The Moths of America North of Mexico

FASCICLE 15.3

PYRALOIDEA
Pyralidae (Part)

H. H. NEUNZIG

1990

THE WEDGE ENTOMOLOGICAL RESEARCH FOUNDATION

THE WEDGE ENTOMOLOGICAL RESEARCH FOUNDATION

Patrons

HRH THE DUKE OF EDINBURGH, KG, KT
GORDON F. CLARINGBULL, BSC, PHD, FINST P, FGS, FMA
GERALD M. DURRELL, FIAL, MIBIOL BERNARD OSTRY, BA ROGER TORY PETERSON, NAD, DSC
S. DILLON RIPLEY, PHD, DHL, DSC, LLD DAVID ROCKEFELLER, PHD, LLD SIR PETER SCOTT, CBE, DSC

The dates of publication of previous parts of this work:

Fascicle 21 **Sphingoidea** 30 January 1971

Fascicle 20.2A **Bombycoidea,** Saturniidae (part)
31 December 1971

Fascicle 20.2B **Bombycoidea,** Saturniidae (conclusion)
28 April 1972

Fascicle 13.1A **Pyraloidea,** Pyralidae (part)
31 October 1972

Fascicle 13.1B **Pyraloidea,** Pyralidae (part)
11 December 1972

Fascicle 20.1 **Mimallonoidea,** Mimallonidae
and **Bombycoidea,** Apatelodidae, Bombycidae, Lasiocampidae
31 July 1973

Fascicle 13.1C **Pyraloidea,** Pyralidae (conclusion of Part 1)
31 January 1974

Fascicle 6.2 **Gelechioidea,** Oecophoridae
1 July 1974

Fascicle 13.2A **Pyraloidea,** Pyralidae (part)
16 September 1976

Fascicle 13.2B **Pyraloidea,** Pyralidae (part)
22 December 1976

Fascicle 22.2 **Noctuoidea,** Lymantriidae
25 March 1978

Fascicle 6.1 **Gelechioidea,** Cosmopterigidae
29 December 1978

Fascicle 18.1 **Geometroidea,** Geometridae (part)
25 May 1985

Fascicle 15.2 **Pyraloidea,** Pyralidae (part)
20 February 1986

Fascicle 7.1 **Gelechioidea,** Gelechiidae (part)
26 November 1986

Fascicle 27.2 **Noctuoidea,** Noctuidae (part)
22 October 1987

Fascicle 5.1 **Sesioidea,** Sesiidae
18 January 1989

Check List of The Lepidoptera of America North of Mexico
30 May 1983

THE MOTHS OF AMERICA NORTH OF MEXICO

The Moths of America North of Mexico

INCLUDING GREENLAND

FASCICLE 15.3

PYRALOIDEA

PYRALIDAE (PART)

PHYCITINAE (PART)

H. H. NEUNZIG
DEPARTMENT OF ENTOMOLOGY
NORTH CAROLINA STATE UNIVERSITY
RALEIGH, NORTH CAROLINA

COLOR PHOTOGRAPHS BY
KJELL B. SANDVED
SMITHSONIAN INSTITUTION

SEM PHOTOGRAPHS BY
N. A. LEIDY

LINE DRAWINGS BY
H. H. NEUNZIG

1990
WASHINGTON

THE WEDGE ENTOMOLOGICAL RESEARCH FOUNDATION

THE MOTHS OF NORTH AMERICA

RONALD W. HODGES, EDITOR-IN-CHIEF

BOARD OF EDITORS

DONALD R. DAVIS PH.D.

TATIANA DOMINICK

DOUGLAS C. FERGUSON PH.D.

JOHN G. FRANCLEMONT PH.D.

EUGENE G. MUNROE PH.D., F.R.S.C.

JERRY A. POWELL PH.D.

This work is to be cited as
Neunzig, H. H., 1990. Pyraloidea, Pyralidae (part)
in Dominick, R. B., et al.,
The Moths of America North of Mexico, fasc. 15.3

DISTRIBUTORS

THE WEDGE ENTOMOLOGICAL RESEARCH FOUNDATION
% National Museum of Natural History,
MRC-127, Washington, D.C. 20560, U.S.A.

E. W. CLASSEY LTD
P.O. Box 93, Faringdon, Oxfordshire SN7 7DR, England

BIOQUIP PRODUCTS
17893 LaSalle Avenue
Gardena, California 90248, U.S.A.

ENTOMOLOGICAL REPRINT SPECIALISTS
P.O. Box 77224, Dockweiler Station
Los Angeles, California 90007, U.S.A.

ISBN 0-933003-06-6

LIBRARY OF CONGRESS CATALOG NUMBER 90-70020

Printed in the United States of America by Allen Press, Inc., Lawrence, Kansas

Color plates by Lanman Progressive Co., Washington, D.C.

ABSTRACT

Neunzig, H. H. PYRALOIDEA, PYRALIDAE (PART), PHYCITINAE (PART). The Moths of America North of Mexico including Greenland, Fascicle 15.3, 165 pages, 70 text figures, 5 color plates, 2 black and white plates, 1990. Thirty-five genera of phycitines are treated, including the new taxa *Australephestiodes, Moodnodes,* and *Heinrichiessa.* Information on adult morphology and, if known, descriptions of the immature stages and notes on the biology are included for each genus. Figures are provided of the male genitalia and, with one exception, the female genitalia, of representative species of all genera. There are also figures of palpi, wing venation, antennae, male scale tufts, and larvae. Of 81 species described and illustrated, the following are new: *Crocidomera imitata, Selga californica, Euzophera habrella, Euzophera vinnulella, Ephestiodes monticolus, Ephestiodes griseus, Moodna pallidostrinella, Caudellia floridensis, Volatica gallivorella, Vitula aegerella, Vitula insula, Vitula coconinoana, Sosipatra proximanthophila, Sosipatra knudsoni, Heinrichiessa sanpetella, Ribua droozi, Ephestia columbiella. Ephestiodes stictella* (Hampson) and *Ephestiodes indentella* Dyar are referred to *Australephestiodes* and *Ephestiodes plorella* Dyar to *Moodnodes* as new combinations.

CONTENTS

Preface	9
Author's Acknowledgements	10
PYRALOIDEA	13
PYRALIDAE (continued)	13
PHYCITINAE (part)	13
Key to Genera	13
Adanarsa	17
Cuniberta	18
Crocidomera	20
Bertelia	23
Hypsipyla	25
Anypsipyla	29
Chararica	31
Myelopsis	32
Selga	40
Pseudocabima	42
Apomyelois	44
Ectomyelois	46
Amyelois	48
Euzophera	52
Eulogia	61
Ephestiodes	63
Australephestiodes	68
Moodnodes	69
Moodna	72
Caudellia	76
Volatica	80
Vitula	84
Sosipatra	92

Heinrichiessa 98

Ribua 99

Plodia 102

Ephestia 103

Cadra 110

Bandera 115

Wakulla 117

Tampa 118

Varneria 120

Eurythmia 122

Erelieva 125

Cabnia 128

Literature 130

Monochrome Plates 135

Color Plates 139

Notes 161

Index to Animal Names 162

Index to Plant and Fungus Names 164

PREFACE

This second contribution dealing with the Phycitinae includes species that resemble *Acrobasis* Zeller and allies covered in fascicle 15.2. Together the genera in the two publications possibly could be included in a natural group within the subfamily. However, additional information is needed, particularly on the immature stages, before a formal classification can be proposed. In this second study about a third of the included genera have wings with a full phycitine complement of veins (11 in forewing, 8 in hindwing (1A, 2A, and 3A of hindwing together treated as one vein) as in *Acrobasis*; the remaining taxa have reduced venation (8–10 in forewing, 5–7 in hindwing) that appears to be the result of the fusion of veins. Despite these differences in wing venation, the genera treated have similar genitalia. Although Heinrich (1956) arranged the phycitines, to a large extent, on the basis of number and location of veins in the wings, he was aware that a more natural classification should emphasize genital relationships. He tentatively grouped genera, based on genital similarities, in a table (1956: vii). This latter arrangement is, with a few exceptions, followed here.

The available evidence regarding the morphology of the immature stages supports a classification based on the genitalia. Most significant is the presence, in larvae of some genera, of partial pinaculum rings and associated specialized setae on abdominal segments 1–7, in addition to the usual phycitine pinaculum rings on the mesothorax and abdominal segment 8. For example, although *Euzophera* Zeller has fewer veins in the hindwing than *Ectomyelois* Heinrich, on the basis of genitalia the genera are obviously close relatives, and larvae of both possess pinaculum rings on abdominal segments 1–7. This number and arrangement of pinaculum rings has been found in only species belonging to these genera and to two other closely related genera, *Amyelois* Amsel and *Mussidia* Ragonot.

Biological information is available for about half of the included genera, and most appear to have similar larval habits. The majority feed on weakened, dead, or quiescent (usually mature fruits or seeds) plant material; a few feed on actively growing plant tissue. Some feed in part or entirely on fungi; and a few injest some dead insect fragments, or sometimes develop on live, but relatively inactive, immature insects in addition to consuming plant materials.

AUTHOR'S ACKNOWLEDGEMENTS

I am particularly indebted to D. C. Ferguson and R. W. Hodges at the USNM who, during my trips to Washington, made available their time, advice, and the Museum facilities and specimens, including many fine phycitines that they had collected. Their assistance and encouragement, as well as their enthusiasm for *The Moths of America North of Mexico* project, have to a large extent made possible this fascicle.

I am also pleased to acknowledge the following who generously provided adults and/or immatures for study: S. Allyson (Canadian National Collection), E. Armstrong (Harvard University), D. Azuma (Academy of Natural Sciences of Philadelphia), H. D. Baggett (University of Florida), A. Blanchard, deceased (Houston, Texas), R. L. Blinn (University of Missouri-Columbia), W. Brooks (University of Kansas), R. L. Brown (Mississippi Entomological Museum), R. A. Cannings (Royal British Columbia Museum), C. V. Covell, Jr. (University of Louisville), T. S. Dickel (Homestead, Florida), L. C. Dow (Largo, Florida), A. T. Drooz (Cary, North Carolina), W. R. Enns, (University of Missouri-Columbia), D. K. Faulkner (San Diego Natural History Museum), J. R. Heitzman (Independence, Missouri), G. W. Hughes (Royal British Columbia Museum), D. W. Keever (Tobacco Research Laboratory, Oxford, North Carolina), E. C. Knudson (Bellaire, Texas), J. D. Lafontaine (Canadian National Collection), G. Luquet (Muséum National d'Histoire Naturelle), K. C. McGiffen (Illinois Natural History Survey), C. Salvino (Field Museum of Natural History), T. E. Moore (University of Michigan), M. F. O'Brien (University of Michigan), A. H. Porter (University of California, Davis), J. A. Powell (University of California, Berkeley), J. E. Rawlins (Carnegie Museum of Natural History), K. Sattler (British Museum (Natural History)), M. Shaffer (British Museum (Natural History)), S. Shaw (Harvard University), R. O. Shuster (University of California, Davis), D. L. Stephan (North Carolina State University), P. Viette (Muséum National d'Histoire Naturelle), B. Wright (Nova Scotia Museum), R. S. Zack (Washington State University).

Many of the new larval host records included in this fascicle resulted from the efforts of J. A. Powell (UCB) and his associates. Specimens lent by Powell included series of reared phycitines with information on host associations.

An initial draft of the manuscript was reviewed at North Carolina State University by W. M. Brooks, L. L. Deitz, and J. W. Hardin. Additional assistance by several of the editors of *The Moths of America North of Mexico,* particularly R. W. Hodges, and two outside reviewers, in the preparation of a final draft, is also gratefully acknowledged.

THE MOTHS OF AMERICA NORTH OF MEXICO

SUPERFAMILY
PYRALOIDEA (continued)

FAMILY
Pyralidae (continued)

SUBFAMILY
Phycitinae (part)

The moths of the genera included in this fascicle possess the following combination of character states: Male antenna usually simple, a few male antennae with scape broadly scaled or with compact cluster of sensilla, or shaft with basal sinus (with or without sensilla and sometimes with an inconspicuous scale tuft), or shaft unipectinate (antenna never with the inner part of the basal segments of the shaft produced apically into a series of spines that sometimes are within a sinus and frequently are covered, or partially covered, with a tuft of scales). Male genitalia usually with a broad, subtriangular, hoodlike uncus; gnathos almost always with an apical hook or bifurcate hooklike process (gnathos never with a large, distal, in part anteriorly projecting, flanged process or anteriorly produced, paired lobes); valva rather broad, usually simple, occasionally with one or more costal projections (valva never narrowly elongate or with sacculus greatly produced); juxta usually with setiferous lateral elements (juxta never with long central spine); aedoeagus usually without cornuti (aedoeagus never with one or more strongly developed, large, spinelike cornuti). Female genitalia with ductus bursae and corpus bursae membranous, or mostly membranous, sometimes with scobinations or very small spines, or ductus bursae partly or mostly sclerotized and corpus bursae mostly or entirely membranous (ductus bursae never spiraled and corpus bursae never with numerous large spines or spinous processes, and never extensively covered or matted with spines or granulate patches or bearing large, densely spined, round plates).

KEY TO GENERA

1. Males 2
— Females 36

2. Antenna with distinct sinus in shaft (text figures 6 *a*, 70 *b*; plate A, figure 1; plate B, figures 1, 3) 3
— Antenna without distinct sinus in shaft 8

3. Labial palpus with second segment very broadly scaled (text figure 70 *a*); hindwing with 5 veins (1A, 2A, and 3A together count as 1 vein) ..... *Cabnia* p. 128
— Labial palpus with second segment not as broadly scaled; hindwing with 6–8 veins (1A, 2A, and 3A together count as 1 vein) 4

4. Antenna with unipectinate shaft (text figure 6 *a, b*) ..... *Bertelia* p. 23
— Antenna with simple to slightly serrate shaft ... 5

5. Antenna with row of compact groups of short sensilla in sinus of shaft (plate A, figures 1, 2); forewing without costal fold ..... *Cuniberta* p. 18
— Antenna without row of sensilla in sinus (plate B, figures 1, 3); forewing with costal fold 6

6. Forewing with 9 veins (text figure 36 *a*) .. *Caudellia* p. 76
— Forewing with 10 veins (text figures 33 *b*, 34 *a*) 7

7. Gnathos apically produced into 2 short, round-

ed elements (text figure 32 *d*); transtilla fused distally into a hook (text figure 32 *d*) .. *Moodnodes* p. 69

— Gnathos with apical projection a pointed hook (text figure 34 *b*); transtilla incomplete (text figure 34 *b*) ..... *Moodna* p. 72

8. Antenna with cluster of sensilla at base of shaft (plate A, figures 3, 4) (sensilla sometimes partially covered with scales) ..... *Crocidomera* p. 20

— Antenna without cluster of dark sensilla at base of shaft 9

9. Forewing with 11 veins 10

— Forewing with 8–10 veins 22

10. Valva with large basal clasper (text figure 1 *b*) ..... *Adanarsa* p. 17

— Valva without large basal clasper 11

11. Transtilla with 2 diverging, hornlike, setaeless, apical elements (text figures 7 *b*; 23 *b*; 25 *a*; 26 *a, c*; 27 *a, c*) 12

— Transtilla without 2 diverging, hornlike, apical elements (if strongly developed apical elements present, they bear numerous, long setae) 13

12. Hindwing with 8 veins (1A, 2A, and 3A together count as 1 vein) (text figure 7 *a*) ..... *Hypsipyla* p. 25

— Hindwing with 7 veins (1A, 2A, and 3A together count as 1 vein) (text figure 23 *a*) .... *Euzophera* p. 52

13. Valva with costa produced apically into a well-developed hook (text figure 9 *b*) ..... *Anypsipyla* p. 29

— Valva without a costal hook or with a weakly developed costal hook 14

14. Valva very broad (text figure 10 *b*); maxillary palpus featherlike ..... *Chararica* p. 31

— Valva more elongate; maxillary palpus more robust, squamous 15

15. Juxta with long lateral elements (text figure 20 *b*); valva with distal ½ greatly reduced (text figure 20 *b*) ..... *Amyelois* p. 48

— Juxta with shorter elements; valva with distal ½ not greatly reduced 16

16. Uncus strongly expanded in distal ½ (text figure 16 *b*) ..... *Pseudocabima* p. 42

— Uncus not strongly expanded distally 17

17. Hindwing with 8 veins (1A, 2A, and 3A together count as 1 vein) 18

— Hindwing with 7 veins (1A, 2A, and 3A together count as 1 vein) 20

18. Gnathos with apex distinctly forked (text figures 11 *a*, 12 *a*, 14 *a*) ..... *Myelopsis* p. 32

— Gnathos with apex simple (text figures 17 *b*, 18 *b*) 19

19. Juxta with lateral elements robust distally (text figure 18 *b*); transtilla very shallowly bifid distally, or entire (text figure 18 *b*) ..... *Ectomyelois* p. 46

— Juxta with lateral elements slender distally (text figure 17 *b*); transtilla distinctly bifid distally (text figure 17 *b*) ..... *Apomyelois* p. 44

20. Gnathos with apex simple (text figure 41 *a*) ..... *Volatica* p. 80

— Gnathos with apex distinctly forked (text figures 13 *c*, 15 *b*, 28 *b*) 21

21. Gnathos strongly U-shaped apically (text figures 13 *c*, 15 *b*) ..... *Selga* p. 40

— Gnathos shallowly V-shaped apically (text figure 28 *b*) ..... *Eulogia* p. 61

22. Forewing with 10 veins 23

— Forewing with 8 or 9 veins 25

23. Uncus short and broadly rounded (text figure 29 *b*) ..... *Ephestiodes* p. 63

— Uncus not short and broadly rounded 24

24. Gnathos with apex a single hook (text figures 42 *b*; 44 *a, c*; 45 *a*); transtilla distally simple or incomplete (text figures 42 *b*; 44 *a, c*; 45 *a*) ..... *Vitula* p. 84

— Gnathos apically produced into 2 elongate, hooked processes (text figure 32 *a*); transtilla with 2 distal, asymmetrically curved arms (text figure 32 *a*) ..... *Australephestiodes* p. 68

25. Aedoeagus with long spiral of sawtoothed spines (text figure 67 *c*) ..... *Eurythmia* p. 122
— Aedoeagus without long spiral of sawtoothed spines 26

26. Valva with fingerlike costal projection near base (text figures 50 *a*, 66 *b*) 27
— Valva without fingerlike costal projection near base 28

27. Gnathos with simple apical element (text figure 50 *a*) ..... *Heinrichiessa* p. 98
— Gnathos with apex strongly bifurcate (text figure 66 *b*) ..... *Varneria* p. 120

28. Gnathos with apical element asymmetrical (text figure 51 *b*) ..... *Ribua* p. 99
— Gnathos with apical element symmetrical 29

29. Haustellum reduced 30
— Haustellum not reduced 32

30. Forewing with 8 veins (text figure 64 *a*); transtilla complete (text figure 64 *b*) ..... *Tampa* p. 118
— Forewing with 9 veins (text figure 61 *a*); transtilla incomplete or weak mesially (text figures 61 *b*, 63 *a*) 31

31. Uncus broadened distally (text figure 63 *a*); valva with small costal projection (text figure 63 *a*) ..... *Wakulla* p. 117
— Uncus tapering distally (text figure 61 *b*); valva simple (text figure 61 *b*) ..... *Bandera* p. 115

32. Gnathos fused apically into large subanal plate (text figure 68 *b*); transtilla strongly produced into 2 distal, distinctly wrinkled arms (text figure 68 *b*) ..... *Erelieva* p. 125
— Gnathos not fused apically into a plate; transtilla not strongly produced into distinctly wrinkled arms 33

33. Gnathos apically enlarged, knobbed or looped (text figures 47 *b*, 48 *a*, 49 *a*) ..... *Sosipatra* p. 92
— Gnathos apically not enlarged, knobbed or looped, sometimes bifurcate apically 34

34. Uncus distinctly narrow (text figure 53 *b*) .. *Plodia* p. 102
— Uncus broader 35

35. Valva with costa simple (text figure 56 *b*), *or* with a distal extension (text figures 58 *a*, 59 *a*) ..... *Ephestia* p. 103
— Valva with more dorsally directed costal element located at ½–⅔ distance to apex of valva (text figure 60 *b*, *e*) ..... *Cadra* p. 110

36. Corpus bursae with slender clawlike signum (text figure 1 *d*) ..... *Adanarsa* p. 17
— Corpus bursae with or without signum, signum never clawlike 37

37. Genital opening with associated large, posterior patch, or patches of dense microspines (microspines sometimes covering lobate structures) (text figures 3 *d*, 5 *c*) 38
— Genital opening without associated large patch, or patches, of dense microspines 39

38. Ductus bursae with distinct wrinkles or ridges (text figure 3 *d*) ..... *Crocidomera* p. 20
— Ductus bursae without sclerotized wrinkles or ridges (text figure 5 *c*) ..... *Bertelia* p. 23

39. Ductus bursae transversely wrinkled or ridged anterior of genital opening (text figure 10 *d*) ..... *Chararica* p. 31
— Ductus bursae without transverse wrinkles or ridges anterior of genital opening 40

40. Genital opening with associated pair of triangular, sclerotized plates (text figure 20 *d*) .. *Amyelois* p. 48
— Genital opening without associated triangular, sclerotized plates 41

41. Forewing with 11 veins 42
— Forewing with 8–10 veins 52

42. Hindwing with 8 veins (1A, 2A, and 3A together count as 1 vein) 43
— Hindwing with 7 veins (1A, 2A, and 3A together count as 1 vein) 49

43. Ductus bursae very slender and elongate, and corpus bursae considerably broader than duc-

tus bursae (text figure 9 *d*) ..... *Anypsipyla* p. 29

— Ductus bursae usually broader and always shorter, and corpus bursae more slender 44

44. Signum of corpus bursae an invaginate cup or an elongate patch of scobinations or microspines (text figures 2 *d*, 7 *d*, 18 *d*) 45

— Signum of corpus bursae present or absent; never an invaginate cup, usually formed of platelike, disclike or scalelike spines 47

45. Corpus bursae with anterior ½ distinctly more enlarged than posterior ½ (text figure 2 *d*); signum of small scobinations (text figure 2 *d*) ..... *Cuniberta* p. 18

— Corpus bursae with anterior ½ not distinctly more enlarged than posterior ½ (text figures 7 *d*, 18 *d*); signum of larger scobinations or microspines (text figures 7 *d*, 18 *d*) 46

46. Corpus bursae distinctly broader than ductus bursae (text figure 7 *d*) ..... *Hypsipyla* p. 25

— Corpus bursae only slightly broader than ductus bursae (text figure 18 *d*) ..... *Ectomyelois* p. 46

47. Signum of corpus bursae a pair of discs or blunt spines (text figures 12 *c*, 13 *b*, 14 *d*) *or* signum absent (text figure 11 *c*) ..... *Myelopsis* p. 32

— Signum of corpus bursae a cluster of 8 or more spines, discs, or plates 48

48. Signum of corpus bursae a cluster of many, pointed spines (text figure 17 *d*) ..... *Apomyelois* p. 44

— Signum of corpus bursae a cluster of about 10 blunt spines, discs, or plates (text figure 16 *d*) ..... *Pseudocabima* p. 42

49. Labial palpus porrect, extending forward beyond head 2× length of head; ductus bursae strongly and uniformly sclerotized for about ½–⅘ length (text figure 41 *c*) ..... *Volatica* p. 80

— Labial palpus oblique to upturned *or* if porrect, extending forward less than 2× length of head; ductus bursae membranous throughout *or* less uniformly or less extensively sclerotized (text figures 15 *d*, 23 *d*, 28 *d*) 50

50. Ductus bursae and corpus bursae with numerous scobinate or microspine bearing folds (text figure 23 *d*) ..... *Euzophera* p. 52

— Ductus bursae and corpus bursae without scobinate or microspine bearing folds (text figures 15 *d*, 28 *d*) 51

51. Ductus bursae with pair of weakly sclerotized plates (text figure 15 *d*) or unsclerotized at or just before genital opening ..... *Selga* p. 40

— Ductus bursae strongly sclerotized at and just before genital opening (text figure 28 *d*) .. *Eulogia* p. 61

52. Forewing with 10 veins (text figures 29 *a*; 33 *a*, *b*; 34 *a*; 42 *a*) 53

— Forewing with 8 or 9 veins 57

53. Apophyses anteriores short, about ½ width of ductus bursae at genital opening (text figure 29 *d*) ..... *Ephestiodes* p. 63

— Apophyses anteriores longer than width of ductus bursae at genital opening 54

54. Eighth abdominal segment produced anteriorly into an elongate tonguelike sclerite and posterolaterally into projecting arms (text figure 32 *c*) ..... *Australephestiodes* p. 68

— Eighth abdominal segment lacking this character state 55

55. Signum of corpus bursae oval, platelike and partially serrate ..... *Moodnodes* p. 69

— Signum of corpus bursae a blunt disclike spine or cluster of 2 or more blunt spines (text figure 34 *d*, 42 *d*, 46 *a–c*) 56

56. Corpus bursae with concentric wrinkles (text figure 34 *d*) ..... *Moodna* p. 72

— Corpus bursae without concentric wrinkles (text figures 42 *d*, 46 *a–c*) ..... *Vitula* p. 84

57. Signum of corpus bursae a thin plate with several sharply pointed spines (text figure 50 *d*); ductus bursae and corpus bursae small compared to rest of genitalia (text figure 50 *c*, *d*) ..... *Heinrichiessa* p. 98

— Signum of corpus bursae composed of one or more blunt to sharply pointed spines or discs

or a plate with many blunt spines *or* signum absent; ductus bursae and corpus bursae not reduced in size relative to rest of genitalia 58

58. Ductus bursae strongly and uniformly sclerotized for ⅓ or more its length (text figures 36 *d*, 39 *c*, 47 *d*, 48 *c*, 51 *d*, 53 *d*, 66 *d*) 59
— Ductus bursae unsclerotized or bearing a longitudinal row of sclerotized ridges or spiral of spines (text figures 56 *d*, 58 *c*, 60 *d*, *f*, 61 *d*, 64 *d*, 67 *d*, 68 *d*, 69 *d*) 63

59. Signum a blunt disc or two fused blunt discs (text figures 47 *d*, 48 *c*) ..... *Sosipatra* p. 92
— Signum a pair, or cluster, of bluntly rounded spines more or less fused at base *or* signum absent 60

60. Ductus bursae enlarged anteriorly (text figures 51 *d*, 53 *d*) 61
— Ductus bursae not enlarged anteriorly 62

61. Signum composed of 1 or 2 blunt spines (text figure 51 *d*), *or* signum absent ..... *Ribua* p. 99
— Signum composed of 3–6 blunt spines (text figure 53 *d*) ..... *Plodia* p. 102

62. Forewing with M_2 + M_3 and CuA_1 stalked for about ½ their lengths; hindwing with fused M_{2+3} and CuA_1 stalked for over ½ their lengths .. .. *Varneria* p. 120
— Forewing with M_2 + M_3 and CuA_1 not stalked; hindwing with M_{2+3} and CuA_1 connate, rarely short stalked ..... *Caudellia* p. 76

63. Hindwing with 5 veins (1A, 2A, and 3A together count as 1 vein) (text figure 69 *a*) ... *Cabnia* p. 128
— Hindwing with 6–7 veins (1A, 2A, and 3A together count as 1 vein) 64

64. Haustellum reduced 65
— Haustellum long 67

65. Forewing with 8 veins (text figure 64 *a*) ... *Tampa* p. 118
— Forewing with 9 veins (text figure 61 *a*) 66

66. Signum of corpus bursae composed of small, flattened, broad, dull spines (text figure 61 *d*) ..... *Bandera* p. 115
— Signum of corpus bursae composed of several slender, distinctly pointed spines ..... *Wakulla* p. 117

67. Hindwing with M_{2+3} and CuA_1 either approximate or shortly stalked at base; signum of corpus bursae composed of very weakly pointed spines (text figures 56 *d*, 58 *c*, 59 *d*, 60 *d*) 68
— Hindwing with M_{2+3} and CuA_1 stalked for about ½ their lengths; signum of corpus bursae composed mostly of sharp-pointed spines (text figures 67 *d*, 68 *d*) 69

68. Papillae anales (ovipositor lobes) reduced (text figure 60 *d*); lamella postvaginalis with small scale tufts (text figure 60 *d*) ..... *Cadra* p. 110
— Papillae anales not reduced; lamella postvaginalis without scale tufts ..... *Ephestia* p. 103

69. Junction of corpus bursae and ductus bursae with cluster of small spines (text figure 67 *d*) ..... *Eurythmia* p. 122
— Junction of corpus bursae and ductus bursae without small spines (text figure 68 *d*), *or*, if spines present, spines spirally arranged ... *Erelieva* p. 125

GENUS
Adanarsa Heinrich

Adanarsa Heinrich, 1956, *U. S. Natl. Mus. Bull.*, **207**: 35.
Type species: *Rhodophaea intransitella* Dyar, 1905. Original designation.

Adanarsa is a monobasic genus whose single species occurs in New Mexico and Arizona. The genus appears to be most closely related to *Trachycera* Ragonot and *Cuniberta* Heinrich; *Adanarsa* adults differ from them by having a relatively large clasper at the inner extreme base of the valva of the male genitalia and a broad sclerotized band encircling the ductus bursae of the female genitalia near the junction of the ductus bursae with the corpus bursae. Other differences are given under the generic descriptions of the three genera.

Antenna of both sexes simple, male antenna more robust; sensilla trichodea (cilia) of shaft numerous and, at base of shaft, about ⅓ as long as basal di-

ameter of shaft. Frons weakly rounded, smoothly scaled. Labial palpus of both sexes upturned, reaching vertex, slightly flattened laterally, third segment about ½ length of second, blunt and slightly broadened. Maxillary palpus small, simple. Haustellum well developed. Ocellus present. Forewing of male (text figure 1 *a*) with costa slightly convex on basal ⅓; under surface without sex-scaling or costal fold. Forewing smooth scaled; with 11 veins; R_2 closely approximate to stalk of R_{3+4} and R_5 for a short distance beyond cell; R_{3+4} and R_5 stalked for ½ their lengths; M_1 from below upper angle of cell, more or less straight; M_2 and M_3 shortly stalked, separated at base from CuA_1; CuA_1 from lower angle of cell; CuA_2 from before lower outer angle of cell. Hindwing (text figure 1 *a*) with 8 veins; $Sc+R_1$ and Rs weakly fused for short distance beyond cell; M_2 and M_3 stalked for ½ or nearly ½ their lengths; CuA_1 arising at lower angle of cell, approximate to $M_2 + M_3$ at base; CuA_2 from well before lower angle of cell; cell ½, or slightly more than ½, length of wing. Male with lateral metathoracic sclerites bearing large scale penicilli; penicilli covered posteriorly by layer of enlarged, curved scales. Eighth abdominal segment of male with paired ventrolateral scale tufts; each tuft a single fascicle of simple, thin, more or less straight scales. Relatively robust transverse sclerotized bar associated with scale tufts. Male genitalia (text figure 1 *b, c*) with uncus semitriangular, broadly rounded apically; gnathos a relatively long hook with slightly forked apex; transtilla complete with curved, platelike, central element; juxta possessing short, robust, setiferous dorsolateral lobes; valva simple except for relatively large, sclerotized, erect clasper at extreme inner base; aedoeagus with a sclerotized, sinuate inner element; vinculum broad with terminal margin rounded. Female genitalia (text figure 1 *d*) with corpus bursae membranous; ductus bursae with broad sclerotized band near junction of ductus bursae and corpus bursae; genital opening weakly and narrowly sclerotized along its lower margin; corpus bursae, in part, with numerous, small scobinations; signum a slender, strongly sclerotized, clawlike element; ductus seminalis from corpus bursae near its junction with ductus bursae.

