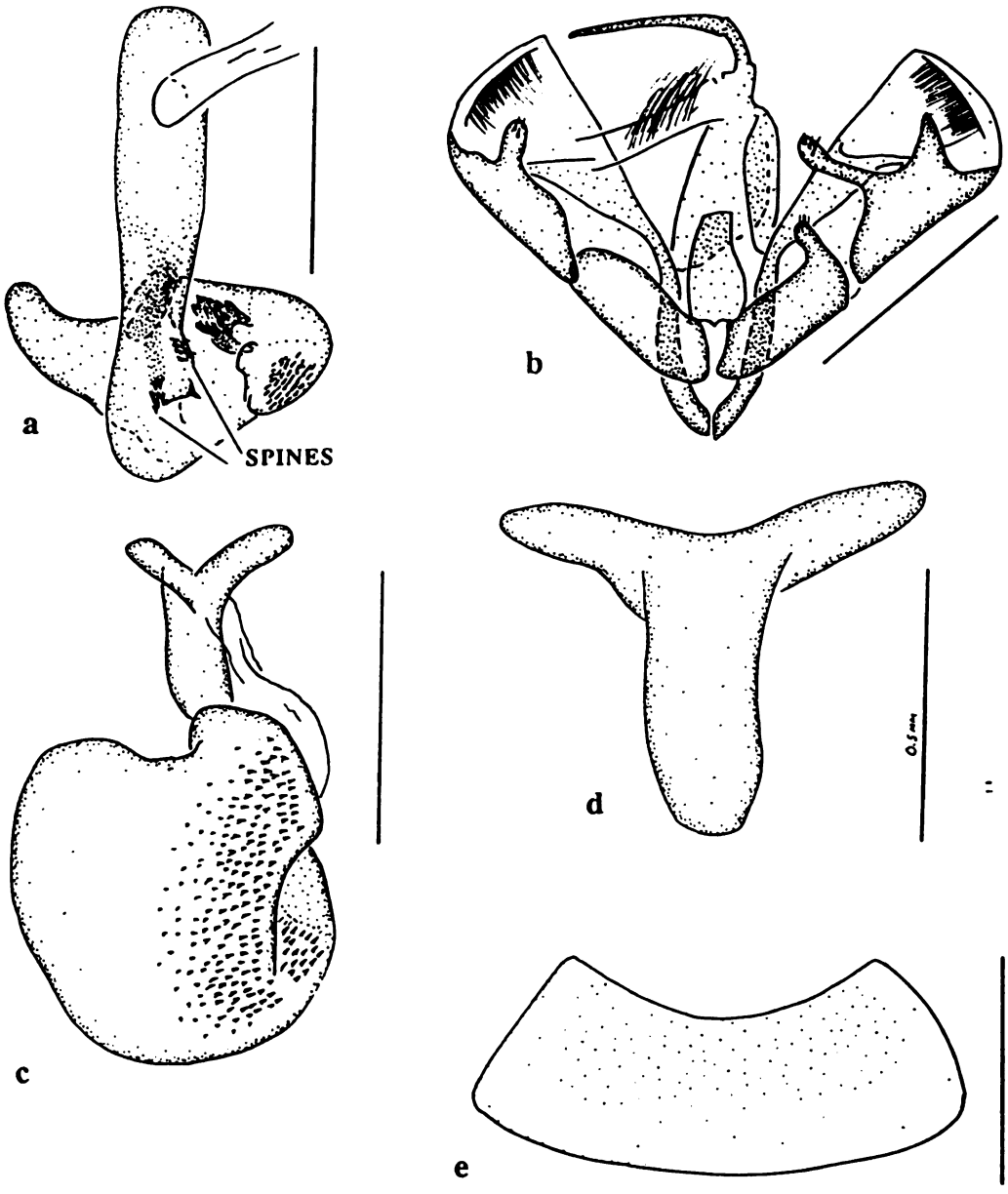


Figure 9. Genitalia of *Spragueia jaguaralis*. Male, a-b (Guadalajara, Mexico): a) aedeagus with vesica everted, dorsal; b) valves. Female, c-e (Bexar Co., Texas): c) ostium, ductus and corpus bursae, dorsal; d) ostium and ductus bursae, ventral; e) 7th abdominal sternite. Measure = 1.0 mm unless indicated.

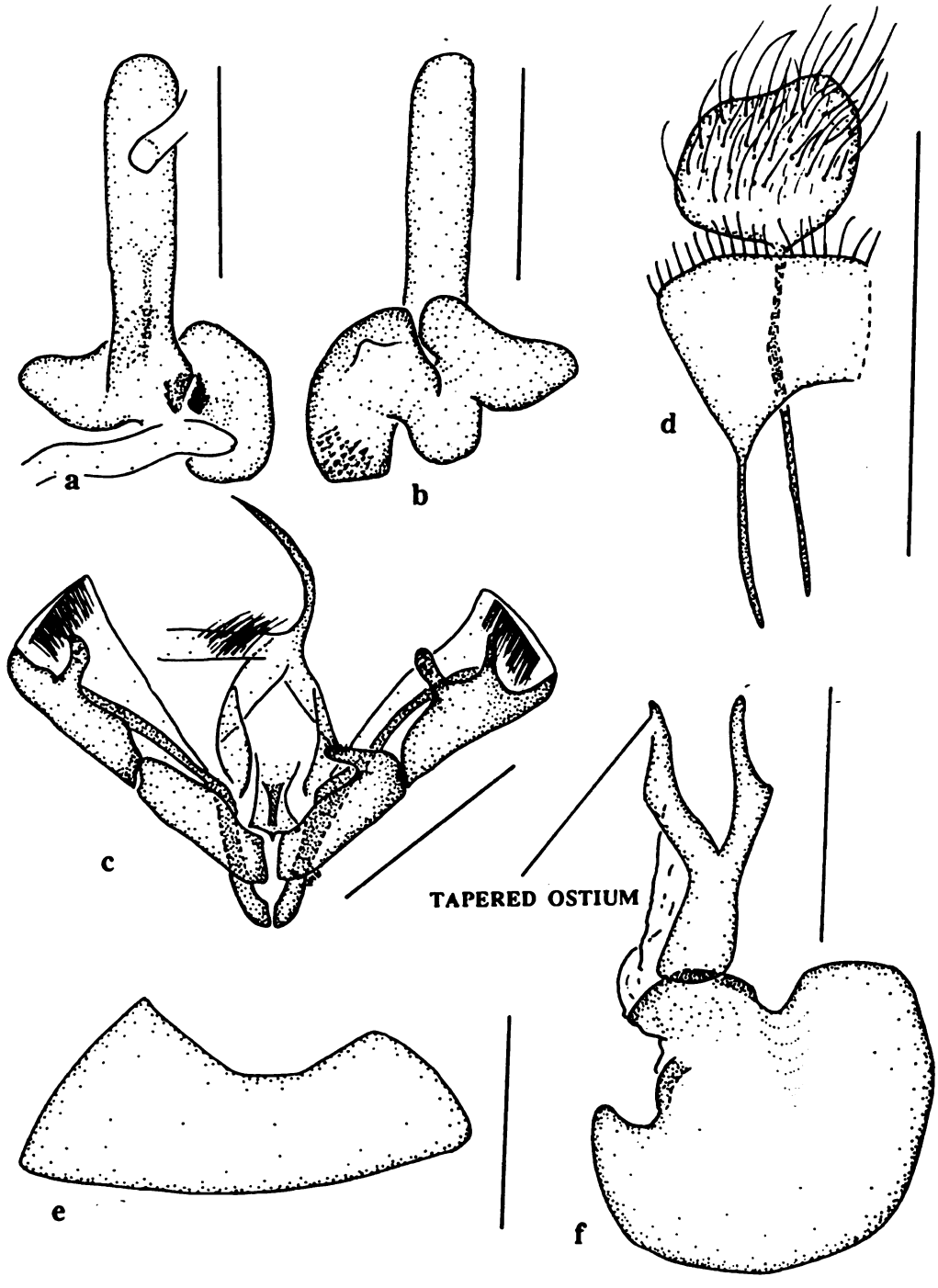


Figure 10. Genitalia of *Spragueia funeralis*. Male, a-c (Cochise Co., Arizona): a) aedeagus with vesica everted, dorsal; b) ventral; c) valves. Female, d-f (Chihuahua, Mexico): d) ovipositor and 8th abdominal segment, right lateral; e) 7th abdominal sternite; f) ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

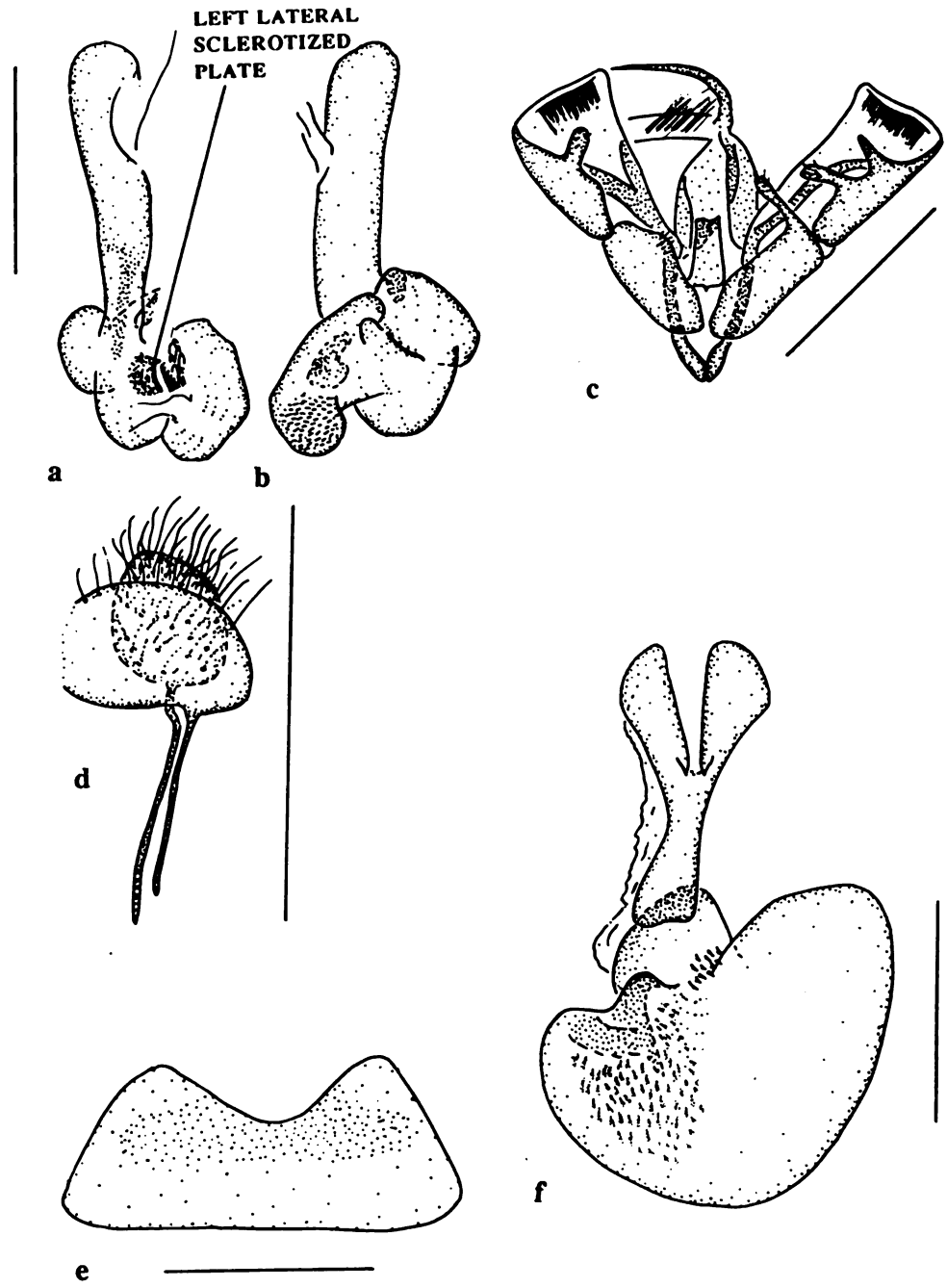


Figure 11. Genitalia of *Spragueia xericosa*. Male and female, (Baja California Sur, Mexico): a) aedeagus with vesica everted, ventral; b) dorsal; c) valves; d) ovipositor and 8th abdominal segment, right lateral; e) 7th abdominal sternite; f) ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

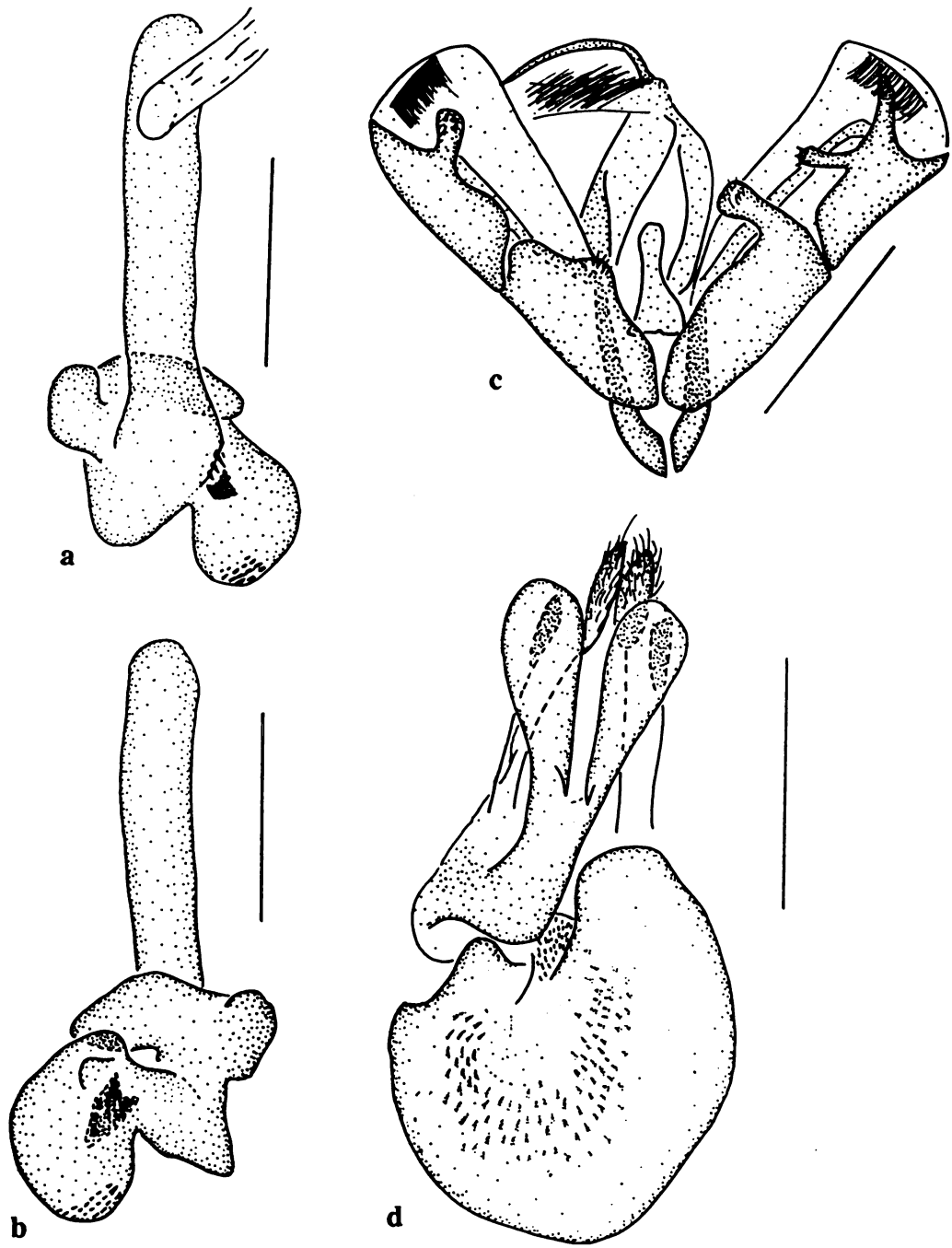


Figure 12. Genitalia of *Spragueia obatra*. Male, a-c (Puebla, Mexico): a) aedeagus with vesica everted, left dorso-lateral; b) ventral; c) valves. Female, d) (Cochise Co., Arizona): ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

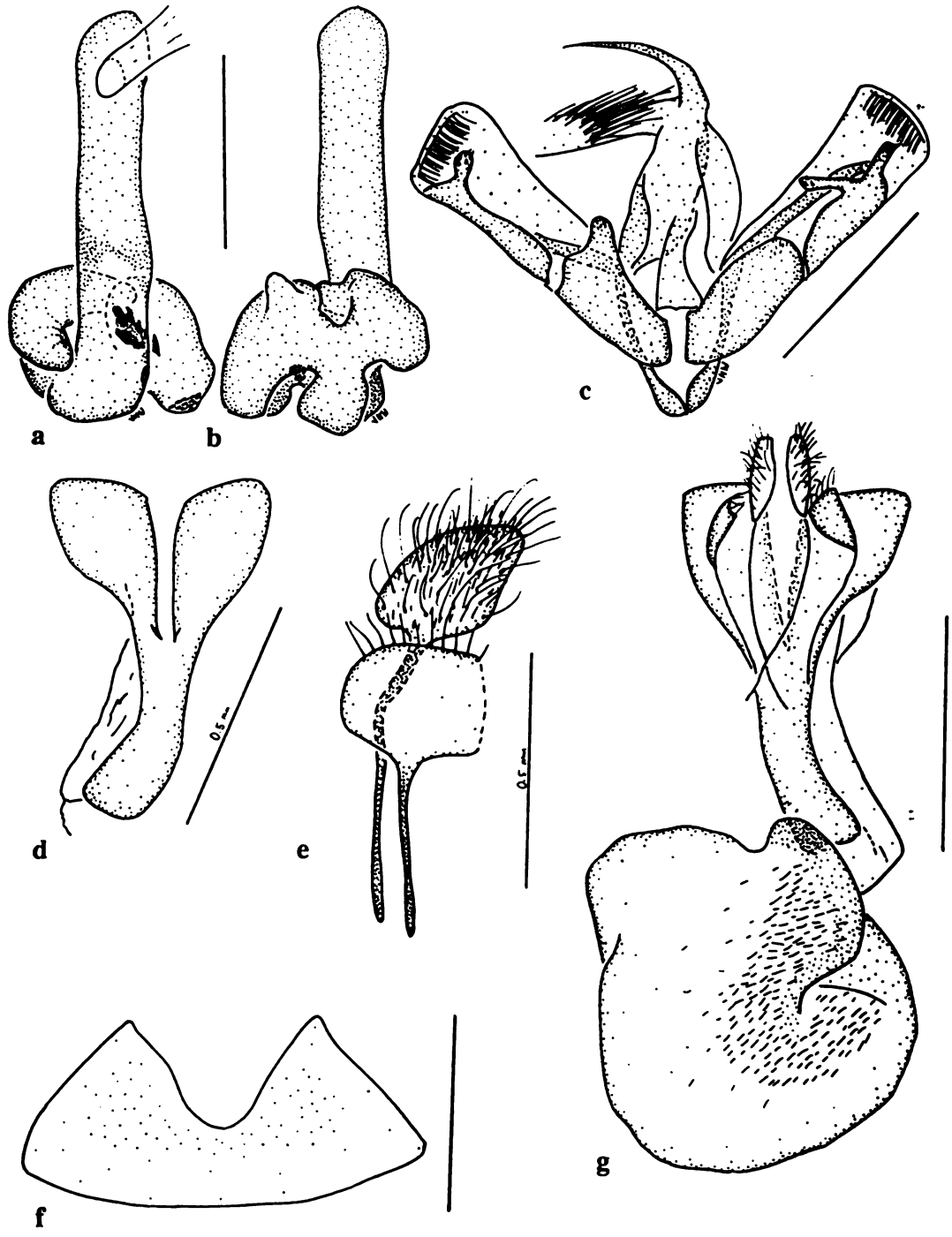


Figure 13. Genitalia of *Spragueia dama*. Male, a-c (Guarico, Venezuela): a) aedeagus with vesica everted, dorsal; b) ventral; c) valves. Female, d-g (Nayarit, Mexico): d) ostium bursae and ductus bursae, ventral; e) ovipositor and 8th abdominal segment, left lateral; f) 7th abdominal sternite; g) ostium, ductus and corpus bursae, dorsal. Measure = 1.0 mm.