The immature stages are unknown.

Adanarsa intransitella (Dyar)

PL. 1, FIGS. 17–18. TEXT FIG. 1 *a–d* (RWH 5708).

Rhodophaea intransitella Dyar, 1905, *Proc. Ent. Soc. Washington,* **7**: 33.

Type locality: Albuquerque, New Mexico. [USNM]

NOTE—Described from nine specimens. I hereby designate as lectotype the specimen bearing the following labels: 1. "Oslar. Albuquerque N. Mex."; 2. "Type No. 8182 U.S.N.M."; 3. "*Rhodophaea intransitella* Dyar type"; 4. "♂ genitalia slide 615 1983 HHN"; 5. "LECTOTYPE *intransitella* Dyar by H. H. Neunzig."

The male and female genitalia of *intransitella* readily separate this species from its relatives. Particularly diagnostic are the relatively large basal clasper on the valva of the male (text figure 1 *b*) and the partially sclerotized ductus bursae and clawlike signum of the female (text figure 1 *d*). Wing length 8.0–10.5 mm.

A. intransitella is known only from Bernalillo County, New Mexico and Maricopa, Gila, Mohave, and Yavapai Counties, Arizona. It has been collected in New Mexico in July and in Arizona in March, April, June, August, and October.

GENUS

Cuniberta Heinrich

Cuniberta Heinrich, 1956, *U. S. Natl. Mus. Bull.,* **207**: 34.

Type species: *Nephopteryx* [sic] *subtinctella* Ragonot, 1887. Original designation.

The monobasic *Cuniberta* is most easily distinguished from its close relatives by the male antenna that has a strongly developed basal sinus with a row of compact clusters of short sensilla (plate A, figures 1, 2). The male antenna of the allied genus *Bertelia* Barnes and McDunnough is similar (text figure 6 *a, b*), but in *Bertelia* the shaft is strongly pectinate and the sensilla usually are solitary.

Antenna of male with sensilla trichodea (cilia) of shaft moderately abundant, and at base of shaft about as long as basal diameter of shaft. Frons weakly rounded and more or less smoothly scaled. Labial palpus upturned, scarcely reaching vertex in male, slightly longer in female. Maxillary palpus small, squamous. Haustellum well developed. Ocellus present. Basal ½ of costa of forewing of male straight (text figure 2 *a*); under surface of costal area with an indistinct, pale contrasting streak of scales. Forewing smooth, without transverse ridge or tufts of scales; with 11 veins; R_{3+4} and R_5 stalked for ½ their lengths; M_1 from below upper angle of cell, straight; M_2 and M_3 shortly stalked; CuA_1 from the lower angle of cell, but little farther from CuA_2 at base

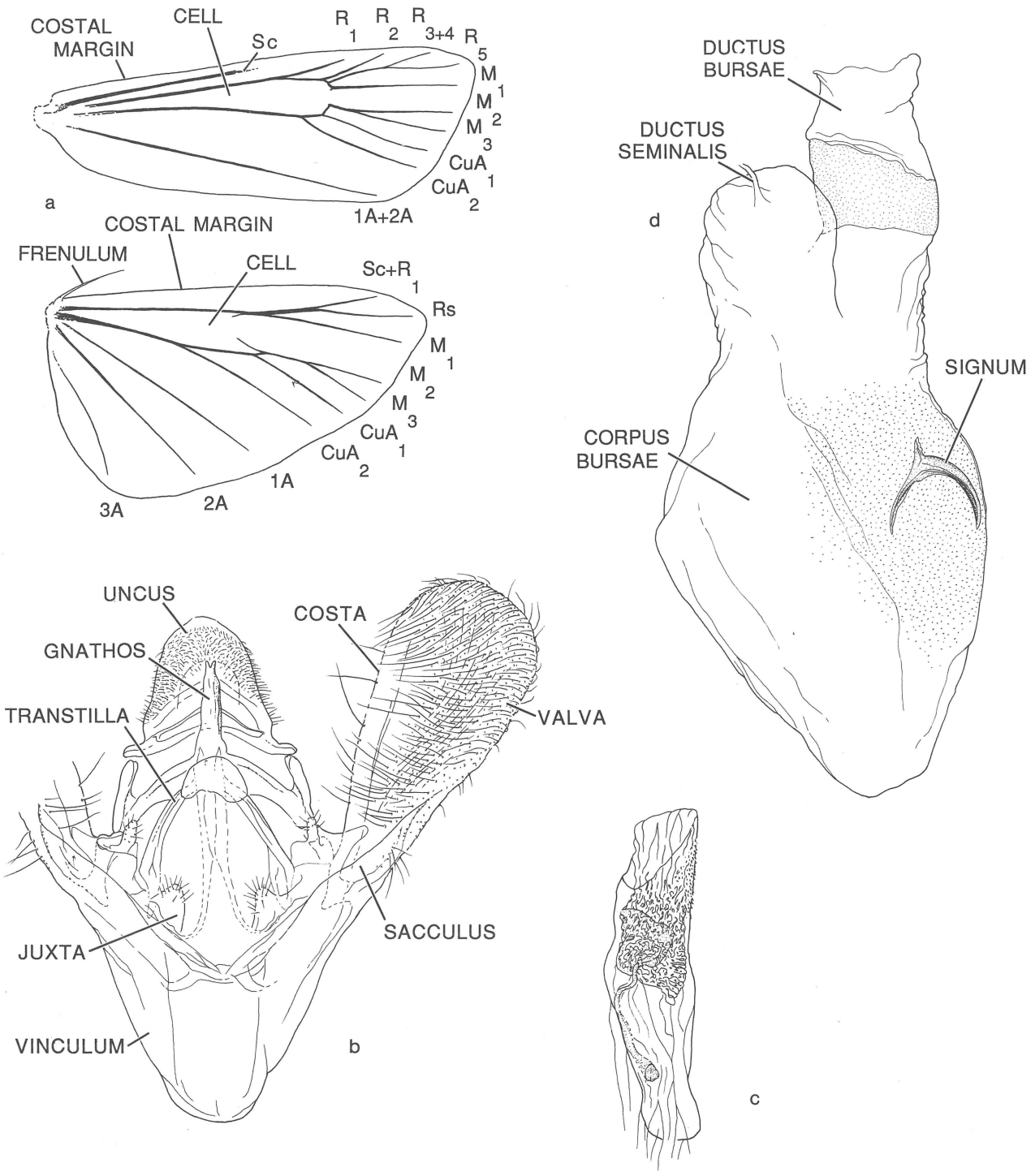


FIGURE 1: VENATION AND GENITALIA OF *ADANARSA INTRANSITELLA*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 615); *c.* Aedoeagus; *d.* Corpus bursae, ductus bursae, and part of ductus seminalis (HHN 616).

than from M_3; CuA_2 from before lower angle of cell. Hindwing (text figure 2 *a*) with 8 veins; $Sc+R_1$ and Rs closely approximate beyond cell; M_2 and M_3 stalked for approximately ½ their lengths; CuA_1 from lower angle of cell, connate with M_2 and M_3; CuA_2 from before lower angle of cell; cell less than ½ length of wing. Eighth abdominal segment of male with paired ventrolateral scale tufts (text figure 4 *a*); each tuft composed of three clusters of scales, anterior cluster large, obscuring other groups. Transverse, sclerotized bar associated with scale tufts. Male genitalia (text figure 2 *b, c*) with uncus triangular; apical process of gnathos hooked, shallowly bifid; transtilla complete, terminal margin strongly produced, broadly U-shaped; juxta a U-shaped plate with setiferous lateral processes; valva simple except for a slightly raised, elongate, setiferous element on inner surface near base; aedoeagus simple, relatively stout with short row of serrations along lateral margin. Female genitalia (text figure 2 *d*) with ductus bursae and corpus bursae membranous except for a sclerotized plate near genital opening; signum present, consisting of a scobinate invaginated cup; a cluster of small scobinations surrounding signum; ductus seminalis arising from a lobe on posterior part of corpus bursae.

The immature stages are unknown.

Cuniberta subtinctella (Ragonot)
PL. 1, FIGS. 5–7; PL. A, FIGS. 1, 2. TEXT FIGS. 2 *a–d*; 4 *a* (RWH 5707).

Nephopteryx [sic] *subtinctella* Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 7.
Type locality: California. [MNHP]

Morphological features useful in recognizing *C. subtinctella* are given in the generic description. Also, the fused, unequal, discal spots usually form a distinctive angulate mark on the upper surface of the forewing. Wing length 10.0–12.5 mm.

C. subtinctella is known from British Columbia (June), Idaho (June, July), Utah (June–August), California (July, August), and New Mexico (July).

Heinrich (1956) thought that the ductus bursae of the female genitalia of *subtinctella* is relatively long and that the ductus seminalis is attached to this structure near the genital opening. I conclude that the ductus bursae is short in this species and that the ductus seminalis arises from the posterior part of an elongate corpus bursae. This latter interpretation agrees with the more obvious condition in the related genera *Crocidomera* Zeller and *Bertelia.* The similarities of the bursae of *Bertelia* (text figure 5 *d*) and those of *Cuniberta* (text figure 2 *d*) are particularly evident.

GENUS
Crocidomera Zeller

Crocidomera Zeller, 1848, *Isis von Oken,* **41**: 865.
Type species: *Crocidomera turbidella* Zeller, 1848. Monotypy.

Crocidomera is a tropical American genus containing four species, one of which occurs in southern Texas and southern Florida. It can be recognized easily by the juxta of the male genitalia that has distinctive, broad, dorsoventrally flattened, truncate arms, and the female genitalia that possess unique, strongly sclerotized ridges in the ductus bursae.

Basal segment of antennal shaft of male (plate A, figures 3, 4) with small, compact, fused cluster of dark sensilla partially overlaid with tuft of pale scales; sensilla trichodea (cilia) of shaft moderately abundant and at base of shaft ⅔–¾ as long as basal diameter of shaft. Frons weakly rounded, smooth to somewhat roughened with scales. Labial palpus of both sexes upturned, reaching vertex, or slightly above it. Maxillary palpus broadly squamous. Haustellum well developed. Ocellus present. Basal ½ of costa of forewing of male (text figure 3 *a*) straight to slightly concave; under surface simple or with elongate group of slender scales originating along basal ½ of costa and covering area between costa and Sc (*imitata* Neunzig). Forewing smooth scaled; with 11 veins; R_2 approximate to the stalk of R_{3+4} and R_5; R_{3+4} and R_5 stalked for about ½ their lengths; M_1 from below upper angle of cell, slightly bent toward base; M_2 and M_3 approximate for short distance from cell; CuA_1 from lower angle of cell; CuA_2 from before lower angle of cell. Hindwing (text figure 3 *a*) with 8 veins; $Sc+R_1$ and Rs closely approximate beyond cell; M_2 and M_3 contiguous for about ⅓ their lengths beyond cell; CuA_1 from lower angle of cell; CuA_2 from well before lower angle of cell; cell slightly less than ½ length of wing. Eighth abdominal segment of male with paired ventrolateral scale tufts (text figure 4 *b*); each tuft composed of several clusters of scales. Most posterior cluster platelike, consisting of closely grouped, apparently fused scales. Transverse, sclerotized bar associated with scale tufts. Male genitalia (text figure 3 *b, c*) with uncus broadly triangular, to more or less trun-

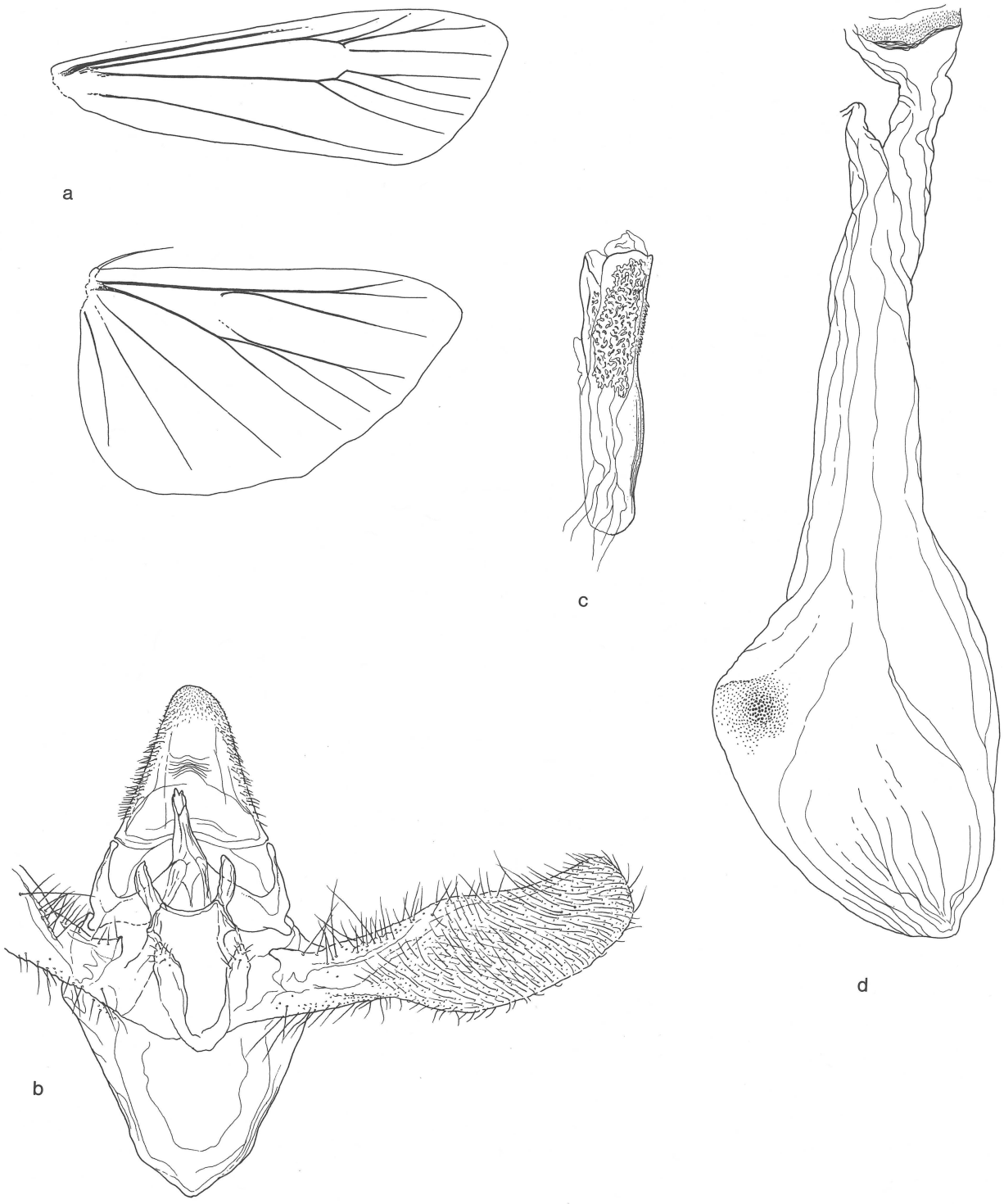


FIGURE 2: VENATION AND GENITALIA OF *CUNIBERTA SUBTINCTELLA*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 765); *c.* Aedoeagus; *d.* Corpus bursae, ductus bursae, and part of ductus seminalis (HHN 766).

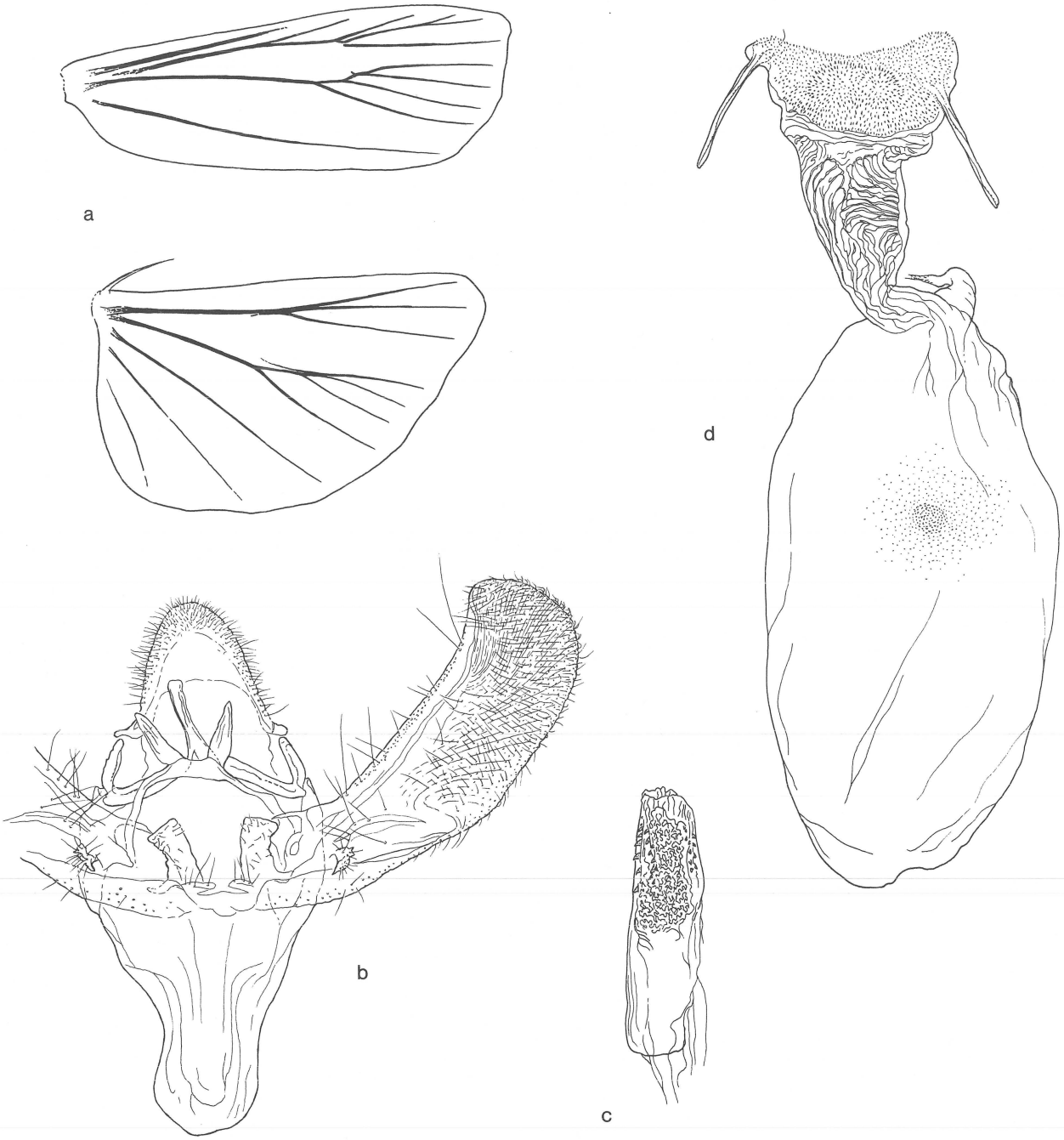


FIGURE 3: VENATION AND GENITALIA OF *CROCIDOMERA IMITATA*

a. Male forewing and hindwing; *b.* Male genitalia, holotype (most of left valva and aedoeagus omitted) (HHN 618); *c.* Aedoeagus; *d.* Corpus bursae, ductus bursae, apophyses anteriores, lamella postvaginalis, and part of ductus seminalis (HHN 1204).

cate, sometimes notched (*turbidella*); gnathos with apical process an elongate, blunt hook, somewhat rounded or slightly notched at apex; transtilla complete, stout, strongly bifid medially; juxta with broad, dorsoventrally flattened truncate lateral arms; valva simple except for small, clawlike or fingerlike protuberance on inner surface near base; aedoeagus with longitudinal rows of small spines toward apex; vinculum slightly longer than greatest width, saccus convex or truncate. Ductus bursae of female genitalia (text figure 3 *d*) lightly sclerotized, strongly wrinkled or ridged before genital opening; corpus

bursae membranous, sometimes finely scobinate; signum a small invaginated cup of scobinations; patch of dense microspines posterior to genital opening; ductus seminalis arising from lobe of corpus bursae near junction of ductus bursae and corpus bursae.

The immature stages of all species of *Crocidomera* are unknown.

Crocidomera imitata Neunzig, NEW SPECIES PL. 1, FIGS. 46–48; PL. A, FIGS. 3, 4. TEXT FIGS. 3 *a–d*; 4 *b*.

Crocidomera imitata Neunzig
Type locality: Key Largo, Monroe Co., Florida. [USNM]

DIAGNOSIS. The adult of *imitata* is similar to both *Crocidomera turbidella* Zeller and *Crocidomera stenopteryx* (Dyar) in general appearance. *C. imitata* can be separated from *turbidella* and *stenopteryx* because the latter two species have the upper discal spot obsolete and the lower discal spot strongly developed, whereas in the former species both spots are distinct, and the lower spot is not appreciably larger than the upper spot. Also, the male of *imitata* has a distinct, large, elongate tuft of scales along the costa of the under surface of the forewing, and the valva (text figure 3 *b*) is broadly rounded apically; *turbidella* and *stenopteryx* lack an elongate costal tuft on the forewing, and the valva is narrowly rounded or bluntly pointed apically.

DESCRIPTION. Wing length 9.0–12.0 mm. Head: frons white to brownish white; vertex brownish white to brownish red; labial palpus white with patches of brownish white or brown. Thorax: collar brownish white, shaded with brown in some specimens; dorsum of thorax brownish white sometimes with a few reddish-brown, fuscous, or black scales. Forewing: ground color white to brownish white; antemedial line obscure, its location indicated by a few fuscous or black patches (part of the dark border usually present in most phycitines); discal spots relatively small, fuscous to black, lower spot not appreciably enlarged; postmedial line similar to antemedial line; a few to many reddish-brown, dark-purple, or black scales mostly on posterior ½ and always as a medial patch on posterior ½; under surface of male with brownish-white, elongate, costal tuft of slender scales. Hindwing: white with some fuscous shading along margins. Male genitalia (text figure 3 *b, c*): gnathos bluntly rounded apically; apex of valva broadly rounded and produced dorsally. Female genitalia (text figure 3 *d*): as described for genus.

The immature stages of *imitata* are unknown.

TYPES. Holotype: ♂. Key Largo, Monroe Co., Florida; 25-X-1965; Mrs. Spencer Kemp; genitalia slide 618 HHN. USNM. Paratypes: 2 ♂, 11 ♀. FLORIDA: same data as for holotype 5-I-1968, 5-IX-1967, 3-XI-1967; genitalia slides 619 HHN, 1204 HHN (1 ♂, 2 ♀). TEXAS: San Benito; 24–30 Apr, 8–15 May; genitalia slide CH 2989 (2 ♀). Santa Ana Wildlife Ref. (Hidalgo); 18-XI-66; A. and M. E. Blanchard (1 ♀). Alamo, Hidalgo Co.; 22-X-70; A. and M. E. Blanchard; genitalia slide AB 2466 (1 ♀). Laguna Atascosa, Cameron Co.; 23-IV-73, 16-XI-73, 12-IX-74; A. and M. E. Blanchard (1 ♂, 5 ♀). NCSU, USNM.

Ragonot (1893: 133) recognized two neotropical species of *Crocidomera, fissuralis* Walker with a large, distinct, dark, longitudinal streak on the forewing and *turbidella* Zeller without a streak on the forewing. Heinrich (1956: 33) did not follow Ragonot; he concluded that the streaked and unstreaked moths represented a single species (*fissuralis*), and that another *Crocidomera* occurring in the southern United States and also in the neotropics was Zeller's *turbidella.* I have been able to look at recently collected *Crocidomera* with and without the streak from the Neotropics. Also, I have examined the type of *fissuralis.* I attempted to look at the type of *turbidella,* as well, which is supposed to be in the British Museum (Natural History), but apparently it is lost. In studying the new material, the description of *turbidella* in Zeller, the type of *fissuralis,* and the description and colored figures of *Crocidomera* in Ragonot, there is no doubt in my mind that the *Crocidomera* in our fauna is a species distinct from *turbidella.*

GENUS
Bertelia Barnes and McDunnough

Bertelia Barnes and McDunnough, 1913, *Contrib. Nat. Hist. Lep. N. Am.,* **2**: 140.
Type species: *Bertelia grisella* Barnes and McDunnough, 1913. Original designation.

Bertelia appears to have two species. One occurs in Arizona and the other in Texas. Although obviously related to both *Cuniberta* and *Crocidomera,* it is a

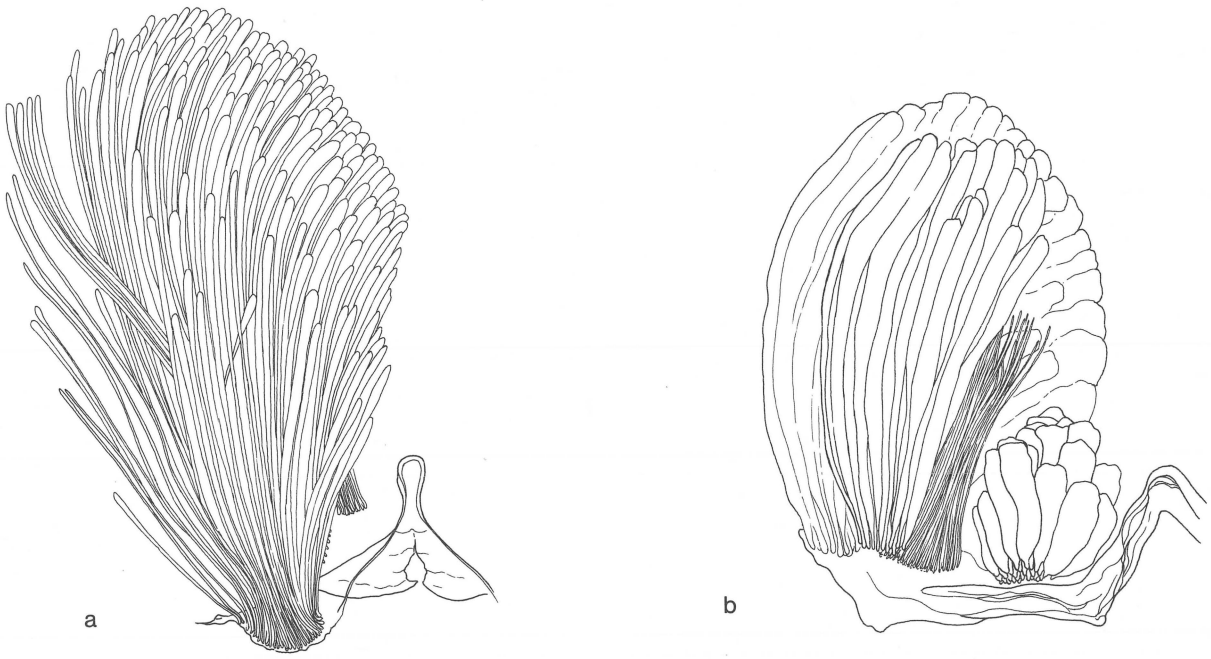


FIGURE 4: EIGHTH ABDOMINAL SCALE TUFTS (LEFT SIDE) OF MALE *CUNIBERTA* AND *CROCIDOMERA*

a. Cuniberta subtinctella; b. Crocidomera imitata.

distinct genus whose males are particularly easy to distinguish from related genera by the strongly pectinate antenna. The genitalia of the females of *Bertelia* have an unusual pair of spinose lobes near the genital opening (text figure 5 *c*).

Antenna of males (text figure 6 *a, b*) with scape cylindrical; base of shaft with strong sinus, bearing near scape a curved row of small, black scales, and along upper ½ of sinus a row of two to three small, dark spinelike sensilla (row sometimes of two to three pairs of sensilla); shaft unipectinate, strongly so beyond sinus. Frons flattened to very shallowly concave with low, rounded carina dorsally, and with anteriorly projecting scales. Labial palpus of male oblique, reaching slightly above vertex, oblique to upturned on female. Maxillary palpus simple. Haustellum well developed. Ocellus present. Basal ½ of forewing of male straight to slightly convex; under surface of forewing with yellowish-white to tan patches or streaks of scales. Forewing smooth scaled; with 11 veins; R_2 closely approximate to stalk of R_{3+4} and R_5; R_{3+4} and R_5 stalked slightly more than ½ their lengths; M_1 from below upper angle of cell, straight; M_2 and M_3 shortly stalked; CuA_1 from lower angle of cell; CuA_2 from before lower angle of cell. Hindwing with 8 veins; discocellular vein curved; $Sc+R_1$ and Rs closely approximate for ½ their lengths beyond cell; M_2 and M_3 contiguous, shortly anastomosed or stalked, usually stalked for less than ½ their lengths; CuA_1 from lower angle of cell; CuA_2 from well before lower angle of cell; cell about ½ length of wing. Eighth abdominal segment of male with paired ventrolateral scale tufts; each tuft a single cluster of simple, more or less straight, scales. Transverse, sclerotized, rather robust bar associated with scale tufts. Male genitalia (text figure 5 *a, b*) with uncus broadly triangular; gnathos a shallowly bifurcate hook; transtilla with distal element somewhat broadly developed, bearing two to several large spines; juxta a U-shaped plate with dorsolaterally flattened lateral arms; valva simple, with small setiferous protuberance on inner surface at base; aedoeagus relatively stout with row of scobinations along the lateral edge toward apex; vinculum slightly shorter than greatest width. Female genitalia (text figure 5 *c, d*) with ductus bursae and corpus bursae membranous except for sclerotized, thin plate and pair of spinose lobes near genital opening; ductus bursae short, without scobinations; corpus bursae elongate with small, scobinate, cuplike signum and associated faint, small scobinations, ductus seminalis from lobe of bursa near junction with ductus bursae.

The immature stages are unknown.

KEY TO MALES OF SPECIES OF *BERTELIA*

1. Transtilla with pair of large, distal spines (text figure 5 *a*); Arizona ..... *grisella* p. 25

— Transtilla with more than one pair of large, distal spines; Texas ..... *dupla* p. 25

Bertelia grisella Barnes and McDunnough
PL. 1, FIGS. 1, 2. TEXT FIGS. 5 *a–d*; 6 *a, b* (RWH 5709).

Bertelia grisella Barnes and McDunnough, 1913, *Contrib. Nat. Hist. Lep. N. Am.*, **2**: 140.
Type locality: Redington, Arizona. [USNM]

In addition to the generic character state pectinate antennae, *grisella* is best identified by its male genitalia (text figure 5 *a, b*). The pair of large, distal spines of the transtilla are particularly characteristic of the species. Wing length 11.5–12.0 mm.

B. grisella is known only from the type series collected in September in Pima County, Arizona.

Bertelia dupla A. Blanchard
PL. 1, FIGS. 3, 4 (RWH 5710).

Bertelia dupla A. Blanchard, 1976, *Jour. Lep. Soc.*, **30**: 211.
Type locality: Shafter, Presidio Co., Texas. [USNM]

B. dupla is easily confused with *grisella*; maculation of the upper surface of the forewing is identical. Indeed, additional collecting and study may show that the two names should be applied to a single species. However, as outlined in the key, the male genitalia of Arizona and Texas moths appear to differ. Blanchard (1976) illustrated the differences between the two in these structures. Wing length 11.0–13.0 mm.

B. dupla has thus far been collected only in west Texas. Almost all specimens were obtained by Blanchard in Presidio County during October. I have seen only one other, collected by Hodges in Culberson County in May.

GENUS
Hypsipyla Ragonot

Hypsipyla Ragonot, 1888, *Nouveaux Genres et Espèces de Phycitidae & Galleriidae*, 10.
Type species: *Hypsipyla pagodella* Ragonot, 1888, considered to be a synonym of *Magiria robusta* Moore 1886. Monotypy.

Hypsipyla includes about six species in the Old and New World tropics. Its closest relative appears to be *Sematoneura* Ragonot that occurs from Mexico south to Argentina. Adults of *Hypsipyla* are usually relatively large phycitines, have smooth wings, and each sex has a simple antenna.

Sensilla trichodea (cilia) of shaft of antenna of male moderately abundant and at base of shaft about as long, to almost twice as long, as basal diameter of shaft. Frons rounded, smoothly scaled. Labial palpus of male upturned, reaching to, or slightly above, vertex, of female obliquely ascending. Maxillary palpus simple. Haustellum well developed. Ocellus present. Basal ½ of costa of forewing of male (text figure 7 *a*) straight to shallowly concave; under surface without streaks or patches of contrastingly colored scales (androconia) or costal fold. Forewing smooth scaled; with 11 veins; R_2 connate, or stalked with R_{3+4} and R_5; M_1 with base approximate to upper angle of cell; M_2 and M_3 approximate for short distance from cell, occasionally connate (rarely short stalked); CuA_1 from lower angle of cell, much closer to M_3 than to CuA_2; CuA_2 from before lower angle of cell. Hindwing (text figure 7 *a*) with 8 veins; $Sc+R_1$ and Rs closely approximate beyond cell; M_2 and M_3 usually short stalked, occasionally connate, partially fused or closely approximate for a short distance from cell; CuA_1 from before, but near lower angle of cell; CuA_2 from well before lower angle of cell; cell ½ or somewhat less than ½ length of wing. Lateral thoracic sclerites of male usually without sex-scaling but *ferralis* (Hampson) with some black scales on prothorax. Eighth abdominal segment of males, of some species, with paired ventrolateral scale tufts; each tuft composed of two to three clusters of simple, more or less straight, scales. Transverse, sclerotized bar associated with scale tufts. Male genitalia (text figure 7 *b, c*) with uncus subtriangular, apex convex; apical process of gnathos a bifurcate hook; transtilla complete, terminal margin with pair of usually well-developed (small in *robusta*) horns; juxta a U- to V-shaped sclerotized plate with long lateral processes; valva simple, with inconspicuous setiferous protuberance near base of inner surface and costa strongly sclerotized; aedoeagus relatively stout and usually armed with a single, somewhat twisted, bladelike cornutus (cornutus absent in *dorsimacula* (Schaus)) and minute spines distally; vinculum usually broad, shorter than greatest width (about as long as broad in *robusta* and *ferralis*). Fe-

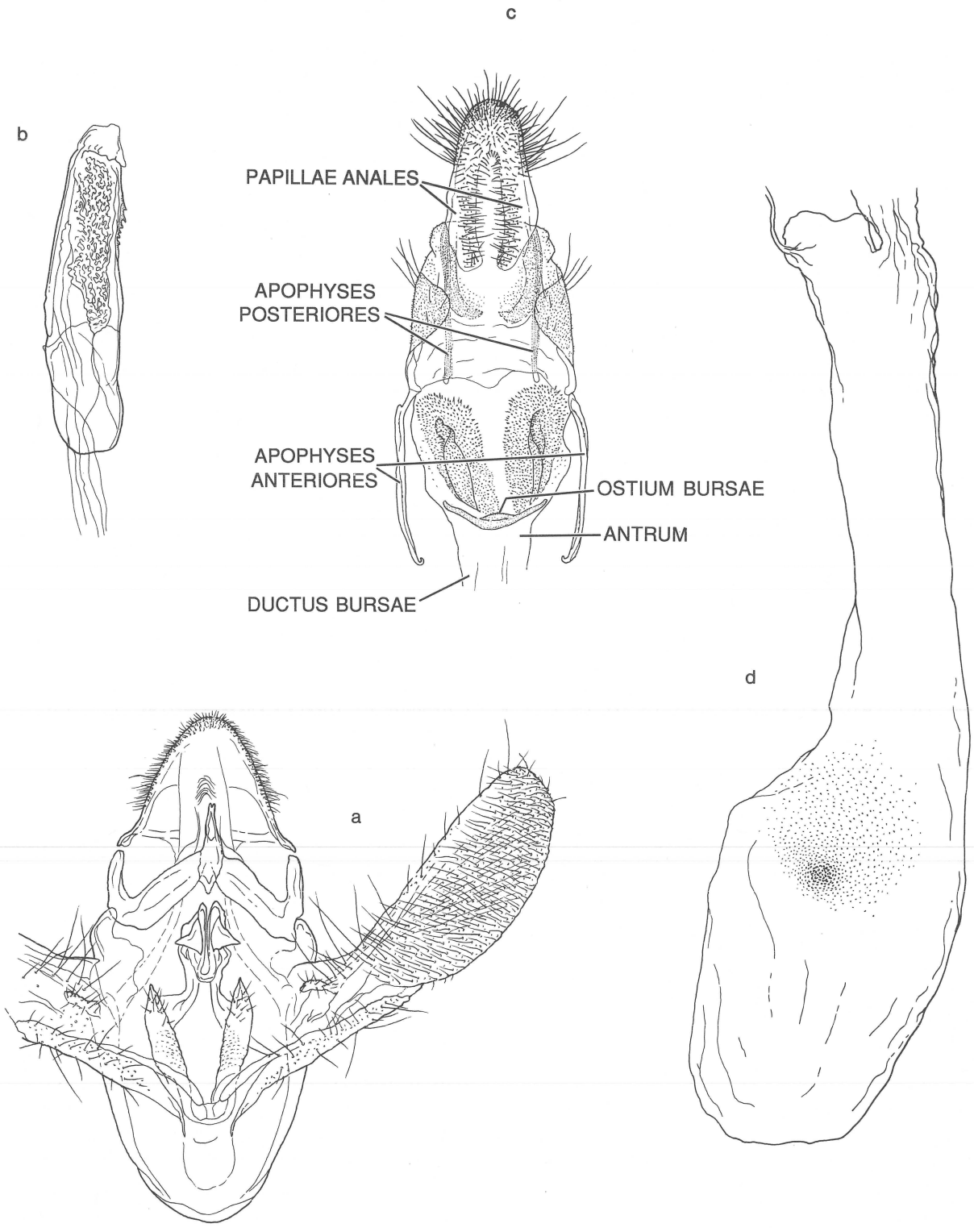


FIGURE 5: GENITALIA OF *BERTELIA GRISELLA*

a. Male genitalia (most of left valva and aedoeagus omitted) (USNM 52494); *b.* Aedoeagus; *c.* Posterior part of female genitalia (HHN 1217); *d.* Anterior part of female genitalia (HHN 1217).

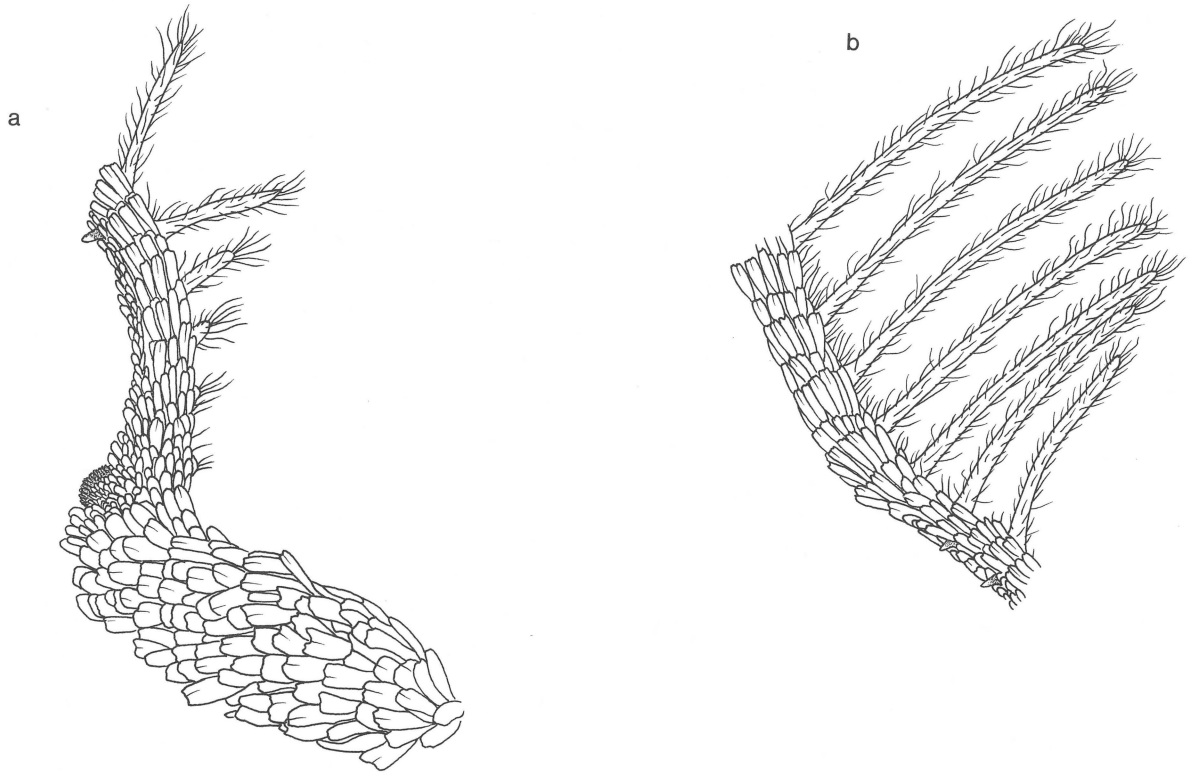


FIGURE 6: ANTENNA (LEFT SIDE) OF MALE OF *BERTELIA GRISELLA*
a. Scape and basal part of shaft; *b.* Subbasal part of shaft.

male genitalia (text figure 7 *d*) with ductus bursae and corpus bursae membranous, except for a sclerotized, narrow plate near genital opening; ductus bursae distinctly shorter than corpus bursae; most of corpus bursae with numerous small, inconspicuous scobinations and sometimes (*robusta, grandella*) with a signum consisting of a scobinate, invaginated cup; ductus seminalis arising from a lobe of corpus bursae near junction of ductus bursae and corpus bursae.

Last stage larvae (text figure 8) robust, with large distinct pinaculum rings at the base of SD1 on the mesothorax and the eighth abdominal segment. Head only slightly roughened with mostly pale tonofibrillary platelets. Body without stripes, darkened with granulations, with indistinct tonofibrillary platelets, and last pair of spiracles somewhat caudally directed. Mandible simple. Maxilla with forked sensilla trichodea. Pupae robust. Thoracic spiracles present. Gibba absent. Spinose cremastral setae relatively short, hooked.

Known host plants of the larvae belong to the Meliaceae. Shoots, fruits, and seeds are eaten.

Hypsipyla grandella (Zeller) (Mahogany Shootborer)
PL. 1, FIGS. 62–64. TEXT FIGS. 7 *a–d*; 8 (RWH 5705).

Nephopteryx [sic] *grandella* Zeller, 1848, *Isis von Oken,* **41**: 881.
Type locality: Brazil. [lost]

Hypsipyla cnabella Dyar, 1914, *Proc. U. S. Natl. Mus.,* **47**: 405.
Type locality: Córdoba, Mexico. [USNM]

Adults are usually rather large (wing length 12.0–20.0 mm) and smoothly scaled. They are mostly brown with the veins of the upper surface of the forewing overlaid with black; discal spots are obscure. Pinned specimens frequently become greasy.

Last stage larvae (text figure 8) 22.0–31.0 mm long. Head reddish brown, darker anteriorly, with dark submental and genal patch. Thoracic shield mostly yellowish brown, darker at margins. Body usually greenish blue with strongly developed brown

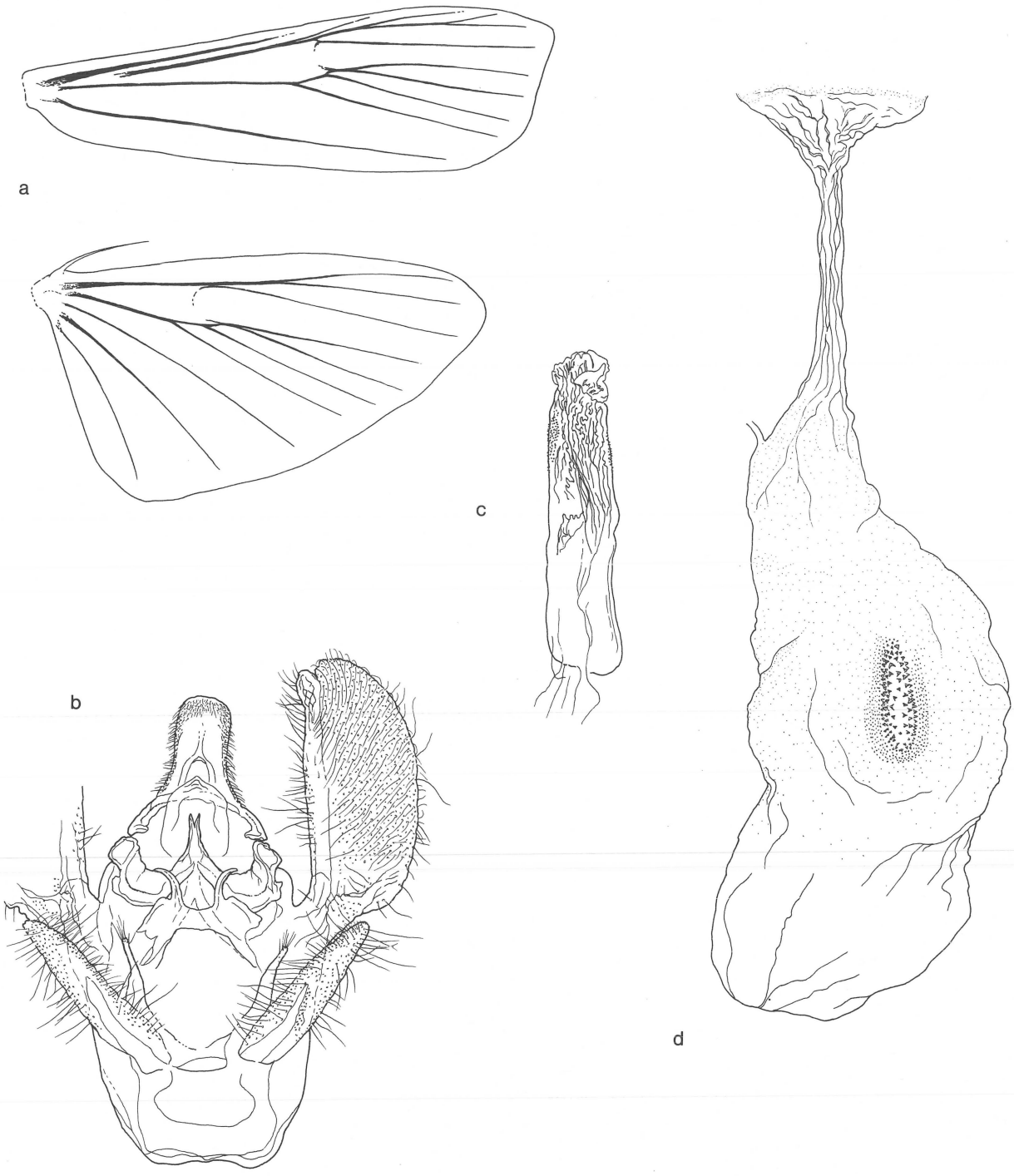


FIGURE 7: VENATION AND GENITALIA OF *HYPSIPYLA GRANDELLA*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 608); *c.* Aedoeagus; *d.* Corpus bursae, ductus bursae, and part of ductus seminalis (HHN 609).

to dark-brown pinacula. SD1 pinaculum rings on mesothorax and eighth abdominal segment brown to dark brown.

Pupa 13.0–15.5 mm long, reddish brown. Head slightly wrinkled. Prothorax and mesothorax smooth, but with a few punctures near meson. Abdominal segments 1–9 with numerous punctures. Usually eight, spinose, hooked cremastral setae.

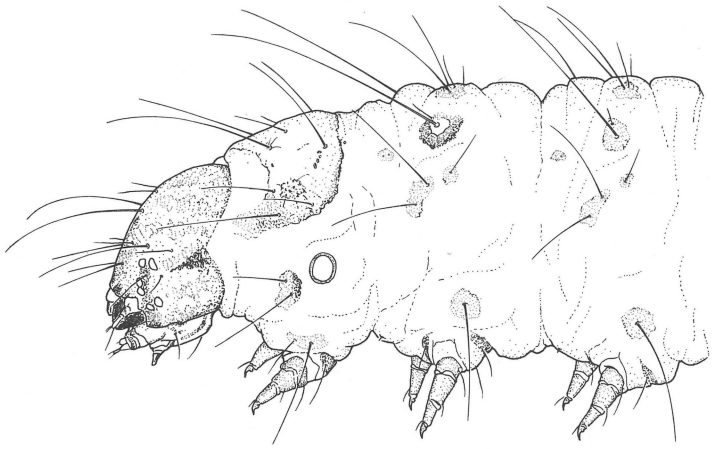


FIGURE 8: LAST STAGE LARVA OF *HYPSIPYLA GRANDELLA* (LATERAL VIEW OF HEAD AND THORAX)

Larval hosts of *grandella* include West Indian mahogany (*Swietenia mahagoni* (L.) Jacquin), Honduras mahogany (*Swietenia macrophylla* G. King), cigar box or Spanish cedar (*Cedrela odorata* L.), Mexican cedrela (*Cedrela mexicana* M. Roemer), crabwood (*Carapa* sp.), khaya (*Khaya* sp.), and muskwood or trompillo (*Guarea* sp.).

According to Ramirez-Sanchez (1964) and Roovers (1971), females place their eggs on leaves or stems of small, rapidly growing hosts, or on, or near, the flowers or developing fruit of older trees. Small larvae bore into leaf veins, rachises, stems, flowers, or fruit. Large larvae occur in large stems or fruit. Conspicuous frass is extruded from the galleries. Several good photographs showing typical damage to young nursery trees are in Ramirez-Sanchez (1964). Pupation occurs in a silken cocoon in the hollowed-out stem or fruit. Janzen (1987) reported that *grandella* has several generations each year in Costa Rica. A generation feeds in nearly mature host fruit during the dry season and at least two generations of larvae occur in host stems during the rainy season. The species is of considerable economic importance in young plantations of mahogany or *Cedrela* throughout much of the American tropics. *H. grandella* sometimes can be collected in southern Florida. I have seen moths of this species from Coral Gables (March), Key Largo (March), Miami (November), and Tavernier (April).

GENUS
Anypsipyla Dyar

Anypsipyla Dyar, 1914, *Proc. U. S. Natl. Mus.*, **47**: 327.

Type species: *Anypsipyla univitella* Dyar, 1914. Original designation.

Anypsipyla is a distinct genus with one tropical American species.

Antenna simple in both sexes; sensilla trichodea (cilia) of shaft moderately abundant and at base of shaft about as long as basal diameter of shaft. Frons weakly rounded, with some anteriorly projecting scales. Labial palpus of male obliquely upturned, reaching slightly above vertex, third segment as long as second, acuminate, somewhat porrect in female. Maxillary palpus small, simple. Haustellum well developed. Ocellus present. Forewing of male (text figure 9 *a*) with costa more or less straight on basal ⅓; under surface with narrow costal fold. Forewing smooth scaled; with 11 veins; R_{3+4} and R_5 stalked for ½ their lengths or slightly more; M_1 from below upper angle of cell, straight; M_2 and M_3 stalked for approximately ½ their lengths; CuA_1 from lower angle; CuA_2 from before, but close to, lower angle of cell. Hindwing (text figure 9 *a*) with 8 veins; $Sc+R_1+Rs$ fused beyond cell for appreciably more than ½ their lengths; M_2 and M_3 long stalked; CuA_1 arising from stalk of M_2 and M_3; CuA_2 from well before lower angle of cell; cell slightly less than ½ length of wing. Eighth abdominal segment of male with paired ventrolateral scale tufts; each tuft a single fascicle of simple, more or less straight, scales. Transverse, sclerotized bar associated with scale tufts. Male genitalia (text figure 9 *b, c*) with uncus subtriangular; gnathos a well-developed, somewhat elongate, hook with notched apex; transtilla complete, strongly arched; juxta with slender, seta-bearing, dorsolateral lobes; valva slender, rounded apically, with costa

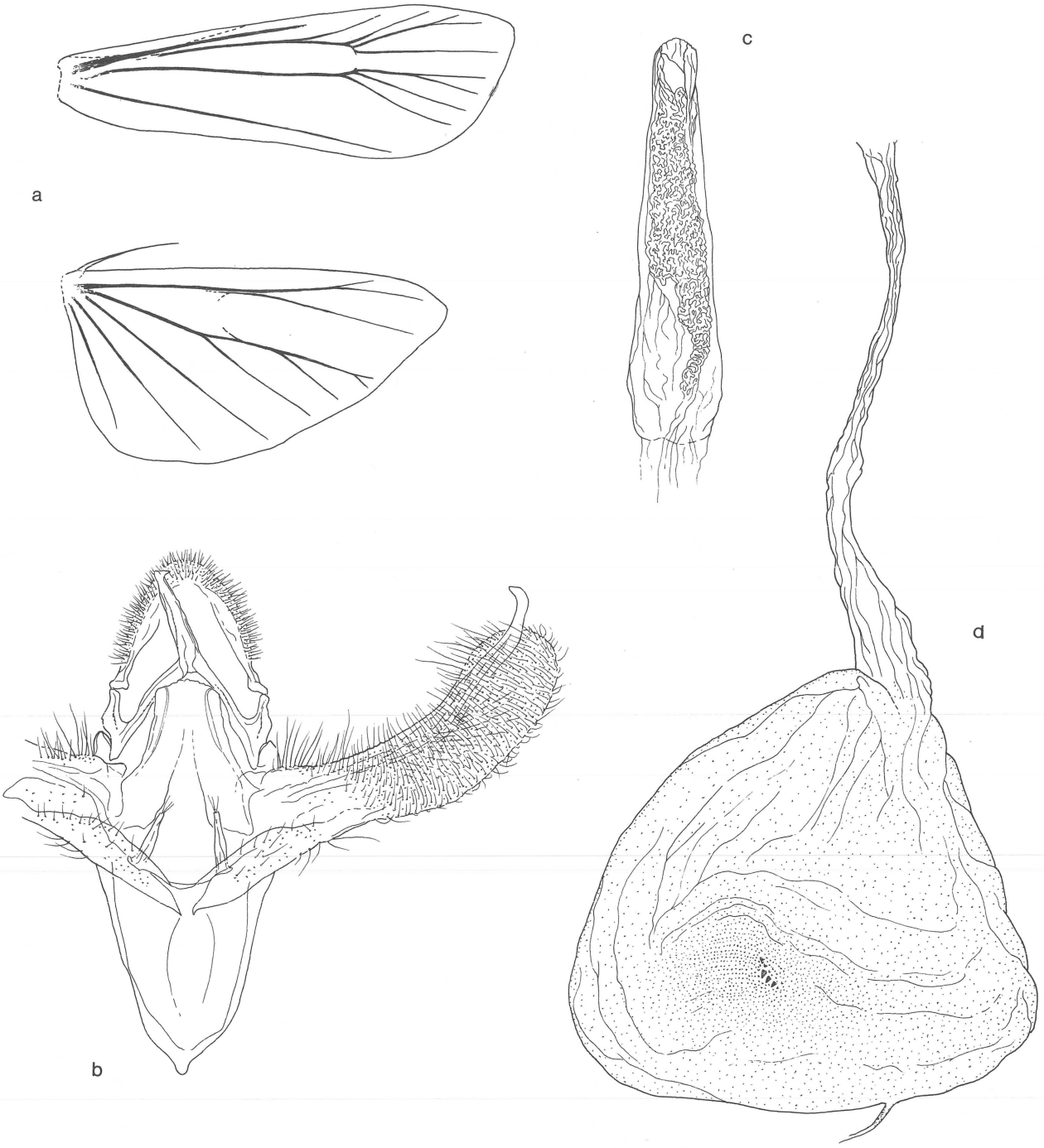


FIGURE 9: VENATION AND GENITALIA OF *ANYPSIPYLA UNIVITELLA*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 1429); *c.* Aedoeagus; *d.* Corpus bursae, ductus bursae, and part of ductus seminalis (HHN 1430).

strongly sclerotized, produced beyond valva into a distinctive distal hook; aedoeagus simple, gradually tapered distally; vinculum about as long as broadest width. Female genitalia (text figure 9 *d*) with ductus bursae and corpus bursae membranous; genital opening simple; ductus bursae slender, considerably longer than corpus bursae; corpus bursae with numerous, weakly developed scobinations, and small signum composed of cluster of about six, small, short spines; ductus seminalis attached to anterior part of corpus bursae.

Last stage larva with pinaculum rings at base of

SD1 on the mesothorax and the eighth abdominal segment. Head slightly roughened. Body without stripes. Mandible with usual complement of teeth, no retinaculum. Maxilla with simple sensilla trichodea.

Larval host plants are Fabaceae. Only the fruit is eaten.

Anypsipyla univitella Dyar

PL. 1, FIG. 61. TEXT FIG. 9 *a–d.*

Anypsipyla univitella Dyar, 1914, *Proc. U. S. Natl. Mus.*, **47**: 327.

Type locality: Corozal, Panama. [USNM]

Adults are usually easily recognized by the broad, white subcostal streak that is dusted with red and partially outlined in black, on the upper surface of the forewing. Also, the male and female genitalia (text figure 9 *b–d*) should not be confused with any other known phycitine.

Last stage larva 18.0–27.0 mm long. Head reddish brown. Thoracic shield yellowish brown with slightly darker platelets. Mesothoracic and eighth abdominal pinaculum rings pale brown.

Larvae have been collected from the fruit of Brazilian senna (*Cassia brasiliana* Lamark), saman or raintree (*Pithecellobium saman* (Jacquin) Bentham), and cabbage angelintree (*Andira inermis* (W. Wright) Humboldt, Bonpland, Kunth ex Decandolle).

A. univitella is generally distributed in tropical America. Recently, a few adults have been taken at lights in Key Largo, Florida in February, March, and April.

GENUS

Chararica Heinrich

Chararica Heinrich, 1956, *U. S. Natl. Mus. Bull.*, **207**: 38.

Type species: *Myelois annuliferella* Dyar, 1905. Original designation.

Chararica is a small genus whose three species occur primarily in western North America; *C. hystriculella* (Hulst) is found in west Texas, central Texas, and Florida. Adults can be identified by the presence of a small orbicular mark on the upper surface of the forewing in place of the usual discal spots. This character is somewhat obscure in *bicolorella* (Barnes and McDunnough). Both sexes also have featherlike maxillary palpi.

Antenna with scape and shaft simple in male. Sensilla trichodea (cilia) abundant, and at base of shaft $\frac{1}{7}$–$\frac{1}{10}$ as long as basal diameter of shaft. Frons slightly convex, more or less smoothly scaled. Labial palpus of both sexes upturned, reaching approximately to vertex. Maxillary palpus of both sexes in form of aigrette. Haustellum well developed. Ocellus present. Basal ½ of costa of forewing of male (text figure 10 *a*) straight to slightly convex; under surface without costal fold or contrastingly colored streaks or patches of sex-scaling. Forewing smooth scaled; with 11 veins; R_2 approximate to stalk of R_{3+4} and R_5 for a short distance; R_{3+4} and R_5 stalked for slightly less than ½ their lengths; M_1 from below upper angle of cell, straight; M_2 and M_3 separated at base; CuA_1 from lower angle of cell; CuA_2 from before lower angle of cell. Hindwing (text figure 10 *a*) with 8 veins; $Sc+R_1$ and Rs fused or approximate for a short distance beyond cell; M_2 and M_3 shortly stalked; CuA_1 from lower angle of cell, connate with or very closely approximate to M_3 at base; CuA_2 from well before lower angle of cell; cell about ½ length of wing. Lateral sclerites of thorax of males usually (*hystriculella* and *bicolorella*) with large penicillus. Coxa of foreleg sometimes (*bicolorella*) with penicillus attached to inner surface at base. Eighth abdominal segment of male with paired ventrolateral scale tufts; each tuft a single cluster of simple, more or less, straight scales. Transverse, mesially broadened, sclerotized bar associated with scale tufts. Male genitalia (text figure 10 *b, c*) with uncus triangular, tapering to blunt point; gnathos with weakly developed, elongate, mesial element; transtilla complete, lateral elements with long setae; juxta with short, robust setiferous elements; valva simple, broadly rounded with setiferous protuberance near base; aedoeagus with lateral margins serrate toward apex; vinculum shorter than greatest width. Female genitalia (text figure 10 *d*) with corpus bursae membranous; ductus bursae slightly sclerotized and transversely wrinkled toward genital opening, with strongly sclerotized, more or less lobed plate at genital opening; signum present, consisting of scobinate invaginate cup; signum surrounded by a concentric patch of scobinations; ductus seminalis from bursa near junction of bursa and ductus bursae.

The immature stages are unknown.

KEY TO SPECIES OF *CHARARICA*

1. Forewing with most of posterior ½, and medial area of costal ½, ochreous to pale orange, contrasting with rest of wing (plate 1, figures 20, 21); coxa of foreleg of male with penicillus attached to inner surface at base ..... *bicolorella* p. 32

— Forewing with few to no ochreous to pale-orange scales; coxa of foreleg of male without penicillus 2

2. Forewing heavily dusted with white; lateral sclerite of metathorax of male with large penicillus ..... *hystriculella* p. 32

— Forewing lightly to moderately dusted with white; lateral sclerite of metathorax of male without large penicillus ..... *annuliferella* p. 32

Chararica annuliferella (Dyar)
PL. 1, FIG. 19 (RWH 5712).