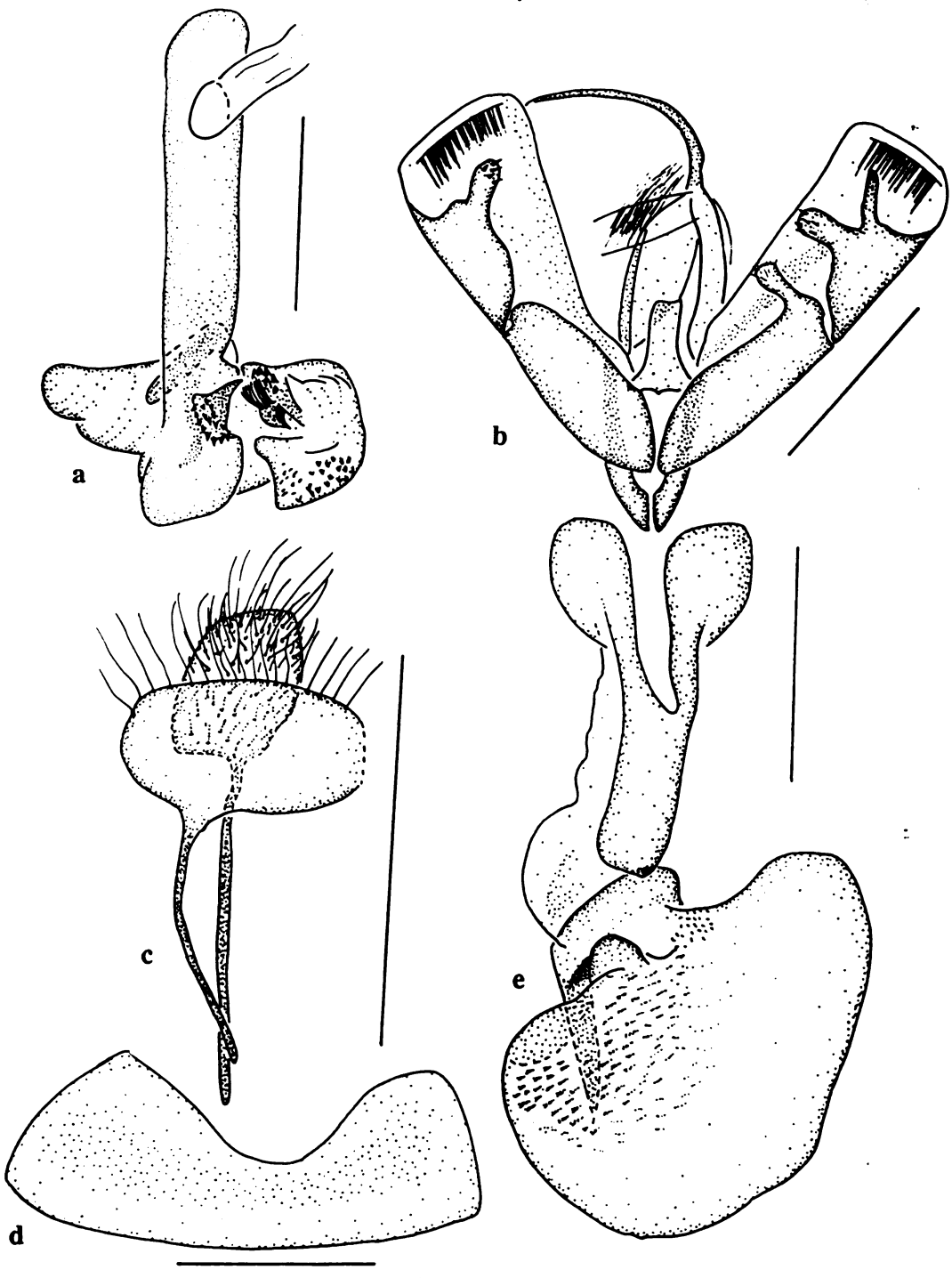


Figure 14. Genitalia of *Spragueia valena*. Male, a-b (Vera Cruz, Mexico): a) aedeagus with vesica everted, dorsal; b) valves. Female, c-e (Aguascalientes, Mexico): c) ovipositor and 8th abdominal segment, left lateral; d) 7th abdominal sternite; e) ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

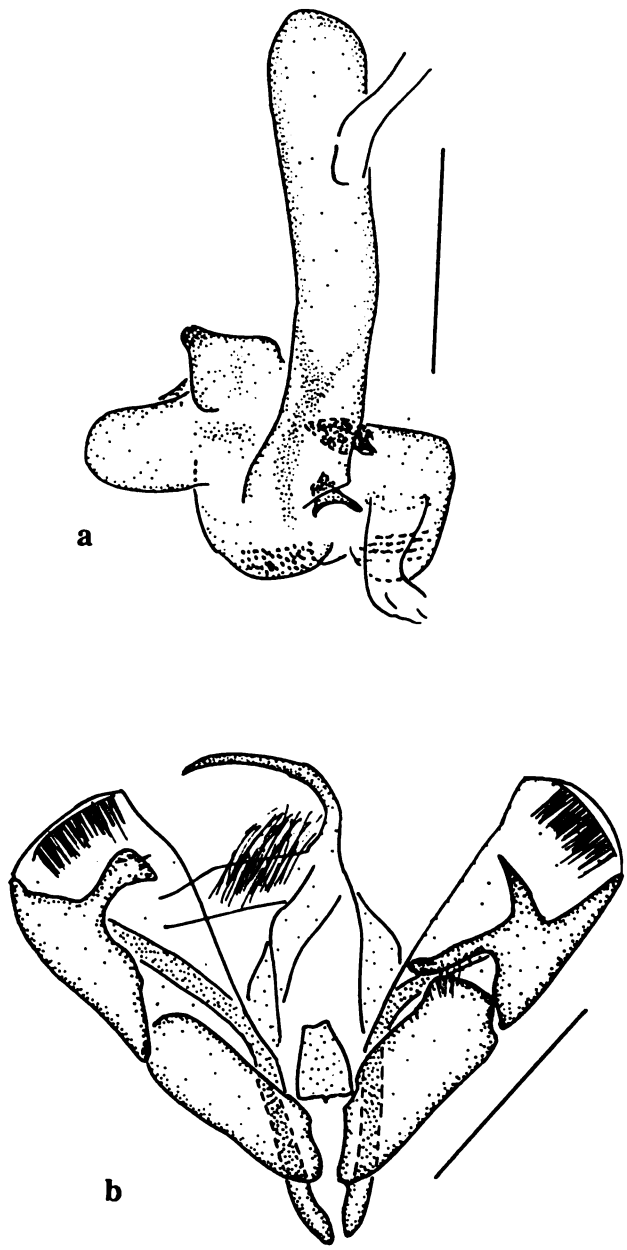


Figure 15. Genitalia of *Spragueia pyralidia*. Male (Tehuacan, Mexico): a) aedeagus with vesica everted, left dorso-lateral; b) valves. Measure = 1.0 mm.

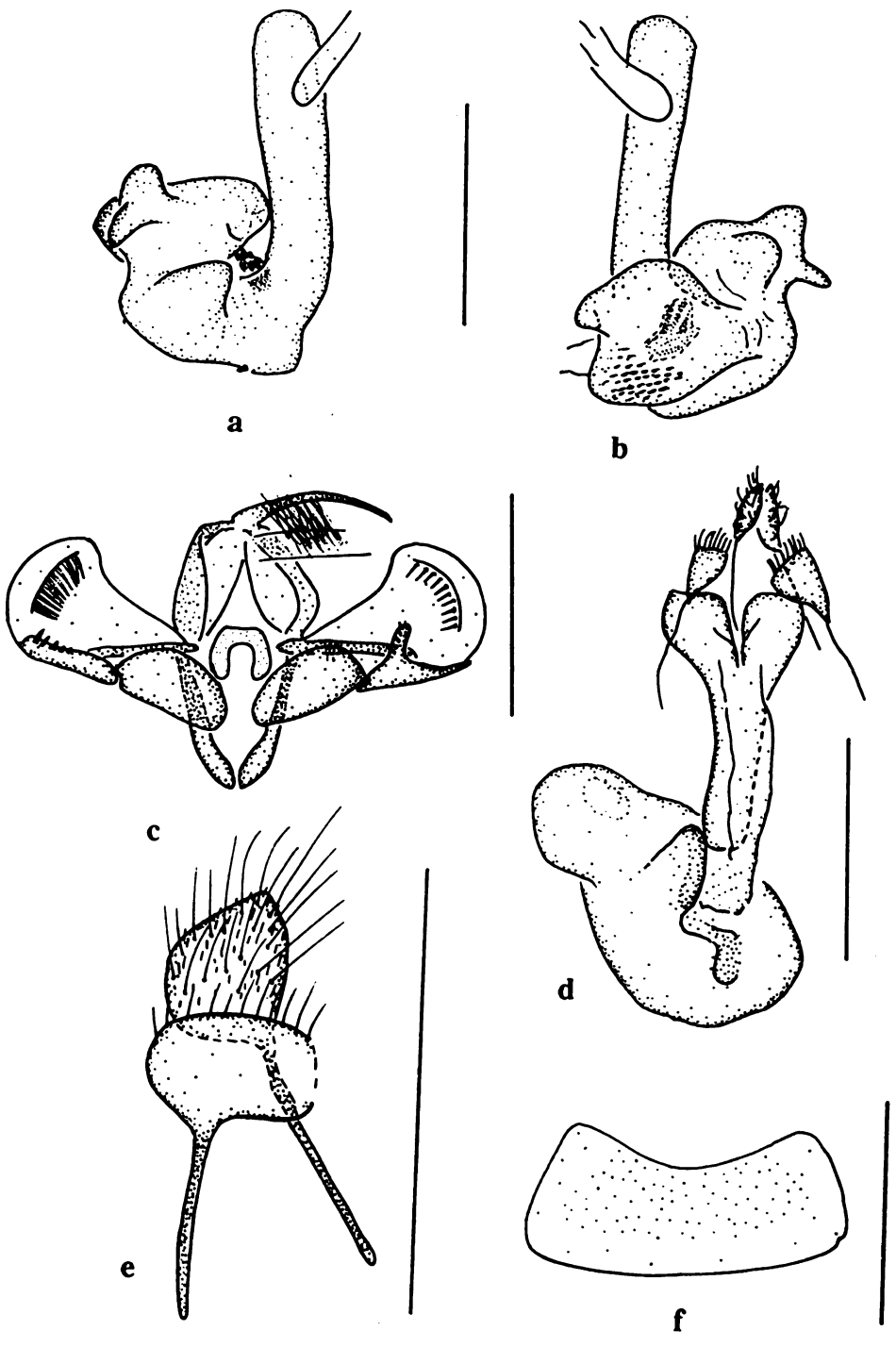


Figure 16. Genitalia of *Spragueia margana*. Male, a-c (Jamaica): a) aedeagus with vesica everted, left lateral; b) right lateral; c) valves. Female, d-f (Puerto Rico): d) ostium, ductus and corpus bursae, dorsal; e) ovipositor and 8th abdominal segment, left lateral; f) 7th abdominal sternite. Measure = 1.0 mm.

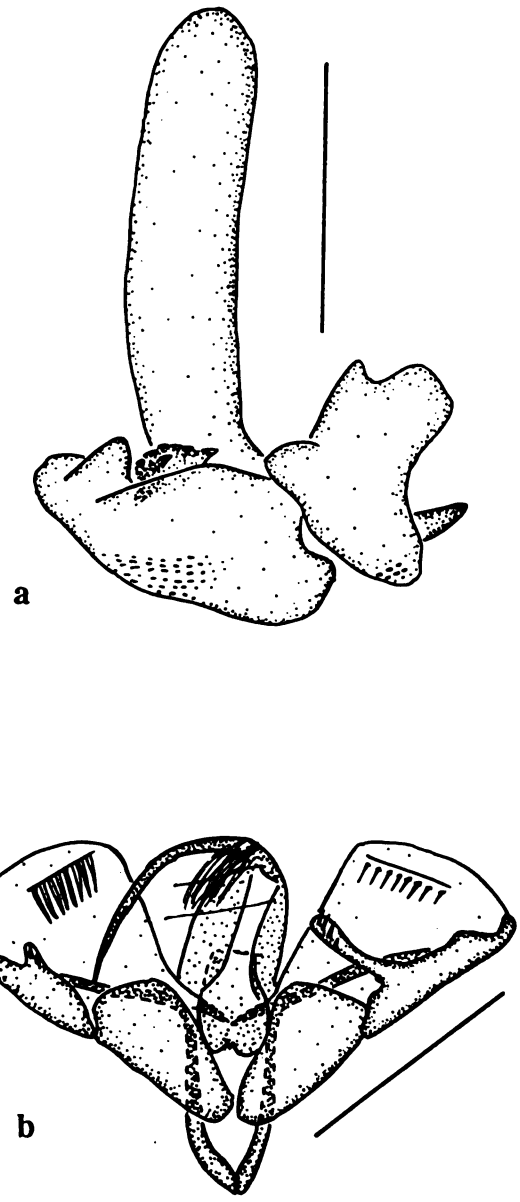


Figure 17. Genitalia of *Spragueia cryptomargana*, male (Guanacaste, Costa Rica): a) aedeagus with vesica everted, ventral; b) valves. Measure = 1.0 mm.

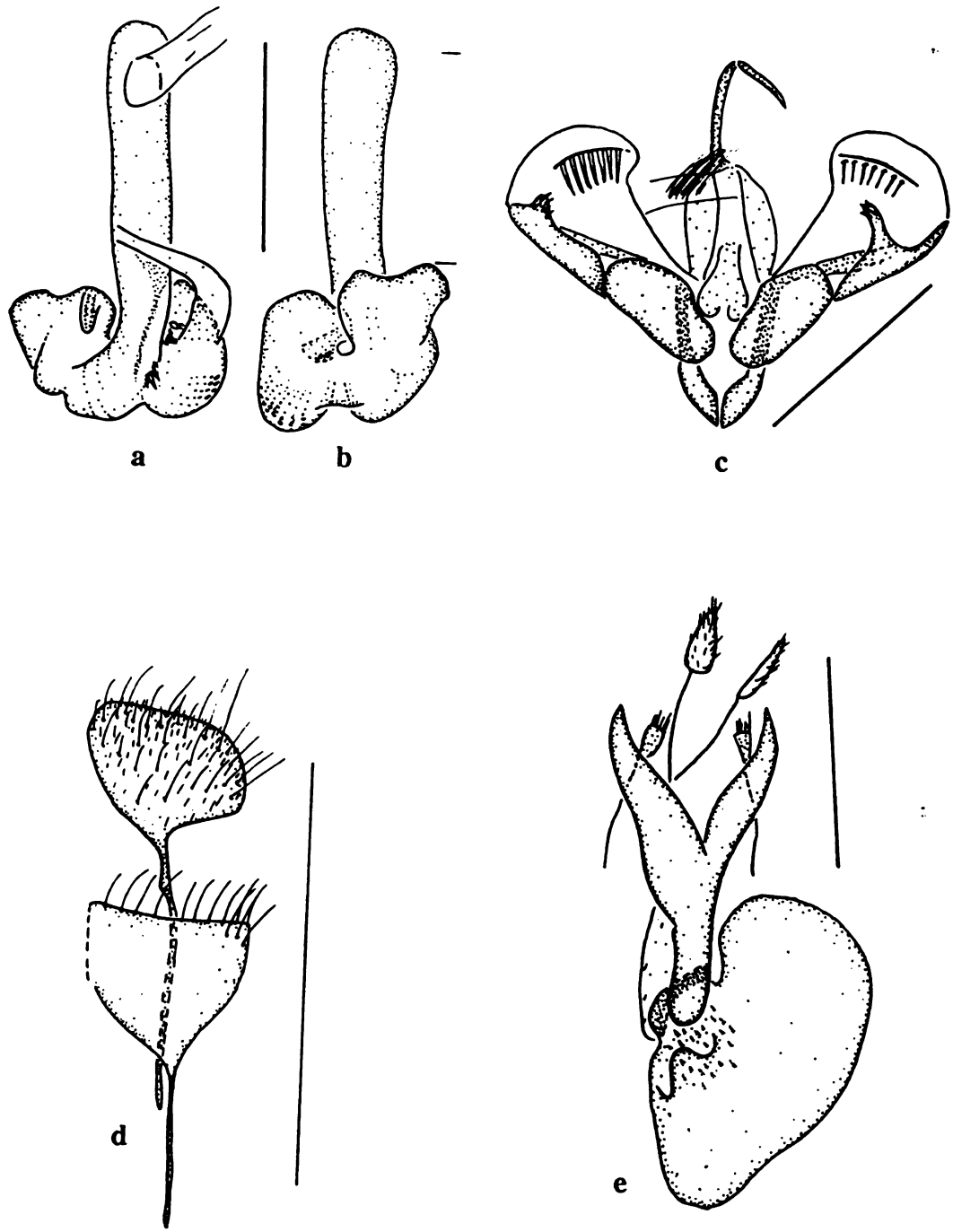


Figure 18. Genitalia of *Spragueia perstructana*. Male, a-c (Guarico, Venezuela): a) aedeagus with vesica everted, dorsal; b) ventral; c) valves. Female, d-e (St. John Parish, Louisiana): d) ovipositor and 8th abdominal segment, right lateral; e) ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

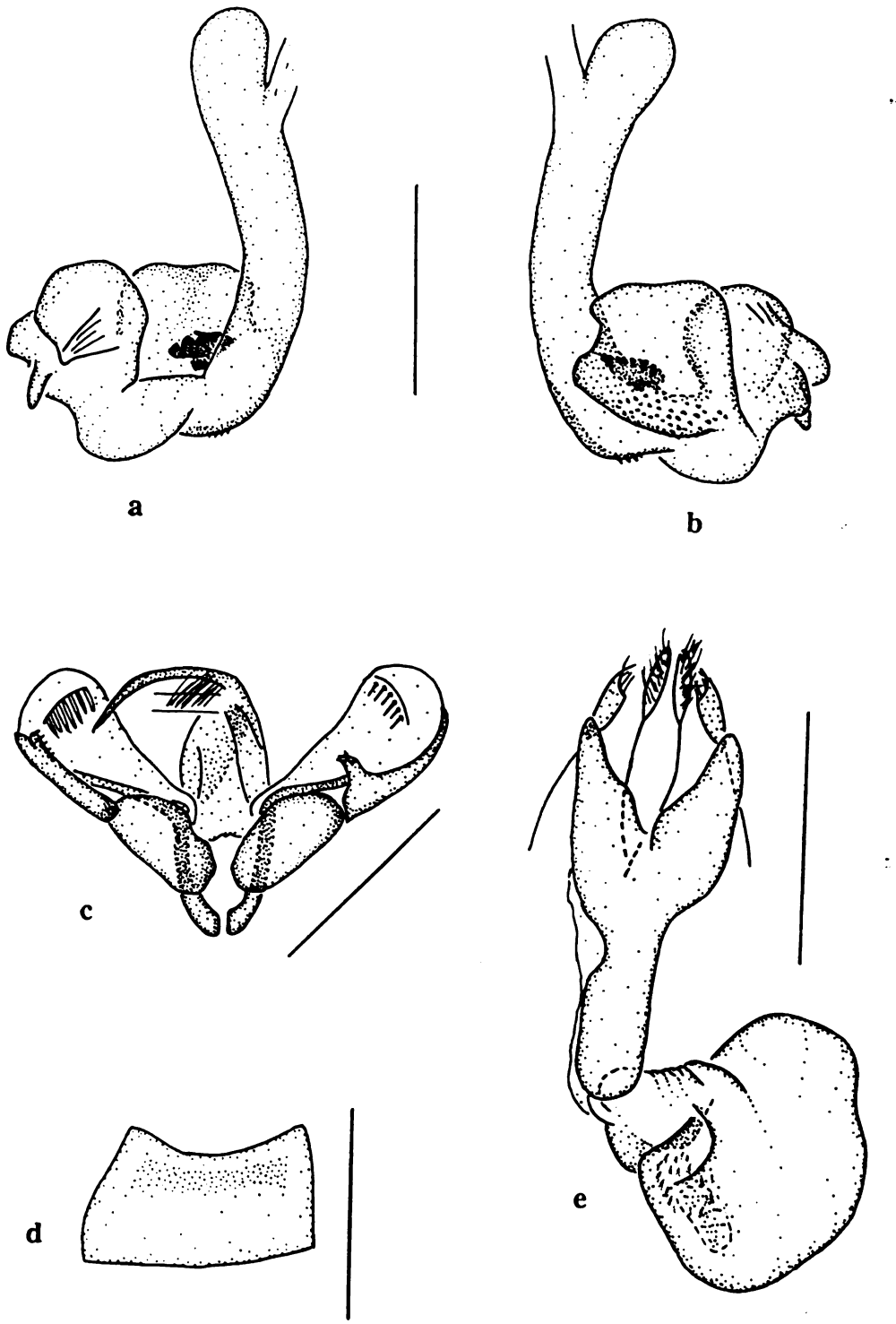


Figure 19. Genitalia of *Spragueia ochracea*. Male, a-c (Los Hidalgo, Dominican Republic): a) aedeagus with vesica everted, left lateral; b) right lateral; c) valves. Female, d-e (Convento, Dominican Republic): d) 7th abdominal sternite; e) ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

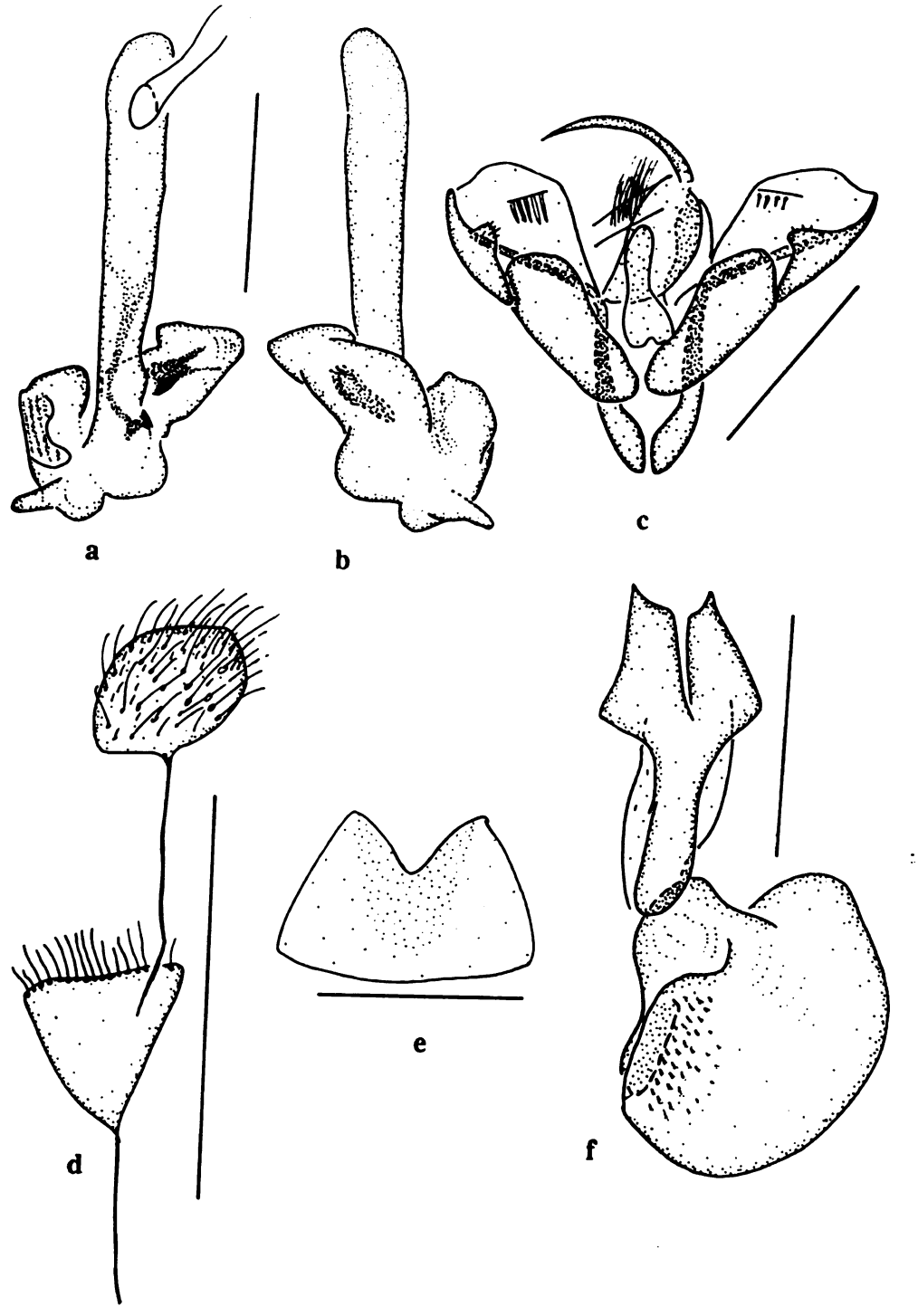


Figure 20. Genitalia of *Spragueia lukesi*. Male, a-b (Vera Cruz, Mexico): a) aedeagus with vesica everted, dorsal; b) ventral. Male, (Oaxaca, Mexico); c) valves. Female, d-f (Chihuahua, Mexico): d) ovipositor and 8th abdominal segment, left lateral; e) 7th abdominal sternite; f) ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