Myelois annuliferella Dyar, 1905, *Proc. Ent. Soc. Washington,* **7**: 33.
Type locality: Gallinas Canyon, New Mexico. [USNM]

NOTE—Described from a male and female. I hereby designate as lectotype the male bearing the following labels: 1. "Oslar. Gallinas Canon (sic) N. Mex."; 2. "Type No. 8193 U.S.N.M."; 3. "*Myelois annuliferella* type Dyar"; 4. "LECTOTYPE *annuliferella* Dyar by H. H. Neunzig."

The adult of *annuliferella* is most similar to *hystriculella* in color and pattern of the forewing. The former, however, is a darker species, lacking most of the heavy white dusting found in *hystriculella.* Wing length 7.0–9.5 mm.

Male genitalia with uncus shaped approximately like an equilateral triangle; setae of lateral elements of juxta not reaching to or near base of uncus (Heinrich 1956: figure 189). Female genitalia (Heinrich 1956: figure 670) with transverse band on lower margin of genital opening about ½ as wide as that of *C. hystriculella.*

C. annuliferella has been collected in New Mexico and Arizona. Collection dates are in July for Lincoln County, New Mexico and April, May, and October for Yavapai County, Arizona.

Chararica hystriculella (Hulst)
PL. 1, FIGS. 22–25. TEXT FIG. 10 *a–d* (RWH 5713).

Acrobasis hystriculella Hulst, 1887, *Ent. Americana,* **3**: 135.
Type locality: Texas. [AMNH]

NOTE—Hulst's description of *hystriculella* was based on two males and two females. I hereby designate as lectotype the specimen in the AMNH bearing the following labels: 1. "Tex."; 2. "Collection G. D. Hulst"; 3. "*Acrobasis hystriculella* type Hulst"; 4. "♀ genitalia on slide 13 June 1946 C. H. #3131"; 5. "LECTOTYPE *hystriculella* Hulst by H. H. Neunzig."

Adults of *hystriculella* can be separated easily from the other species in the genus by the heavy white dusting and the distinct antemedial line of the upper surface of the forewing. Wing length 7.0–9.0 mm.

Male genitalia with uncus narrow, and lateral elements of juxta with long setae reaching to or near base of uncus.

C. hystriculella has been collected in southern Texas and central and southern Florida. The species most likely also occurs in Mexico. In Texas, moths have been taken every month from March through November. *C. hystriculella* in Florida has been recorded in May (Kimball, 1965).

Chararica bicolorella (Barnes and McDunnough)
PL. 1, FIGS. 20, 21 (RWH 5714).

Rhodophaea bicolorella Barnes and McDunnough, 1917, *Can. Ent.,* **49**: 404.
Type locality: Christmas, Gila Co., Arizona. [USNM]

A very distinct species. Easily recognized by the contrasting colors of the upper surface of the forewing. The male is also unusual in having a penicillus attached to the inner surface of the base of the coxa of the foreleg. Wing length 7.5–10.5 mm.

Male and female genitalia essentially like those of *C. hystriculella.*

C. bicolorella has been collected in Arizona, Nevada, and California. Flight periods for *bicolorella* adults are May through September, Mohave County, Arizona; April, July, Clark County, Nevada; April, San Bernardino County, California.

GENUS
Myelopsis Heinrich

Myelopsis Heinrich, 1956, *U. S. Natl. Mus. Bull.,* **207**: 40.
Type species: *Myelois coniella* Ragonot, 1887, considered to be a junior synonym of *Dioryctria minutularia* Hulst, 1887. Original designation.

Myelopsis is a holarctic genus with five species. One species (*tetricella* (Denis and Schiffermüller)) occurs in Europe, and the others are found in North America. Major structural character states of the genus are smooth wings, male antenna simple with sensilla trichodea (cilia) short, male genitalia with apical process of gnathos broadly U-shaped, transtilla

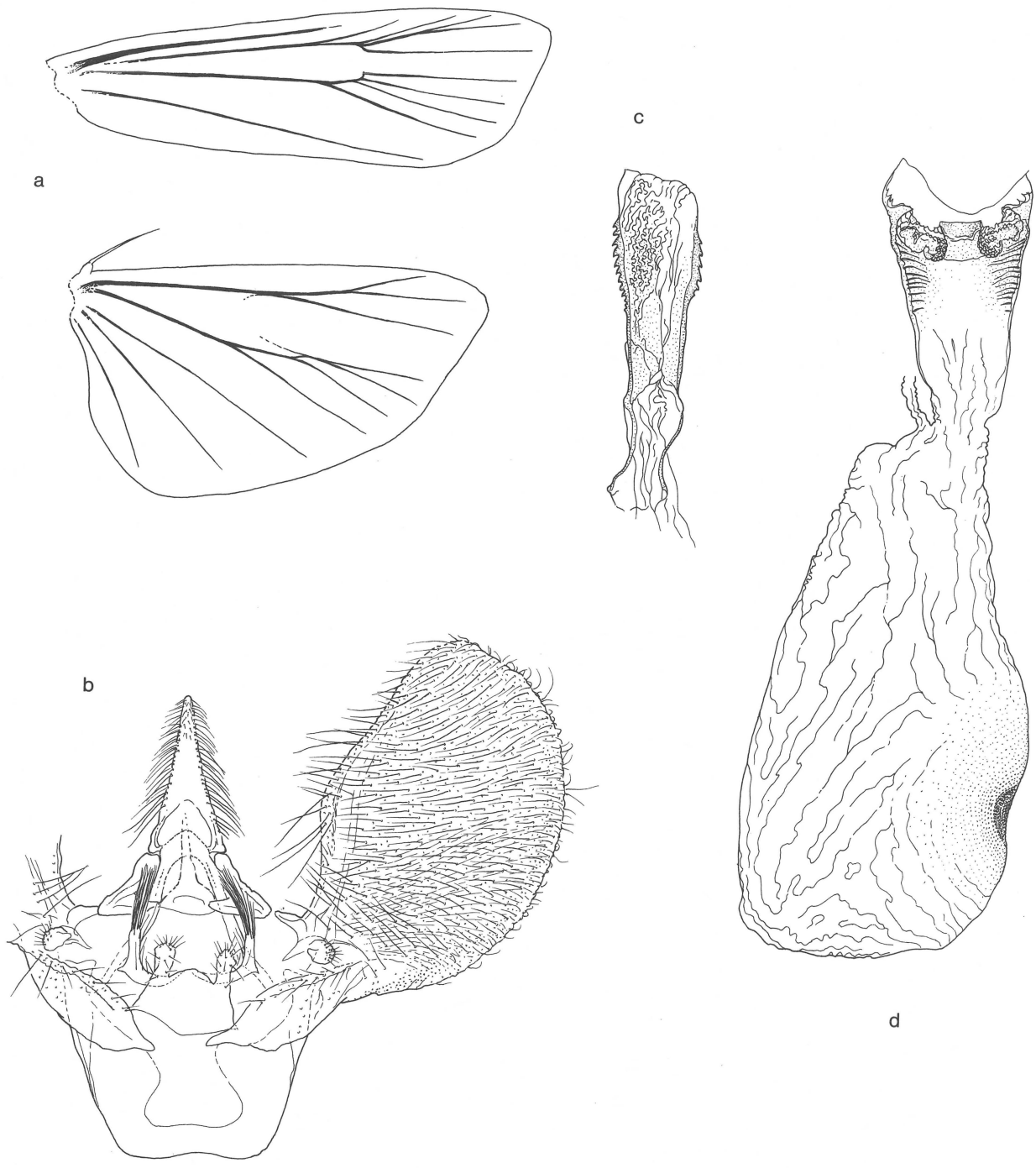


FIGURE 10: VENATION AND GENITALIA OF *CHARARICA HYSTRICULELLA*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 638); *c.* Aedoeagus; *d.* Corpus bursae, ductus bursae, and part of ductus seminalis (HHN 606).

complete but weakly sclerotized, and valva with costa strongly sclerotized.

Sensilla trichodea of shaft of male moderately abundant, and at base of shaft about ½ as long as basal diameter of shaft. Frons convex, somewhat roughly scaled. Labial palpus of both sexes upturned, extending slightly above vertex. Maxillary palpus simple. Haustellum well developed. Ocellus present. Basal ½ of costa of forewing of male (text figure 13 *a*) straight to slightly convex; under surface

sometimes (*minutularia* (Hulst), *alatella* (Hulst)) with a very shallow costal fold. Forewing smooth scaled; with 11 veins; R_2 separated from R_{3+4} and R_5 at base; M_1 from below upper angle of cell; M_2 and M_3 shortly stalked, the stalk at base separated from CuA_1 for a distance but slightly less than that between CuA_1 and CuA_2; CuA_1 from lower angle of cell, CuA_2 from before but near lower angle of cell. Hindwing (text figure 13 *a*) with 8 veins; $Sc+R_1$ and Rs strongly fused beyond cell; free element of Sc short; M_2 and M_3 stalked for slightly less than ½ their lengths; CuA_1 from lower angle of cell; CuA_2 from well before lower angle of cell; cell ½, or slightly over ½, length of wing. Eighth abdominal segment of male without scale tufts. Male genitalia (text figures 11 *a, b*; 12 *a, b*; 14 *a, b*) with uncus either broadly, or somewhat narrowly, triangular; apical process of gnathos U-shaped; transtilla complete, but usually weakly sclerotized (very weak medially in *minutularia*); juxta U-shaped, narrow; valva with costa in part, or completely, strongly sclerotized and usually produced free of valva into a short digitlike element; aedoeagus simple, with small spines apically, or with a cluster of small, short cornuti (cornuti particularly distinct in *subtetricella* (Ragonot) and *tetricella*); vinculum almost as long as greatest width. Female genitalia (text figures 11 *c*; 12 *c*; 13 *b*; 14 *c, d*) with ductus bursae membranous; corpus bursae usually membranous and with scobinations (elongate, sclerotized fold in *subtetricella*; dorsal surface of *alatella* weakly sclerotized); ductus bursae short to long; signum present or absent; ductus seminalis from middle or toward anterior end of corpus bursae.

Hasenfuss (1960) described the larva of the European *tetricella.* There is no information on the American species. Larvae of *tetricella* have been reported as feeding on Salicaceae. Hosts of North American species are unknown.

KEY TO NORTH AMERICAN SPECIES OF *MYELOPSIS*

1. Sclerotized, basal part of costa of valva very broad (text figure 14 *a*); corpus bursae more or less oval and lightly sclerotized dorsally (text figure 14 *d*) ..... *alatella* p. 36

— Sclerotized, basal part of costa more narrow; corpus bursae either somewhat oval and membranous, or elongate and with or without sclerotization (text figures 11 *c,* 12 *c,* 13 *b*) 2

2. Sclerotized part of costa of valva projecting to, or produced slightly beyond, apex of valva (text figure 11 *a*); female genitalia without signum ..... *minutularia* p. 34

— Sclerotized part of costa of valva not extending to apex of valva; female genitalia with signum 3

3. Aedoeagus without cornuti (text figure 12 *b*); corpus bursae (text figure 12 *c*) not sclerotized (except signum) ..... *immundella* p. 35

— Aedoeagus with distinct cluster of small, short cornuti; corpus bursae (text figure 13 *b*) with elongate, sclerotized fold ..... *subtetricella* p. 35

Myelopsis minutularia (Hulst)

PL. 2, FIGS. 1–4. TEXT FIG. 11 *a–c* (RWH 5716, 5719).

Dioryctria minutularia Hulst, 1887, *Ent. Americana,* **3**: 136.
Type locality: Blanco Co., Texas. [AMNH]

NOTE—*D. minutularia* apparently was described from two specimens. A moth labeled type is in the AMNH, and another, also labeled type is in the USNM. Both are females, not males as stated by Hulst (1887). I hereby designate as lectotype the moth in the AMNH bearing the following labels: 1. "Blanco Co. Cent. Tex."; 2. "Collection G. D. Hulst"; 3. "*Dioryctria minutulella* (sic) Type Hulst"; 4. "♀ genitalia on slide 13 June 1946 C. H. # 3127"; 5. "LECTOTYPE *minutularia* Hulst by H. H. Neunzig."

Myelois coniella Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 3.
NEW SYNONYMY
Type locality: Nevada. [MNHP]

Rampylla nefas Dyar, 1922, *Ins. Insc. Mens.,* **10**: 172.
Type locality: Mexico City, Mexico. [USNM]

M. minutularia usually has a distinct ochreous to reddish-brown basal patch of scales on the posterior ½ of the upper surface of the forewing (other *Myelopsis* lack this patch, or sometimes have a weakly developed basal patch (*Myelopsis immundella* (Hulst)). Male genitalia are similar to those of *immundella,* but the apex of the sclerotized costa of the valva projects farther distally, and the transtilla is more weakly developed mesially in *minutularia. M. minutularia* is a somewhat variable species in color, with some individuals slightly darker than

others (plate 2, figures1–4). Wing length 6.0–10.5 mm.

Male genitalia (text figure 11 *a, b*) with gnathos well developed and broadly U-shaped apically; transtilla very weakly sclerotized mesially; costa of valva narrowly sclerotized and projecting to or slightly beyond apex of valva; aedoeagus with cluster of very small spines distally. Female genitalia (text figure 11 *c*) with ductus bursae and corpus bursae membranous, without signum.

The immature stages are unknown.

The species has a wide distribution in North America, occurring from southern Ontario and Maine to southern British Columbia and Montana south mainly along the Rocky Mountains into Central Mexico. Flight periods include: Ontario (July, August); Manitoba (August); British Columbia (July, August); Maine (August); Michigan (July); Nebraska (July); Montana (July); Utah (July–September); Nevada (September); Colorado (August); Arizona (April, July–September); Texas (March, May); Mexico (March, September).

Heinrich (1956: 41) expressed the opinion that *minutularia* and *coniella* might prove to be conspecific. Additional collecting, particularly by Ferguson, Franclemont, and Hodges, has provided more specimens and shows that size, previously used to separate *minutularia* and *coniella,* is no longer diagnostic. A continuous series from small to medium-sized moths is available for study. Heinrich (1956: 41) also mentioned that ". . . the ductus bursae of *minutularia* is longer than that of typical *coniella* and the bursae shows considerably more scobinations." I have examined the genitalia slides made by Heinrich, studied additional slides of my own of small and medium-sized females, and have not been able to find a consistent difference.

Myelopsis immundella (Hulst)
PL. 1, FIGS. 8, 9. TEXT FIG. 12 *a–c* (RWH 5717).

Myelois immundella Hulst, 1890, *Trans. Amer. Ent. Soc.,* **17**: 117.
Type locality: Texas. [AMNH]

M. immundella is similar to *minutularia* in general wing pattern and coloration, but specimens of *immundella* have the outer dark border of the antemedial line more angulate on the inner half of the wing than in *minutularia.* The gnathos (text figure 12 *a*) has characteristic, relatively long, apical arms that should easily separate this species from its congeners. Female genitalia (text figure 12 *c*) with ductus bursae and corpus bursae membranous, and corpus with distinct signum. Wing length 10.0–12.5 mm.

The immature stages are unknown.

M. immundella has been collected in southern Texas from the end of March to the beginning of May.

Heinrich (1956) during his revisional studies was able to examine only the type of *immundella,* which lacks the abdomen. Understandably, therefore, he was uncertain as to the status of the name, and suggested that it possibly should be applied to a color form of *subtetricella.* I have also examined the type of *immundella* in the AMNH, and the specimen agrees with moths recently collected by Blanchard and Knudson in Texas. Examination of the genitalia of this new material leaves no doubt that *immundella* is a discrete species.

Myelopsis subtetricella (Ragonot)
PL. 1, FIGS. 15, 16. TEXT FIG. 13 *a, b* (RWH 5718).

Myelois subtetricella Ragonot, 1889, *Ent. Americana,* **5**: 113.
Type locality: North America. [MNHP]

Myelois zonulella Ragonot, 1889, *Ent. Americana,* **5**: 113.
Type locality: north Illinois. [BMNH]
NOTE—Heinrich (1956: 41) selected a lectotype for *M. zonulella.*

Myelois obnupsella Hulst, 1890, *Trans. Amer. Ent. Soc.,* **17**: 118.
Type locality: Canada. [AMNH]
NOTE—Barnes and McDunnough (1916: 193) designated a lectotype for *M. obnupsella.*

The species is best identified by the male and female genitalia. Unique features are male genitalia with sclerotized costa of valva fused for entire length to valva, and aedoeagus with a distinct cluster of small, but stout cornuti (Heinrich, 1956: figure 192); female genitalia (text figure 13 *b*) with elongate, sclerotized fold in corpus bursae. Wing length 8.0–13.0 mm.

The immature stages are unknown.

M. subtetricella occurs from Nova Scotia to southern Alberta and along the northeastern and northcentral United States south into Nebraska and Colorado. The species is collected most frequently in the northeastern and northcentral United States. Heinrich (1956) listed *subtetricella* as occurring in Florida. However, he based this distribution record on a single specimen that had been questionably

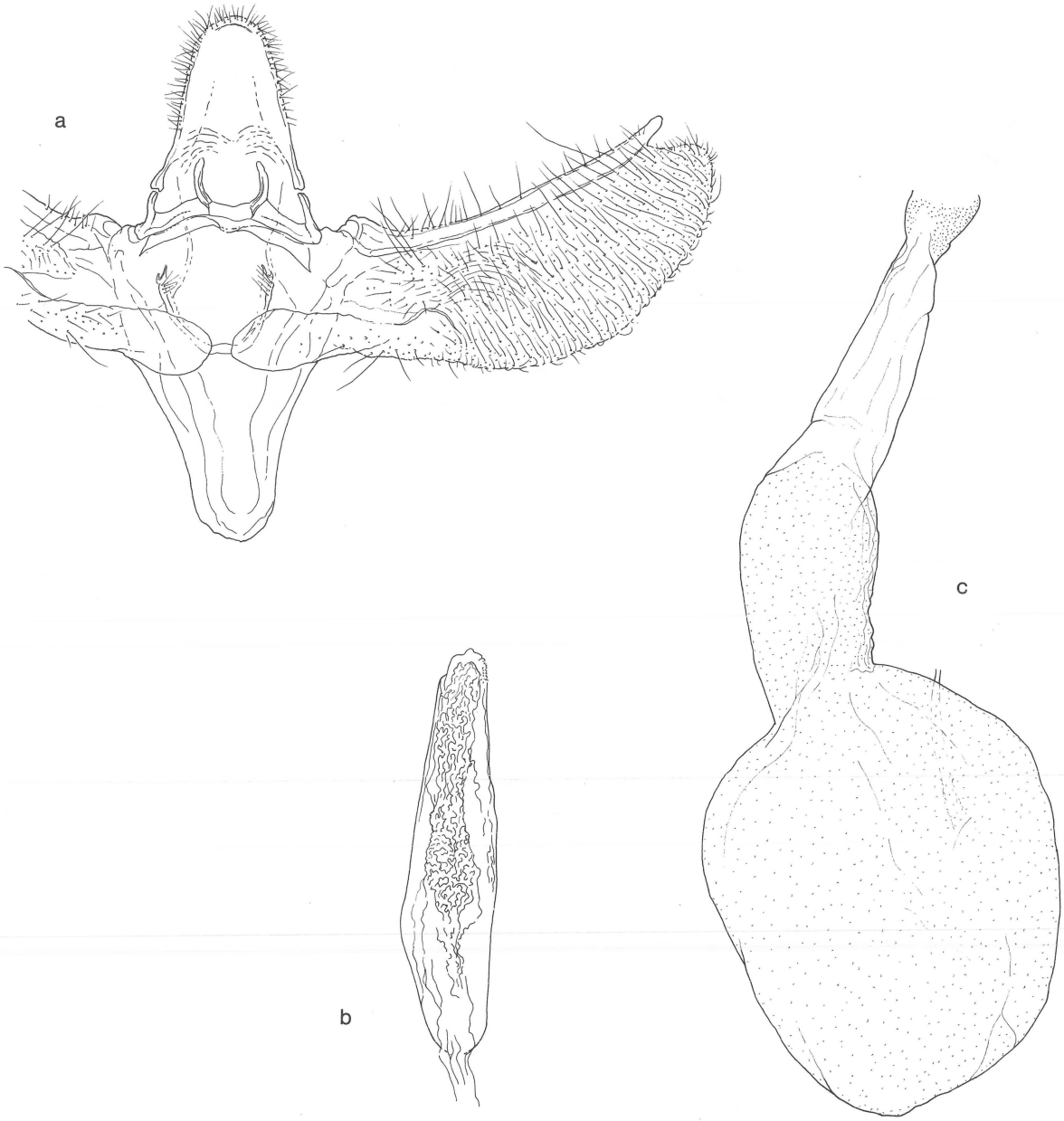


FIGURE 11: GENITALIA OF *MYELOPSIS MINUTULARIA*

a. Male genitalia (most of left valva and aedoeagus omitted) (HHN 611); *b.* Aedoeagus; *c.* Corpus bursae, ductus bursae, and part of ductus seminalis (HHN 1706).

labeled. It is unlikely that *subtetricella* occurs in Florida judging from other distribution records; also, recent intensive collecting in Florida has provided no new records. Almost all *subtetricella* have been collected in May and June. A few are in flight as early as late April and as late as July.

Myelopsis alatella (Hulst)

PL. 1, FIGS. 10–14. TEXT FIG. 14 *a–d* (RWH 5720).

Acrobasis alatella, Hulst, 1887, *Ent. Americana,* **3**: 135.

Type locality: Napa, California. [AMNH]

NOTE—Described from 3 males and 1 female. I hereby designate as lectotype the moth in the AMNH bearing the following labels: 1. "Napa Co. California"; 2. "Collection G. D. Hulst"; 3. "*Acrobasis alatella* Type Hulst"; 4. "♂ genitalia on slide 13 June 1946 C.H. # 3129"; 5. "LECTOTYPE *alatella* Hulst by H. H. Neunzig."

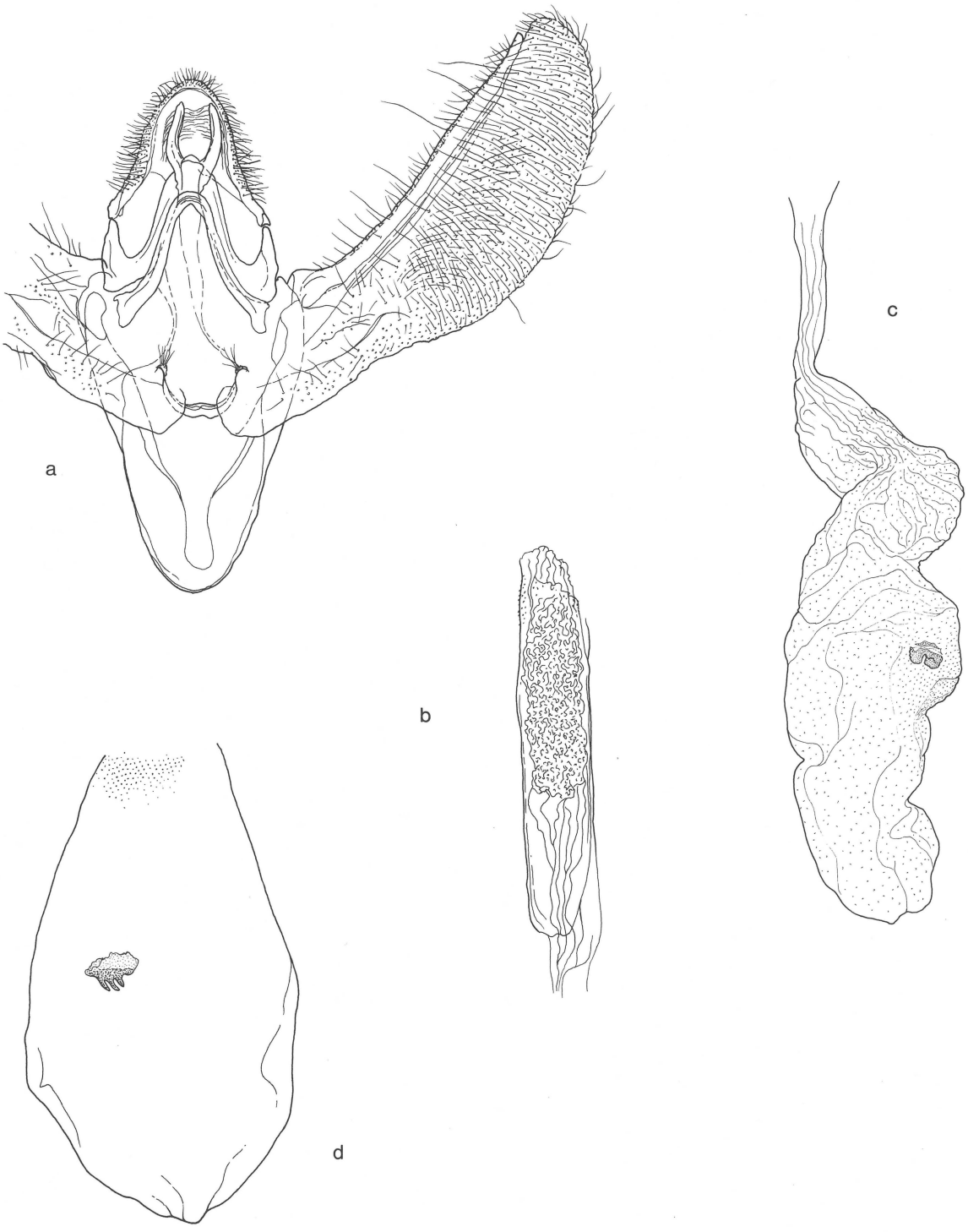


FIGURE 12: MALE AND FEMALE GENITALIA OF *MYELOPSIS IMMUNDELLA* AND FEMALE GENITALIA OF *SELGA CALIFORNICA*

a. M. immundella, male genitalia (most of left valva and aedoeagus omitted) (HHN 1180); *b.* Aedoeagus; *c.* Corpus bursae and ductus bursae (HHN 1487). *d. S. californica,* corpus bursae (HHN 2630a).

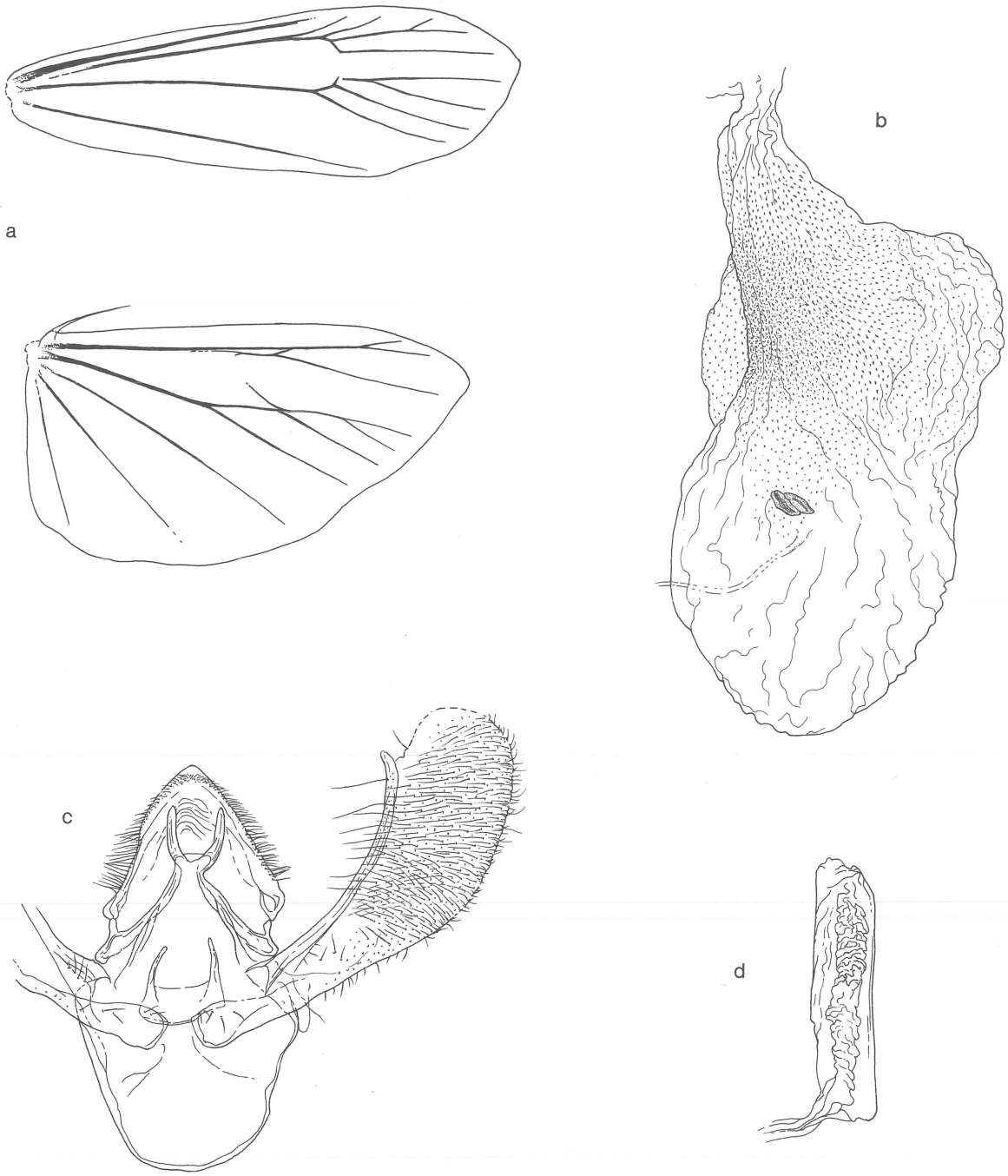


FIGURE 13: VENATION AND FEMALE GENITALIA OF *MYELOPSIS SUBTETRICELLA* AND MALE GENITALIA OF *SELGA CALIFORNICA*

a. M. subtetricella, male forewing and hindwing; *b.* Corpus bursae, ductus bursae, and part of ductus seminalis (HHN 933). *c. S. californica,* holotype, male genitalia (most of left valva and aedoeagus omitted) (HHN 2619); *d.* Aedoeagus.