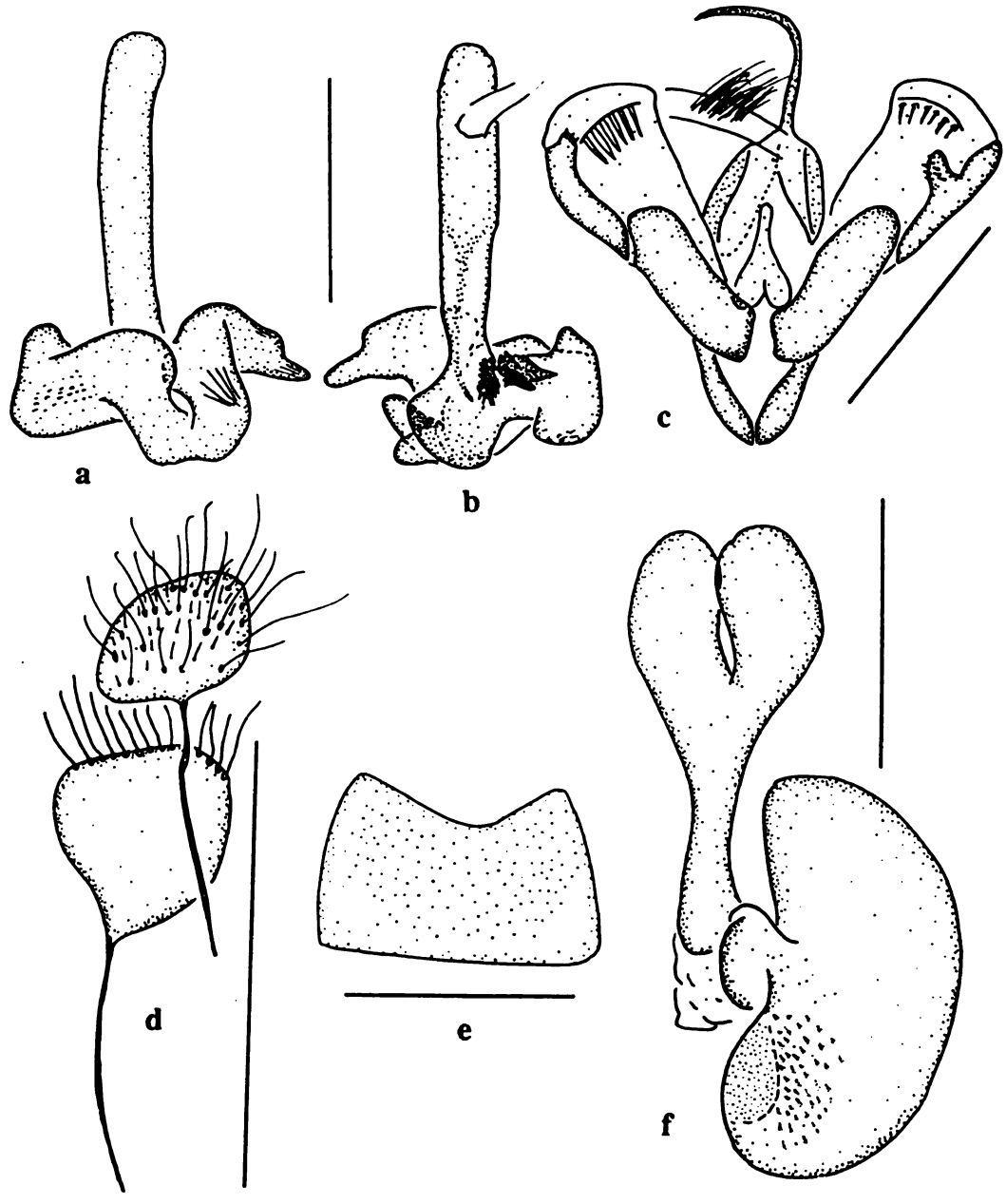


Figure 21. Genitalia of *Spragueia mexicana*, (Chihuahua, Mexico): a) aedeagus with vesica everted, dorsal; b) ventral; c) valves; d) ovipositor and 8th abdominal segment, left lateral; e) 7th abdominal sternite; f) ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

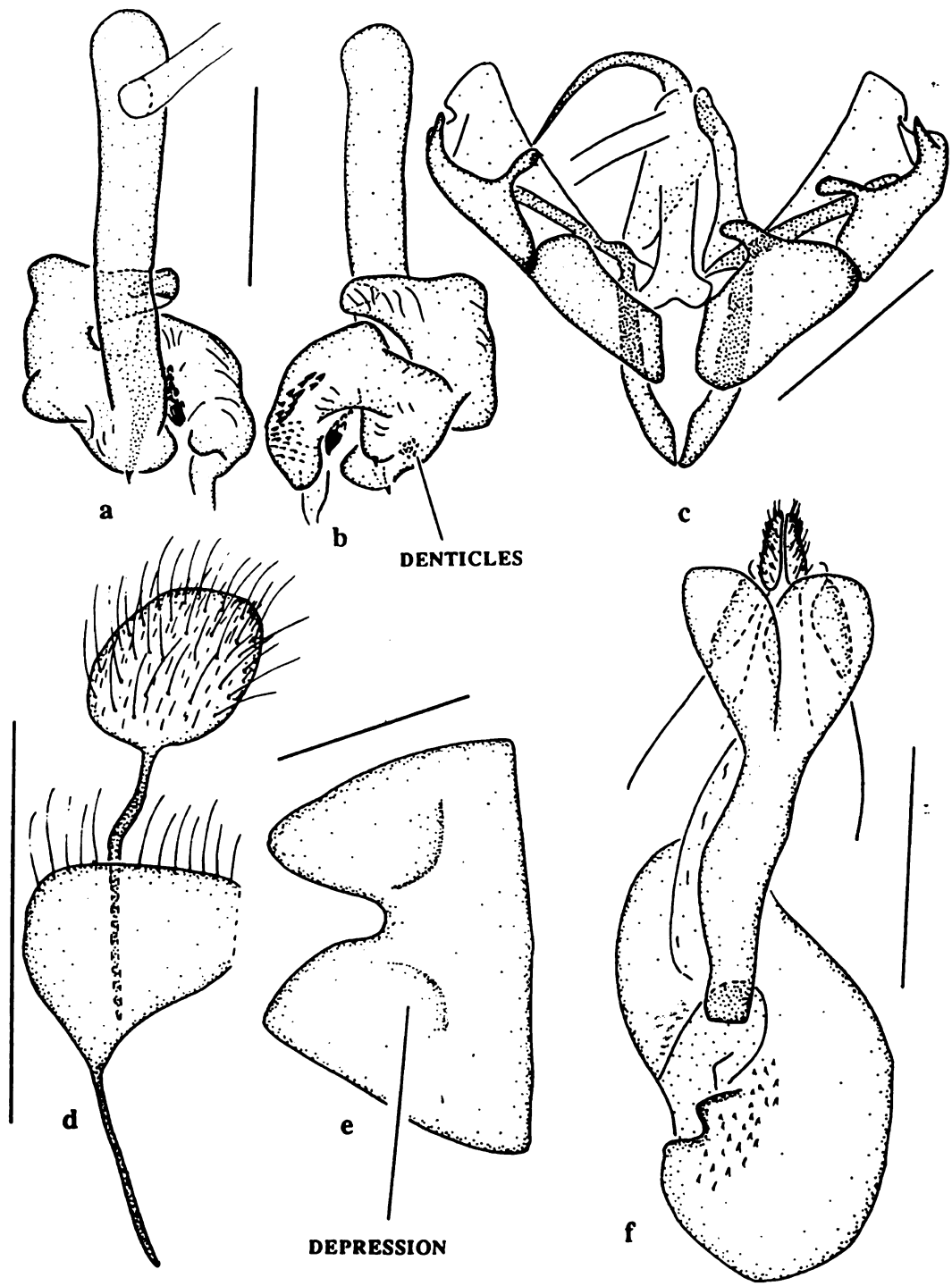


Figure 22. Genitalia of *Spragueia apicalis*. Male, a-c (Nayarit, Mexico): a) aedeagus with vesica everted, dorsal; b) ventral; c) valves. Female, d-f (Baton Rouge, Louisiana): d) ovipositor and 8th abdominal segment, left lateral; e) 7th abdominal sternite; f) ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.

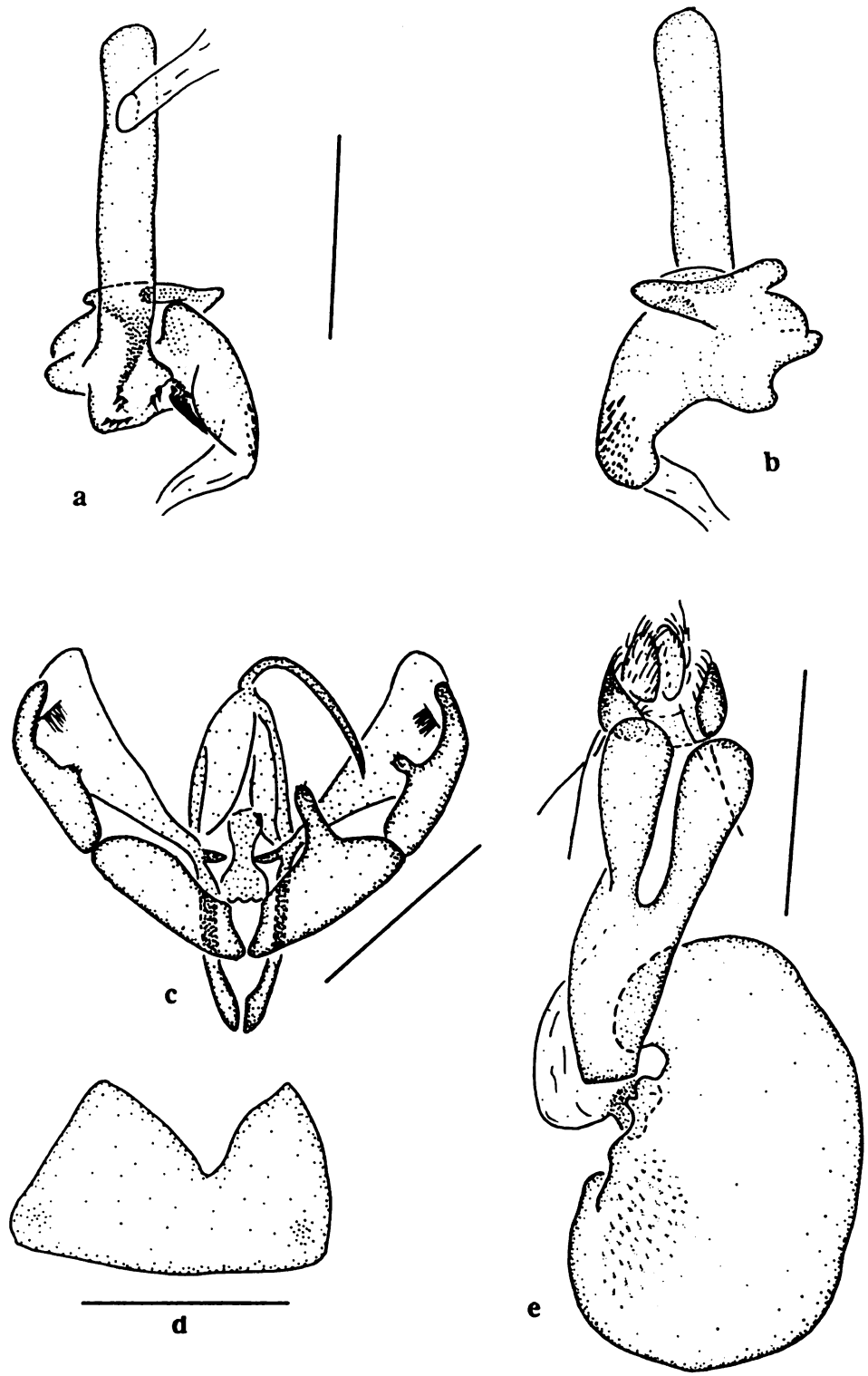
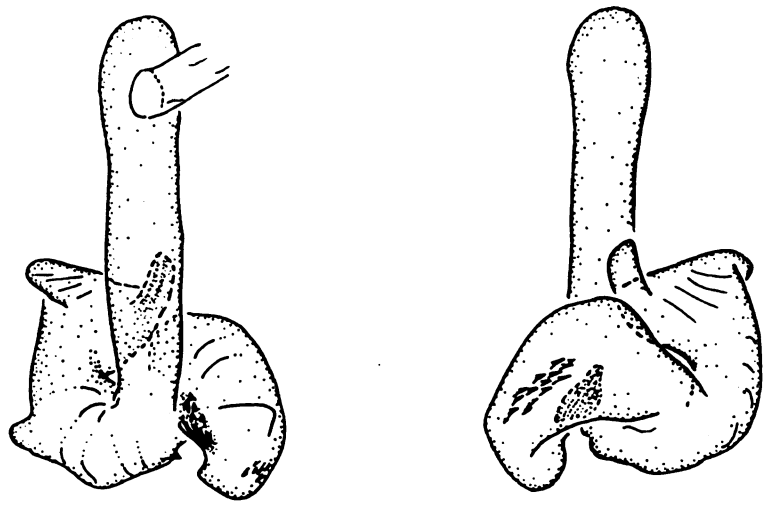
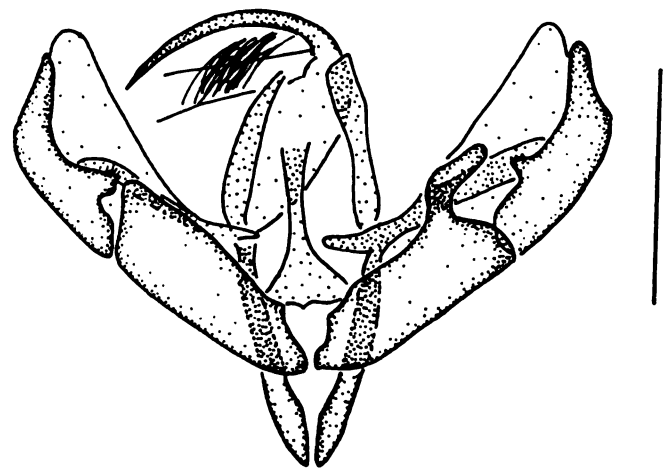


Figure 23. Genitalia of *Spragueia trichostrota*. Male, a-c (Santa Cruz, Bolivia); a) aedeagus with vesica everted, dorsal; b) ventral; c) valves. Female, d-f (Minas Geraes, Brazil): d) 7th abdominal sternite; e) ostium, ductus and corpus bursae, ventral. Measure = 1.0 mm.



a b



c

Figure 24. Genitalia of *Spragueia stehri*, male (La Vega Prov., Dominican Republic): a) aedeagus with vesica everted, dorsal; b) ventral; c) valves. Measure = 1.0 mm.

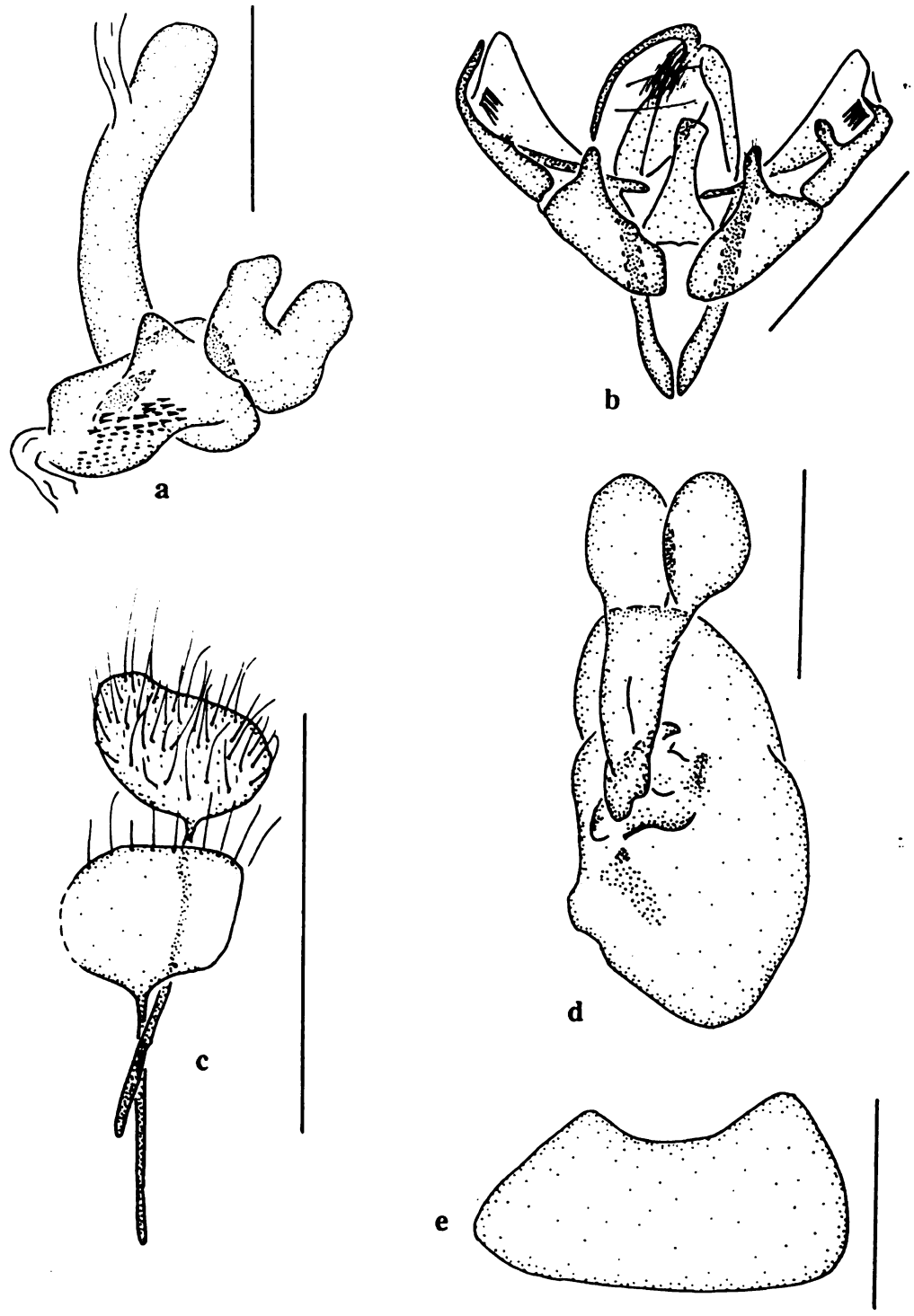


Figure 25. Genitalia of *Spragueia pantherula*. Male and female (Santiago, Cuba): a) aedeagus with vesica everted, ventral; b) valves, c) ovipositor and 8th abdominal segment, right lateral; d) ostium, ductus and corpus bursae, ventral; e) 7th abdominal sternite. Measure = 1.0 mm.

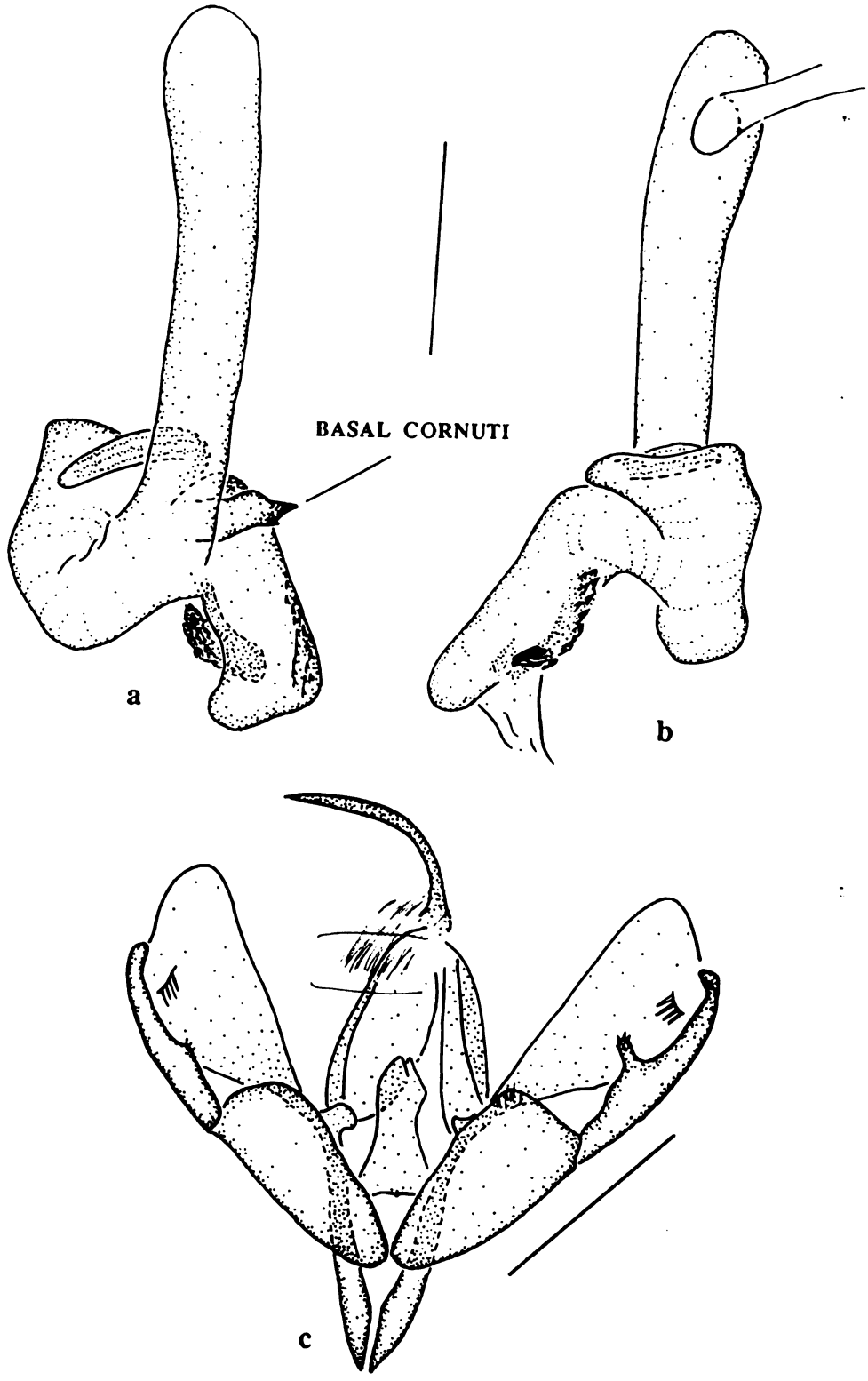


Figure 26. Genitalia of *Spragueia marmorea*, male (T.F. Amazonas, Venezuela): a) aedeagus with vesica everted, dorsal; b) ventral; c) valves. Measure = 1.0 mm.

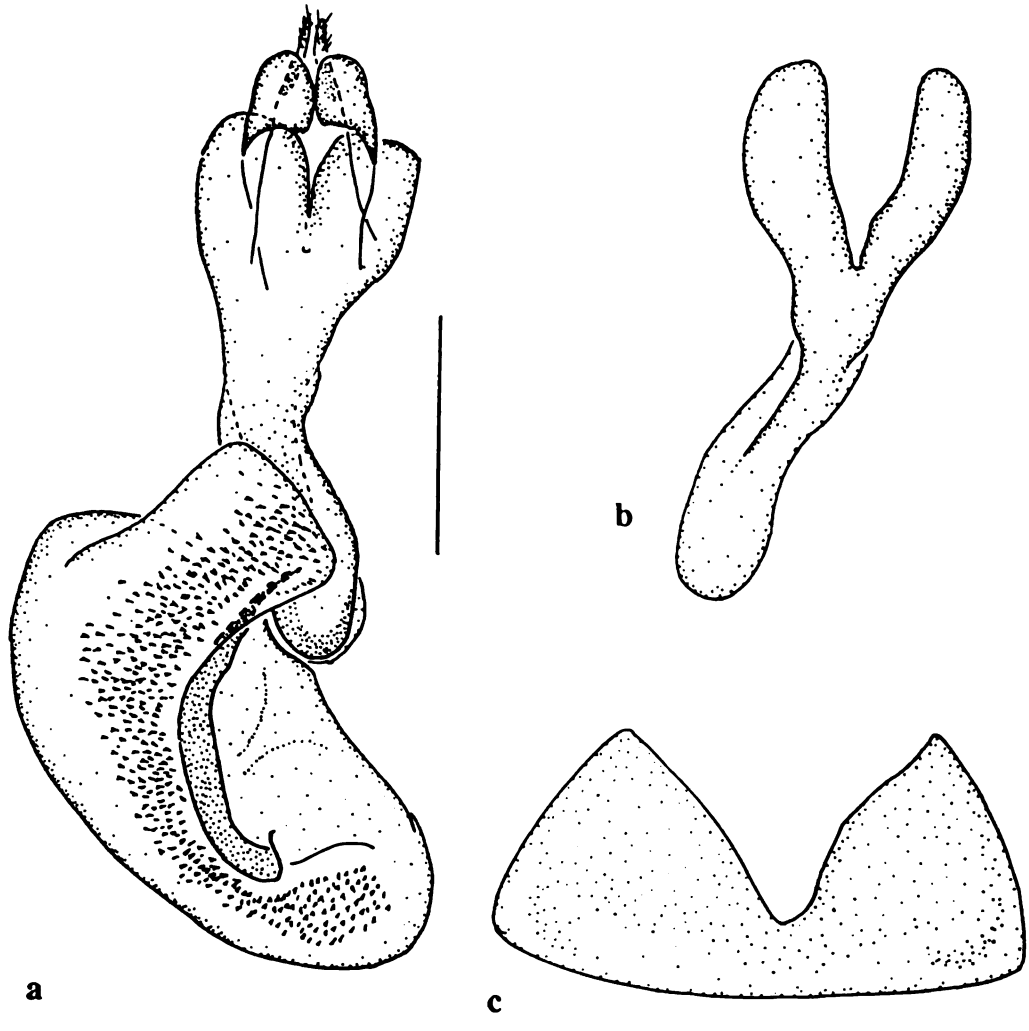


Figure 27. Genitalia of *Spragueia marmorea*, female (T.F. Amazonas, Venezuela): a) ostium, ductus and corpus bursae, dorsal; b) ostium and ductus bursae, ventral; c) 7th abdominal sternite. Measure 1.0 mm.

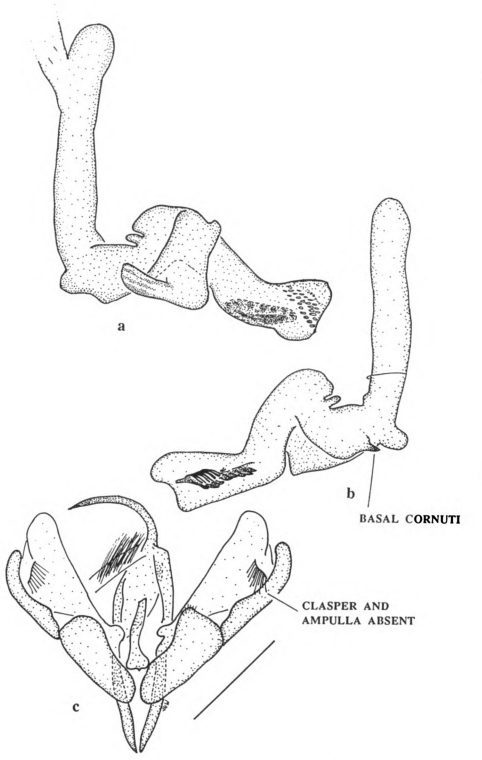


Figure 28. Genitalia of *Spragueia lepus*, male (Moengo Boven, Surinam): a) aedeagus with vesica everted, left lateral; b) right lateral; c) valves. Measure = 1.0 mm.

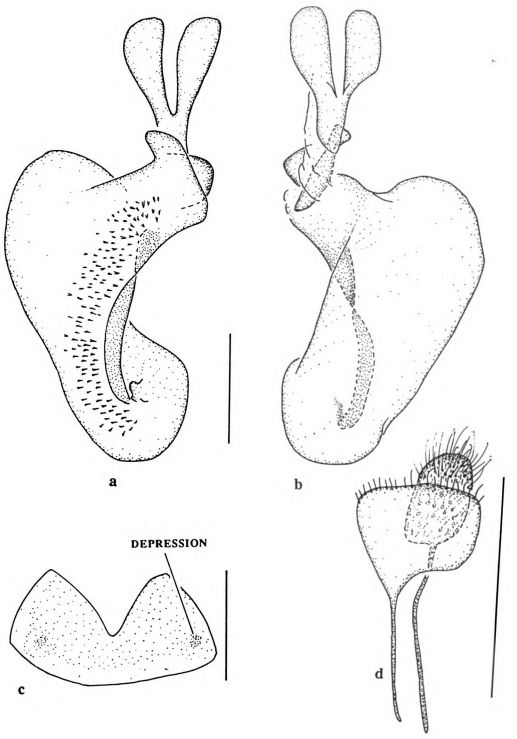


Figure 29. Genitalia of *Spragueia lepus*, female (Caparo, Trinidad): a) ostium, ductus and corpus bursae, dorsal; b) ventral; c) 7th abdominal sternite; d) ovipositor and 8th abdominal segment, left lateral. Measure = 1.0 mm.

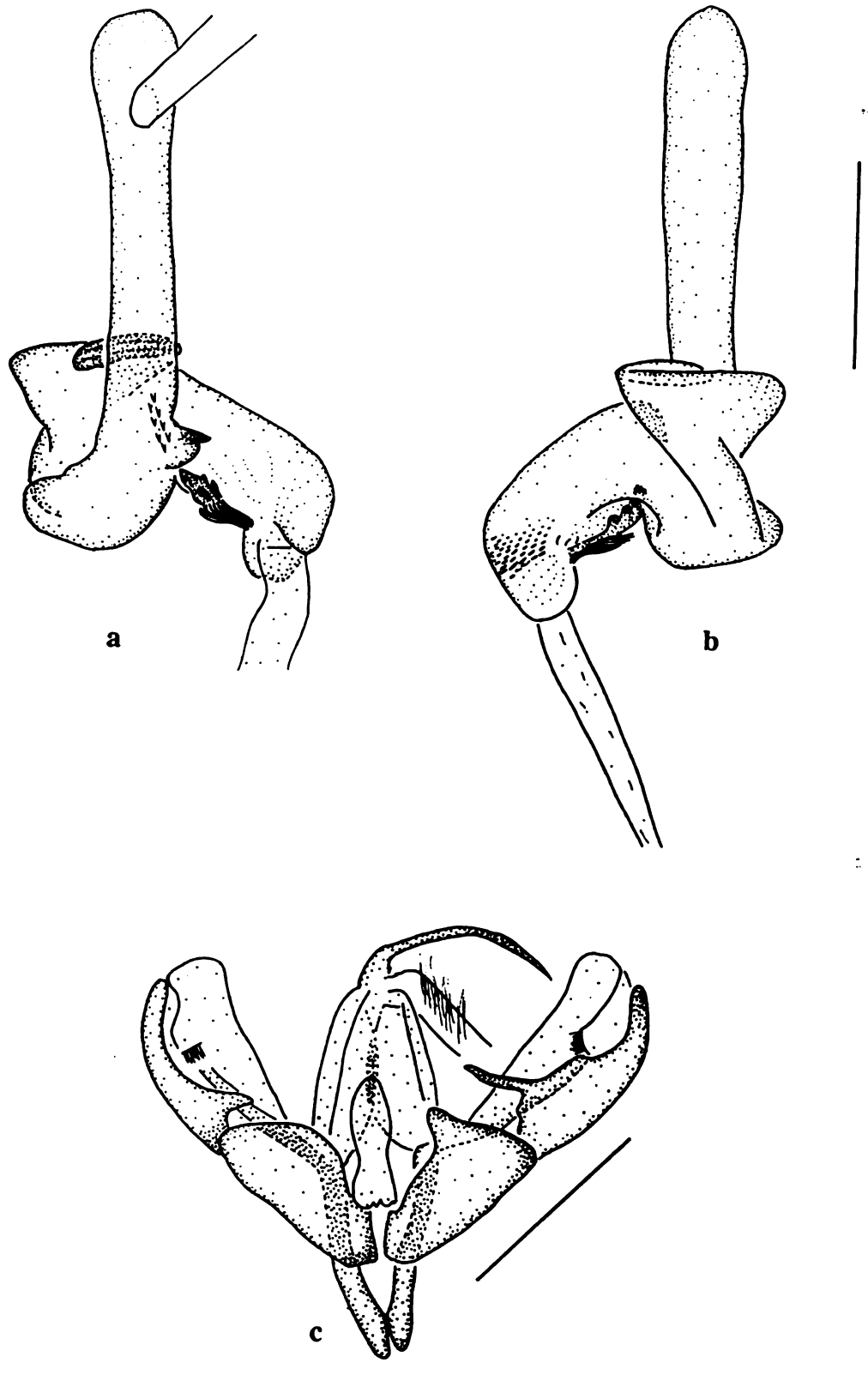


Figure 30. Genitalia of *Spragueia llanosa*, male (Guarico, Venezuela): a) aedeagus with vesica everted, dorsal; b) IBID ventral; c) valves. Measure = 1.0 mm.

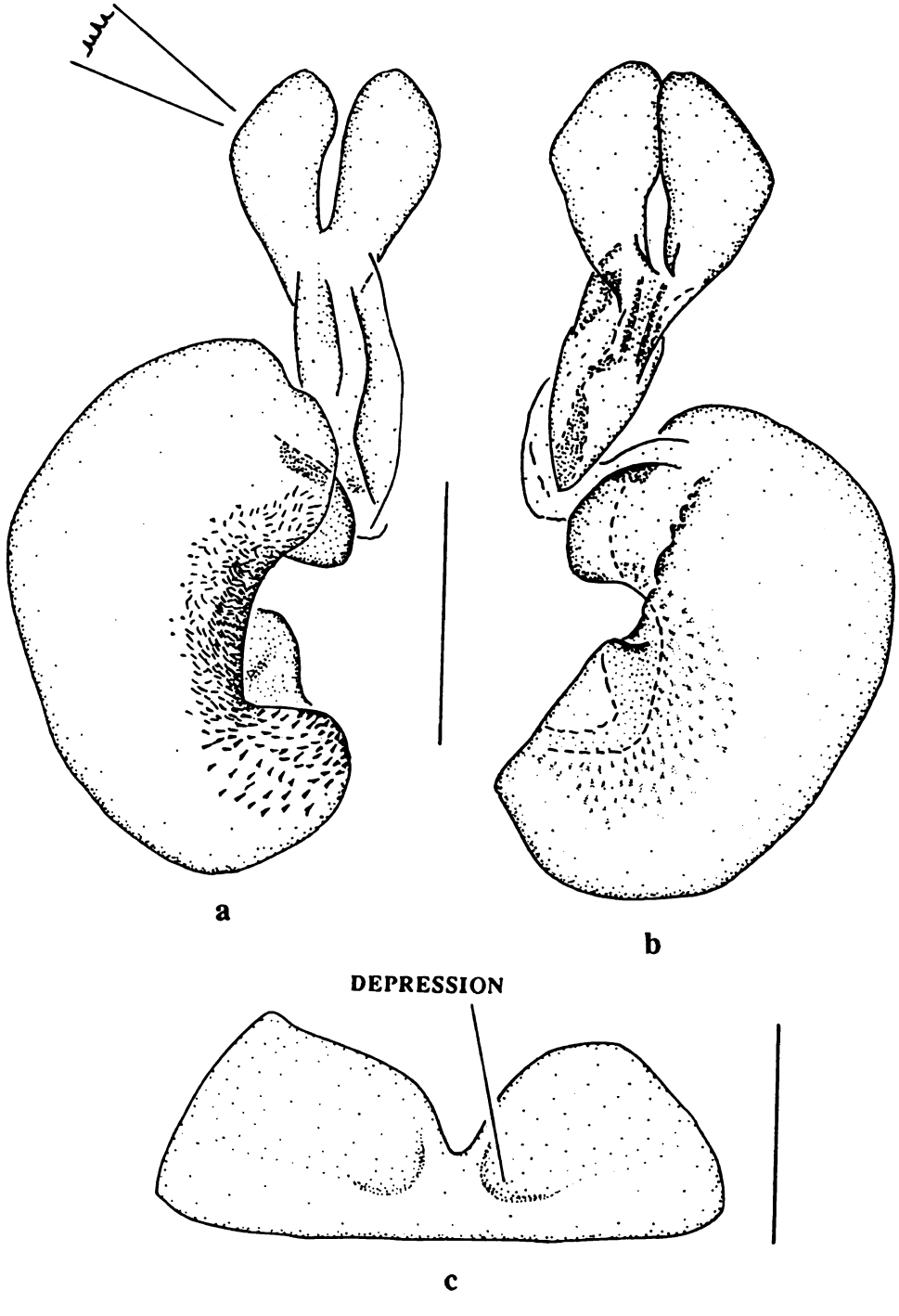


Figure 31. Genitalia of *Spragueia llanosa*, female (Guarico, Venezuela): a) ostium, ductus and corpus bursae, dorsal; b) ventral; c) 7th abdominal sternite. Measure = 1.0 mm.

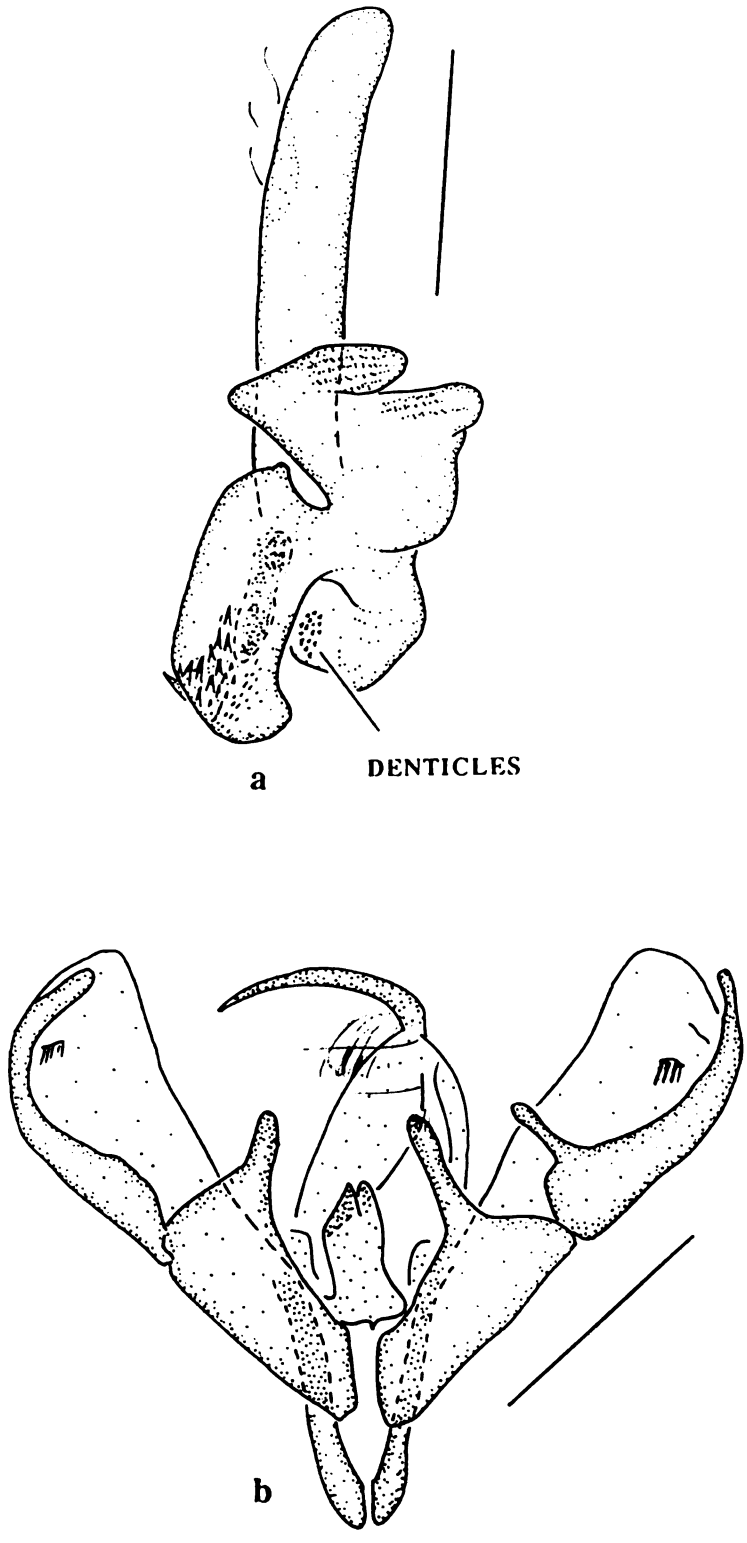


Figure 32. Genitalia of *Spragueia olmeca*, male (Jalisco, Mexico): a) aedeagus with vesica everted, ventral; b) valves. Measure = 1.0 mm.

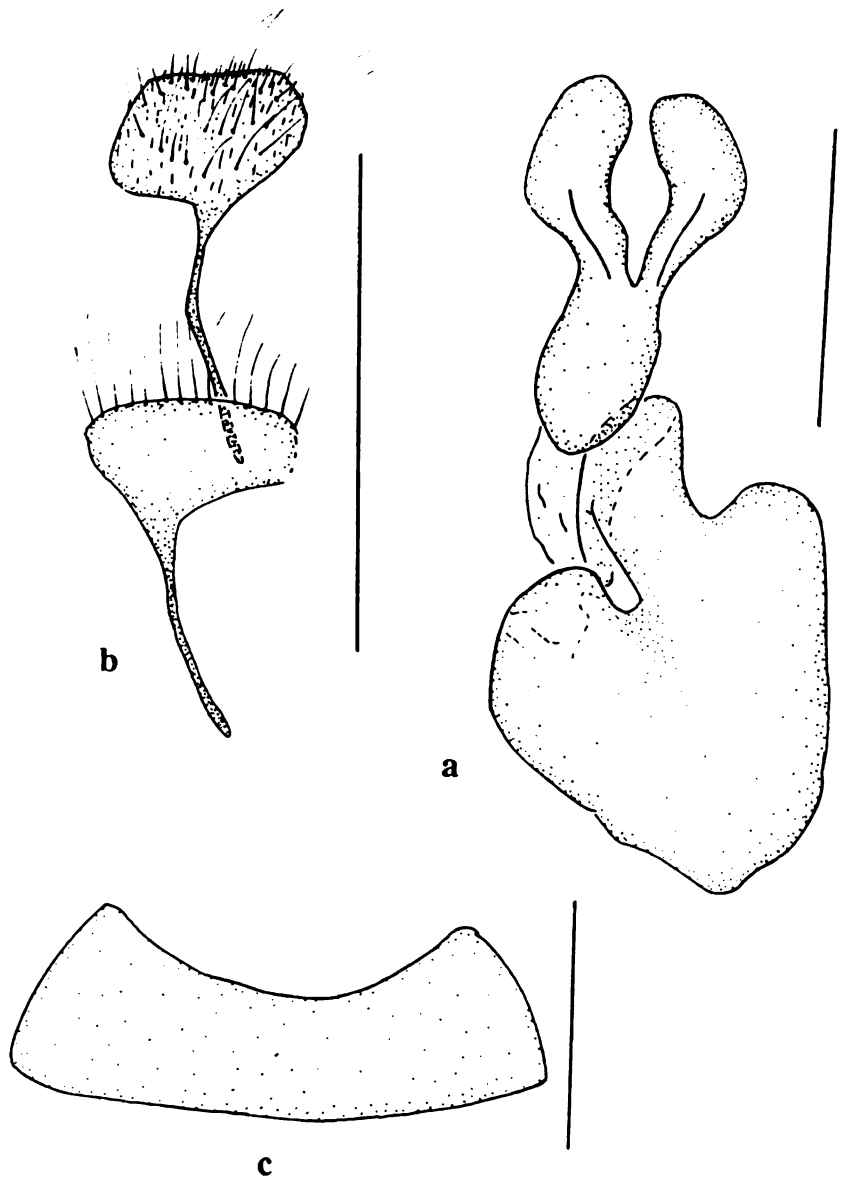


Figure 33. Genitalia of *Spragueia rawlinsi*, female (Oaxaca, Mexico): a) ostium, ductus and corpus bursae, ventral; b) 8th abdominal segment and ovipositor, left lateral; c) 7th abdominal segment. Measure = 1.0 mm.