Myelois rectistrigella Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 3.
Type locality: California. [MNHP]

Myelois fragilella Dyar, 1904, *Proc. Ent. Soc. Washington,* **6**: 114.
Type locality: Pecos, New Mexico. [USNM]

Myelois piazzella Dyar, 1925, *Ins. Insc. Mens.,* **13:** 11.
Type locality: San Diego, California. [USNM]

The overall color and the intensity of the dark mark-

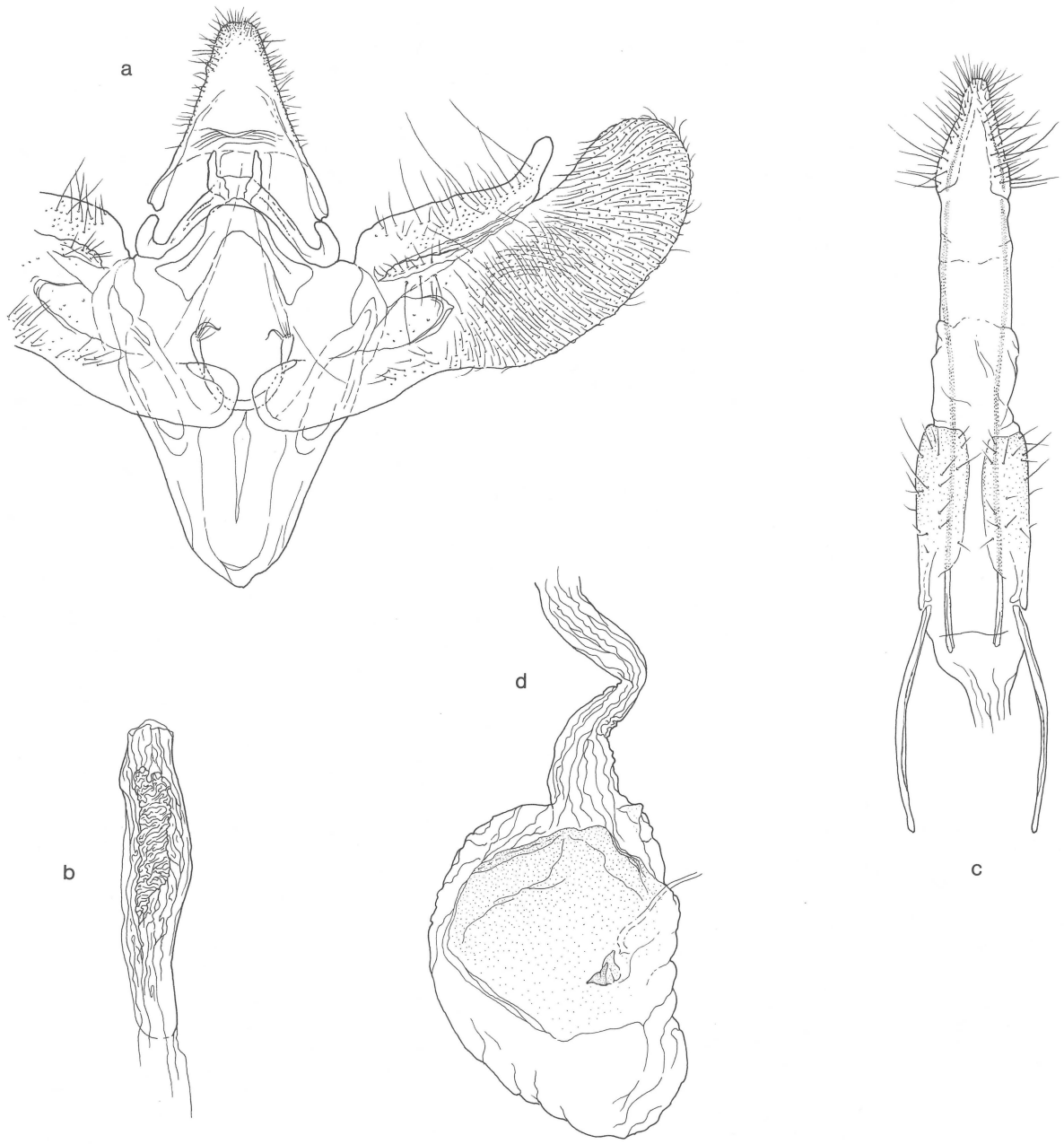


FIGURE 14: GENITALIA OF *MYELOPSIS ALATELLA*

a. Male genitalia (most of left valva and aedoeagus omitted) (HHN 711); *b.* Aedoeagus; *c.* Posterior part of female genitalia (HHN 1206); *d.* Anterior part of female genitalia (HHN 1206).

ings on the upper surface of the forewing are variable (plate 1, figures 10–14). However, the male genitalia, particularly the very broad, sclerotized, basal part of costa of the valva (text figure 14 *a*), easily separate this species from other members of the genus. Wing length 8.0–13.5 mm. Under surface of forewing of male with a brown to dark-brown, narrow costal fold (extending about ¼ distance to apex). Male genitalia (text figure 14 *a, b*) with gnathos well developed, U-shaped apically; transtilla a thin, weakly sclerotized plate; valva with basal part of costa broadly sclerotized; aedoeagus simple. Female genitalia (text figure 14 *c, d*) with small signum and a rather large, round area of dorsal surface of corpus bursae sclerotized.

The immature stages of *alatella* have yet to be described. I have seen two adults that apparently were collected from island manzanita (*Arctostaphy-*

los insularis) Greene, by sweeping the foliage of the plant (Powell, personal communication). Whether the larvae of *alatella* are in some way associated with *Arctostaphylos* is not known.

Almost all *alatella* have been collected in the western United States, including central Texas, California (numerous localities), Oregon, Utah, Colorado, Montana, Arizona, Nevada, and New Mexico. Specimens have been captured in March–August in California, March–May in central Texas, and April–August in the other states.

GENUS

Selga Heinrich

Selga Heinrich, 1956, *U. S. Natl. Mus. Bull.*, **207**: 265.

Type species: *Heterographis arizonella* Hulst, 1900. Original designation.

Selga contains two species, one from Arizona and west Texas, and another from California. The genitalia of *Selga,* particularly of the male (text figures 13 *c, d*; 15 *b, c*) are similar to those of species of *Myelopsis* and *Pseudocabima* Heinrich, to which it appears to be closely allied. *Selga,* however, has fewer (7) veins in the hindwing than the other two genera.

Antenna of both sexes simple; sensilla trichodea (cilia) at base of shaft of male about ⅓ to ½ as long as basal diameter of shaft. Frons rounded, with anteriorly projecting scales. Labial palpus of both sexes oblique to porrect, third segment about as long as second, apex bluntly pointed. Maxillary palpus simple. Haustellum well developed. Ocellus present. Basal ½ of costa of forewing of male (text figure 15 *a*) more or less straight; under surface of forewing with a costal fold (extends from base about ⅓ distance to apex). Forewing smooth scaled; with 11 veins; R_2 separate and divergent from stalk of R_{3+4} and R_5; M_1 from below upper angle of cell, straight; M_2 and M_3 shortly stalked, stalk separated at base from CuA_1; CuA_2 from before but near lower angle of discal cell. Hindwing (text figure 15 *a*) with 7 veins; $Sc+R_1$ and Rs strongly fused for most of their lengths beyond discal cell; M_2+M_3 and CuA_1 from lower angle of cell, shortly stalked; CuA_2 from before lower angle of cell; cell about ½ length of wing. Eighth abdominal segment of male without scale tufts. Male genitalia (text figures 13 *c, d*; 15 *b, c*) with uncus sometimes slightly expanded laterally; apical process of gnathos bifurcate; transtilla incomplete; juxta a broad curved plate, with or without lateral lobes; valva with costa strongly sclerotized and slightly projecting free before apex of valva; aedoeagus simple; vinculum slightly shorter than greatest width. Female genitalia (text figures 12 *d,* 15 *d*) with ductus bursae and corpus bursae membranous (ductus bursae sometimes with a pair of weakly sclerotized plates near genital opening); signum present, consisting of pointed or truncate spines; ductus seminalis from near middle of corpus bursae or attached near junction of ductus bursae and corpus bursae.

Immature stages are unknown.

KEY TO SPECIES OF *SELGA*

1. Postmedial line of forewing distinctly dentate, bordered by dark scales on posterior ½ (plate 2, figure 5); uncus broadened in distal ½ (text figure 15 *b*); signum of corpus bursae composed of numerous, mostly truncate spines (text figure 15 *d*) ..... *arizonella* p. 40

— Postmedial line of forewing mostly straight, not bordered by dark scales on posterior ½ (plate 2, figure 6); uncus narrow in distal ½ (text figure 13 *c*); signum of corpus bursae consisting of a few sharp spines (text figure 12 *d*) ..... *californica* p. 40

Selga arizonella (Hulst)

PL. 2, FIG. 5. TEXT FIG. 15 *a–d* (RWH 5994).

Heterographis arizonella Hulst, 1900, *Jour. New York Ent. Soc.,* **8**: 222.

Type locality: Catalina Springs, Arizona. [?USNM]

NOTE—According to Heinrich (1956: 266), the type is in the USNM, but I have not been able to find it.

S. arizonella is a small species with a wing length of 7.0–8.0 mm. The forewing of *arizonella* has numerous dark patches of scales, whereas *californica* Neunzig has only a few groups of dark scales. The flared uncus of the male genitalia and the bluntly spined signum of the female genitalia of *arizonella* also can be used to separate this species from *californica.*

Larvae and pupae of *arizonella* have not been described.

S. arizonella has been collected in southcentral Arizona in April, May, and June and in west Texas in May.

Selga californica Neunzig, NEW SPECIES

PL. 2, FIG. 6. TEXT FIGS. 12 *d*; 13 *c, d.*

Selga californica Neunzig

Type locality: Cronise Valley, San Bernardino Co., California. [UCB]



FIGURE 15: VENATION AND GENITALIA OF *SELGA ARIZONELLA*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 1767); *c.* Aedoeagus; *d.* Corpus bursae and ductus bursae (HHN 961).

DIAGNOSIS. *S. californica* is smaller than *arizonella* (wing length of *californica* 5.5–6.5 mm). *S. californica* also has fewer patches of black on the forewing than *arizonella*; the postmedial line of *californica* lacks black borders in the posterior ½. Major genital differences are given in the key.

DESCRIPTION. Head: frons and vertex fuscous,

brown, pale brown, and white; labial palpus fuscous, brown, pale brown, and white. Forewing: ground color white with many scattered pale-brown, brown, fuscous, or black scales; base with patch of black scales; antemedial line obscure, its location and shape somewhat delineated by two fuscous to black patches; discal spots fuscous, weakly developed; postmedial line more distinct than antemedial line, particularly in costal ½, posterior ½ of postmedial line without fuscous or black borders; under surface of male with brown and white costal fold. Hindwing: white with some brown shading along margins. Male genitalia (text figure 13 *c, d*): uncus subtriangular; juxta with slender lateral lobes; valva with costa strongly sclerotized and with digitiform process projecting before apex. Female genitalia (text figure 12 *d*): ductus bursae and corpus bursae with scobinations near junction of ductus bursae and corpus bursae; signum a plate bearing several sharply pointed, flattened, slightly curved spines; ductus seminalis attached to corpus bursae near juncture with ductus bursae.

The immature stages of *californica* are unknown.

TYPES. Holotype: ♂. Cronise Valley, San Bernardino Co., California; 29-IV-1956; J. Powell; genitalia slide 2619 HHN. UCB. Paratypes: 2 ♀. CALIFORNIA: same data as for holotype; genitalia slide 2630a HHN. UCB.

GENUS
Pseudocabima Heinrich

Pseudocabima Heinrich, 1956, *U. S. Natl. Mus. Bull.,* **207**: 53.
Type species: *Myelois euzopherella* Dyar, 1914. Original designation.

NOTE—*Pseudocabima* was omitted from the *Check List* (Munroe, 1983).

Heinrich (1956) recognized 10 species in *Pseudocabima* and stated that additional species probably are yet to be described. Only one species occurs in the southwestern United States; the genus is principally neotropical. *Pseudocabima* is most closely related to the Central and South American *Diatomocera* Ragonot and *Entmemacornis* Dyar. The uncus of the male genitalia of all three genera is greatly expanded into a characteristic spoon shape. *Pseudocabima* can be separated from *Diatomocera* and *Entmemacornis* by the male antenna that is simple in *Pseudocabima* and distinctly notched in the other two genera. *Pseudocabima* also shows some affinity to *Selga,* but the uncus of the latter is expanded laterally more gradually or not expanded.

Sensilla trichodea (cilia) of shaft of male antenna moderately abundant and at base of shaft about ¾ as long as basal diameter of shaft. Frons convex, smoothly scaled. Labial palpus of both sexes upturned, reaching almost to vertex, third segment nearly as long as second. Maxillary palpus simple. Haustellum well developed. Ocellus present. Forewing of male (text figure 16 *a*) with costa slightly convex on basal ½; under surface without costal fold or sex-scaling. Forewing smooth scaled; with 11 veins; R_2 approximate to stalk of R_{3+4} and R_5; M_1 from below upper angle of cell, very slightly bent toward base; M_2 and M_3 stalked; CuA_1 from lower angle of cell; CuA_2 from before lower angle of cell. Hindwing (text figure 16 *a*) with 8 veins; $Sc+R_1+Rs$ fused for most of their lengths beyond cell; M_2 and M_3 long stalked; CuA_1 from lower angle of cell, connate with stalk of M_2 and M_3; CuA_2 from well before lower angle of cell; cell slightly more than ½ length of wing. Eighth abdominal segment of male with paired ventrolateral scale tufts; each tuft a single fascicle of simple, slender, more or less straight scales. Transverse sclerotized bar associated with scale tufts. Male genitalia (text figure 16 *b, c*) with apex of uncus expanded (spoon shaped); gnathos usually with U-shaped apex, consisting of well-separated, paired, short elements, but apex only shallowly bifid in *rubrizonalis* (Hampson); transtilla complete, but weakly sclerotized; juxta platelike with setiferous, lateral lobes; valva with well-sclerotized costa; aedoeagus robust, simple, usually tapered distally; vinculum elongate, usually constricted toward terminal margin. Female genitalia (text figure 16 *d*) with corpus bursae and ductus bursae membranous; usually both corpus bursae and ductus bursae, in part, finely scobinate; signum consisting of cluster of very short stout spines; ductus seminalis arising from corpus bursae near signum, or between signum and junction of corpus bursae and ductus bursae.

The only information on biology was provided by Heinrich (1956: 55) who listed the larval food plant of *expunctrix* (Dyar and Heinrich) as "stem of leguminous tree."

Pseudocabima arizonensis Heinrich

PL. 1, FIG. 45. TEXT FIG. 16 *a–d.*

Pseudocabima arizonensis Heinrich, 1956, *U. S. Natl. Mus. Bull.,* **207**: 55.
Type locality: Redington, Arizona. [?USNM]

NOTE—According to Heinrich (1956: 55), the type

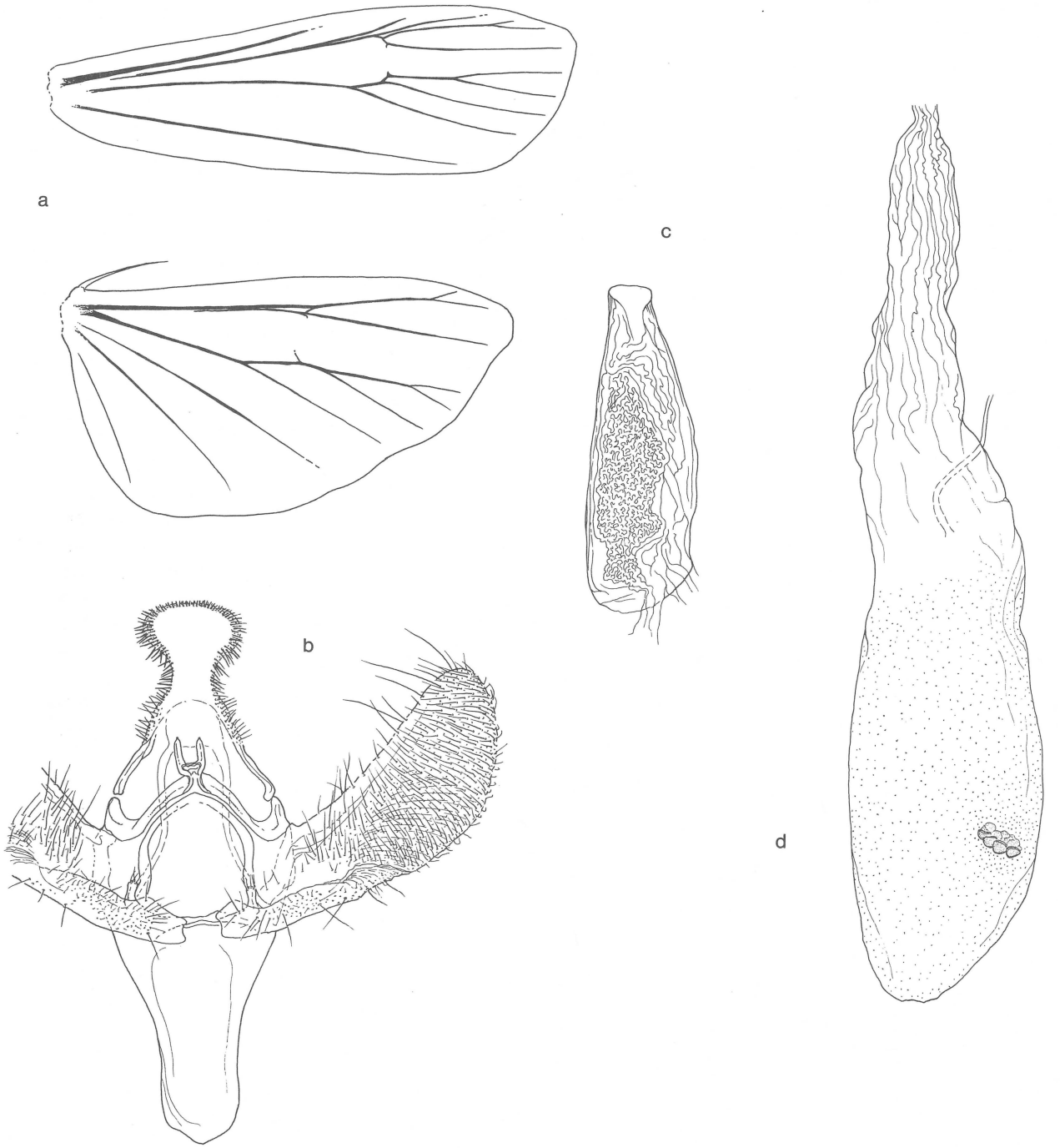


FIGURE 16: VENATION AND GENITALIA OF *PSEUDOCABIMA ARIZONENSIS*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 1215); *c.* Aedoeagus; *d.* Corpus bursae, ductus bursae, and part of ductus seminalis (HHN 1216).

is in the USNM. I have not been able to find a specimen of *P. arizonensis* with an attached type label. A specimen in the USNM with the correct type locality label, a genitalia slide label, but no red type label probably is the type.

NOTE—*P. arizonensis* was omitted from the *Check List* (Munroe, 1983).

P. arizonensis usually can be recognized by the pale, broad-angled band between the antemedial and postmedial lines on the forewing and the cluster of long, thin scales that originate on the prothorax and extend forward to cover much of the eye. The spoon-shaped uncus of the male genitalia also readily distinguishes the species. Wing length 11.0–11.5 mm.

P. arizonensis has been collected in the mountains of southern Arizona during June–September.

GENUS
Apomyelois Heinrich

Apomyelois Heinrich, 1956, *U. S. Natl. Mus. Bull.*, **207**: 42.
Type species: *Dioryctria bistriatella* Hulst, 1887. Original designation.

Apomyelois contains one species. The genus is closely allied to *Myelois* Hübner of Europe. In the male genitalia, the apex of the gnathos is a simple hook in *Apomyelois,* a deeply forked process in *Myelois*; and the transtilla is produced into a bilobed element in *Apomyelois,* simple in *Myelois.* The ductus bursae of *Apomyelois* is membranous, partially sclerotized in *Myelois.*

Antenna simple in both sexes. Sensilla trichodea (cilia) of shaft of antenna of male dense and at base of shaft about ⅛ as long as basal diameter of shaft. Frons convex, smoothly scaled. Labial palpus of both sexes upturned, reaching to slightly above vertex. Maxillary palpus simple. Haustellum well developed. Ocellus present. Basal ½ of costa of forewing of male (text figure 17 *a*) slightly convex; under surface without sex-scaling or costal fold. Forewing smooth scaled; with 11 veins; R_2 from stalk of R_{3+4} and R_5; R_{3+4} and R_5 long stalked; M_1 from below upper angle of cell, straight; M_2 and M_3 stalked for less than ½ their lengths, their stalk separated from CuA_1 at base; CuA_1 from lower angle of cell; CuA_2 from well before lower angle of cell. Hindwing (text figure 17 *a*) with 8 veins; $Sc+R_1$ and Rs fused beyond cell for about ½ their lengths; M_2 and M_3 stalked for about ½ their lengths; CuA_1 from lower angle of cell; CuA_2 from well before lower angle of cell; cell slightly more than ½ length of wing. Eighth abdominal segment of male with paired ventrolateral scale tufts; each tuft a cluster of simple, more or less straight scales. Transverse, sclerotized bar associated with scale tufts. Male genitalia (text figure 17 *b, c*) with uncus subtriangular; apical process of gnathos a strong, simple hook; transtilla complete, well sclerotized, with bilobed terminal element; juxta U-shaped with tapered, setiferous lateral lobes; valva simple with costa strongly sclerotized and slightly produced at apex, and with very low, inconspicuous, setiferous lobe near base; aedoeagus simple (no cornutus); vinculum shorter than greatest width; base of anellus and sacculus usually darkly pigmented. Female genitalia (text figure 17 *d*) with ductus bursae and corpus bursae membranous; most of ductus bursae with minute scobinations; signum a tight cluster of scalelike spines; ductus seminalis arising near anterior end of corpus bursae.

Beirne (1952) illustrated and briefly described the larva; it is a fungus feeder. Known hosts belong to the family Xylariaceae.

Roesler's 1968 decision that *Apomyelois* is a synonym of *Spectrobates* Meyrick has not been followed by recent authors, as far as I am aware. I have examined the male holotype and a female paratype of the type species of *Spectrobates* (*artonoma* Meyrick) and consider *Apomyelois* to represent a separate genus. Morphological and biological features of *Spectrobates* are discussed under *Ectomyelois.*

Apomyelois bistriatella (Hulst)
PL. 1, FIGS. 54–57. TEXT FIG. 17 *a–d*
(RWH 5721).

Dioryctria bistriatella Hulst, 1887, *Ent. Americana,* **3**: 136.
Type locality: ?Iowa. [?lost]
NOTE—Hulst cited "Washington, D.C." as the type locality in the original description, but no specimen of *bistriatella* from the District of Columbia could be found by Heinrich (1956), nor can I locate such a specimen. Rindge (1955: 158) stated that Hulst's type of *bistriatella,* with an "Iowa" locality label, was in the AMNH collection. I have been unable to find the Iowa type in the AMNH. However, on the basis of the distribution of the species, Iowa, rather than D.C., would appear to be the more likely type locality.

Myelois bilineatella Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleridae,* 3.
Type locality: North America. [MNHP]

Myelois neophanes Durrant, 1915, *Ent. Mo. Mag.,* **51**: 302.
Type locality: Dorset, England. [BMNH]

The adult of *bistriatella* is best recognized by the simple gnathos, and distinctly bifid condition of the apical part of the transtilla of its male genitalia (text figure 17 *b, c*). Most moths have a distinct, contrasting antemedial line on the upper surface of the forewing, but this line can be faint on some specimens. Wing length 7.5–11.0 mm.

According to Beirne (1952: 108), the larva is ". . . dark smoky greenish or greyish with whitish hairs and dark brown head and prothorax and anal plates." Adults have been reared from *Hypoxylon* and *Daldinia,* fungi growing on recently killed oak (*Quercus*), poplar (*Populus*), gorse (*Ulex europaeus* L.),

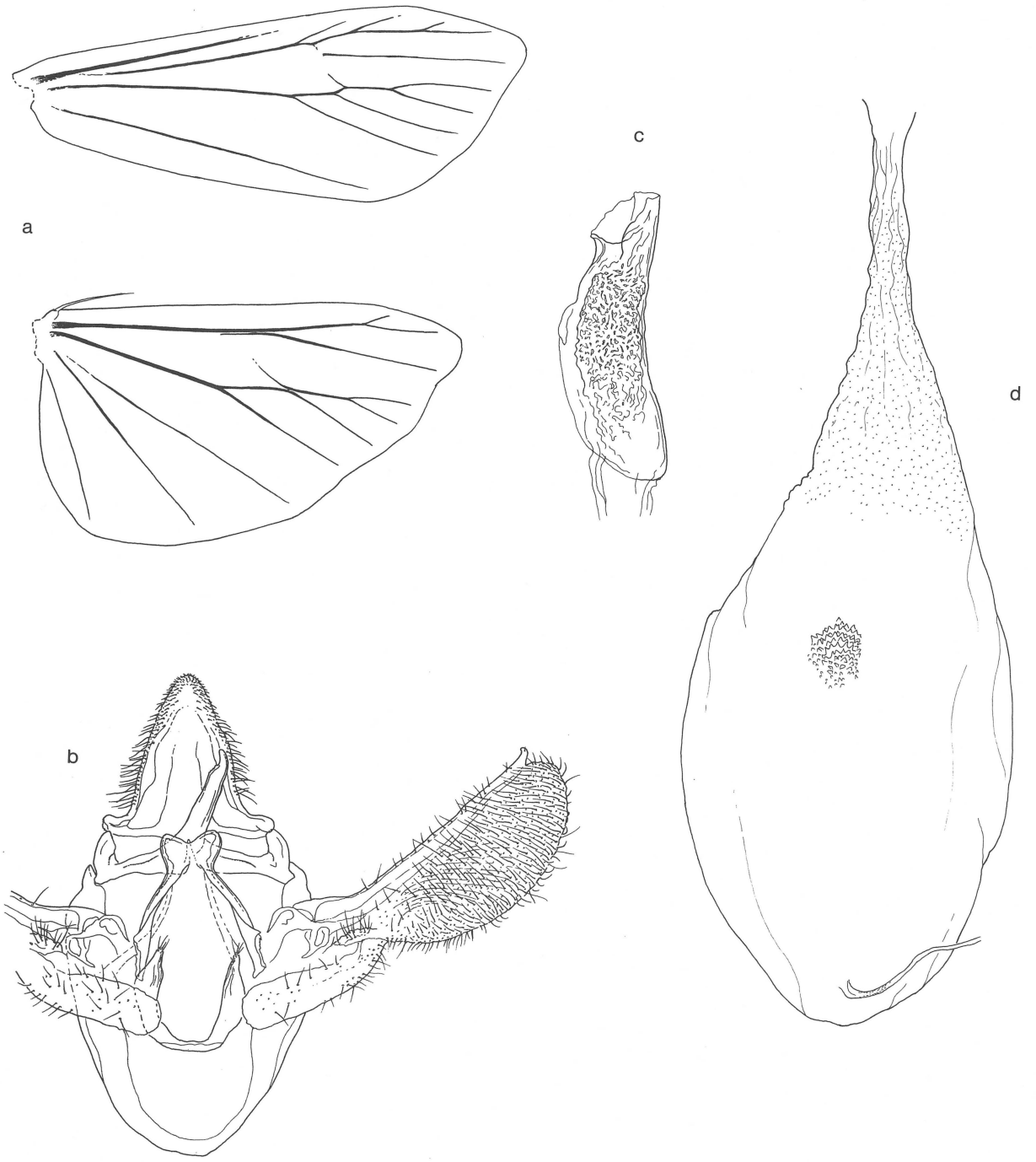


FIGURE 17: VENATION AND GENITALIA OF *APOMYELOIS BISTRIATELLA*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 639); *c.* Aedoeagus; *d.* Corpus bursae, ductus bursae, and part of ductus seminalis (HHN 700).

and birch (*Betula*). Beirne (1952: 108), as *Myelois neophanes,* and Powell (1967: 192–193) said that feeding occurs in irregular tunnels in the fungal stromata, and pupation takes place either in the fungus or in dead wood near the fungus.

In North America, *bistriatella* is generally distributed in all provinces in southern Canada, and I have seen one specimen in the Canadian National Collection from as far north as Great Slave Lake, Northwest Territories. In the United States the species is widespread in Maine, Massachusetts, New York, Michigan, Illinois, Wisconsin, and Iowa; and

it occurs in the coastal foothills and at higher elevations in California. In southern Canada moth flight has been documented from late May to mid-August. In the northeast and northcentral United States *bistriatella* has been caught at lights from April to August. Larvae have been collected in California in February, April, May, June, and October and adults obtained about one month later.

A. bistriatella also occurs in Europe as the subspecies *neophanes* (Durrant) (Whalley, 1963).

GENUS
Ectomyelois Heinrich

> *Ectomyelois* Heinrich, 1956, *U. S. Natl. Mus. Bull.*, **207**: 43.
> Type species: *Myelois decolor* Zeller, 1881. Original designation.

Ectomyelois has five species. Most are neotropical, but *ceratoniae* (Zeller) occurs in the New and Old World. The genus is similar to *Apomyelois* but differs in having the ductus seminalis attached to the corpus bursae near the junction of the corpus bursae and ductus bursae; *Apomyelois* has the ductus seminalis arising from the anterior part of the corpus bursae.

Shaft of male antenna simple to slightly serrate, with sensilla trichodea (cilia) moderately abundant and at base of shaft about ½ as long, or as long as, basal diameter of shaft. Frons convex, with anteriorly projecting scales. Labial palpus of both sexes upturned or porrect (*decolor*), third segment shorter than second. Maxillary palpus simple. Haustellum well developed. Ocellus present. Basal ½ of costa of forewing of male (text figure 18 *a*) very slightly convex at base; under surface without costal fold or streaks or patches of contrastingly colored scales. Forewing smooth scaled; with 11 veins; R_2 from cell, closely approximate to stalk of R_{3+4} and R_5 for about ⅓ distance from cell; R_{3+4} and R_5 stalked for over ⅔ their lengths; M_1 from below upper angle of cell; M_2 and M_3 stalked for ½ or less the length of the veins; CuA_1 from lower angle of cell; CuA_2 from before lower angle of cell. Hindwing (text figure 18 *a*) with 8 veins; $Sc+R_1$ and Rs strongly fused for most of their lengths beyond cell; M_2 and M_3 stalked for about ½ their lengths, the stalk connate or very closely approximate to CuA_1 at base; CuA_1 from lower angle of cell; CuA_2 from well before lower angle; cell ½ length of wing. Eighth abdominal segment of male without scale tufts (*muriscis* (Dyar), *zeteki* Heinrich), or with paired ventral scale tufts (*ceratoniae, decolor*) (condition in *furvidorsella* (Ragonot) not known); when present each tuft a single cluster of simple, more or less straight scales. Transverse, sclerotized bar associated with scale tufts. Male genitalia (text figure 18 *b, c*) similar to those of *Apomyelois* except: apical process of transtilla more shallowly bifid or entire; costa of valva not produced apically (except slightly in *muriscis* and *zeteki*). Female genitalia (text figure 18 *d*) with ductus bursae and corpus bursae membranous except for weakly sclerotized area near genital opening; signum usually present and consisting of an elongate patch of scobinations or microspines (absent in *furvidorsella*); ductus seminalis arising from lobe of corpus bursae near junction of ductus bursae and corpus bursae.

The larva and pupa of *ceratoniae* have been described (Neunzig, 1979). Last stage larva (text figure 19 *f*) with distinct pinaculum rings associated with SD1 setae of mesothorax and eighth abdominal segment. Head only slightly roughened, with indistinct tonofibrillary platelets. Body without stripes. SD1 setae of abdominal segments 1–7 partially encircled with pinaculum rings. Tonofibrillary platelets of body indistinct. Mandible simple. Maxilla with sensilla trichodea entire. Pupa of *ceratoniae* with unusual, distinctly elevated, middorsal, thoracic carina, and dorsal spinous processes on abdominal segments 1–7. Caudal abdominal segments with pair of very robust, hooked cremastral setae. Thoracic spiracles present. Setae on head and body somewhat longer than in most phycitine pupae.