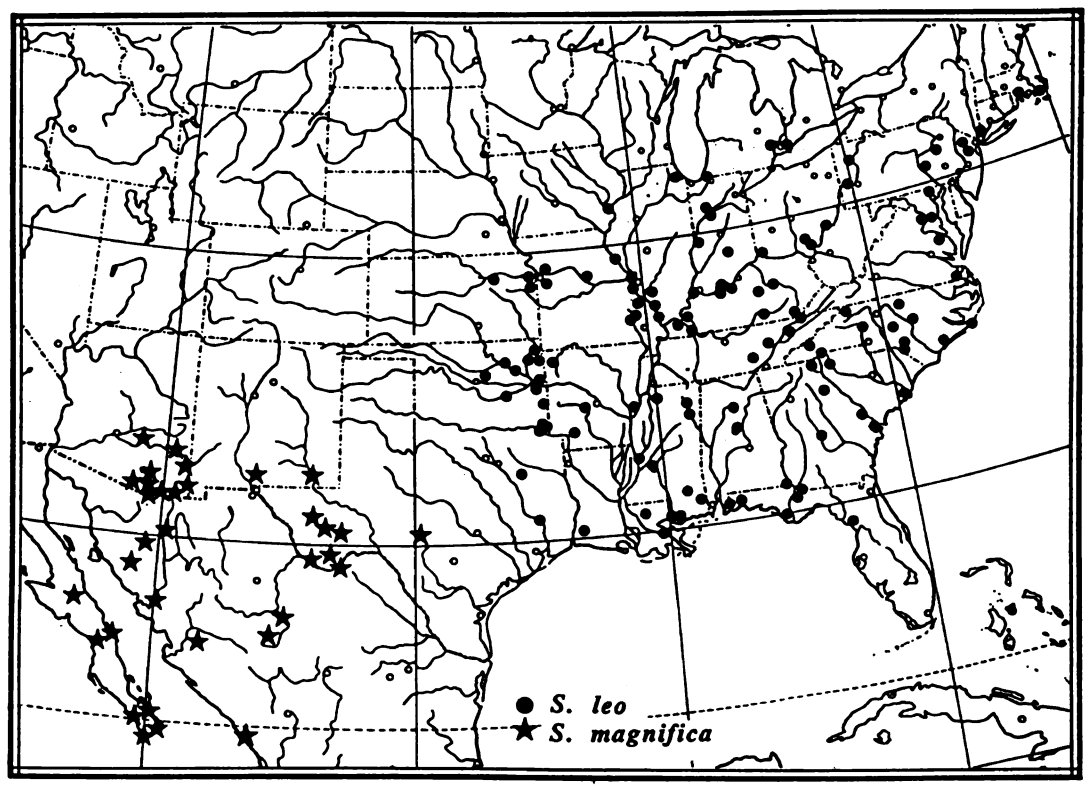


Figure 34. Distribution of *Spragueia leo* and *S. magnifica*.

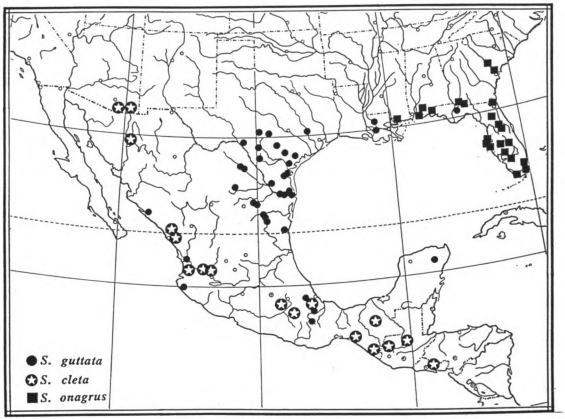


Figure 35. Distribution of *Spragueia guttata*, *S. cleta*, and *S. onagrus*.

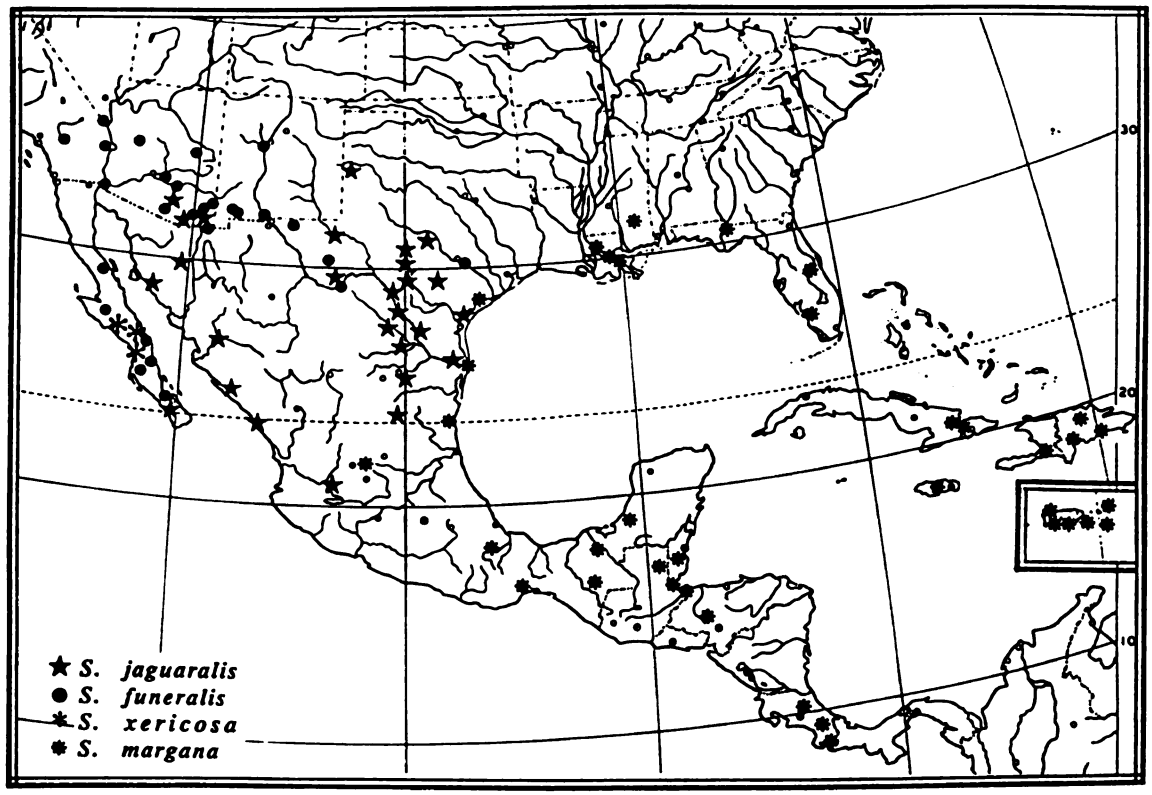


Figure 36. Distribution of *Spragueia jaguaralis*, *S. funeralis*, *S. xericosa*, *S. margana*. Inset Puerto Rico (also see fig. 42, *margana*).

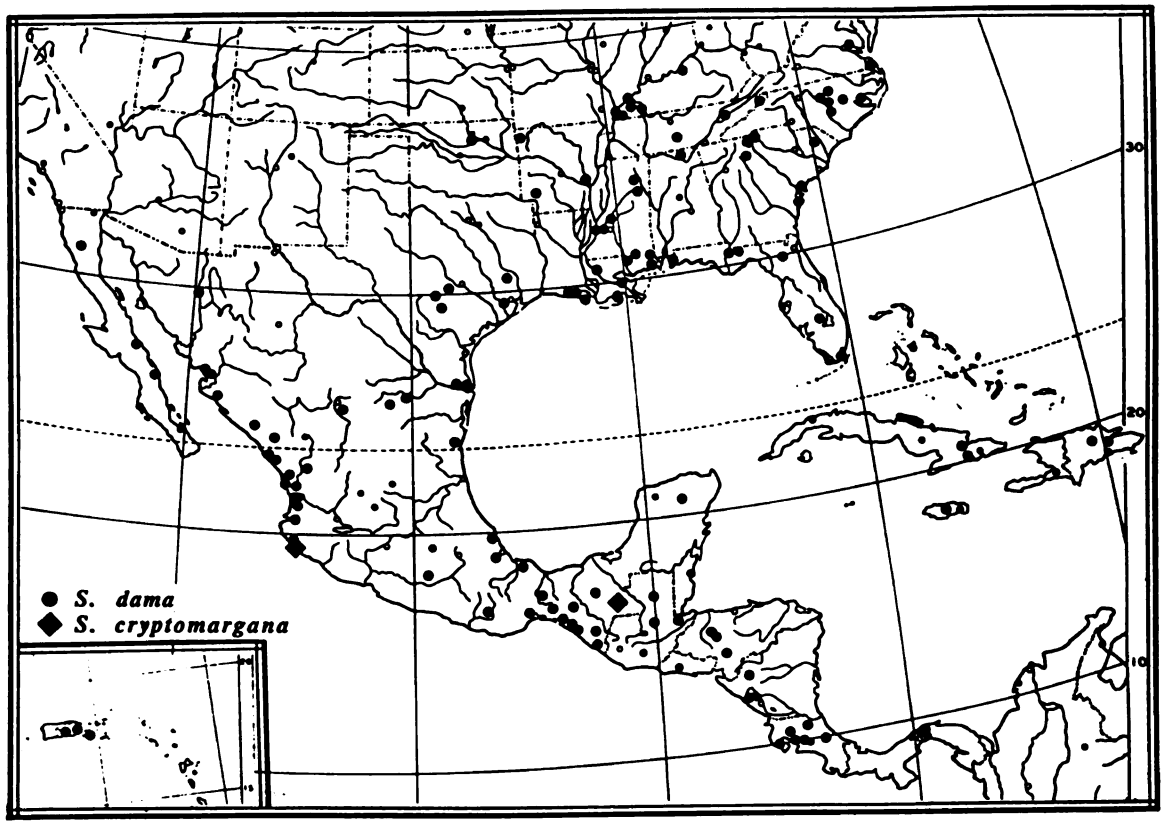


Figure 37. Distribution of *Sprageia dama* and *S. cryptomargana* (also see fig. 42, *dama*).

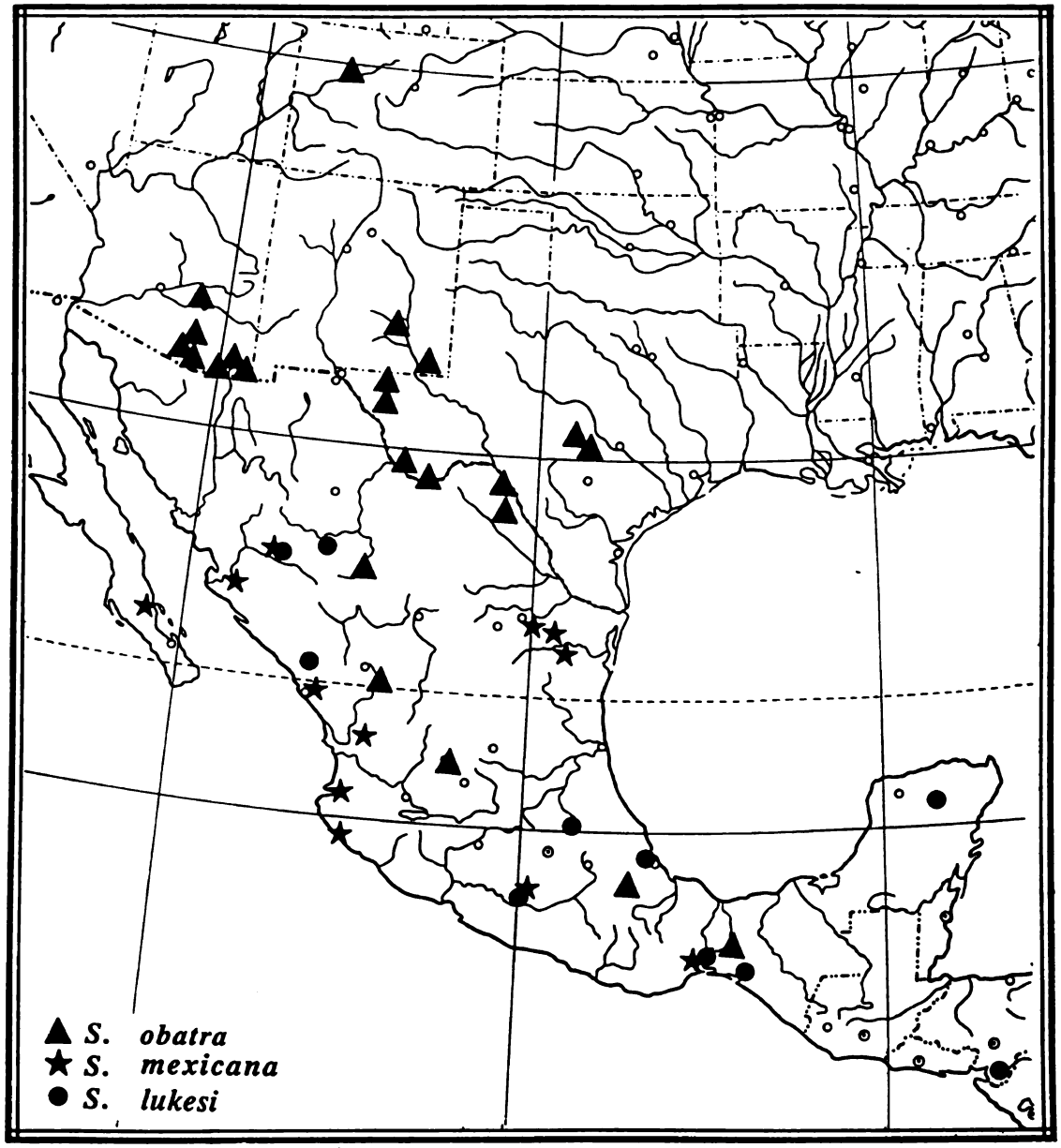


Figure 38. Distribution of *Spragueia obatra*, *S. lukesi* and *S. mexicana*.

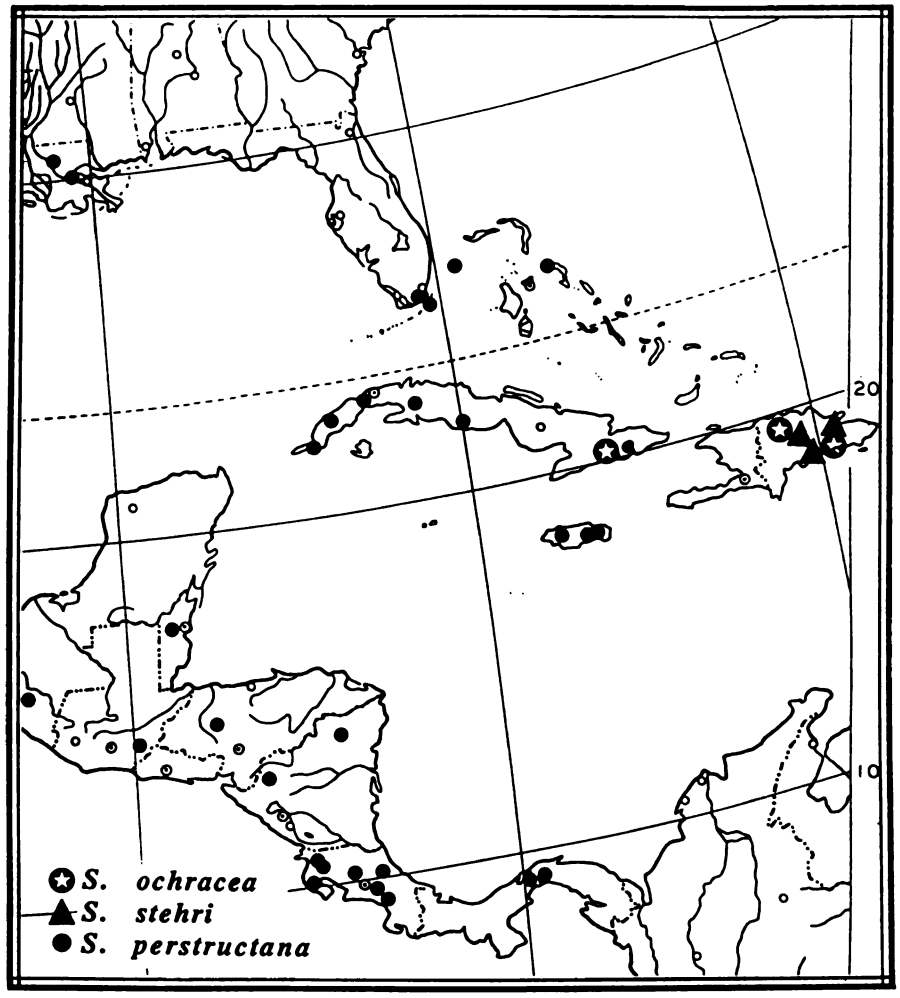


Figure 39. Distribution of *Spragueia ochracea*, *S. stehri* and *S. perstructana* (also see fig. 42, perstructana).

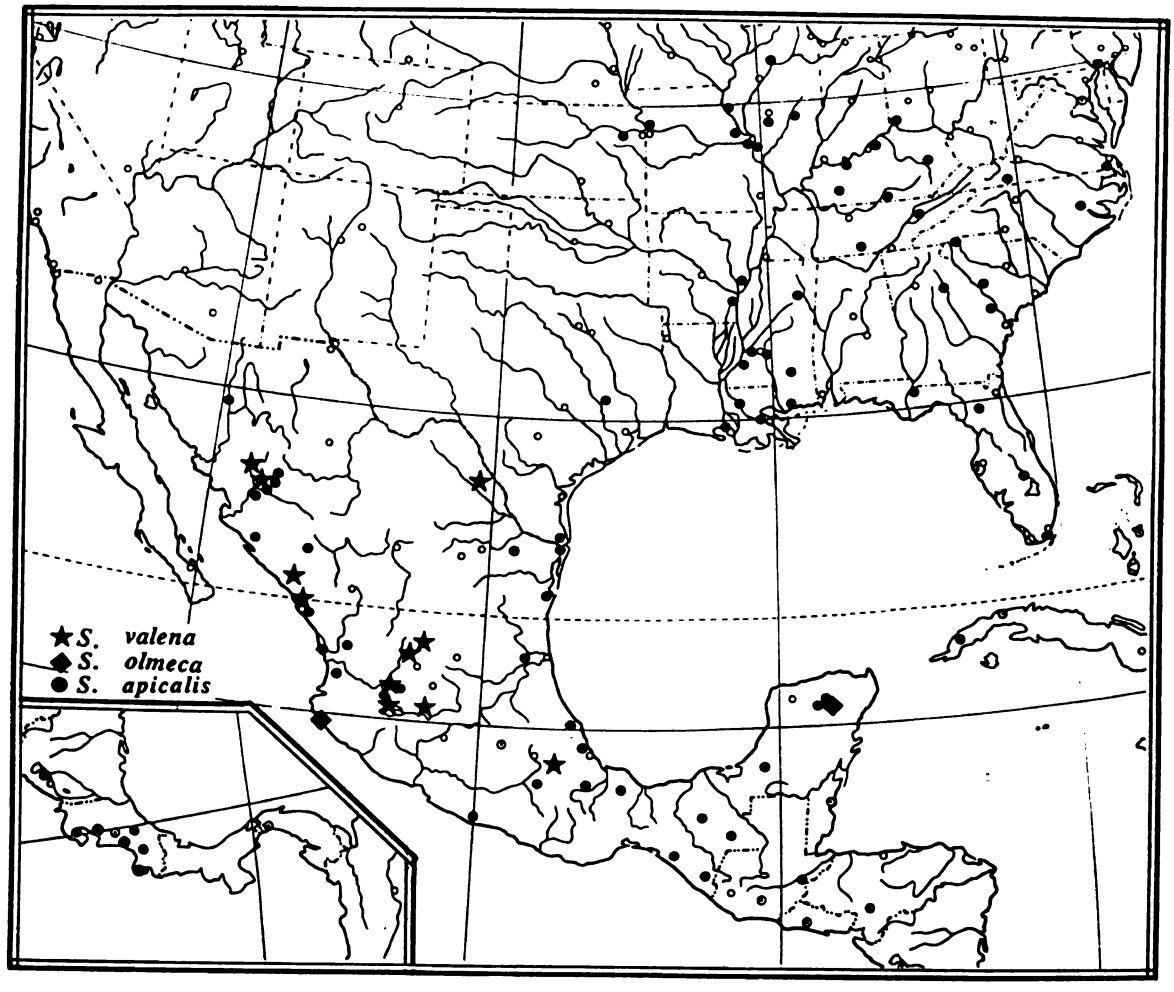


Figure 40. Distribution of *Spragueia olmeca*, *S. apicalis* and *S. valena*.

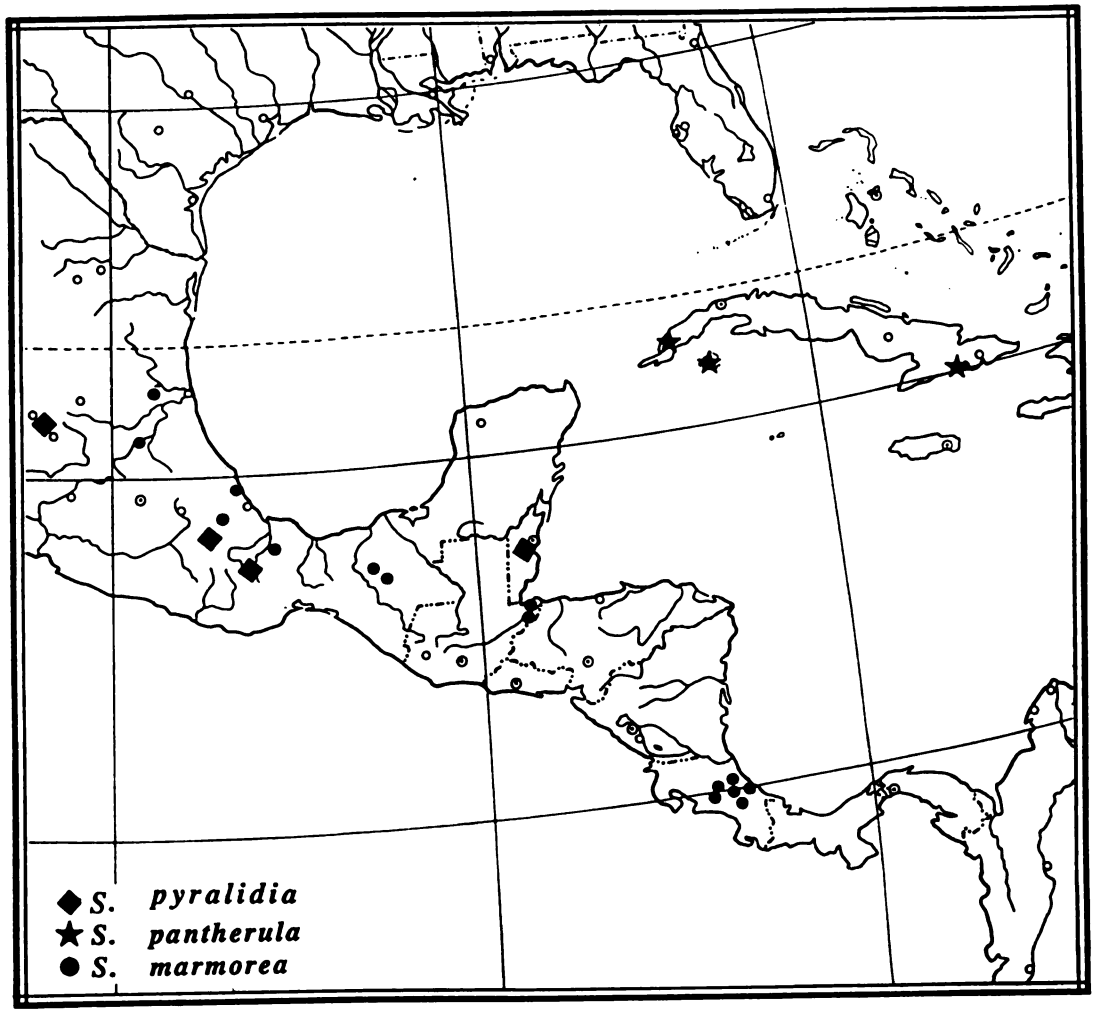


Figure 41. Distribution of *Spragueia pantherula, S. pyralidia* and *S. marmorea* (also see fig.43, *marmorea*).

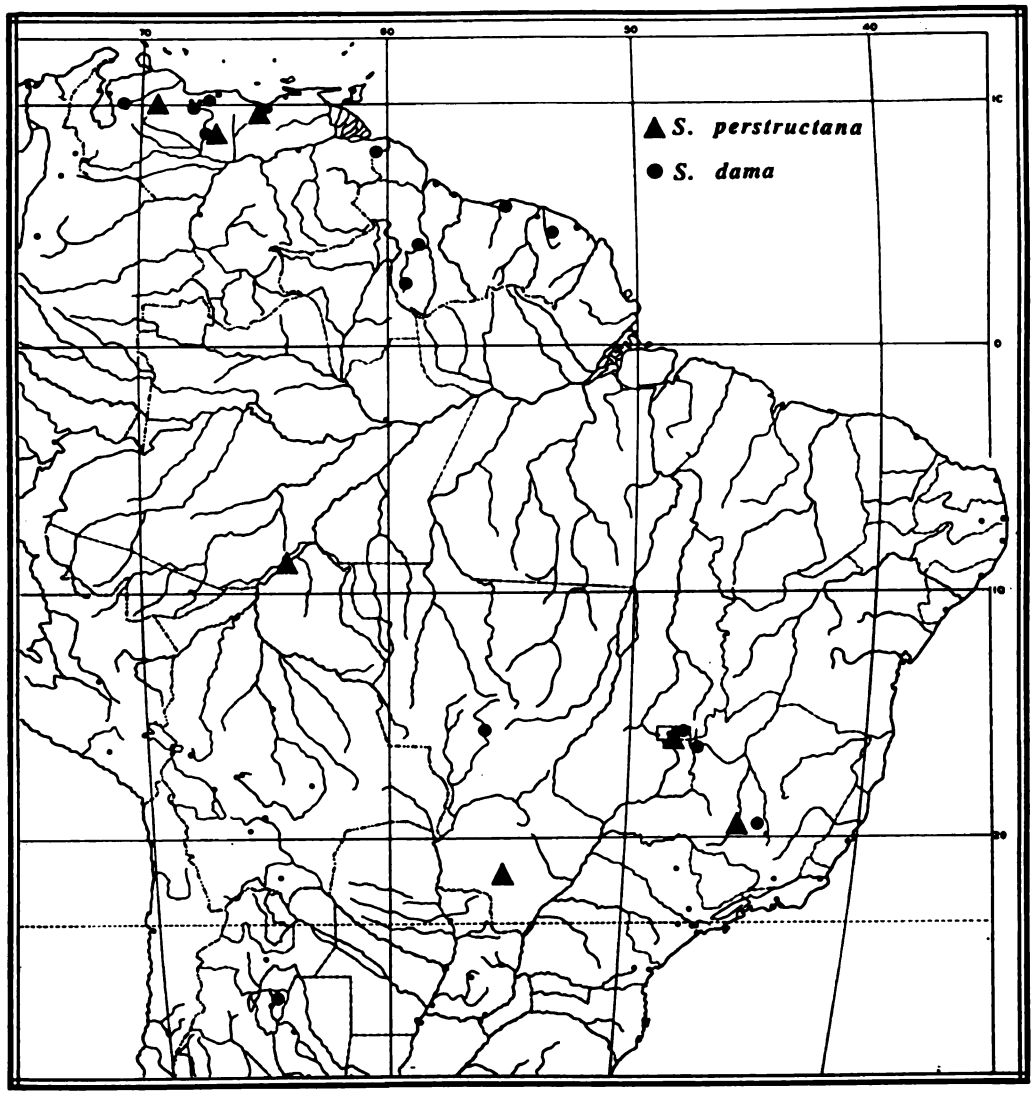


Figure 42. Distribution of *Spragueia perstructana* and *S. dama* (also see figures 37, *dama*, and 39, *perstructana*.)

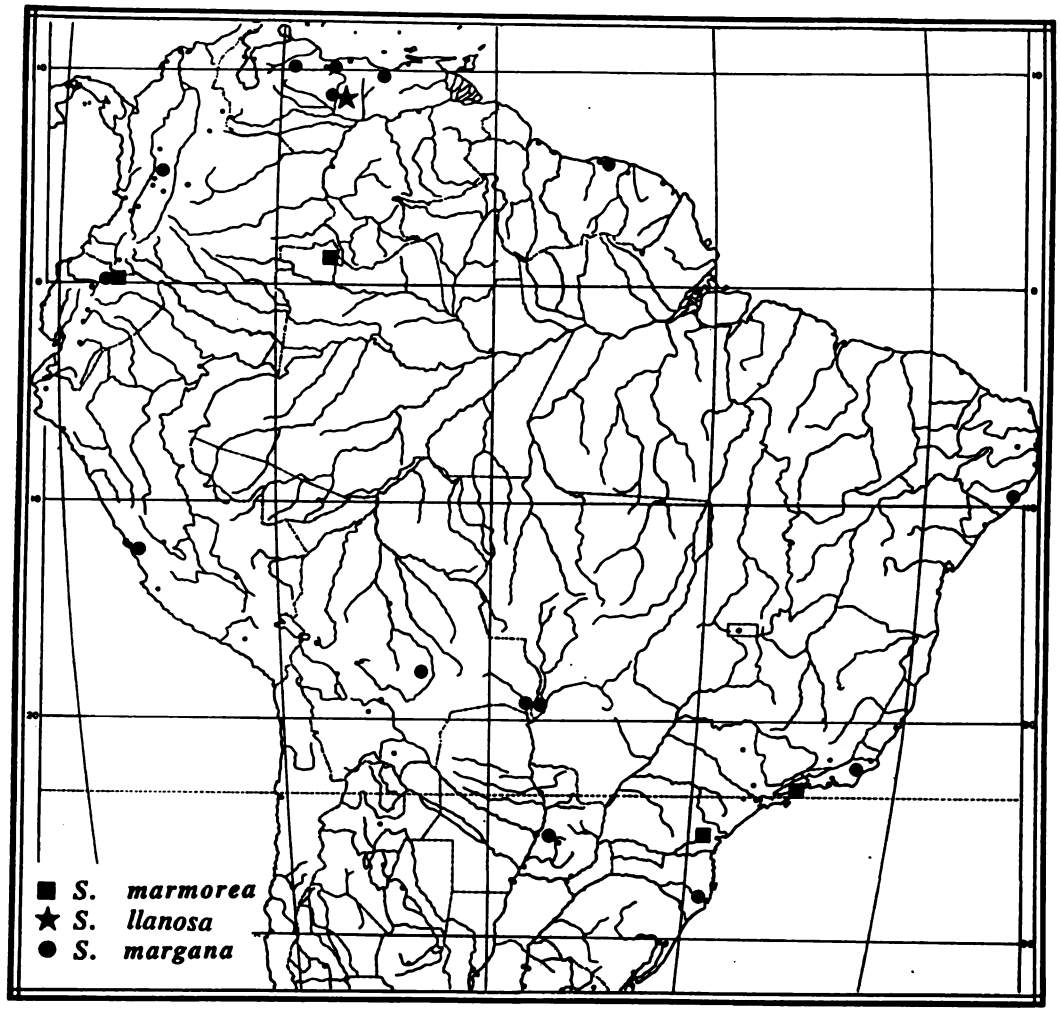


Figure 43. Distribution of *Spragueia marmorea*, *S llanosa*, and *S. margana* (also see figures 36, *margana*, and 41 *marmorea*).

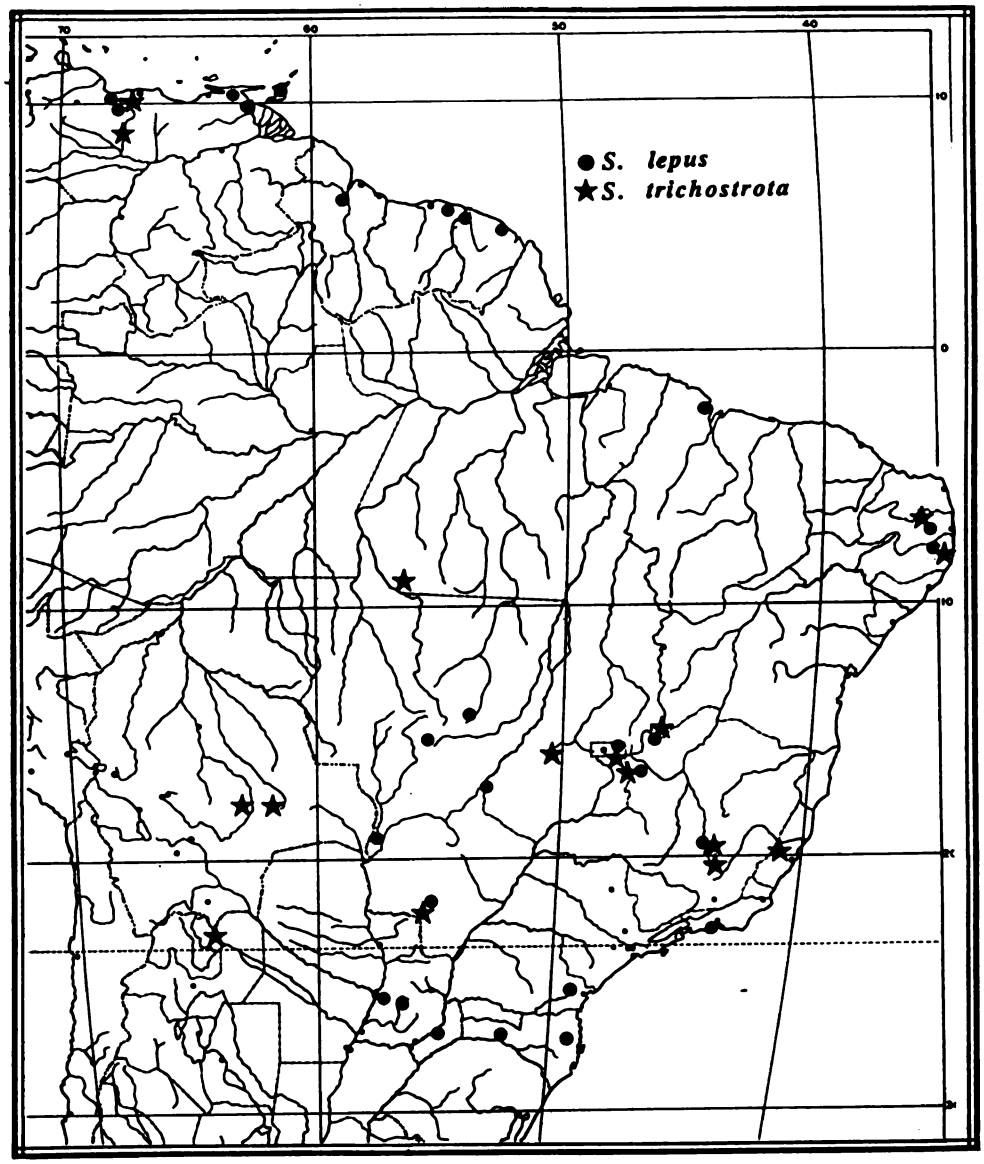


Figure 44. Distribution of *Spragueia lepus* and *S. trichostrota.*

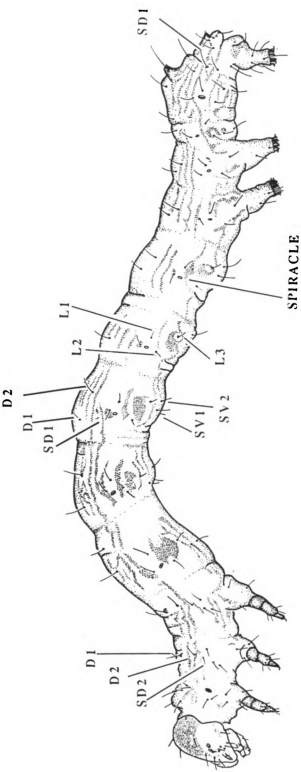


Figure 45. Last instar larvae of Sprageueia onagrus, Florida, Alachua Co., D. H. Habeck, USNM.

Figure 46. *Spragueia leo*, male, New Jersey, Lakehurst, AMNH.
Figure 47. *Spragueia leo*, female, Missouri, Clay Co., AMNH.
Figure 48. *Spragueia onagrus*, male, Florida, Alachua Co., NYSM.
Figure 49. *Spragueia onagrus*, female, Florida, Alachua Co., NYSM
Figure 50. *Spragueia guttata*, male, Texas, San Patricio Co., MEM.
Figure 51. *Spragueia guttata*, female, Texas, San Patricio Co., MEM.
Figure 52. *Spragueia cleta*, male, Arizona, Santa Cruz Co., LACM.
Figure 53. *Spragueia cleta*, female, Mexico, Chiapas, CMNH.
Figure 54. *Spragueia magnifica*, male, Arizona, Cochise Co., NYSM.
Figure 55. *Spragueia magnifica*, male, Arizona, Cochise Co, NYSM.
Figure 56. *Spragueia jaguaralis*, male, Arizona, Cochise Co., NYSM.
Figure 57. *Spragueia jaguaralis*, male, New Mexico, White City, CNC.
Figure 58. *Spragueia jaguaralis*, female, Texas, Bexar Co., UK.
Figure 59. *Spragueia funeralis*, male, Arizona, Santa Cruz Co., UCDC.
Figure 60. *Spragueia funeralis*, female, Arizona, Cochise Co., NYSM.
Figure 61. *Spragueia xericosa*, male, Holotype, Mexico, Baja California Sur, LACM.
Figure 62. *Spragueia xericosa*, female, Allotype, same data as figure 61, LACM.
Figure 63. *Spragueia obatra*, male, Mexico, Chihuahua, UCDC.
Figure 64. *Spragueia obatra*, female, Mexico, Chihuahua, UCDC.
Figure 65. *Spragueia dama*, male, Guatemala, Chejel, CMNH.
Figure 66. *Spragueia dama*, female, Mississippi, Oktibbeha, Co., MEM.
Figure 67. *Spragueia dama*, male, Venezuela, Guarico, USNM.
Figure 68. *Spragueia dama*, female, Brazil, Mata Grosso, Unai, VOB.
Figure 69. *Spragueia valena*, male, Mexico, Jalisco, NHSD.
Figure 70. *Spragueia valena*, female, Mexico, Jalisco, USNM.
Figure 71. *Spragueia pyralidia*, male, Mexico, Tehnuacan [sic], USNM.
Figure 72. *Spragueia margana*, male, Texas, Brownsville, AMNH.
Figure 73. *Spragueia margana*, male, Bolivia, Santa Cruz, CMNH.
Figure 74. *Spragueia margana*, female, Bolivia, Santa Cruz, CMNH.
Figure 75. *Spragueia margana*, female, Bolivia, Santa Cruz, CMNH.
Figure 76. *Spragueia cryptomargana*, male, Mexico, Jalisco, UCB.
Figure 77. *Spragueia cryptomargana*, female, Mexico, Chiapas, CMNH.


46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77

Figure 78. *Spragueia perstructana*, male, Louisiana, St. John Parish, LSU.
Figure 79. *Spragueia perstructana*, male, Cuba, Santiago, USNM.
Figure 80. *Spragueia perstructana*, male, Venezuela, Guarico, USNM.
Figure 81. *Spragueia perstructana*, female, Louisiana, St. John Parish, LSU.
Figure 82. *Spragueia perstructana*, female, Florida, Alachua Co., SMNY.
Figure 83. *Spragueia ochracea*, male, Dominican Republic, Azua, CMNH.
Figure 84. *Spragueia ochracea*, female, Dominican Republic, Azua, CMNH.
Figure 85. *Spragueia lukesi*, male, Mexico, Puebla, CMNH.
Figure 86. *Spragueia lukesi*, male, Mexico, Puebla, CMNH.
Figure 87. *Spragueia lukesi*, female, Mexico, Puebla, CMNH.
Figure 88. *Spragueia mexicana*, male, Mexico, Nayarit, NHSD.
Figure 89. *Spragueia mexicana* female, Mexico, Guerrero, CNC.
Figure 90. *Spragueia apicalis*, male, Mississsippi, Oktibbeha Co., MEM.
Figure 91. *Spragueia apicalis*, female, Mississippi, Oktibbeha Co., MEM.
Figure 92. *Spragueia trichostrota*, male, Venezuela, Aragua, USNM.
Figure 93. *Spragueia trichostrota*, female, Venezuela, Aragua, USNM.
Figure 94. *Spragueia stehri*, male, Dominican Republic, La Vega Prov., CMNH.
Figure 95. *Spragueia pantherula*, male, Cuba, Santiago, USNM.
Figure 96. *Spragueia pantherula*, female, Los Indies [Cuba], CMNH.
Figure 97. *Spragueia marmorea*, male, Venezuela, Amazonas, USNM.
Figure 98. *Spragueia marmorea*, female, Venezuela, Amazonas, USNM.
Figure 99. *Spragueia marmorea*, male, Brazil, Parana, VOB.
Figure 100. *Spragueia lepus*, male, Trinidad, Caparo, USNM.
Figure 101. *Spragueia lepus*, female, Trinidad, Caparo, USNM.
Figure 102. *Spragueia llanosa*, male, Venezuela, Guarico, USNM.
Figure 103. *Spragueia llanosa*, female, Venezuela, Guarico, USNM.
Figure 104. *Spragueia olmeca*, male, Mexico, Yucatan, CMNH.
Figure 105. *Spragueia rawlinsi*, female, Mexico, Puebla, CMNH.


78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105

CLADISTIC ANALYSIS

Cladistic analysis was performed on the genus *Spragueia* in order to test the generic limits of the group, and to study hypotheses of character evolution using PAUP (Swofford, 1990). What follows is a description of the characters used; plesiomorphic characters are coded (0) and apomorphic characters are (1). Some of the characters used in the analysis are uninformative at this level of analysis; I have included these since they are likely to be informative at the supraspecific level and should be tested in a more detailed analysis of the tribe. Analytical procedures, character analysis, and a discussion of the perferred cladogram follows a description of the characters used.

Wings:

1 Accessory cell of forewing present (0) (Figure 1b) or absent (Figure 1a). The loss of the accessory cell is common and widespread in the Noctuidae, particularly in smaller taxa, and appears to be the derived state in the Acontiini. I treat its loss as the apomorphic state. This character is polymorphic in *S. valena*, *xericosa*, and *guttata*. In these taxa the character is coded to the plesiomorphic state.

2 Forewing markings without (0) (Figures 48, 49) or with distinct sexual dimorphism (1) (Figures 76, 77). Sexual dimorphism in the Acontiini is widespread, but rare to the extreme extent seen in some species groups of *Spragueia* (*margana* and *apicalis*

Figures 72- 96). Many species (*guttata*) frequently show a slight degree of dimorphism, but it is not markedly obvious and is scored as absent.

3 Base of hindwing in male ochreous to light gray coloration (0) (Figure 46, 53, 71, 95); base dark gray to black (1) (Figure 76, 88). Dark hindwings in the Acontiini are widespread and rare and appear to be the derived state.

4 Reniform spot on the forewing of the male distinct (0) (Figures 52, 69, 85); reniform spot not distinctly marked (1) (Figure 97). The presence of the reniform spot in the Noctuidae is the widespread, plesiomorphic state for this character.

5 Base of forewing with a distinct transverse band running from costal margin near base of wing to the posterior margin (1) (Figures 1a, 60, 64, 91); forewing not so marked (0) (Figure 48). The polarity of the character is uncertain.

Thorax:

6 Metathorax with scales developed into a prominent tuft (1); scales adpressed to thorax (0). Crests of scales on the thorax and abdomen are common in the Acontiinae *sensu latu*, but modification of the metathorax in the Acontiini is rare. Tufts of scales and other modifications are common in the Noctuidae and

probably evolved a number of times. I treat the development of the metathoracic tuft as the derived condition.

7 Scales of pectus (lateral thorax) ochreous to off-white (0); scales suffused with shiny leaden gray coloration (1). I have not observed leaden gray suffusion in any other genera in the Acontiini, therefore I treat it as derived.

Valves

8 Tegumen of the male genitalia symmetric (0) (Figure 15b); tegumen distinctly assymmetric, left side nearly twice the width of the right side (1) (Figure 3b). Asymmetry in the male genitalia is uncommon, but widespread in the Acontiini, the majority of genera, however, appear to lack an asymmetric tegumen, therefore I treat this state as the derived condition.

9 Features of the valves, exclusive of tegumen, symmetric (0), or asymmetric (1). Asymmetry is widespread in the Acontiini, and where it occurs it usually is only weakly asymmetric as in *S. lepus* (Figure 28c). Most general have relatively simple valves that are usually symmetric; therefore I treat asymmetry as the derived state.

10 Right ampulla present (1) (Figure 3b) or absent (0) (Figure 28c). See above discussion.

11 Clasper on right valve present (0) (Figure 3b) or absent (1)(Figure 16c). The presence of a clasper is widespread in the trifid noctuids and in the Acontiini; loss of this character appears to be derived (Lafontaine and Poole 1991). The *dama* and *leo* groups are the only *Spragueia* to have a clasper, and in these groups it is partially reduced and found only on the right valve.

12 Sacculus on right valve with extension (1) (Figure 3b); sacculus without swelling or extension (0) (Figure 16c). The sacculus maybe variously modified into broad or tapered processes. In *Acontia areli*, the saccular extention is tapered at its distal end giving it the appearance of a clasper. Extensions and elaborate modifications of the sacculus are common in the Noctuidae; the absence of these features appears to be the primitive state.

13 Right sacculus of valve reaching reaching beyond costa (1) (Figure 7c); right sacculus not reaching beyond costa (0) (Figure 5c).

14 Left saccular extension absent (0), or present (1) (see character 13 for discussion).

15 Corona present (0) (Figure 3b) or reduced to absent (1) (Figure 26c). The corona is usually present in the trifid noctuids but is often secondarily lost (Lafontaine and Poole 1991).

16 Corona, when present, uniordinal (0) (Figure 3b) or biordinal (1) Figure 16c). The biordinal corona seen in the *margana* group is unique in *Spragueia* and probably rare or absent in the Acontiini, therefore I treat the biordinal condition as the derived state.

17 Anal tube naked (0) or covered with hair masses (1) (Figure 3b). Probably autapomorphic for the Acontiini, the character should be tested in a rigorous analysis of the group.