Larvae are found primarily associated with plants belonging to the Fabaceae, but members of the Annonaceae, Apocynaceae, Arecaceae, Clusiaceae, Fagaceae, Moraceae, Punicaceae, Rhamnaceae, Rutaceae, Rosaceae, and Sterculiaceae are also hosts.

Roesler, in 1968, made *Ectomyelois* a junior synonym of *Spectrobates* Meyrick, and Roesler and Küppers (1981: 79) treated *Ectomyelois* as a junior synonym of *Apomyelois*. Most recent authors (Munroe, 1983, Palm, 1986, Goater, 1986) have not followed these interpretations. I used the name *Spectrobates* for *ceratoniae* (1979: 14), but further study including an examination of the male holotype and a female paratype of *Spectrobates artonoma,* leads me to conclude that *Ectomyelois* is a separate taxon. These types agree with species of *Ectomyelois* with regard to habitus, the general appearance of the female genitalia, the shape of the uncus and valva, and the short vinculum. The male genitalia differ as follows: 1) The gnathos of *Ectomyelois* has a strong, median hook, whereas the gnathos of *Spectrobates* is a transverse band without a central element (a fold in the integument of the preparation

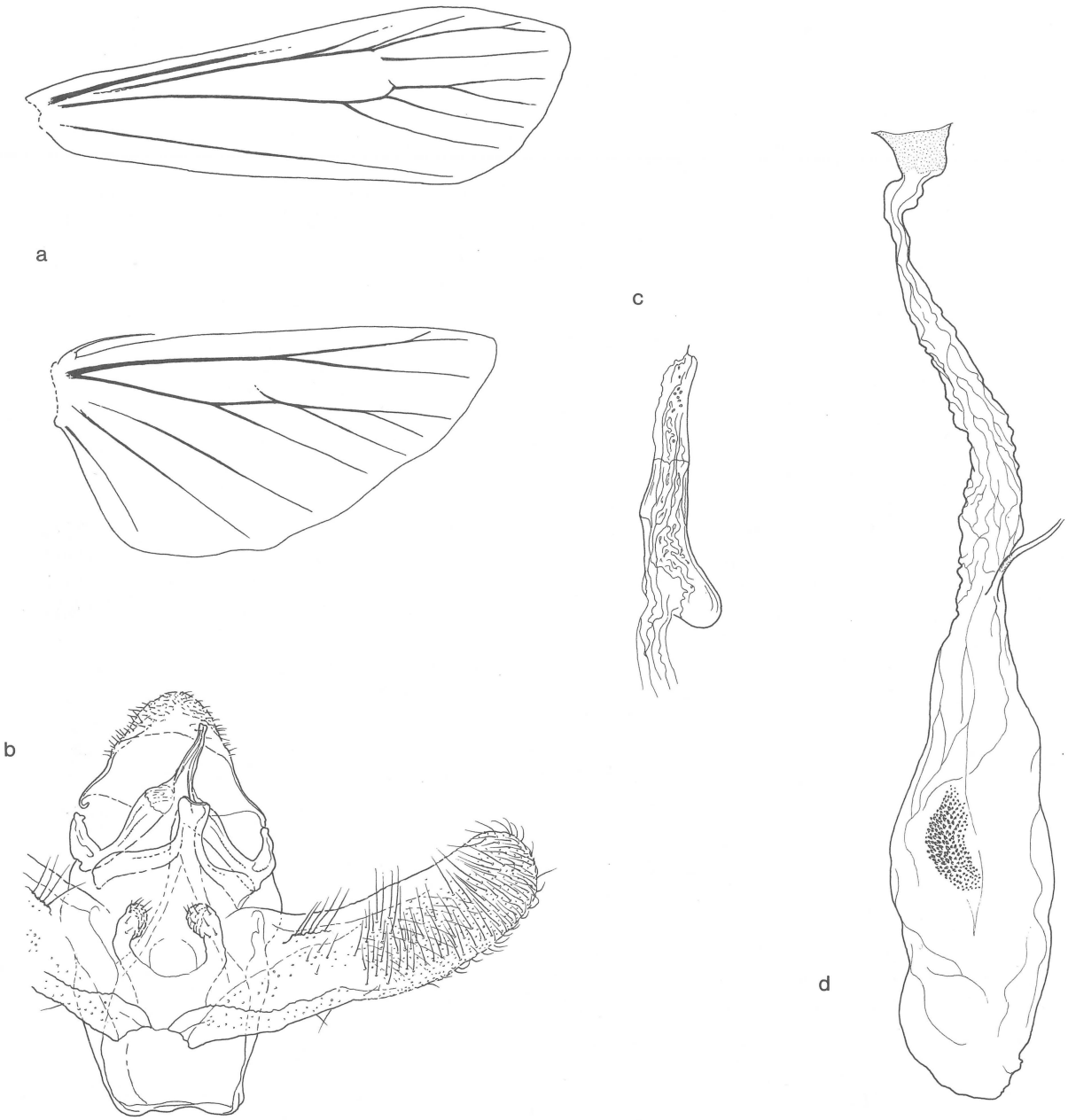


FIGURE 18: VENATION AND GENITALIA OF *ECTOMYELOIS CERATONIAE*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 625); *c.* Aedoeagus; *d.* Corpus bursae, ductus bursae, and part of ductus seminalis (HHN 1200).

of the holotype might be mistaken for a hook). 2) The transtilla and juxta in *Ectomyelois* are strongly developed; these structures are weakly developed in *Spectrobates.* 3) *Spectrobates* has a prominent, subbasal lobe on the inner surface of the valva; *Ectomyelois* lacks such a lobe. The lobe bears about 30 prominent scales that are slender and simple on the distal ½ of the lobe and broad and multiforked on the basal half.

Meyrick (1935: 553) said that his type series of *S. artonoma* were ". . . from larvae feeding on leaves . . . ." This would further support the concept that *Ectomyelois* and *Spectrobates* are separate genera because *Ectomyelois* larvae feed within host fruit.

Ectomyelois ceratoniae (Zeller) (Carob Moth) PL. 1, FIGS. 52, 53. TEXT FIGS. 18*a–d*; 19 *a, f* (RWH 5723).

Myelois ceratoniae Zeller, 1839, *Isis von Oken,* **32**: 176.
Type locality: Laibach, Austria. [BMNH]

Phycis ceratoniella Fischer von Röslerstamm, 1839, *Abbildungen zur Berichtigung und Ergänzung der Schmetterlingskunde,* 147.
Type locality: Europe. [?lost]

Trachonitis pryerella Vaughan, 1870, *Ent. Mo. Mag.,* **7**: 130.
Type locality: London. [BMNH]

Myelois tuerckheimiella Sorhagen, 1881, *Berl. ent. Zeits.,* **25**: 103.
Type locality: Málaga, Spain. [?lost]

Euzophera zellerella Sorhagan, 1881, *Berl. ent. Zeits.,* **25**: 104.
Type locality: not given. [?lost]

Hypsipyla psarella Hampson, 1903, *Jour. Bombay nat. Hist. Soc.,* **15**: 30.
Type locality: Sikhim, India. [BMNH]

Myelois oporedestella Dyar, 1911, *Proc. Ent. Soc. Washington,* **13**: 30.
Type locality: Miami, Florida. [USNM]

Myelois phoenicis Durrant, 1915, *Ent. Mo. Mag.,* **51**: 303.
Type locality: Constantine, Algeria. [BMNH]

Adults of *E. ceratoniae* are rather nondescript moths with no distinct markings on the forewings. They are best distinguished by the genitalia. The males have the juxta with robust, clublike lateral elements and the distal part of the transtilla shallowly bifid (text figure 18 *b*); females have the signum of the corpus bursae an elongate patch of microspines (text figure 18 *d*). Wing length 7.5–11.5 mm.

Last stage larva (text figure 19 *f*) 13.5–19.5 mm long. Head yellowish brown with dark-brown genal streaks. Thoracic shield yellowish brown to dark brown. Body yellowish white, sometimes faintly pink. SD1 pinaculum rings on mesothorax and eighth abdominal segment pale brown to dark brown. Partial SD1 pinaculum rings on abdominal segments 1–7 (text figure 19 *a*) pale brown to dark brown (these crescentric rings difficult to detect on some very pale specimens). Pupa 6.9–11.5 mm long, yellowish brown to reddish brown dorsally with dark-brown to black middorsal carina, spinous processes on abdomen and spinose cremastral setae. More detailed information and figures of the larva and pupa were given by Neunzig (1979) under *Spectrobates ceratoniae.*

E. ceratoniae larvae have many hosts. The following have been reported in the literature (Agenjo, 1959; Balachowsky and Mesnil, 1935; Bodenheimer, 1930; Carter, 1984; Gothilf, 1970; Heinrich, 1956; Neunzig, 1979; Palmoni, 1969; Roesler, 1973): carob (*Ceratonia siliqua* L.), cassia (*Cassia bicapsularis* L.), citris (*Citrus* sp.), date (*Phoenix dactylifera* L.), European chestnut (*Castanea sativa* Miller), fan palm (*Livistona chinensis* Robert Brown), fig (*Ficus carica* L.), jujube (*Zizyphus* sp.), locust (*Robinia* sp.), loquat (*Eriobotrya japonica* (Thunberg) Lindley), Natal plum (*Carissa grandiflora* (E. Meyer) A. de Candolle), pomegranate (*Punica granatum* L.), quince (*Cydonia oblonga* Miller), sweet acacia (*Acacia farnesiana* (L.) Willdenow), tamarind (*Tamarindus indica* L.). Its preferred host appears to be carob, but in the United States it almost always is associated with tamarind. Adults oviposit on mature fruits on, or off, the host. Females prefer fungus- or insect-damaged fruit. Larvae feed on fruit pulp, seeds, and, if present, fungi. Pupation takes place within the damaged fruit. Several generations occur each year.

E. ceratoniae is widespread in Mediterranean Europe, North Africa, and parts of Asia. It also occurs in the tropical regions of the New World. In our fauna it has been found only in southern Florida, where adults fly throughout the year.

GENUS
Amyelois Amsel

Amyelois Amsel, 1956, *Bol. Ent. Venezolana,* **10**: 42.
Type species: *Myelois venipars* Dyar, 1914, considered to be a synonym of *Myelois transitella* Walker, 1863. Original designation.

Paramyelois Heinrich, 1956, *U. S. Natl. Mus. Bull.,* **207**: 46.
Type species: *Myelois solitella* Zeller, 1881, considered to be a synonym of *Myelois transitella* Walker, 1863. Original designation.

NOTE—*Paramyelois* is a subjective, isogenotypic synonym of *Amyelois.*

NOTE—The publication date of Heinrich's revision was September 1956; Amsel's description of *Amyelois* was published June 1956 (figures in December 1957).

Amyelois is monobasic. Its single species occurs in the southern United States and much of the neotropics. *Amyelois* is related to *Ectomyelois* and *Apomyelois* but can be distinguished by the noticeably abbreviated uncus, incomplete transtilla, long lat-

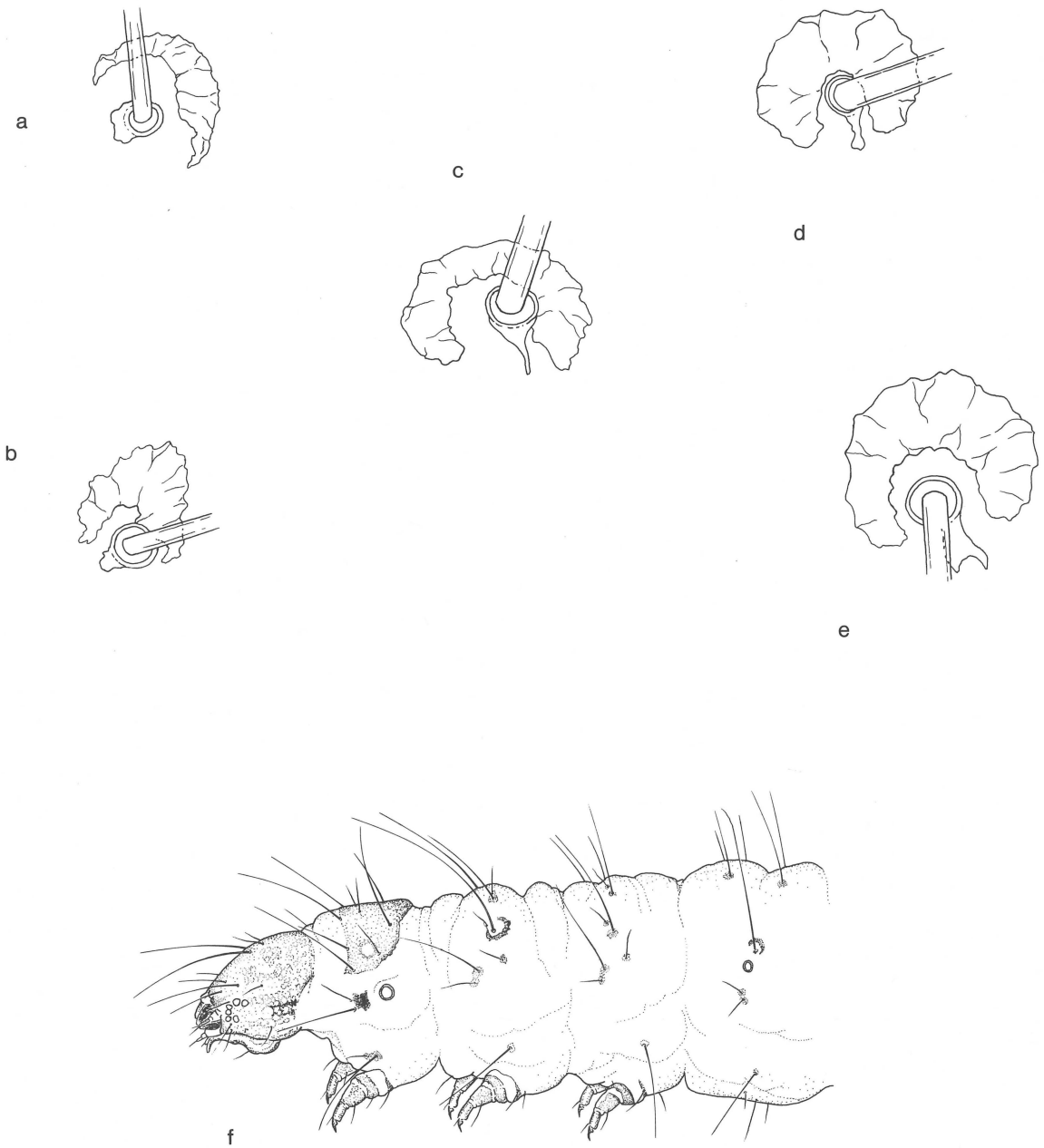


FIGURE 19: BASE OF SETA SD1 AND ASSOCIATED PINACULUM RING OF ABDOMINAL SEGMENT 1 OF *ECTOMYELOIS*, *AMYELOIS*, AND *EUZOPHERA*, AND LAST STAGE LARVA OF *ECTOMYELOIS CERATONIAE*

a. Ectomyelois ceratoniae; *b. Amyelois transitella*; *c. Euzophera nigricantella*; *d. Euzophera magnolialis*; *e. Euzophera semifuneralis*; *f. Ectomyelois ceratoniae* (lateral view of head, thorax, and abdominal segment 1).

eral elements of the juxta, and reduced distal ½ of the valva (text figure 20 *b*). Also, the genital opening of the female has an associated pair of triangular sclerotized plates (text figure 20 *d*).

Antennal shaft of male simple, sensilla trichodea (cilia) moderately abundant and at base of shaft about ½ as long as basal diameter of shaft. Frons convex, with anteriorly projecting scales. Labial palpus of male (text figure 22) and female oblique, laterally flattened, somewhat roughly scaled. Maxillary palpus simple, somewhat broadly scaled. Haustellum well developed. Ocellus present. Basal ½ of costa of forewing of male (text figure 20 *a*) slightly convex; under surface without streaks or patches of contrastingly colored scales, or costal fold. Forewing smooth scaled; with 11 veins; R_2 approximate to

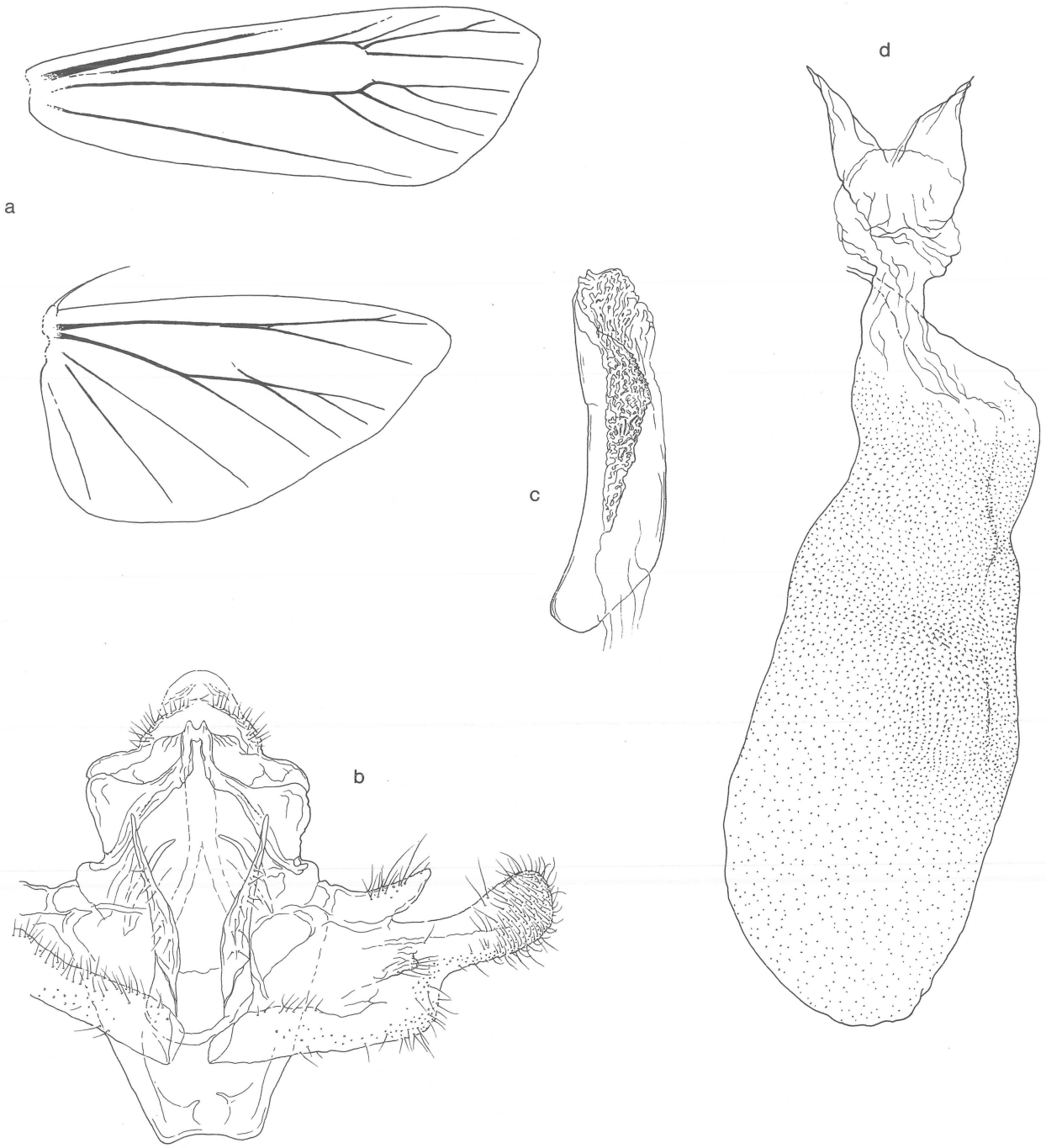


FIGURE 20: VENATION AND GENITALIA OF *AMYELOIS TRANSITELLA*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 621); *c.* Aedoeagus; *d.* Corpus bursae, ductus bursae, and part of ductus seminalis (HHN 624).

stalk of R_{3+4} and R_5 for a short distance from base; R_{3+4} and R_5 stalked for about ⅔ their lengths; M_1 arising from below upper angle of cell, straight; M_2 and M_3 shortly stalked; CuA_1 from lower angle of cell, separated from stalk of $M_2 + M_3$ at base, but nearer to $M_2 + M_3$ than to CuA_2; CuA_2 from slightly before lower angle of cell. Hindwing (text figure 20 *a*) with 8 veins; $Sc+R_1$ and Rs strongly fused for most of their lengths; M_2 and M_3 usually stalked for ½ or slightly less than ½ their lengths; CuA_1

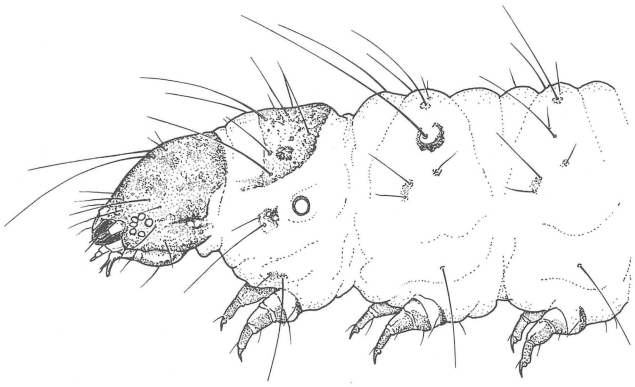


FIGURE 21: LAST STAGE LARVA OF *AMYELOIS TRANSITELLA* (LATERAL VIEW OF HEAD AND THORAX)

arising from lower angle of cell, closely approximate to or connate with the stalk of $M_2 + M_3$; CuA_2 from ⅔ length of cell; cell ½ to slightly over ½ length of wing. Eighth abdominal segment of male without scale tufts. Male genitalia (text figure 20 *b, c*) with uncus relatively small distally, broadened at base; apical process of gnathos a short, shallowly bifurcate hook; transtilla incomplete; juxta a V-shaped plate with long, prominent, pointed lateral processes; valva simple, with base normally developed and distal ½ greatly reduced; aedoeagus simple, with few, very small spines laterodorsally; vinculum considerably shorter than greatest width. Female genitalia (text figure 20 *d*) with ductus bursae and corpus bursae membranous except for a pair of triangular, sclerotized plates near genital opening; corpus bursae with numerous scobinations; signum very weakly developed, consisting of a barely perceptible cluster of slightly enlarged scobinations; ductus seminalis attached to corpus bursae near junction with ductus bursae.

Last stage larva (text figure 21) with distinct pinaculum rings associated with SD1 setae of mesothorax and eighth abdominal segment. Head slightly roughened. Body without stripes. SD1 setae of abdominal segments 1–7 partially encircled with very weak pinaculum rings. Tonofibrillary platelets of body indistinct. Mandible simple. Maxilla with sensilla trichodea entire.

Pupa with thoracic spiracles present. Gibba absent. Cremastral setae slender, hooked, arising from just before apex of short, slightly curved conical protuberances.

Larva associated with numerous plants, including members of the Anacardiaceae, Arecaceae, Fabaceae, Juglandaceae, Moraceae, Rosaceae, and Rutaceae.

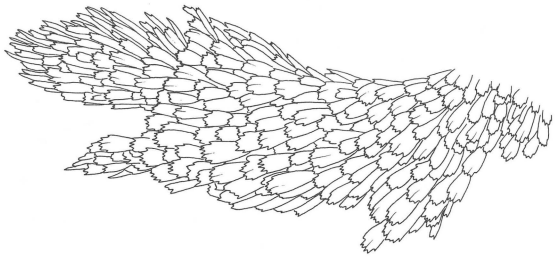


FIGURE 22: LABIAL PALPUS (LEFT SIDE) OF MALE *AMYELOIS TRANSITELLA*

Amyelois transitella (Walker) (Navel Orangeworm*)
PL. 1, FIGS. 49–51; PL. 2, FIGS. 7, 8. TEXT FIGS. 19 *b*; 20 *a–d*; 21; 22 (RWH 5724).

Nephopteryx [sic] *transitella* Walker, 1863, *List of the Specimens of Lepidopterous Insects in the Collection of the British Museum,* **27**: 54.
Type locality: United States. [BMNH]

Nephopteryx [sic] *notatalis* Walker, 1863, *List of the Specimens of Lepidopterous Insects in the Collection of the British Museum,* **27**: 57.
Type locality: Santo Domingo. [BMNH]

Myelois solitella Zeller, 1881, *Hor. Soc. Ent. Rossicae,* **16**: 217.
Type locality: Colombia. [BMNH]

Myelois duplipunctella Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 3.
Type locality: Florida. [MNHP]

Myelois venipars Dyar, 1914, *Proc. U. S. Natl. Mus.,* **47**: 404.
Type locality: Hermosillo, Mexico. [USNM]

Emporia cassiae Dyar, 1917, *Ins. Insc. Mens.,* **5**: 91.
Type locality: Plantation George Hall, Georgetown, British Guiana (=Guyana). [USNM]

Adults have characteristic, heavily scaled labial palpi (text figure 22), and the males have a uniquely reduced valva (text figure 20 *b*). The dark outer border of the antemedial line is enlarged below costa into a conspicuous black spot, and a variable amount of ochre, reddish-brown, or red scales is present at the posterior ½ of the forewing. Wing length 7.0–13.0 mm.

Last stage larva (text figure 21) 11.5–23.5 mm long. Head pale brown, with pale-brown, pale-orange, or black indistinct tonofibrillary platelets. Thoracic shield pale brown or brown. Body yellow-

ish white, sometimes with pink to orange suffusions. SD1 pinaculum ring on mesothorax pale brown to dark brown, weakly developed dorsally. SD1 pinaculum ring on eighth abdominal segment pale brown to dark brown, usually incomplete. SD1 setae of abdominal segments 1–7 partially encircled with pale-brown to dark-brown ring fragments (text figure 19 *b*). Ring fragments frequently a dark smudge and occasionally cannot be detected. Additional details were given by Neunzig (1979).

Pupa 9.0–12.5 mm long and yellowish brown. Other features as in generic description and by Neunzig (1979).

A. transitella is an important pest of almond (*Prunus amygdalus* Batsch), Persian walnut (*Juglans regia* L.), and pistachio (*Pistacia vera* L.) in California (Wade, 1961; Rice, 1978). It also feeds as a larva in the fruit of numerous other plants including: apple (*Malus pumila* (L.) Miller), date (*Phoenix dactylifera* L.), ebony apes-earring (*Pithecellobium flexicaule* (Bentham) Coulter), fig (*Ficus carica* L.), grapefruit (*Citrus paradisi* Macfadyen), honey locust (*Gleditsia triacanthos* L.), locust (*Robinia* sp.), orange (*Citrus sinensis* (L.) Osbeck), peach (*Prunus persica* (L.) Batsch), pinkshower senna (*Cassia grandis* L. f.), sweet acacia (*Acacia farnesiana* (L.) Willdenow) (Neunzig, 1979; Wade, 1961). The larvae feed in the mature fruit of the host. Split, cracked, insect injured, or diseased fruit is infested by larvae. Seeds, surrounding pulp, and sometimes fungus are consumed. In tropical and subtropical areas, development appears to be continuous throughout the year; however, in the northern part of its range development ceases or is slowed down during the cooler months of the year. Pupation occurs in the damaged fruit.

In the United States, *transitella* has been collected in all the states south of a line drawn between North Carolina and northern California. At its northern limits adults fly from April to October; in south Florida and south Texas adults are present throughout the year.

GENUS
Euzophera Zeller

Euzophera Zeller, 1867, *Trans. Ent. Soc. London,* **5**: 456.
Type species: *Myelois cinerosella* Zeller, 1839. Designated by Hulst, 1890, *Trans. Amer. Ent. Soc.,* **17**: 174.

Stenoptycha Heinemann, 1865, *Die Schmetterlinge Deutschlands und Der Schweiz,* **1**(2): 190.
Type species: *Myelois cinerosella* Zeller, 1839. Designated by Hulst 1890, *Trans. Amer. Ent. Soc.,* **17**: 174.

NOTE—*Stenoptycha* Heinemann, 1865, is preoccupied by *Stenoptycha* Agassiz, 1862, in the Cnidaria, and by *Stenoptycha* Zeller, 1863, in the Lepidoptera, Pyralidae.

Melia Heinemann, 1865, *Die Schmetterlinge Deutschlands und Der Schweiz,* **1**(2): 209.
Type species: *Myelois cinerosella* Zeller, 1839.

NOTE—*Melia* Heinemann, 1865 is an objective replacement name for *Stenoptycha* Heinemann, 1865.

NOTE—*Melia* Heinemann, 1865, is preoccupied by *Melia* Bosc, 1813, in the Crustacea and by *Melia* Curtis, 1828, in the Lepidoptera, Pyralidae.

Ahwazia Amsel, 1949, *Bull. Soc. Fouad Ier Ent. Egypte,* **33**: 285.
Type species: *Ahwazia albocostalis* Amsel, 1949, considered to be a synonym of *Euzophera albicostalis* Hampson, 1903. Monotypy.

Longignathia Roesler, 1965, *Untersuchungen systematik chorologie Homoeosoma-Ephestia-Komplexes,* 26.
Type species: *Longignathia cornutella* Roesler, 1965. Original designation.

Euzophera is a large genus. Roesler (1973) considered the group to be cosmopolitan; he recognized 42 species for the Palearctic Region alone. We have seven species in North America. Adults of our species, for the most part, form a discrete, relatively easily recognized group: upper surface of forewing with broad, contrasting band between transverse lines (area between transverse lines about same color as rest of wing in *nigricantella*); robust male genitalia with apical process of gnathos a simple elongate hook that extends to or beyond apex of uncus, and transtilla with distinct, caudally projecting, lateral lobes; female genitalia membranous with numerous small spines associated with folds over most or part of the ductus bursae and corpus bursae, corpus bursae with small, cupped, scobinate signum and ductus seminalis attached to corpus bursae near signum. The palearctic species, as included by Roesler in his 1973 study, are a more heterogeneous group, including pale to dark adults with various wing patterns, and, sometimes with dissimilar genitalia. I question whether all species included by Roesler in *Euzophera* belong in the group and have excluded *subcribrella* Ragonot, *sordidella* Chrétien,

fuliginosella (Heinemann) and *ultimella* Roesler from my description of the genus. I have been unable to study some palearctic species with regard to a few characters, mainly of the wings.