18 Left lobe of the aedeagus with two prominent diverticula (0) (Figure 2a); left lobe with three to five diverticula (Figures 16a, 18a, 19a). The left lobe in the Acontiini is the membranous lobe from which the primary gonopore does not emerge. It is usually membranous with two or fewer prominent diverticula, often with singular long cornuti. In the *margana* group the there are always more than two, and in some taxa as many as five, diverticula.

19 Posterior aedeagus with one or more groups of small spines present (0) (Figures 3a, 16a). Posterior aedeagus with a left lateral circular sclerotized patch ringed with small spines (1) (Figure 10a). Spining on the posterior aedeagus is common and widepread in the Acontiini; the sclerotized patch of the aedeagus described above has not been observed outside of the *dama* group.

20 Laminate cornuti absent (0) or present (1) (Figure 2a-b). I hypothesize that the laminate cornuti is derived from the reduction of a vesica with numerous collections or cornuti; the reduction probably results from their condensation bringing them into close proximity. This character is present, but widespread in many genera (*Tarachidia* and *Acontia*). Its significance in the Acontiini must further be investigated.

21 Laminate cornuti with a basal collection of hair-like sclerotized filaments present (1) (Figure 2b) or absent (0). This appears to be autapomorphic for *Spragueia*.

22 Right lobe of vesica (see Acontiini discussion pg) with variable series of shagreened plates and adpressed cornuti in linear series and rows (1) (Figure 5a); no such modifications present (0). As discussed in the introduction, this character is probably apomorphic in the Acontiini, but further testing is required.

23 Seventh abdominal sternite with distinct depressions ventrally to near pleurite (1) (Figure 22e), and absent (0). This character is unique to the *apicalis* group and perhaps the Acontiini.

24 Length of ductus bursae less than or equal to the maximum width of the ostium bursae (0); length of bursae greater than maximum width of ostium bursae (1). The length of the ductus bursae is correlated with the length of the shaft of the aedeagus.

Most female Acontiini appear to have a short ductus but this character needs further analysis.

25 Lobes of ostium bursae symmetric (0) (Figure 4a); lobes asymmetric (1) (Figure 6f). The derived condition is autapomorphic for *S. guttata.*

26 Posterior margin of ostium bursae with small teeth-like projections (1) (Figure 31a); ostium without such modifications (0). The presence of teeth-like ridges on the ostium is autapomorphic for *S. llanosa.*

Analytical procedures:

Methods of Phylogenetic analysis:

The character states coded for taxa in the analysis can be found in Table 1. Not all *Spragueia* taxa were used in the analysis; S. *stehri*, *pyralidia*, *olmeca*, and *rawlinsi* were excluded due to rarity and/or the absense of one of the sexes. *Acontia areli* Stkr. was used as the outgroup in the analysis. Heuristic search procedure was used to generate trees; initial trees were generated using the simple addition sequence. Tree-bisection-reconnection (TBR) branch swapping was performed. MULPARS option was in effect to save equally parsimonious trees and zero length branches were collapsed to yield polytomies.

Table 1. Character state matrix for cladistic analysis of *Spragueia*.

taxa	Character States																									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
leo	0	0	0	0	0	0	1	1	1	1	0	1	1	0	0	0	1	0	0	1	1	1	0	0	0	0
onagrus	0	0	0	0	0	0	1	1	1	1	0	1	1	0	0	0	1	0	0	1	1	1	0	0	0	0
guttata	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	1	0	0	1	1	1	0	0	1	0
cleta	0	0	0	0	0	0	0	1	1	1	0	1	1	0	0	0	1	0	0	1	1	1	0	0	0	0
jaguaralis	0	1	0	0	0	0	1	1	1	1	0	1	0	0	0	0	1	0	0	1	1	1	0	0	0	0
magnifica	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	1	0	0	1	1	1	0	0	0	0
obatra	0	0	0	0	1	0	0	1	1	1	0	1	1	1	0	0	1	0	1	1	1	1	0	0	0	0
funeralis	0	0	0	0	1	0	0	0	1	1	0	1	1	0	0	0	1	0	1	1	1	1	0	0	0	0
pyralidia	0	0	0	0	1	1	0	0	1	1	0	1	1	0	0	0	1	0	1	1	1	1	0	0	0	0
valena	0	1	0	0	1	1	0	1	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0
dama	0	1	0	0	1	0	0	1	1	1	0	0	0	1	0	0	1	0	1	1	1	1	0	0	0	0
xericosa	0	1	0	0	1	0	0	1	1	1	0	1	0	1	0	0	1	0	1	1	1	1	0	0	0	0
pantherula	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	1	1	1	0	0
llanosa	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	1	1	1	1	1	0	1
trichostrota	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	1	1	1	1	1	0	0
apicalis	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	1	1	1	1	1	0	0
lepus	1	1	0	0	1	1	1	1	1	0	1	1	0	0	1	0	1	0	0	1	1	1	1	1	0	0
marmorea	1	0	1	1	1	1	0	1	1	1	1	1	0	0	1	0	1	0	0	1	1	1	1	1	0	0
lukesi	1	1	0	0	0	1	0	1	0	1	1	0	0	0	0	1	1	1	0	1	1	1	0	1	0	0
mexicana	1	1	1	0	0	1	0	1	1	1	1	0	0	0	0	1	1	1	0	1	1	1	0	1	0	0
margana	1	1	0	0	0	1	0	0	1	1	1	0	0	0	0	1	1	1	0	1	1	1	0	1	0	0
cryptomargana	1	1	1	0	0	1	0	1	1	1	1	0	0	0	0	1	1	1	0	1	1	1	0	1	0	0
perstructana	1	1	0	0	0	1	0	0	1	1	1	0	0	0	0	1	1	1	0	1	1	1	0	1	0	0
ochracea	1	1	0	0	0	1	0	1	1	1	1	0	0	0	0	1	1	1	0	1	1	1	0	1	0	0
Acontia areli	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	0	1	0	1	0	1	0	0

Thirty six equally parsimonious 40 step trees were generated, each with a consistency index (CI) of 0.514 excluding uniformative characters. All trees were examined and sorted as to overall topological similarity. There were 2 major topological groups of trees. Of the four groups, two were selected for discussion and one selected as the preferred cladogram. Major consideration of character evolution and state changes is on internal nodes, since they will be most informative in discussions of the generic limits of *Spragueia*.

The preferred cladograms is seen in Figure 106, the alternate cladogram in Figure 107. An annotated character analysis follows for the cladogram in Figure 106. After each character number the consistency index (CI) follows in parenthesis. Uninformative characters (UNF) were retained in the analysis as potentially useful characters for the Acontiini; these will require further testing in more comprehensive analyses in the future. Uninformative characters were omitted from any measure in overall consistency since these characters artificially inflate the CI. Some characters with CI = 1.000 are likely to have a lower overall CI due to polymorphisms in some taxa which were not coded in the original data; in these cases the character state was coded to the plesiomorphic state (0).

Character Analysis

Wings:

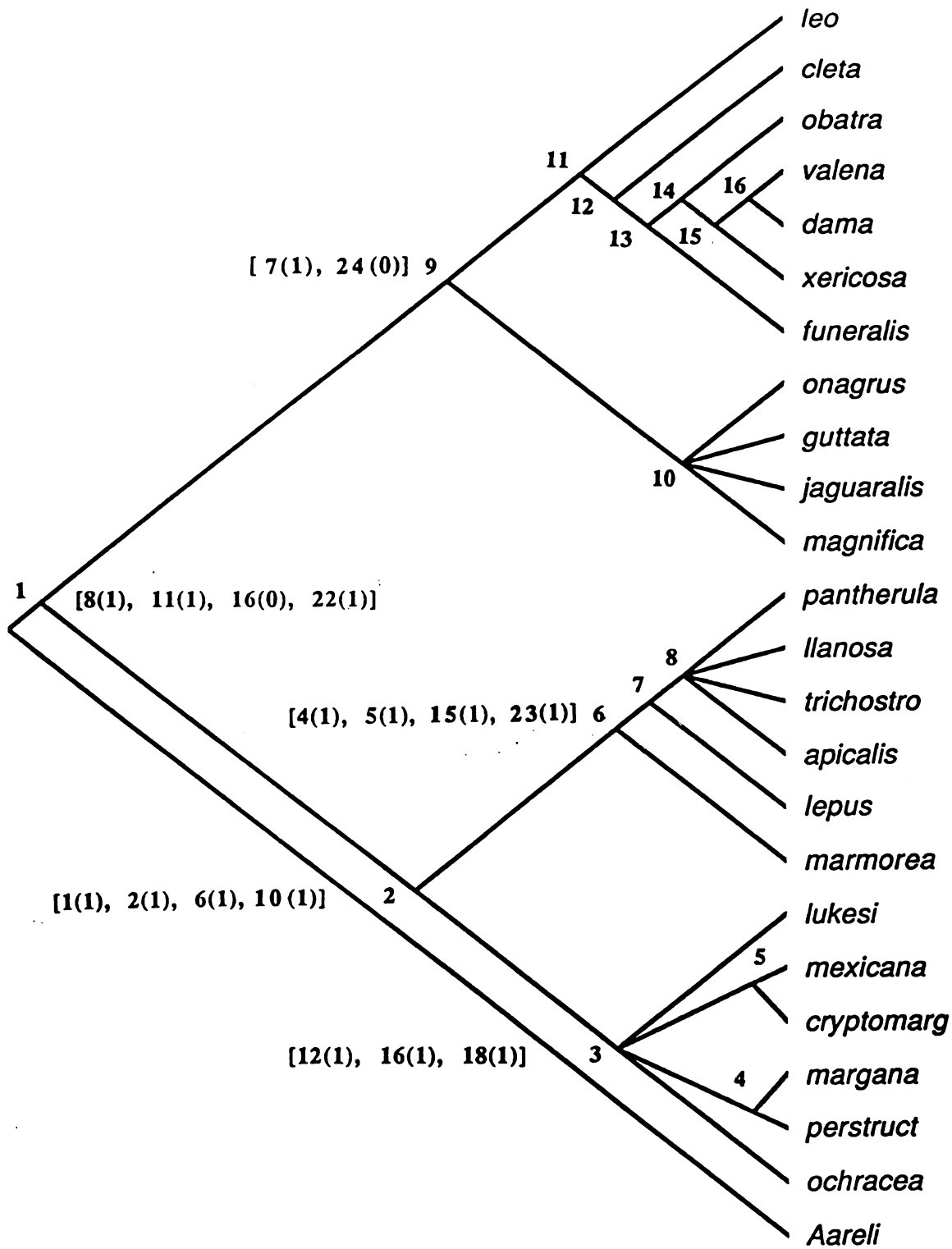


Figure 106. Preferred 40-step cladogram of the genus *Spragueia*.

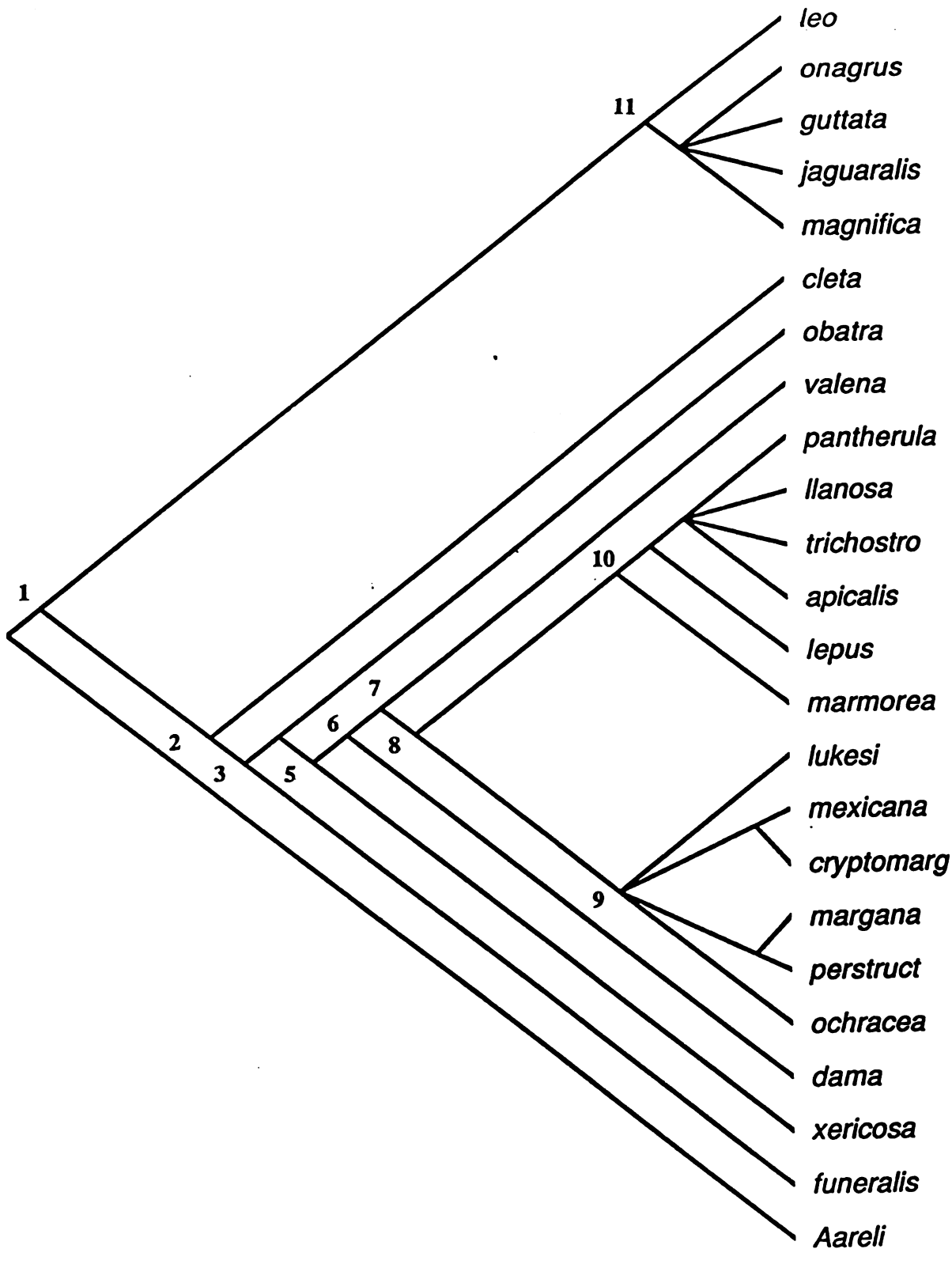


Figure 107. Alternate 40-step cladogram of the genus *Spragueia*.

1 (1.000). The secondary loss of the accessory cells is common and widespread in the Noctuidae. Its loss appears less frequently in the Acontiini. The character is polymorphic in a number of taxa, particularly *S. xericosa* and to a lesser extent in *valena* , therefore the CI in reality, is lower than 1.000. The absence of the accessory cell does not vary and appears fixed in taxa found in the two clades (*Heliocontia*) arising from node 2 (Figure 106). The loss of the accessory and the presence of the metathoracic tuft were the primary characters that Hampson used to describe *Heliocontia*; however, both characters are polymorphic for some taxa making these characters unreliable for defining the generic limits.

2 (0.250). Sexual dimorphism of the forewing is homoplasious, supporting the observation of its widespread occurrence in the Acontiini.

3 (0.500). The dark hindwing of the male is homoplasious and has evolved twice in this cladogram.

4 (0.500). The reniform spot of the forewing, a standard feature of the Noctuidae, has been lost at least twice in *Spragueia*.

5 (0.500). The transverse band at the base of the forewing has evolved twice in this cladogram; as in other cladistic analysis of Lepidoptera (Kitching 1987), wing pattern characters are often homoplasious.

Thorax:

6 (0.500). Presence of a thoracic tuft of scales, like the accessory cell (1), is subject to intraspecific polymorphism. Some specimens of *dama* and*obatra* show a distinct tuft while some smaller specimens in the *margana* have this character reduced. This character, therefore, could arguably be homoplasious. The presence of the tuft and the loss of the accessory cell were the characters Hampson used to erect *Heliocontia* (see also discussion of character 1). *S. valena* was placed in *Heliocontia* on the basis of the metathoracic tuft and the loss of the accessory cell (Hampson's material). However, *valena* always has the tuft of scales but rarely looses the accessory cell. As Hampson characterized *Heliocontia*, the characters are inadequate in delimiting the genus.

7 (0.333). Coloration of the thoracic scales is homoplasious..

Valves:

8 (0.333). Asymmetry of the tegumen is a homoplasious character.

9 (1.000). Asymmetry of the valves has evolved only once in this cladogram, but asymmetry of the valves is widespread in the Acontiiini.

10 (0.500). The presence of the right ampulla is nearly diagnostic in *Spragueia*, with the loss of the character occurring only in *S. lepus*.

11 (1.000). The loss of the clasper occurs at node 2, and is apparently autapomorphic for the clade arising from that node. This could be argued as a useful apomorphy to characterize Hampson's *Heliocontia*. It may not be adequate, however, to use a loss character to delimit the genus without further evidence to support this hypothesis. In addition, acceptance of this character leaves *Spragueia* characterized by a length character of the ductus bursa in the female. Both characters are likely to be homoplasious in other taxa in the Acontiini; neither character would I consider to be good evolutionary novelties (see character 22).

12 (0.500). Modifications of the sacculus into variously shaped processes are common in the trifid lineages and found, to a lesser extent in the Acontiini. The saccular extension of the right valve is lost twice, once in the *margana* group (node 3) and once at node 16.

13 (0.333). The length of the saccular extension of the right valve is homoplasious.

14 (0.333). Extensions of the left sacculus are homoplasious.

15 (0.500). The corona on the male valve is a somewhat labile character, secondarily reduced and often lost in members of the *apicalis* group that were excluded from the analysis.

16 (1.000). The biordinal corona is a unique character in *Spragueia*, supporting the *margana* group as a natural clade (node 3).

17 (UNF). The hairy anal tube is a likely autapomorphy for the Acontiini.

18 (1.000). The evolution of three or more diverticula on the left lobe of the vesica appears to be apomorphic for the *margana* group. This character and the biordinal corona make the *margana* groups the best characterized of all clades in the cladogram (node 3). In addition, all rival trees show this node with the same three character state changes (12, 17, 19).

19 (1.000). The development of the lateral sclerotized patch apparently arose only once in the *dama* group (node 12, Figure 106.

20 (UNF). The condensation of numerous cornuti on the right lobe of the vesica is uncommon, but widespread in the Acontiini.

21 (1.000). The sclerotized filaments provide the most stable character to justify the generic limits of *Spragueia* (node 1).

22 (UNF). Shagreened plates and adpressed cornuti on the right lobe of the vesica is a potential synapomorphy for the tribe; its presence needs further testing (Acontia areli has this feaeture).

23 (1.000). Depression in the 7th abdominal sternite appear to be autapomorphic for the *apicalis* group; the author not aware of this character outside of this group.

24 (1.000). The development of a long ductus bursae is probably correlated with the length of the aedeagus; this character state change occurs in the *Heliocontia sensu stricto*. See discussion below.

25 (1.000). The asymmetric ostium is autapomorphic for *S. guttata*.

26 (1.000). Small serrations at the posterior rim of the ostium bursae is autapomorphic for *S.llanosa*.

Discussion

Phylogenetic analysis was performed to generate trees and study the character states transformations of the trees in order to test the generic limits of *Spragueia*. In the analysis, 36 equally parsimonious trees were generated, and these trees were sorted by topological similarity. It was found that there were 2 groups of trees that shared overall topological similarity (Figures 106, 107). Variation in

tree topology for each group consisted of modifications and rearrangements on terminal nodes. In all trees generated, the *apicalis* (node 6) and *margana* groups (node 3) produced a clade and were supported in a strict consensis tree. These taxa approximated *Heliocontia* with the exclusion of *cleta* and *valena* which Hampson also placed in that genus. Both taxa are polymorphic for his characters (accessory cell [1] and meta-tuft [6]) and are more closely allied genitalically to the *dama* group. The majority of topological variation occured in the *dama* (node 12) and *leo* groups (*Spragueia sensu strictu*, node 10). The preferred cladogram was chosen (Figure 106) over the alternate cladogram (Figure 107) based on the absense of uniquely derived apomorphies in the *leo* and *dama* groups (Figure 107, nodes 33-38 and 40). What follows is a discussion of the preferred cladogram (Figure 106); bold characters are apomorphic.

Character states for nodes in tree 106: node [8(1), 10(1), 15(0), 21(1)], node 2 [1(1), 2(1), 6(1), 11(1)], node 3 [12(0), 16(1), 18(1)], node 4 [8(0)], node 5 [3(1)], node 6 [4(1), 5(1), 15(1), 23(1)], node 7[7(1)], node 8 [13(1)], node 9 [7(1), 23(0)], node 11 [13(1)], node 12 [7(0)[, node 13 [5(1), 19(1)], node 14 [14(1)], node 15 [2(1), 13(0)], node 16 [12(0)], 16-*valena* [6(1), 14(0)], 13-*funeralis* [8(0)], 10-*guttata* [25(0)], 10-*jaguaralis* [2(1)], 8-*pantherula* [14(1)], 6-*marmorea* [2(0), 3(1)], 3-*lukesi* [9(0)].

Character state for internalnodes in alternate cladogram (Figure 107): node 1 [8(1), 10(1), 12(1), 14(0), 20(1), 23(0)], node 3 [5(1), 18(1)], node 5[2(1), 13(0)], node 6 [12(0)], node 7[6(1), 14(0)], node 8 [1(1), 11(1), 19(0), 24(1)], node 11[7(1)], node 10[4(1), 12(1), 15(1), 23(1)], node 9 [5(0), 16(1), 18(1)].

Clade 2 [**1(1)**, 2(1), 6(1), **10(1)**]. This node is *Heliocontia sensu strictu*. Hampson (1910) characterized *Heliocontia* on the loss of the accessory cell (1) and the presence of a well developed metathoracic tuft (6). In this analysis the metathoracic tuft is derived twice, and is also polymorphic in a number of taxa (*obatra*, *cleta*, *margana* and *pyralidia*). The accessory cell is an apomorphy in this analysis (see discussion of character 1) but is polymorphic in a number of taxa; and while the analysis treats this as a uniquely derived apomorphic state, polymorphism in the *dama* group makes this character of dubious value. Character 12 is the hypothesized loss of the clasper on the right valve and appears uniquely derived. It is the only character which would support *Heliocontia*; without additional evidence to support the hypothesis of the loss of the character, it is not advisable to use this character to delimit the genus.

Clade 6 [4(1), 5(1), 16(1), **23(1)**]. The taxa that comprise the *apicalis* group are supported by a single unique apomorphy, the presence of lateral depressions on the 7th abdominal sternite (12). The other characters are homoplasious and widespread in the genus and the tribe.

Clade 3 [13(0), **16(1)**, **18(1)**]. The *margana* group is supported by two unique apomorphies, the biordinal corona (17) and three to five diverticula (19) on the left lobe of the vesica. Character 13 is the reduction in the right saccular extension.

Clade 9 [7(1), **23(0)**]. This clade encompasses the *dama* and *leo* species groups (*Spragueia sensu strictu*) and is supported by one weak apomorphy, the length of the ductus bursa in the female (25). The other is the gray coloration of the pectus of the thorax (7). Like

the loss of the right clasper which characterizes *Heliocontia*, the length character is also suspect without additional characters to support this character state transformations.

Clade 1 [8(1), 11(1), 16(0), **21(1)**]. This node comprises *Spragueia* as presently characterized; it is supported by three homoplasious characters and one good apomorphy. The sclerotized filaments (character 22, and introduction) appear to be uniquely derived; but this character needs further testing against other acontiines. One other character, the presence of the right ampulla on the valve of the male, could be considered to be apomorphic for the genus, it is only secondarily lost in the *lepus*; all other *Spragueia* have this character.

APPENDIX

APPENDIX

An Improved Technique for Everting Vesicae

The genitalia of both male and female Lepidoptera play a prominent role in taxonomic and phylogenetic studies. The morphological features of these structures in the Lepidoptera are diverse, and their taxonomic application varies considerably from group to group. The use of the genitialia and their many features (here the male) in Lepidoptera systematics was a gradual process motivated by systematist's need for increasingly refined structural characters; this process is on-going and refinements in our understanding and use of these structures continues to this day.

Catalyzed by the initial works of White (1876) and Gosse (1883) for Rhopalocera, and subsequently Smith in the Noctuidae (1889 and 1891 for some), Pierce (1909) mounted the first comprehensive study of the male noctuid genitalia. In this work he proposed, perhaps exhaustively, names for features of the male clasper and the morphology of the aedeagus and vesica. In addition to a number of illustrations of the valves of British species, he described and illustrated the aedeagus in the introduction. He described (as did Klots1970) the aedeagus as the sclerotized shaft which houses the eversible vesica that is infolded within the aedeagus; during copulation the aedeagus is introduced into the

ductus bursae of the female and the vesica everted in the corpus bursae for the transmission of the spermatophore.

The aedeagus was seen by many early workers to be a potentially useful feature for study. White (1876) stated that the Lepidopteran "intromittent organ with its sheaths [have] good characters [which] will probably be found to exist." Pierce also recognized the potential value of the aedeagus and the everted vesica stating "... it [aedeagus] is often of the utmost importance." Yet, despite his enthusiasm for the structure his efforts to study the aedeagus were frustrated by "the softness of the structure and the difficulty of extroverting the eversible parts." Because of this, he largely confined his taxonomic uses of the the aedeagus to counting cornuti and other sclerotized features.

Subsequent workers typically studied the shape of the aedeagus and less frequently drew on features of the vesica such as cornuti (spines) for characters at supraspecific levels (Forbes 1954) by following Pierce and studying the features of the vesica through the membrane of the aedeagus. Despite the recognized value of the vesica it would be many years before Hardwick (1950) would develop a standard protocol for the eversion of the vesica that would be widely used. Hardwick's pioneering works on the Heliothinae (1965) and the Noctuinae (*Euxoa*) demonstrated that where characters of the valves are inadequate, the vesica can reveal subtle characteristics and variation sufficient for recognizing taxa, and delimiting genera. Since that time, the vesica of the aedeagus has been utilized by many workers (Poole and Lafontaine 1991, and Lafontaine and Mikkola 1987), notably in larger taxa of the

Noctuiodea for taxonomic as well as phylogenetic characters. Yet, despite its popularity, detailed study of the vesica has not been possible in smaller taxa; as Hardwick noted, "[presently] it is impossible...to inflate the membranous genitalic sacs of small moths.

In addition to the small size of many Lepidoptera, some vesica have so many cornuti that eversion is difficult or nearly impossible; complexity in smaller Lepidoptera further impairs the ability to evert the vesica without incurring significant damage to the aedeagus. Progress in improving the technique has been made; several papers have been published since Hardwick's (1950) paper, each contributing modifications in the technique for the dissection and study of the vesica (Hogue 1963, Lafontaine and Mikkola 1987).

In this paper, I use a blend of techniques from the above papers, and some personal modifications to present a technique to evert small and/or complex vesicae of the Lepidoptera. It is hoped that this paper will serve as a catalyst for other workers to take on the challenge of studying this structure and make modifications of their own. In describing this technique I use the nomenclature (Figure 1a) of Klots (1970) and Hogue (1963).

Procedure

The procedure is a modification of the traditional method of everting the vesica by Lafontaine and Mikkola (1987), Hardwick (1950) and Hogue (1963). I use a hypodermic syringe (1.0cc) with needles of various gauges to perform the eversion. Most commonly needle sizes 27-33 are used (gauges 30-33 gauge are carried by Fine

Scientific Tools Inc., Foster City, CA). I dull and taper the point of the needle with a fine crocus cloth (fine grade sand paper) or a fine sharpening or "Arkansas" stone to prevent tearing of the aedeagus. Re-tooling of the needle is done under the microscope and a small cleaning wire can be inserted into the orifice of the needle to prevent collapse.

1. Remove the abdomen and soak it in hot (near boiling) 10-20% KOH for 1--10 minutes depending on size of the insect or until the majority of tissue is cleared from the sclerotized portions.
2. Dissect out the gential capsule in distilled water. Remove the aedeagus from the center of the valve and place it in glycerin. The aedeagus is held in place by a membrane that must be torn.
3. Cut the ductus ejaculatorius laterally, near the base of the aedeagus (Figure 108a) using fine, iridectomy scissors.
4. Soak the aedeagus in glycerin for 3- 10 minutes, allowing the fluid to penetrate fully into the interior (vesica).
5. Insert a hypodermic needle of suitable size into the ductus ejaculatorius. Note: when the ductus ejaculatorius is too small to enter with a needle, cut the coecum of the aedeagus perpenducular to the length of the aedeagus. This provides a larger opening for the entrance of the needle (Figure 108c).

6. While holding on to the base of the aedeagus with forceps, inject a stream of glycerin from the syringe. The vesica may now begin to move out of the aedeagus and full eversion may be achieved at this point. Frequently, however, the vesica will stop advancing, resulting in an incomplete eversion (Figure 108b).
7. Insert a blunt insect pin of suitable size through the ductus ejaculatorius and gently push the vesica to the posterior end of the aedeagus (Lafontaine and Mikkola 1987). Care should be excerised, however, to avoid packing complex vesicae with numerous long and multispined cornuti tightly against the posterior end of the aedeagus, as this tend to tangle the vesica and prevent sequential unfolding.
8. Dip in glycerin cotton covered polyester sewing thread and remove excess glycerin by running thread between thumb and finger. This holds stray fibers to the thread. Using a simple knot, physically tie the shaft of the aedeagus to the tip of the needle (Figure 108b,c). Holding the knot with a tweezers, inject glycerin slowly into the aedeagus to evert the remainder of the vesica (Figure 108b,c). For small aedeagus only slight pressure should be applied on the plunger to prevent too much glycerin from entering the aedeagus.
9. Remove the needle and knot and place the aedeagus back in KOH for a few minutes.

10. To harden the vesica in the everted condition for study, replace glycerin with absolute isopropyl alcohol or ethanol in the syringe. While holding the aedeagus onto the needle, directly over a dissection dish of alcohol, quickly inject the aedeagus and simultaneously submerge it while maintaining gentle steady pressure on the syringe. I prefer, as Hogue (1963) suggested, that the aedeagus again be tied onto the shaft of the needle; this allows for unidirectional flow of alcohol and results in vesica with fewer wrinkles.

It should be noted that there are some disadvantage inherent in this technique. It is clear that the large amount of handling increases the likelihood of damaging the specimen. Tearing of the aedeagus frequently occurs if special care is not taken, and tying the specimens onto the needle can cause some additional tearing to the anterior portion of the aedeagus, particularly in the case of small specimens. These drawbacks can, to some extent, be overcome by drawing the outline of the aedeagus and relevant features of the aedeagus so that the overall shape of the structure is properly recorded before eversion. Some damage should be expected, but the advantages of clearly accessing these characters, I think, justifies the risk. Lastly, the procedure requires some patience and persistence, and for some attempts expect failure to evert the vesica successfully. Therefore, practice, and save the rare material until you have acheived some confidence, you may not have another opportunity.

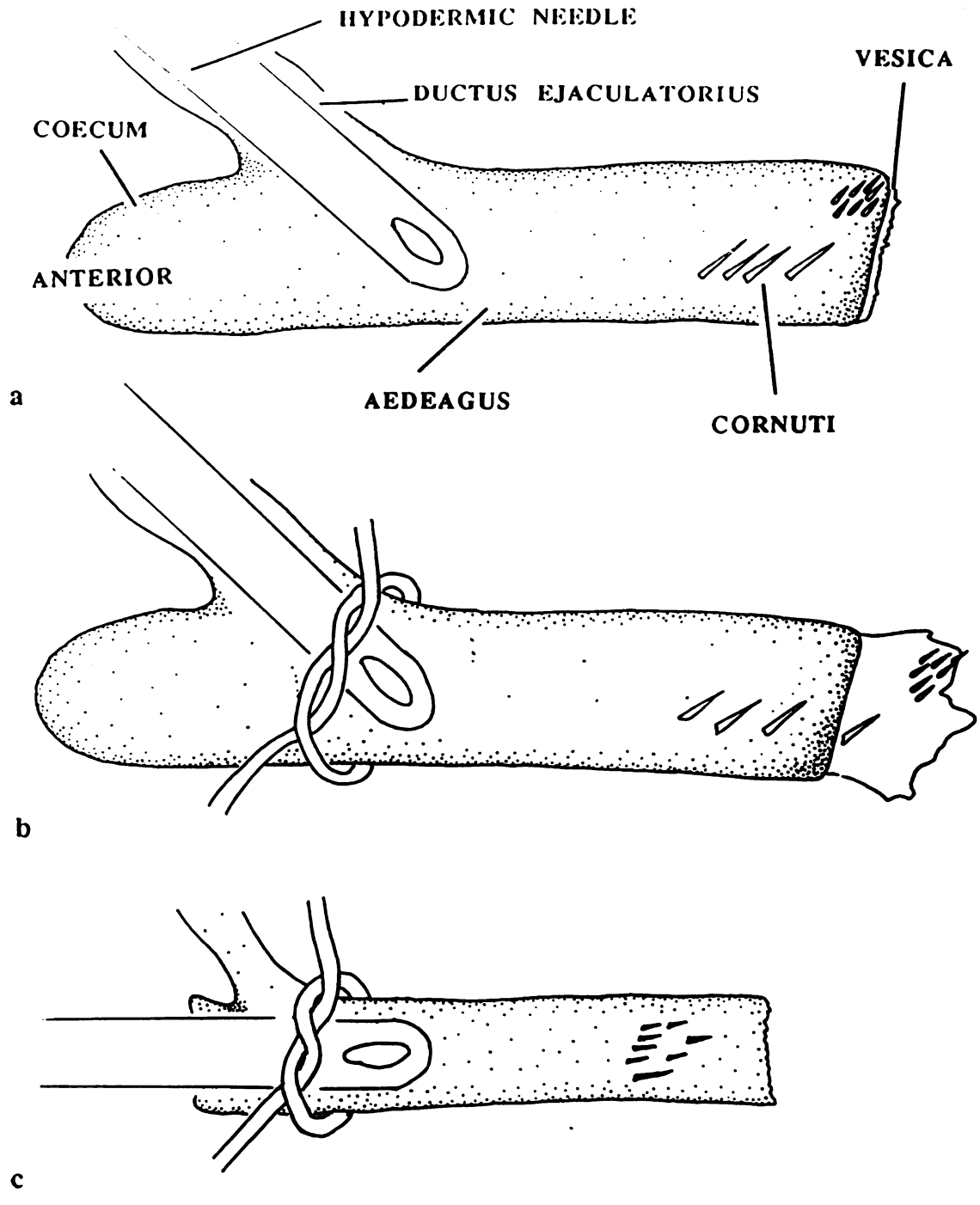


Figure 108. Examples of techniques used to evert vesicae: a) features of the aedeagus and vesica and standard method of eversion; b) aedeagus tied to hypodermic needle; c) small aedeagus with coecum cut and needle placed in and tied to anterior end.

BIBLIOGRAPHY

Boisduval J.B.A.D. de., and A. Guenée, 1852. Histoire naturelle des insectes. Species général des Lépidoptères. Tome sixiéme. Noctuélites. Tome 2. Paris, Roret. 443 pp.

Butler, A. G., 1879. On the Lepidoptera of the Amazons, collected by Dr. James W. H. Trail, during the years 1873-1875. Part III Noctuites. Trans. Entomol. Soc. Lon. 1879: 19-76.

Brown, R. W., 1954. Composition of scientific words. Washington D. C., Smithsonian Institution Press. 1-883.

Clarke, J. F. Gates, 1941. The preparation of slides of the gentitalia of Lepidoptera. Bull. Brook. Entomol. Soc. 36(4): 149-161.

Crumb, S. E., 1956. The larvae of the Phalaenidae. United States Department of Agriculture Technical Bulletin Technical Bulletin No. 1135. U. S. Government Printing Office, Washington D. C., 1-356.

Dognin, P., 1897. Lépidoptères nouveaux de Loja et environs (Equatuer). Annales de la Société Entomologique de Belgique, 41: 407-421.

Draudt, M., 1936. In Seitz, A., 1936. Die gross-Schmetteringe der Erde. Die gross-Schmetterlinge des Amerikanischen Faunengebietes. Volume 6. Die Amerikanischen spinner und schwärmer. Stuttgart. Alfred Kernen. 1-1452, 186 plates.

Druce, H., 1889. In Godman and Salvin. *Biologia Centrali-Americana*; or contributuions to the knowledge and fauna of Mexico and Central America. Zoology. Lepidoptera, Heterocera, Volume London. Taylor and Francis. 1-490, plates 1-64.

- 1898. In Godman and Salvin. *Biologia Centrali-Americana*; or contributuions to the knowledge and fauna of Mexico and

Central America. Zoology. Lepidoptera, Heterocera Volume 1. London. Taylor and Francis. 1-692, plates 65-101.

Dyar, H. G., 1914. Report on the Lepidoptera of the Smithsonian Biological Survey of the Panama Canal Zone. Proc. U.S.N.M. 47: 139-350.

Edwards, H. 1881. New Genera, and Species of North American Noctuidae. Papilio, 1: 19-28.

Fabricius, J. C., 1794. Entomologiae Systematica Emendata et Aucta. Secundum Classes, Ordines, Genera, Species Adjectis, Synonimis, Locis, Observationibus, Descriptionibus. Volume 3, Part 2. Hafniae [Copenhagen]. C.G. Profit, 1-349.

Forbes, W.T.M., 1954. Lepidoptera of New York and neighboring states: Pt III Noctuidae. New York State College of Agriculture, Cornell University Agricultural Experiment Station Bulletin, 1-433.

Forster, J. R., and T. A. Wohlfahrt., 1971. Die Schmetterlinge Mitteleuropas. Eulen (Noctuidae). Stuttart. W. Keller and Co., 1-329, 32 plates.

Franclemont, J. G. and E. L. Todd., 1983. Noctuidae, pp120-159. In Hodges, R. W., et al *Check list of the Lepidoptera of America North of Mexico*. London, E. W. Classey and the Wedge Entomological Research Foundation, 1-284.

Godman, G. A. W. and O. Salvin., 1898. Biologia Centrali-Americana; or Contributions to the knowledge and fauna of Mexico and Central America. Zoology. Lepidoptera, Heterocera volume 2. London. Taylor and Francis, 1- 692, plates 65-101.

Gosse, P. H., 1882 [1883]. On the clasping organs ancillary to generation in certain groups of the Lepidoptera. Trans. Linn. Soc., 2nd series, Zool. 2: 265-345, 8 plates.

Grote, A. R., 1872., Descriptions of North American Noctuidae, no. 1. Trans. Am. Entomol. Soc. 4: 20-28.

- 1875a. Checklist of the Noctuidae of America North of Mexico. I. Bombyciae and Noctuelitae (Nonfasciatae). Buffalo, Reinecke and Zesch. 1-28, 1 plate.

- 1875b. Lepidopterological observations. Can. Entomol. 7(12): 221-227.

- 1877. Six new Noctuae. Can. Entomol. 9: 67-71.

- 1879. The species of *Erotyla*, *Spragueia*, *Fruva*, *Xanthoptera*, *Exyra* and *Prothymia*. Can. Entomol. 11: 231-238.

- 1881a. New moths from Arizona, with remarks on *Catocala* and *Heliothis*. Papilio. 1: 153-168.

- 1881b. New species of *Dicopis*, *Chytonix*, and *Spragueia*. Papilio, 1: 48-50.

- 1882a. New species and notes in structure of moths and genera. Can. Entomol. 14(2): 212-218, 234-237.

- 1882b. Some new Noctuidae and notes. Papilio. 2: 183-187.

Hampson, G. F., 1898. The moths of the lesser Antilles. Trans. Entomol. Soc. Lon. 241-260, 1 plate.

- 1910. Catalogue of the Lepidoptera Phalaenae in the British Museum. Volume 10. London. Taylor and Francis. 1-829, plates 148-173.

Hardwick, D. F., 1965. The Corn Earworm complex. Mem. Entomol. Soc. Can. 40: 1-247.

1950. Preparation of slide mounts of lepidopterous genitalia. Can. Entomol. 82(11): 231- 235.

Herrich-Schäffer, G. A. W., 1868. Die Schmetterlinge der Insel Cuba. Correspondenz-Blatt des Zoologisch-Mineralogischen Vereines in Regensburg. 22: 113-118, 147-156, 179-186.

Holland W. J., 1903. The Moth Book. New York. Doubleday, Page and Company. 1-479, 48 plates.

Hogue, C. L., 1963. A standard method for mounting whole adult Lepidoptera on slides utilizing polystyrene plastic. J. Res. Lepid. 1(3): 223-235.

Jaeger, E. C., 1944. A source-book of biological names and terms. New York. Charles C. Thomas. 1-256.

Kimball, C. D., 1965. The Lepidoptera of Florida: An annotated checklist. Gainsville, Division of Plant Industry. State of Florida Department of Agriculture. 1-363, 26 plates.

Kitching, I. J., 1984. An historical review of the higher classification of the Noctuidae (Lepidoptera). Bull. Br. Mus. (Natural History) Entomol. Series. 49(3): 153-234.

- 1987. Spectacles and silver y's: A synthessis of the systematics, cladistics and biology of the Plusiinae (Lepidoptera: Noctuidae). Bull. Br. Mus. (Natural History) Entomol. Series 54:(2) 75-261.

Klots, A. B. 1970. Lepidoptera. In: Taxonomist's glossary of genitalia. S.L. Tuxen Ed., 117-130. Copenhagen, Munksgaard.

Köhler, P. 1979. Noctuidarum miscellanea VII. Acta Zool. Lilloana. 33: 37-55

Lafontaine, J. D. and K. Mikkola. 1987. Lock-and-key systems in the inner genitalia of Noctuidae (Lepidoptera) as a taxonomic character. Ent. Meddr. 55:161-167.

Lafontaine, J. D., and R. W. Poole, 1991. Noctuiodea, Noctuidae (Part) in Dominick, R.B., et al., The Moths of America North of Mexico, fasc. 25.1. London: E.W. Classey Ltd. and the Wedge Entomological Research Foundation. 1-182.

Meyrick, E., 1913. Descriptions of South American Micro-Lepidoptera. Trans. of the Entomol. Soc. Lon. 170-200.

Morrison, H. K., 1875. Notes on the Noctuidae with descriptions of certain new species. Proc. Boston Soc. Nat. Hist. 18:1 14-126.

Möschler, H. B., 1890. Die Lepilopteren-Fauna der Insel Portorico. Abhandlungen der Senkenbergischen Naturforschenden Gesellschaft. 16: 70-360, 1 plate.

Pierce, F. N., 1909. The genitalia of the British Noctuidae. Liverpool, A. W. Duncan. 1-88, 32 plates.

Poole, R. W., 1989. Lepidopterorum Catalogus (New Series). Fascicle 118, Noctuidae, Part I, Noctuidae. Leiden, E. J. Brill. 1-1314.

Richards, A. G. Jr., 1932. Comparative skeletal morphology of the noctuid tympanum. Entomol. Am. 13: 1-84.

Schaus, W., 1898. New species of Noctuidae from Tropical America. J. New York Entomol. Soc. 6: 117.

- 1904. New species of American Heterocera. Transs Am. Entomol. Soc. 30:135-178.

- 1914. New species of noctuid moths from Tropical America. Proc. U. S. National Mus. 46: 485-549.

- 1923. Galapogos Heterocera: With descriptions of new species. Zool. 5: 22-48.

Smith, J. B., 1889. Contributions toward a monograph of the Noctuidae of temperate North America: Revision of the species of *Oncocnemis*. Trans. Am. Entomol. Soc. 16: 321-349,1 plate.

1891. Notes on some Noctuidae with description of new genera and species. Trans. Am. Entomol. Soc. 18: 103-135.

Strecker, F. H. H., 1898. Lepidoptera, Rhopaloceres and Heteroceres, Indigenous and Exotic. Supplement 1, 1-12.

Swainson, 1900. Notes on the Larvae of Lepidoptera. J. New York Entomol. Soc. 8: 32-34.

Swofford, D. L., 1990. PAUP: Phylogenetic analysis using parsimony, Version 3.0. Computer program distributed by the Illinois Natural History Survey, Champaign, Illinois.

Todd, E. L., 1966. Noctuid moths of the American Genus *Eusceptis* (Hubner). Proc. U.S.N.M. 119 (3546): 1-22, 6 plates.

- 1972. Descriptive and synonymical notes for some of Noctuidae from the Galapagos Islands (Lepidoptera). J. Wash. Acad. Sci. 62: 36-40.

Todd, E. L., A. Blanchard, and R. W. Poole, 1982. Proc. Entomol. Soc. Wash. 86: 951-960.

Ueda, Kyoichiro, 1984. A Revision of the genus *Deltote* R. L. and it allied genera from Japan and Taiwan (Lepidoptera: Noctuidae: Acontiinae). Part I. Bull. Kitakyushu Museum of Nat. Hist. 5: 91-133.

Walker, F., 1863. List of the specimens of Lepidopterous insects in the collection of the British Museum. Volume 28. London. Edward Newman. 287-561.

Walker F., 1865. List of specimens of Lepidopterous insects in the collection of the British Museum. Volume 33. London, Edward Newman. 707-1120.

White, F. B., 1876 [1878]. On the male genital armature in the European Rhopalocera. Trans. Linn. Soc., 2nd series Zool. 1: 357-369, 2 plates.

Zeller, P. C., 1873. Beiträge zur Kenntnis der Nordamericanisches Nachfalters, Besoners der Microlepidopteren. Verhandlungen der Kaiserlich-Königlichen Zoologisch-Botanschen Gesellschaft in Wien. 23: 201-330, 2 plates.