Antenna of male simple, sensilla trichodea (cilia) of shaft abundant and at base of shaft about 1/10–1/7 as long as basal diameter of shaft. Frons convex, usually smoothly scaled, sometimes with anteriorly projecting scales. Labial palpus of both sexes upturned, reaching to or about to vertex. Maxillary palpus simple. Haustellum well developed or reduced. Ocellus present. Basal ½ of costa of forewing of male (text figure 23 *a*) slightly convex; under surface without streaks or patches of contrastingly colored scales or costal fold. Upper surface of forewing of both sexes mostly smooth, but many species with groups of very slightly raised, curled scales. Forewing with 11 veins; R_2 usually from discal cell, separate or approximate to base of fused R_{3+4} and R_5; R_{3+4} and R_5 stalked for about ⅔ length; M_1 from below upper angle of cell; M_2 and M_3 stalked for slightly less than ½ their lengths; CuA_1 arising from lower angle of cell; CuA_2 from about ⅘ length of cell. Hindwing (text figure 23 *a*) with 7 veins; $Sc+R_1$ and Rs fused beyond cell (usually for more than ½ their lengths); M_{2+3} and CuA_1 from lower angle, connate; CuA_2 from well before lower angle of cell; cell slightly more than ½ length of wing. Eighth abdominal segment of male either without scale tufts, or with a pair of ventrolateral tufts; when present, each tuft a single cluster of simple, more or less straight scales. Transverse sclerotized bar associated with scale tufts. Male genitalia (text figures 23 *b, c*; 25 *a, b*; 26 *a–d*; 27 *a–d*) with uncus usually broadly triangular, sometimes with distal part distinctly constricted; apical process of gnathos typically an elongate, simple hook (hook short in some palearctic species); transtilla complete, almost always with distinct, caudally projecting, lateral lobes (lobes reduced or missing in some palearctic species); juxta a U-shaped plate, frequently with lateral lobes enlarged; valva with costa strongly sclerotized and sometimes with a more or less seta-free, apical lobe; aedoeagus usually stout, armed with numerous, short spines in most species; vinculum seldom longer than greatest width. Female genitalia (text figure 23 *d*) with ductus bursae and corpus bursae membranous (a small sclerotized collar around ductus bursae in *nigricantella* Ragonot), usually with numerous small spines or scobinations; signum present (apparently absent in a few palearctic species), usually consisting of a small scobinate cup; ductus seminalis usually arising from about middle of corpus bursae.

Known last stage *Euzophera* larvae with distinct, to relatively distinct, pinaculum rings associated with SD1 setae of the mesothorax and eighth abdominal segment. Head only slightly roughened. Body pale, without stripes. SD1 setae of abdominal segments 1–7 partially encircled with pinaculum rings (text figure 19 *c–e*). Tonofibrillary platelets of body indistinct. Mandible simple. Maxilla with sensilla trichodea forked (*semifuneralis, ostricolorella, magnolialis*).

The few *Euzophera* pupae that have been studied have thoracic spiracles, lack a gibba, and have short and hooked spinose cremastral setae.

Larvae are borers, usually under the bark of various trees, or in the somewhat woody stems or roots of some of the more fibrous herbaceous plants. At times, they feed in fruits, or are found damaging tubers or roots in storage. Known hosts include members of the Asteraceae, Convolvulaceae, Ebenaceae, Fabaceae, Ginkgoaceae, Hamamelidaceae, Juglandaceae, Magnoliaceae, Malvaceae, Moraceae, Oleaceae, Poaceae, Rosaceae, Salicaceae, Solanaceae, and Tiliaceae.

KEY TO SPECIES OF *EUZOPHERA*

1. Forewing without ochre, reddish-brown, or purple scales; (plate 1, figure 44) ..... *nigricantella* p. 59
— Forewing with ochre, reddish-brown, or purple scales 2

2. Subbasal area of forewing not strongly contrasting with area between transverse lines (plate 1, figures 30–33, 42, 43, 65–68) 3
— Subbasal area of forewing mostly distinctly paler and strongly contrasting with area between transverse lines (plate 1, figures 34–41) 5

3. Relatively large species (wing length almost always over 14.0 mm); juxta with lateral arms curved, robust (text figure 27 *c*) ..... *ostricolorella* p. 59
— Usually smaller (wing length 7.5–12.5 mm); juxta with lateral arms straight, rather slender (text figures 23 *b*, 27 *a*) 4

4. Area of forewing between transverse lines uniformly dark (except discal spot sometimes evident) (plate 1, figures 42, 43); lateral lobes of transtilla broadly flared apically (text figure 27 *a*) ..... *magnolialis* p. 59

— Area of forewing between transverse lines with several patches of white scales (plate 1, figures 30–33); lateral lobes of transtilla narrow apically (text figure 23 *b*) ..... *semifuneralis* p. 54

5. Antemedial line of forewing with an associated, sharply defined, linear, black streak on costal ½ (plate 1, figures 34–36) ..... *habrella* p. 56

— Antemedial line of forewing without an associated, sharply defined, linear, black streak on costal ½ (plate 1, figures 37–41) 6

6. Forewing with posterior ½ mostly with pale brown or ochre basally (plate 1, figures 37–39); southern Arizona, southern New Mexico, southern Texas, and adjacent Mexico ... *aglaeella* p. 56

— Forewing with posterior ½ abundantly suffused with reddish brown basally (plate 1, figures 40, 41); southern British Columbia and northeastern California ..... *vinnulella* p. 58

KEY TO LAST STAGE LARVAE OF *EUZOPHERA*

1. Distance between paired V1 setae on abdominal segment 9 more than ½ distance between paired V1 setae on abdominal segment 10; width of anterior abdominal segments about 4–5 mm; host tulip-tree (*Liriodendron tulipifera* L.) ..... *ostricolorella* p. 59

— Distance between paired V1 setae on abdominal segment 9 less than ½, or ½, distance between paired V1 setae on abdominal segment 10; width of anterior abdominal segments about 3 mm; hosts other than tulip-tree 2

2. Host southern magnolia (*Magnolia grandiflora* L.) ..... *magnolialis* p. 59

— Hosts plum (*Prunus domestica* L.), cherry (*Prunus* spp.), peach (*Prunus persica* (L.) Batsch), walnut (*Juglans* spp.), almond (*Prunus amygdalus* Batsch), pecan (*Carya illinoensis* (Wangenheim) K. Koch), and many additional plants ..... *semifuneralis* p. 54

Euzophera semifuneralis (Walker) (American Plum Borer*)

PL. 1, FIGS. 30–33. TEXT FIGS. 19 *e*; 23 *a–d*; 24 (RWH 5995).

Nephopteryx [sic] *semifuneralis* Walker, 1863, *List of Specimens of the Lepidopterous Insects in the Collection of the British Museum,* **27**: 57.
Type locality: North America. [BMNH]

Stenoptycha pallulella Hulst, 1887, *Ent. Americana,* **3**: 137.
Type locality: New York. [AMNH]

E. semifuneralis is a rather dark moth that, as with almost all other North American members of the genus, has the area of the forewing between the transverse lines forming a broad, dark band. This band is usually less uniformly colored in *semifuneralis* than in *magnolialis* or *ostricolorella.* Also, fresh specimens have groups of very slightly raised, curled, mostly white scales on the forewing. *E. semifuneralis* is the most commonly collected North American species in the genus, being widely distributed and having many hosts. See text figure 23 *b–d* for illustrations of male and female genitalia. Wing length 7.5–12.0 mm.

Last stage larva (text figure 24) 16.0–26.0 mm long. Head yellowish brown to dark brown with dark-brown to black genal patches. Thoracic shield pale yellowish brown with dark-brown to black platelets and pigmentation. Body white, pink, or brownish green, without stripes. SD1 pinaculum rings on mesothorax and eighth abdominal segment brown. SD1 setae of abdominal segments 1–7 usually partially encircled with pale-brown pinaculum rings (text figure 19 *e*).

Pupa brown, about 12.0 mm long; yellowish brown to reddish brown. Head, prothorax, and mesothorax slightly wrinkled and with shallow punctures. Abdominal segments 1–9 with shallow punctures. Eight short, hooked, spinose cremastral setae on last abdominal segment, and a few similar spines on ninth segment.

E. semifuneralis sometimes is a pest, particularly of various fruit and nut trees. However, it usually is of minor importance because the insect appears to require damaged plant tissue for the larvae to establish themselves under the bark; non-injured trees are rarely infested. The use of labor-saving, mechanical harvesting devices (shakers), frequently injures plants during harvest and has provided an abundance of suitable host material. Insect damage is more extensive in these hosts. Most larvae feed on the cambium-phloem tissue of the host making irregular galleries. Occasionally trees are completely girdled and killed. Pupation occurs usually beneath the bark of a host. There are one or two generations per year. Blakeslee (1915) gave additional infor-

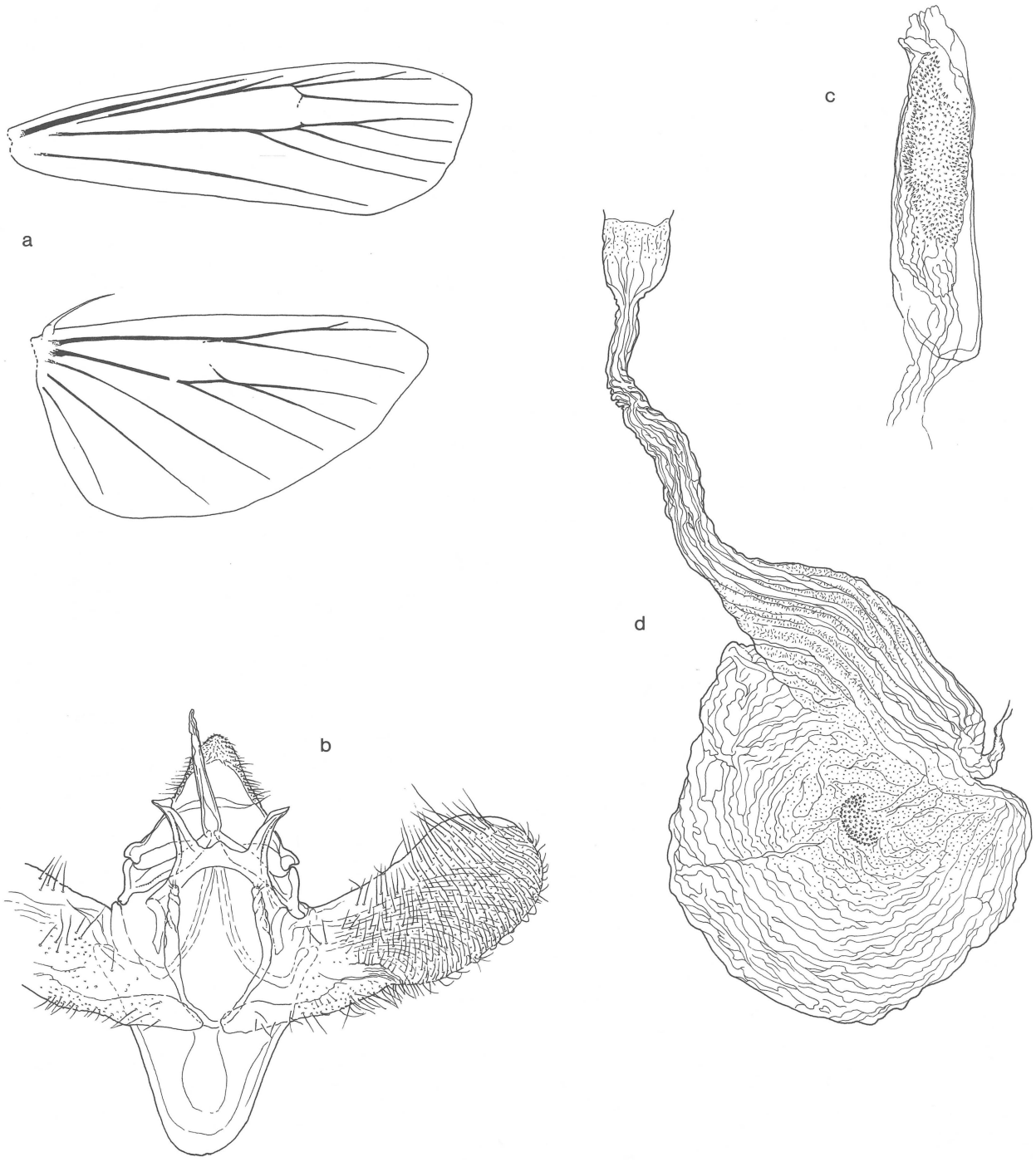


FIGURE 23: VENATION AND GENITALIA OF *EUZOPHERA SEMIFUNERALIS*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 952); *c.* Aedoeagus; *d.* Corpus bursae, ductus bursae, and part of ductus seminalis (HHN 950).

mation on the biology. Sometimes stored products, such as sweet potatoes (*Ipomoea batatas* Poiret), are infested with larvae. Also, D. Biddinger (personal communication) found larvae of *semifuneralis* feeding in galls of *Dibotryon morbosum* (Schweinitz) Theissen and Sydow (Ascomycetes).

Hosts mentioned in the literature (Heinrich, 1956) include the following diverse group: American

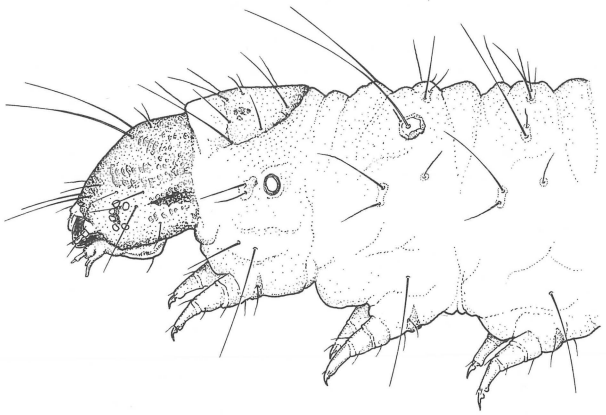


FIGURE 24: LAST STAGE LARVA OF *EUZOPHERA SEMIFUNERALIS* (LATERAL VIEW OF HEAD AND THORAX)

mountain ash (*Sorbus americana* Marshall), apple (*Malus pumila* (L.) Miller), apricot (*Prunus armeniaca* L.), cherry (*Prunus* spp.), cotton (*Gossypium hirsutum* L.), ginkgo (*Ginkgo biloba* L.), linden (*Tilia americana* L.), mulberry (*Morus alba* L.), olive (*Olea europaea* Thunberg), peach (*Prunus persica* (L.) Batsch), pear (*Pyrus communis* L.), pecan (*Carya illinoensis* (Wagenheim) K. Koch), persimmon (*Diospyros virginiana* L.), plum (*Prunus domestica* L.), poplar (*Populus* spp.), sweet gum (*Liquidambar styraciflua* L.), walnut (*Juglans* spp.). Possibly some of these hosts should be listed under one or more of the pale North American *Euzophera* previously considered to be color forms of *semifuneralis.* There is no doubt, however, that *semifuneralis* feeds in the damaged tissues of a wide variety of plants.

E. semifuneralis occurs from Nova Scotia to eastern Manitoba and transcontinentally in the United States with the possible exception of a few of the North Central States. Those individuals overwintering fly in March, April, or May; and the second generation of moths occurs mostly in July and August.

Euzophera aglaeella Ragonot, REVISED STATUS
PL. 1, FIGS. 37–39. TEXT FIG. 25 *a, b.*

Euzophera aglaeella Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 14.
Type locality: Sonora, Mexico. [MNHP]

Similar to *semifuneralis* but with the basal, subbasal and terminal areas of the forewing paler. Also, easily confused with other pale North American *Euzophera. E. aglaeella* appears to be most closely related to *Euzophera habrella* Neunzig, however the latter species has a sharply defined, linear black streak on the costal ½ of the forewing just distad of the antemedial line, whereas the former species has only a diffuse, black patch on the costal ½ of the forewing distad of the antemedial line. Also, *aglaeella* is found in southern Arizona, southern New Mexico, southern Texas, and northern Mexico in contrast to *habrella* which occurs in the northeastern United States (and mountains of Kentucky, West Virginia, and North Carolina). Wing length 9.0–11.0 mm.

The immature stages are unknown.

E. aglaeella has been collected in Cochise County in southern Arizona in late April, early May and early September, in Hidalgo County in southwestern New Mexico in late August, and in San Patricio County in southeastern Texas, in mid-March.

Heinrich (1956) included *aglaeella,* and two other pale species of *Euzophera* described as new in this fascicle, under *semifuneralis*; my examination of large series of North American *Euzophera* has led me to conclude that Heinrich's color forms are discrete taxa. Although the genitalia are similar, consistent differences are apparent in the color and pattern of the forewings.

Euzophera habrella Neunzig, NEW SPECIES
PL. 1, FIGS. 34–36. TEXT FIG. 26 *c, d.*

Euzophera habrella Neunzig
Type locality: Spruce Knob Lake, Randolph Co., West Virginia. [UCB]

DIAGNOSIS. Adults of *habrella* are most similar to those of *aglaeella,* but usually larger. Other differences have been mentioned under *aglaeella.*

DESCRIPTION. Wing length 11.0–17.0 mm. Head: frons pale brown, lightly dusted with white; vertex pale brown; labial palpus pale brown to brown dusted with white, basal segment usually completely white. Thorax: collar pale brown washed with ochre or pale reddish brown. Forewing: ground color pale brown; posterior ½ strongly suffused with ochre, pale reddish-brown, and red scales basally and subbasally, costal ½ mostly white with some ochre and pale reddish-brown scales subbasally; antemedial line white to ochre, somewhat obscure, straight, bordered distally by distinct, linear, black streak, on costal ½; postmedial line white, relatively distinct; medial area heavily suffused with black and with patches of white, some ochre and red scales, and black discal streak; terminal area ochre or red basally, white distally, and usually with complete ter-

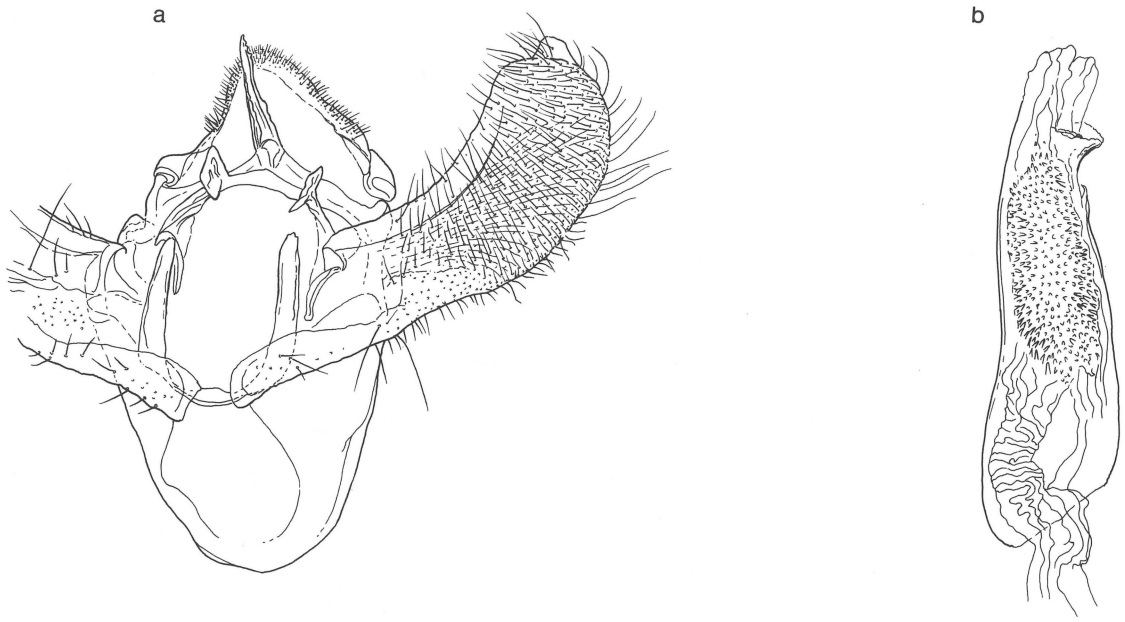


FIGURE 25: MALE GENITALIA OF *EUZOPHERA AGLAEELLA*
a. Genitalia, holotype (most of left valva and aedoeagus omitted) (HHN 2423); *b.* Aedoeagus, holotype.

minal line. Hindwing: pale smoky brown, darker along margins. Male genitalia (text figure 26 *c, d*): valva somewhat elongate with apical lobe indistinct; transtilla with medial arch broadly developed; vinculum slightly less than ½ as long as greatest width. Female genitalia similar to those of *semifuneralis.*

The immature stages of *habrella* are unknown.

TYPES. Holotype: ♂. Spruce Knob Lake, 4,000′, Randolph Co., West Virginia, 10 July 1983, Opler and Powell; genitalia slide 2425 HHN. UCB. Paratypes: 1 ♂, 11 ♀. Kentucky: Big Black Mountain, Harlan Co., 14 July 1979, C. V. Covell, Jr. (1 ♀). New York: Six Mile Creek, Ithaca, 31 May 1954, 9 June 1954, 25 May 1957, 6 July 1957, 29 May 1957, J. G. Franclemont; genitalia slide 2426 HHN (7 ♀). North Carolina: Black Mountains, 26 June 1912, 7 July 1912, Beutenmüller (2 ♀). Pennsylvania: Shawville, Clearfield Co., June 19 [No year]; John Bauer (1 ♂, 1 ♀). ANSP, CM, NCSU, USNM.

Euzophera vinnulella Neunzig, NEW SPECIES
PL. 1, FIGS. 40, 41. TEXT FIG. 26 *a, b.*

Euzophera vinnulella Neunzig.
Type locality: Seton Lake, [Lillooet], British Columbia. [CNC]

DIAGNOSIS. *E. vinnulella* adults are superficially similar to other pale North American *Euzophera.* However, the forewing has the posterior ½ more heavily suffused with reddish brown than in other close relatives, and it has a characteristic small, white discal spot. *E. vinnulella* has thus far only been collected in British Columbia and California.

DESCRIPTION. Wing length 7.5–11.0 mm. Head: frons and vertex brown dusted with white; labial palpus brown to fuscous dusted with white. Thorax: collar and dorsum fuscous with numerous pale reddish-brown scales. Forewing: ground color brown; posterior ½ strongly suffused with red or reddish-brown scales basally and subbasally, costal ½ with numerous white scales subbasally, particularly along costa and with some red or reddish-brown scales; antemedial line white, weakly developed, diffuse near costa; postmedial line white, distinct; medial area rather uniformly black with small, white discal spot and weakly developed pale patch of scales on posterior ½ just beyond antemedial line; terminal area mostly pale red to reddish brown basally, white distally and usually with complete terminal line. Hindwing: pale smoky brown, darker along margins. Male genitalia (text figure 26 *a, b*): valva rather short, robust, with apical lobe well developed, distinct; transtilla with medial arch narrow; vinculum slightly more than ½ as long as greatest width. Female genitalia similar to those of *semifuneralis.*

The immature stages are unknown.

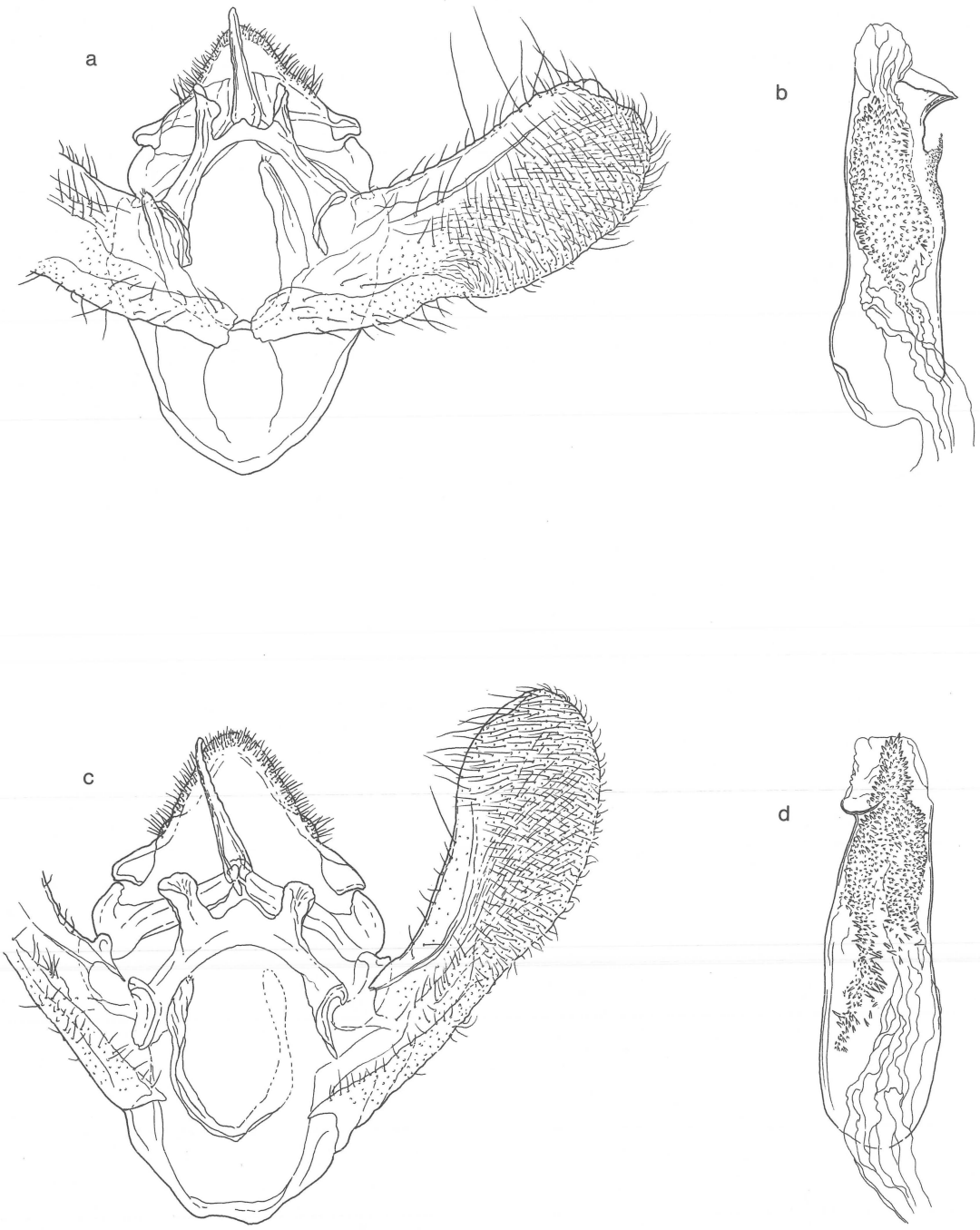


FIGURE 26: MALE GENITALIA OF *EUZOPHERA VINNULELLA* AND *EUZOPHERA HABRELLA*
a. E. vinnulella, holotype (most of left valva and aedoeagus omitted) (HHN 2430); *b.* aedoeagus. *c. E. habrella,* holotype (most of left valva and aedoeagus omitted) (HHN 2425); *d.* aedoeagus.

TYPES. Holotype: ♂. Seton Lake, British Columbia; 1 August 1933; J. McDunnough; genitalia slide 2430 HHN. CNC. Paratypes: 6 ♂, 3 ♀. British Columbia: Same location and collector as for holotype, 30 July 1933, 4 August 1933; genitalia slides 2427, 2430 HHN; (1 ♂, 1 ♀). Seton Lake, Lillooet, 28 June 1926, J. McDunnough (1 ♂). Nicola, 19 July 1922, P. N. Vroom (1 ♀). Oliver, 1,000′, 11, 12 August 1953, D. F. Hardwick (1 ♂, 1 ♀). 8 mi W of Keremeos, 1,600′, 5 August 1960, D. F. Hardwick (1 ♂). California: 8 mi S Markleeville, Carson River, Alpine Co., 22 June 1962, J. Powell (2 ♂). CNC, UCB.

Euzophera magnolialis Capps (Magnolia Borer)

PL. 1, FIGS. 42, 43. TEXT FIGS. 19 *d*; 27 *a, b* (RWH 5996).

Euzophora [sic] *magnolialis* Capps, 1964, *Florida Ent.*, **47**: 49.
Type locality: Pembroke, Florida. [USNM]

Adults of *magnolialis* resemble small specimens of *Euzophera ostricolorella* in color and maculation. However, fresh *magnolialis* have numerous patches of slightly raised, curled scales on the upper surface of the forewings; these are absent in *ostricolorella.* The genitalia of *magnolialis* and *ostricolorella* also differ; most noticeably the male genitalia of *magnolialis* have a smaller uncus and less robust and straighter lateral arms on the juxta (compare text figure 27 *a* with 27 *c*); and the female genitalia of *magnolialis* have a longer ductus bursae and a less spinose corpus bursae (compare Capps, 1964: figure 3, and Heinrich, 1956: figure 1065). Wing length 10.0–12.5 mm.

Last stage larva about 27.0 mm long. Head dark brown with a black lateral genal streak. Thoracic shield brownish white to pale brown. Body white. SD1 pinaculum rings on mesothorax and eighth abdominal segment pale brown to brown. SD1 setae of abdominal segments 1–7 with pale-brown, partial, pinaculum rings (text figure 19 *d*). Capps (1964) gave additional information on the larva, including setal maps.

The host plant of *magnolialis* is southern magnolia (*Magnolia grandiflora* L.). Kerr and Brogdon (1958) published a brief account of the damage to the host. Larvae feed on the cambium-phloem tissues at the crown and upper part of the root system of the plant. All larvae collected thus far have been from young plants, mostly growing in nurseries. Whether hosts of all sizes are used under natural conditions is not known. Complete girdling, and subsequent death, of young plants has been documented. Larvae pupate under the bark of damaged trees.

E. magnolialis is known from Florida, Georgia, Louisiana, and North Carolina. Apparently, adults are infrequently collected in light traps. Most adults studied have been reared from larvae. I have seen one female collected at light by Ferguson. Based on this adult, and the reared material, *magnolialis* can be expected to fly in Florida, Georgia, and Louisiana in March and April, and in North Carolina in April and May.

Euzophera ostricolorella Hulst (Tulip-tree Borer)

PL. 1, FIGS. 65–68. TEXT FIG. 27 *c, d* (RWH 5997).

Euzophera ostricolorella Hulst, 1890, *Trans. Amer. Ent. Soc.*, **17**: 175.
Type locality: New York. [AMNH]

Moths of *ostricolorella* are almost always considerably larger (wing length 11.5–19.0 mm) than other North American species in the genus. They resemble adults of *magnolialis*; however, they lack the patches of slightly raised, pale, curled scales on the upper surface of the forewing. Some specimens of *ostricolorella* have abundant red or purplish-red scales on the forewing (plate 1, figures 66, 68). Genital differences are given in the diagnosis of *magnolialis.*

Last stage larva 25.0–30.0 mm long. Head reddish brown with dark genal streak. Body yellowish white to grayish white, without stripes. SD1 pinaculum rings of mesothorax and eighth abdominal segment reddish brown to dark reddish brown. SD1 of abdominal segments 1–7 partially encircled with brown pinaculum rings.

Pupa 13.0–14.5 mm long; brown; eight, hooked, cremastral setae on 10th segment.

Heinrich (1920) provided additional information on the larva and pupa.

The larval host of *ostricolorella* is tulip-tree (*Liriodendron tulipifera* L.). The adult oviposits almost always at the base of the host. Usually moist, partially rotted sites on larger trees are selected for oviposition. The larvae bore under the bark, feeding on the cambium-phloem tissue, located with few exceptions at the crown and roots near the crown. Hay (1958), Heinrich (1920), and Hope and Pless (1979) provided additional information on the biology of this species. In natural mixed hardwood forests *ostricolorella* apparently has little effect on growth and mortality of host trees; however, in ornamental plantings (lawns, woodlots, seed orchards) dieback and death of trees is possible.

E. ostricolorella occurs in the eastern United States. I have seen specimens from the following states: New York (July, August); Kentucky (June, October); Tennessee (May, June, September, October); Missouri (June); Maryland (June, October); Virginia (July); North Carolina (May, June, September, October); South Carolina (June, August); Georgia (July); Florida (August).

Euzophera nigricantella Ragonot

PL. 1, FIG. 44. TEXT FIG. 19 *c* (RWH 5998).

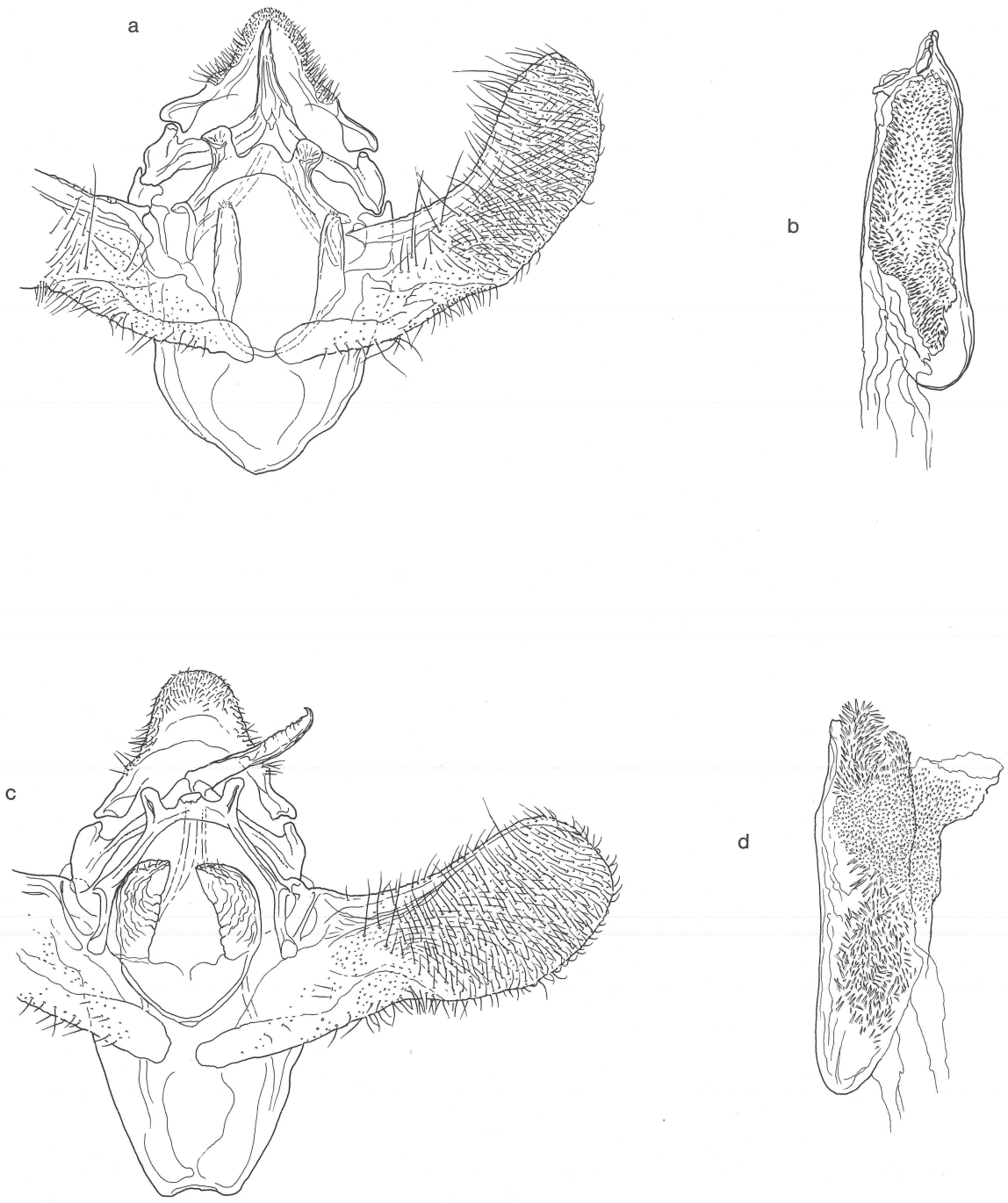


FIGURE 27: MALE GENITALIA OF *EUZOPHERA* SPECIES

a. E. magnolialis (most of left valva and aedoeagus omitted) (HHN 1203); *b.* aedoeagus; *c. E. ostricolorella* (most of left valva and aedoeagus omitted) (HHN 185); *d.* aedoeagus.

Euzophera nigricantella Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 14.
Type locality: Arizona. [MNHP]

Euzophera griselda Dyar, 1913, *Proc. U. S. Natl. Mus.,* **44**: 322.
Type locality: Tehuacan, Mexico. [USNM]

Adults of *nigricantella* are quite distinct from other North American species in the genus. The upper surface of the forewing is more uniformly patterned,

in that the division of the wing into three broad transverse regions is much less apparent. The upper surface of the forewing is also smooth, lacks red or purple suffusions, and has a relatively distinct white discal spot. The juxta of the male genitalia has its outer, distal margins inwardly hooked (Heinrich, 1956: figure 581), and the female genitalia possess a sclerotized collar at the junction of the ductus bursae and the corpus bursae (Heinrich, 1956: figure 1067) (see Capps (1964) concerning mislabeled figures in Heinrich).

The only larval specimen I have seen is that of a partially grown, preserved individual. Head reddish brown with dark-brown genal streak. Thoracic shield mostly yellowish brown. Body yellowish white without stripes. SD1 pinaculum rings of mesothorax and eighth abdominal segment pale brown. SD1 of abdominal segments 1–7 partially encircled with pale-brown pinaculum rings (text figure 19 *c*).

The pupa of *nigricantella* is unknown.

Larvae of *nigricantella* have been found boring under the bark of mesquite (*Prosopis* sp.). Details regarding feeding habits, pupation, etc. have not been obtained. Presumably, most of their biology would be similar to that of other *Euzophera.*

Adults have been collected in southern Arizona in March, April, June, July, August, September, and October, in southern New Mexico in July, in southern Texas in May, and in Puebla (Mexico) in September and Sonora (Mexico) in April, May, and September.

GENUS
Eulogia Heinrich

Eulogia Heinrich, 1956, *U. S. Natl. Mus. Bull.,* **207**: 275.
Type species: *Ephestia ochrifrontella* Zeller, 1875. Original designation.

Heinrich proposed *Eulogia* for the single nearctic species *ochrifrontella.* Superficially, moths of *ochrifrontella* resemble those in the genus *Euzophera,* but *ochrifrontella* has an incomplete transtilla and a strongly developed cornutus in the aedoeagus. Also, the ductus bursae lacks the scobinate or microspine bearing folds found in the ductus bursae of *Euzophera.*

Antenna of male simple, sensilla trichodea (cilia) of shaft abundant and at base of shaft about ¼ as long as basal diameter of shaft. Frons convex, smoothly scaled. Labial palpus of both sexes upturned, reaching to or almost to vertex. Maxillary palpus simple. Haustellum well developed. Ocellus present. Basal ½ of costa of forewing of male (text figure 28 *a*) slightly concave, under surface with long, narrow costal fold. Forewing smooth scaled; with 11 veins; R_2 from discal cell; R_{3+4} and R_5 stalked for about ⅔ their lengths; M_1 from below upper angle of cell, slightly curved; M_2 and M_3 approximate, connate or very shortly stalked; CuA_1 from lower angle of cell; CuA_2 from before lower angle of cell. Hindwing (text figure 28 *a*) with 7 veins; $Sc+R_1$ and Rs strongly fused beyond cell; M_{2+3} and CuA_1 from lower angle of cell, stalked for about ½ their lengths; CuA_2 from well before lower angle of cell; cell about ½ length of wing. Eighth abdominal segment of male with paired ventrolateral scale tufts; each tuft a single cluster of simple, more or less straight scales. Transverse sclerotized bar associated with scale tufts. Male genitalia (text figure 28 *b, c*) with uncus broadly triangular; apical process of gnathos a short, bifurcate plate; transtilla incomplete; juxta a U-shaped plate with robust, setiferous lateral lobes; valva narrow and simple; aedoeagus slender with curved cornutus; vinculum about as long as greatest width. Female genitalia (text figure 28 *d*) with ductus bursae strongly sclerotized at, and just before, genital opening and with slightly sclerotized area near its juncture with corpus bursae; corpus bursae membranous; signum consisting of cluster of short, small spines; ductus seminalis arising from posterior part of corpus bursae.

The immature stages are unknown.

Heinrich (1956) associated the larvae with members of the Fagaceae, Juglandaceae, and Rosaceae. The habits of the larvae are not known.

Eulogia ochrifrontella (Zeller)
PL. 2, FIGS. 9–13. TEXT FIG. 28 *a–d* (RWH 5999).

Ephestia ochrifrontella Zeller, 1875, *Verh. der K.-K. Zool.-Bot. Ges. Wien,* **25**: 337.
Type locality: Texas. [MCZ]

Euzophera ferruginella Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 14.
Type locality: N. Carolina. [MNHP]

The small size (wing length 5.0–6.0 mm) in combination with the color of the upper surface of the forewing (basal ½ reddish brown, distal ½ predominately fuscous or black) will identify most *ochrifrontella.* Some darker individuals occur (plate 2, figure 13) in which the basal ½ of the wing is dark purple.

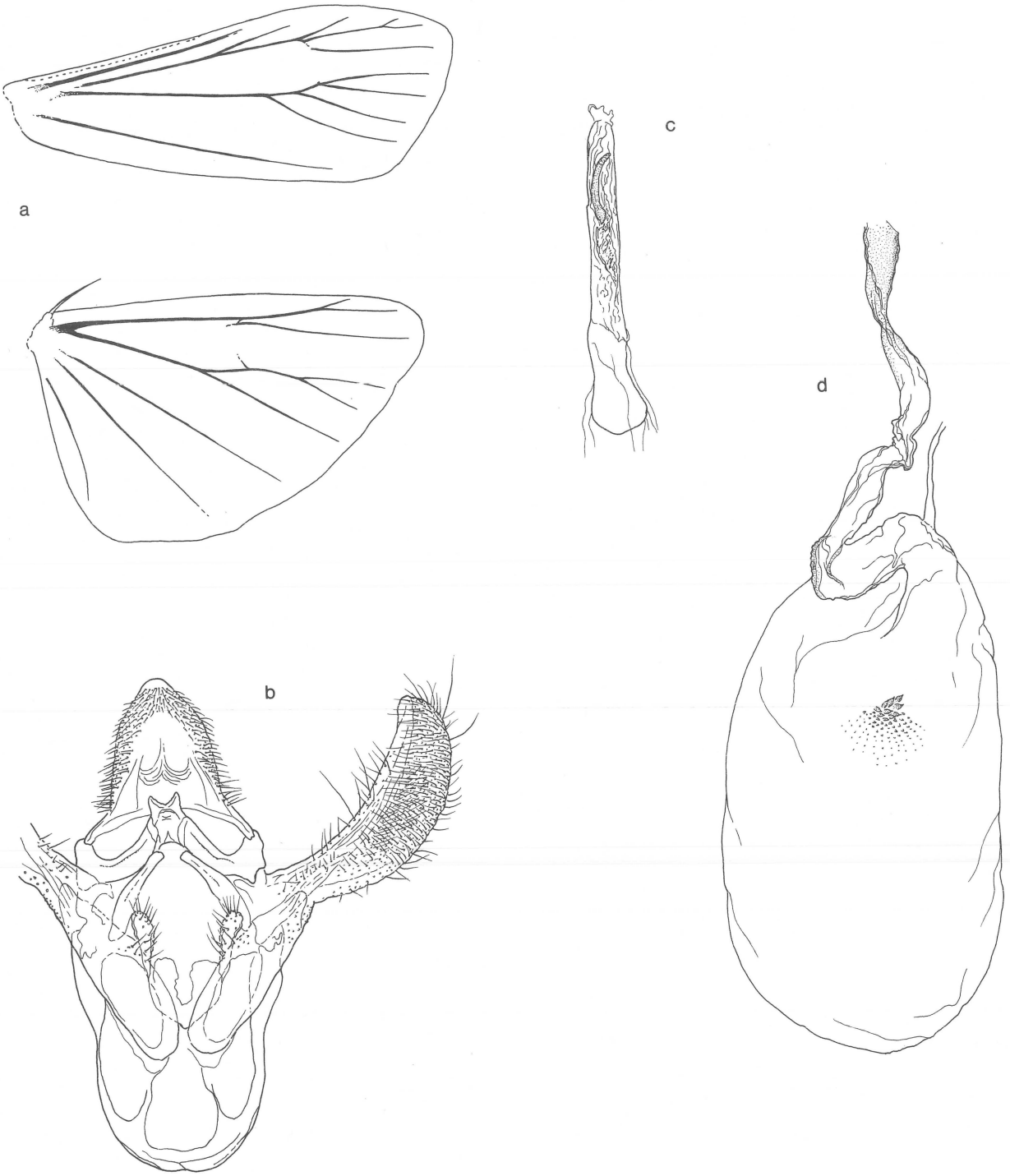


FIGURE 28: VENATION AND GENITALIA OF *EULOGIA OCHRIFRONTELLA*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 732); *c.* Aedoeagus; *d.* Corpus bursae, ductus bursae, and part of ductus seminalis (HHN 930).

Despite the fact that *ochrifrontella* is relatively commonly collected, the only information on host plants of the larvae (apple, oak, pecan) is in Heinrich (1956), and it is based on specimen labels. Whether the larva feeds under the bark, as in *Euzophera,* or on other parts of its host is unknown.

E. ochrifrontella is found from Nova Scotia to British Columbia and throughout the eastern half

of the United States. In the northern part of its range moths fly in June or July. Farther south most adults are first collected as early as March. Apparently, there is more than one generation each year in the United States. I have seen specimens of *ochrifrontella* collected in the fall (usually September) both in the southern and northern United States.

GENUS
Ephestiodes Ragonot

> *Ephestiodes* Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 16.
> Type species: *Ephestiodes gilvescentella* Ragonot, 1887. Original designation.
>
> NOTE—According to Article 30 (b) of the *International Code of Zoological Nomenclature* (third edition), names with the suffix -odes are substantivized adjectives and are masculine. Previous authors have treated *Ephestiodes* as feminine. I have emended the trivial name *erasa* Heinrich to *erasus* to comply with the Code. However, the names formed with the diminutive suffix-ella retain the original orthography.

Ephestiodes is an easily recognized New World genus. All are small moths with characteristic male and female genitalia (text figures 29 *b–d*; 31 *a–d*); the broadly rounded uncus in the male and very short apophyses in the female are particularly useful in identifying members of the group. The neotropical genus *Azaera* Schaus is closely related to *Ephestiodes* and may be congeneric. The relationship of *Ephestiodes* to other phycitine genera is somewhat obscure, but on the basis of the female genitalia, they are relatives of *Vitula* Ragonot, *Caudellia* Dyar, *Sosipatra* Heinrich, and several others. Seven species occur in America north of Mexico.

Antenna of both sexes without basal or subbasal modifications (plate B, figure 2); sensilla trichodea (cilia) of shaft of male antenna moderately abundant, and at base of shaft about ⅓–½ as long as basal diameter of shaft (band of trichodea narrow, sometimes difficult to detect). Frons convex, with anteriorly projecting scales. Labial palpus of both sexes oblique, reaching to vertex, third segment about as long as second. Maxillary palpus simple. Haustellum well developed. Ocellus present. Forewing of male (text figure 29 *a*) with costa slightly convex on basal ½; under surface with costal fold. Forewing smooth scaled; with 10 veins; R_{3+4} and R_5 completely fused; M_1 from below upper angle of cell, straight, or slightly curved; M_2 and M_3 stalked for about ½ their lengths; CuA_1 from lower angle; CuA_2 from near lower angle of cell. Hindwing (text figure 29 *a*) with 6 or 7 veins; $Sc+R_1+Rs$ fused, or almost completely fused, to costa; M_1 from upper angle of cell; M_{2+3} and CuA_1 stalked for about ½ their length; CuA_2 from before, but near lower angle of cell; cell about ½ length of wing. Eighth abdominal segment of male with paired, dorsal scale tufts (text figure 40 *a*); each tuft consists of four clusters of scales; second cluster of each tuft characteristically slender, sinuous, and longer than others. Male genitalia (text figures 29 *b, c*; 31 *a–d*) with uncus broadly rounded; gnathos with apex forked; transtilla incomplete, but with distal elements well developed and flared; juxta a narrow, semicircular band with a broad base, without setae; valva with costa strongly sclerotized, and with an angled, transverse, sclerotized ridge across base of cucullus; aedoeagus straight, relatively long, with a weak, thin cornutus, or a pair of similar cornuti; vinculum triangular, about as long as greatest width. Female genitalia (text figure 29 *d*) with very short apophyses posteriores and apophyses anteriores; ductus bursae longer than corpus bursae, sclerotized and granulate for about $^{9}/_{10}$ its length, with a strongly sclerotized shield behind genital opening and usually with a sclerotized band or shield below opening; ductus bursae membranous, oval, with signum consisting of small cluster of thornlike spines and associated faint scobinations; ductus seminalis attached to bursae close to signum.

Based on the larva of *infimella* Ragonot (text figure 30), the only immature of the genus I have seen, last stage larvae of *Ephestiodes* are slender, somewhat darkened, with granulate integument. The head is relatively smooth. SD1 pinaculum rings are distinct on the mesothorax and eighth abdominal segment. Mandible simple. Maxilla with sensilla trichodea entire.

Pupae have not been collected for the genus.

Larvae are known to feed on members of the Asteraceae, Liliaceae, and Vitaceae. Other possible hosts are Malvaceae, Onagraceae, and Rosaceae. Based on their abundance as adults and wide distribution, they probably are associated with a wide variety of plants.

KEY TO SPECIES OF MALE *EPHESTIODES*

1. Transverse ridge strongly developed along base of cucullus, distinctly projecting beyond lower margin of valva (text figure 29 *b*) 2
— Transverse ridge of cucullus less pronounced, not projecting beyond lower margin of valva (text figure 31 *c*), or only slightly produced (text figure 31 *a*) 3

2. Forewing pale, with little contrast between white and darker markings (plate 2, figure 20); Florida ..... *erasus* p. 64

— Forewing with contrasting white and fuscous markings (plate 2, figures 14–19), sometimes suffused with pale reddish brown; western Canada and western United States ... *gilvescentella* p. 64

3. Transverse ridge of cucullus slightly projecting beyond margin of valva 4

— Transverse ridge of cucullus not projecting beyond margin of valva 5

4. Costa of valva slightly irregular; eastern Canada and eastern United States ..... *infimella* p. 65

— Costa of valva distinctly spined (text figure 31 *a*); southwest Texas ..... *monticolus* p. 66

5. Forewing partly to mainly red (plate 2, figure 29, 30); western Canada and western United States ..... *erythrella* p. 67

— Forewing without red scales 6

6. Transverse lines of forewing distinctly outlined in black (plate 2, figures 32, 33); central Texas ..... *mignonella* p. 68

— Transverse lines of forewing indistinct (plate 2, figure 31); California ..... *griseus* p. 68

Ephestiodes gilvescentella Ragonot

PL. 2, FIGS. 14–19; PL. B, FIG. 2. TEXT FIGS. 29 *a–d*; 40 *a* (RWH 6000).

Ephestiodes gilvescentella Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 16.
Type locality: California. [MNHP]

Ephestiodes nigrella Hulst, 1900, *Jour. New York Ent. Soc.,* **8**: 224.
Type locality: Los Angeles, California. [USNM]

Moths have the forewing either brownish black and white or brownish black and white with some patches of obscure pale reddish brown; or, occasionally, pale-colored individuals with or without red occur. It is the most commonly collected species of the genus in western Canada and the western United States. Wing length 4.5–7.0 mm.

Male genitalia (text figure 29 *b, c*) with apical process of gnathos V-shaped; valva with costa relatively smooth, and transverse ridge of cucullus strongly developed and distinctly projecting beyond lower margin of valva; transtilla with flaring apices divergent. Female genitalia as in text figure 29 *d.*

The immature stages have not been described. Heinrich (1956: 279), stated that the adults have been reared from larvae infesting raisin (*Vitis vinifera* L.), cotton (*Gossypium hirsutum* L.), and gaura (*Gaura parviflora* Douglas ex Lehmann). Rabbitbrush (*Chrysothamnus* sp.), matchweed (*Gutierrezia sarothrae* (Pursh) Britton and Rusby), groundsel (*Senecio blochmanae* Greene), and *Haplopappus* sp. are included as hosts on pins of reared California moths of *gilvescentella* in the University of California, Berkeley Collection. According to Powell (personal communication) these records are based on larvae reared from the crown area of these woody Asteraceae. He has suggested that *gilvescentella* is possibly a detritivore feeding on a wide variety of plants.

Flight dates for *gilvescentella* are as follows: British Columbia, July–September; Washington, April–September; Oregon, August, October; Idaho, September; Utah, June–September; Nebraska, June; California, March–December; Arizona, April, May, September; New Mexico, April–July; Texas, May, June, November; Baja California, April. Donohoe et al. (1949) recorded peak flight of *gilvescentella* in May in California.

Ephestiodes erasus Heinrich

PL. 2, FIG. 20 (RWH 6004).

Ephestiodes erasa [sic] Heinrich, 1956, *U. S. Natl. Mus. Bull.,* **207**: 280.
Type locality: Lake Alfred, Florida. [USNM]

E. erasus appears to be restricted to Florida. The adult is the only pale *Ephestiodes* with little or no strongly contrasting markings on the upper surface of the forewing in the eastern United States. Wing length 5.0–6.5 mm.

Male and female genitalia very similar to those of *gilvescentella* (Heinrich, 1956: figures 588, 1077).

The immature stages are unknown.

E. erasus adults have been caught at lights from March through July. Recent collecting in central Florida has produced several good series of moths that agree well with the type and original description of the species. However, in the same location, a few *Ephestiodes* with genitalia like those of *erasus,* but with a more contrasting color pattern, have been taken. Whether these latter specimens are dark forms

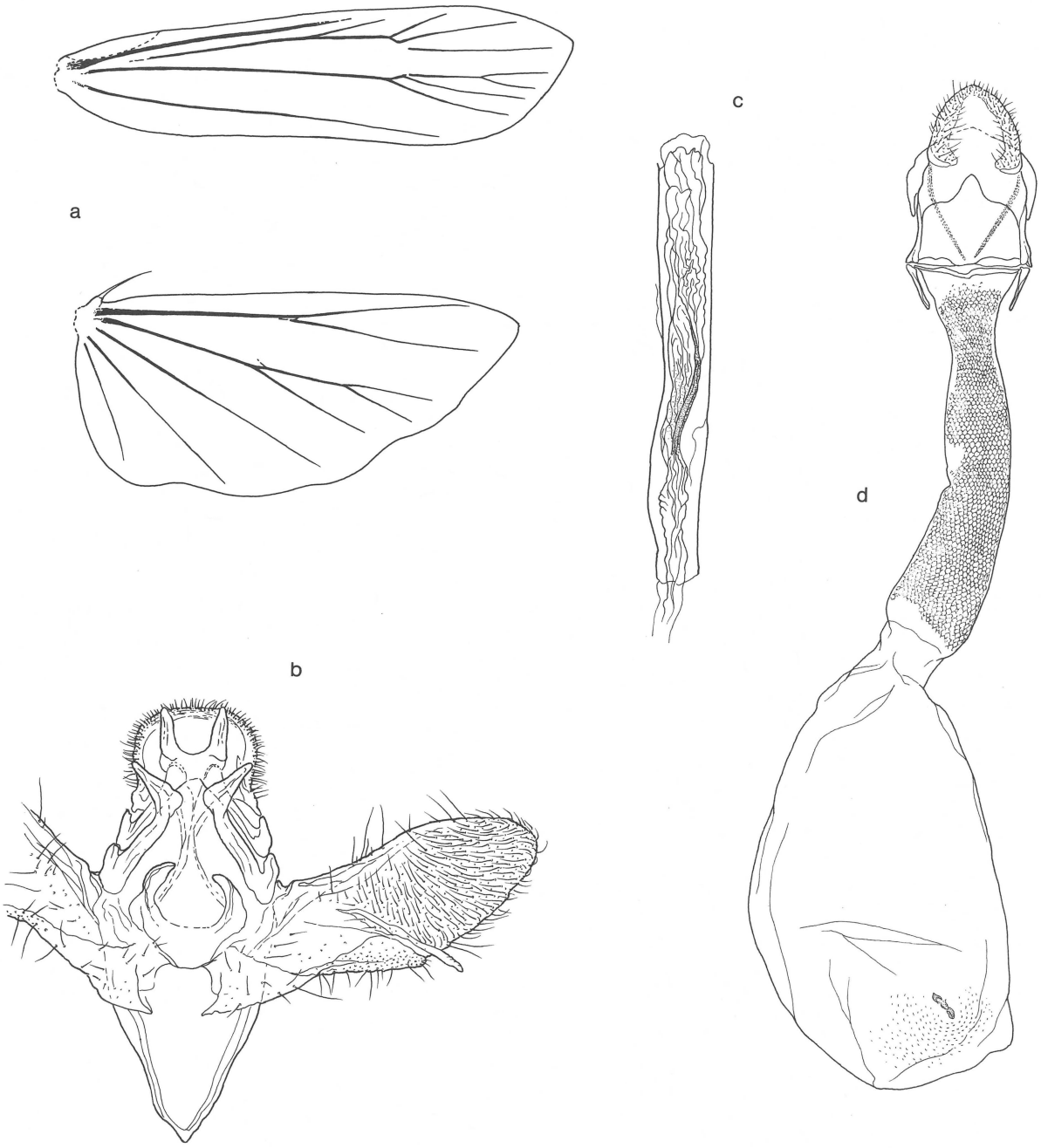


FIGURE 29: VENATION AND GENITALIA OF *EPHESTIODES GILVESCENTELLA*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 1496); *c.* Aedoeagus; *d.* Female genitalia (HHN 964).

of *erasus,* an undescribed species, or an eastern population of *gilvescentella* cannot be determined. Additional collecting, particularly in the Gulf States, and rearing studies are needed.

Ephestiodes infimella Ragonot
PL. 2, FIGS. 21–27. TEXT FIG. 30 (RWH 6001).

Ephestiodes infimella Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 16.
Type locality: North Carolina. [MNHP]

Adults have the forewing mostly fuscous and white suffused with red. Some have a pale-ochre patch at the base of the posterior margin of the forewing. It

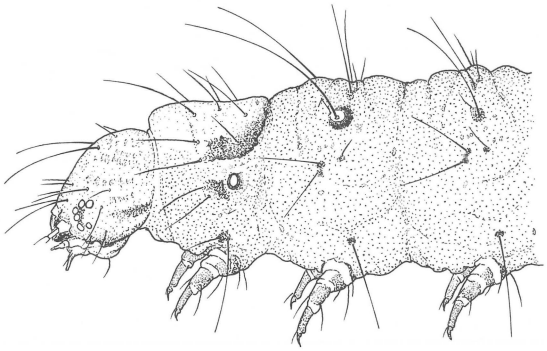


FIGURE 30: LAST STAGE LARVA OF *EPHESTIODES INFIMELLA* (LATERAL VIEW OF HEAD AND THORAX)

is the common species of eastern United States and southeastern Canada. Wing length 4.5–6.5 mm.

Male genitalia with apical process of gnathos U-shaped; valva with costa irregular; transtilla with flaring apices divergent. Heinrich (1956: figure 590) illustrated the male genitalia, but in this figure (and as stated in his description) the ridge of the cucullus does not project beyond the lower margin of the valva. All specimens of *infimella* I have examined have the ridge of the cucullus slightly projecting beyond the margin.

Last stage larva (text figure 30) 9.0–11.0 mm long. Head mostly brownish yellow with indistinct tonofibrillary platelets, black within arc of stemmata, somewhat indistinct dark patch on gena. Thoracic shield mostly brownish yellow (slightly paler than head) with contrasting dark brown to black along lateral and posterior margins. Body yellowish white to greenish white and purple, overlaid with dark-brown granules. SD1 pinaculum rings on mesothorax and eighth abdominal segment dark brown to black. Dorsal pinacula relatively large, brown to black.

The pupa of *infimella* is unknown.

Heinrich (1956: 279) listed wild cherry and *Ambrosia* (seeds) as hosts. I reared several series of adults from the fruits of greenbrier (*Smilax rotundifolia* L.). With greenbrier, females oviposit on mature fruit that has fallen from the plant to the soil or leaf litter. The larvae feed within the berry on the material surrounding the seeds. Apparently the seeds are not eaten. Several infested greenbrier berries are sometimes webbed together. Black frass is deposited in, and sometimes external to, the infested fruit. Pupation occurs in a partially hollowed-out berry.

Adults have been collected in Nova Scotia, New Brunswick, southern Quebec and southern Ontario and most of the eastern United States as far south as northern Florida in the East and central Texas in the West. They fly during the following months: Nova Scotia (July); New Brunswick (July); Quebec (June); Ontario (July); Massachusetts (August); Illinois (May–October); New Jersey (June, August); Pennsylvania (July); Missouri (May, September); Maryland (May, July, August); Arkansas (June, July); Virginia (July); North Carolina (May, August, October); South Carolina (August); Florida (February, September); Oklahoma (June, July); Texas (east and central) (July).

Ephestiodes monticolus Neunzig, NEW SPECIES

PL. 2, FIG. 28. TEXT FIG. 31 *a, b.*

Ephestiodes monticolus Neunzig
Type locality: Chisos Basin, Big Bend National Park, Brewster Co. Texas. [USNM]

DIAGNOSIS. The adult of *monticolus* is similar to *infimella* in general appearance, but the forewing of *monticolus* has less red and a smaller ochre patch preceding the antemedial line. The costa of the valva of the male genitalia is distinctly spined, similar to that of *Ephestiodes mignonella* Dyar.

DESCRIPTION. Wing length 5.5–6.0 mm. Head: frons and vertex fuscous dusted with white; labial palpus fuscous lightly dusted with white on outer surface, paler on inner surface. Thorax: collar fuscous dusted with white, a few scales partly red. Forewing: ground color fuscous, generally dusted with white, posterior margin at base with ochre patch, posterior, subbasal area with patch of dark-red scales; antemedial line white, not particularly distinct because of heavy dusting of white in subbasal part of wing that coalesces with white of line, antemedial line preceded on posterior margin by patch of mainly ochre scales and bordered distally by black; discal spots black, obscure; postmedial line indistinct; longitudinal streak of red scales on posterior ½ extending between antemedial and postmedial lines and extending to costal ½ near postmedial line; other scattered red scales on costal ½ between lines. Hindwing: pale smoky fuscous. Male genitalia (text figure 31 *a, b*): apical arms of gnathos uniformly curved, forming a U-shaped element; apexes of transtilla strongly developed and flared laterally; transverse ridge of cucullus slightly projecting beyond margin of valva; valva with costa irregular, distinctly spined, apex angular.

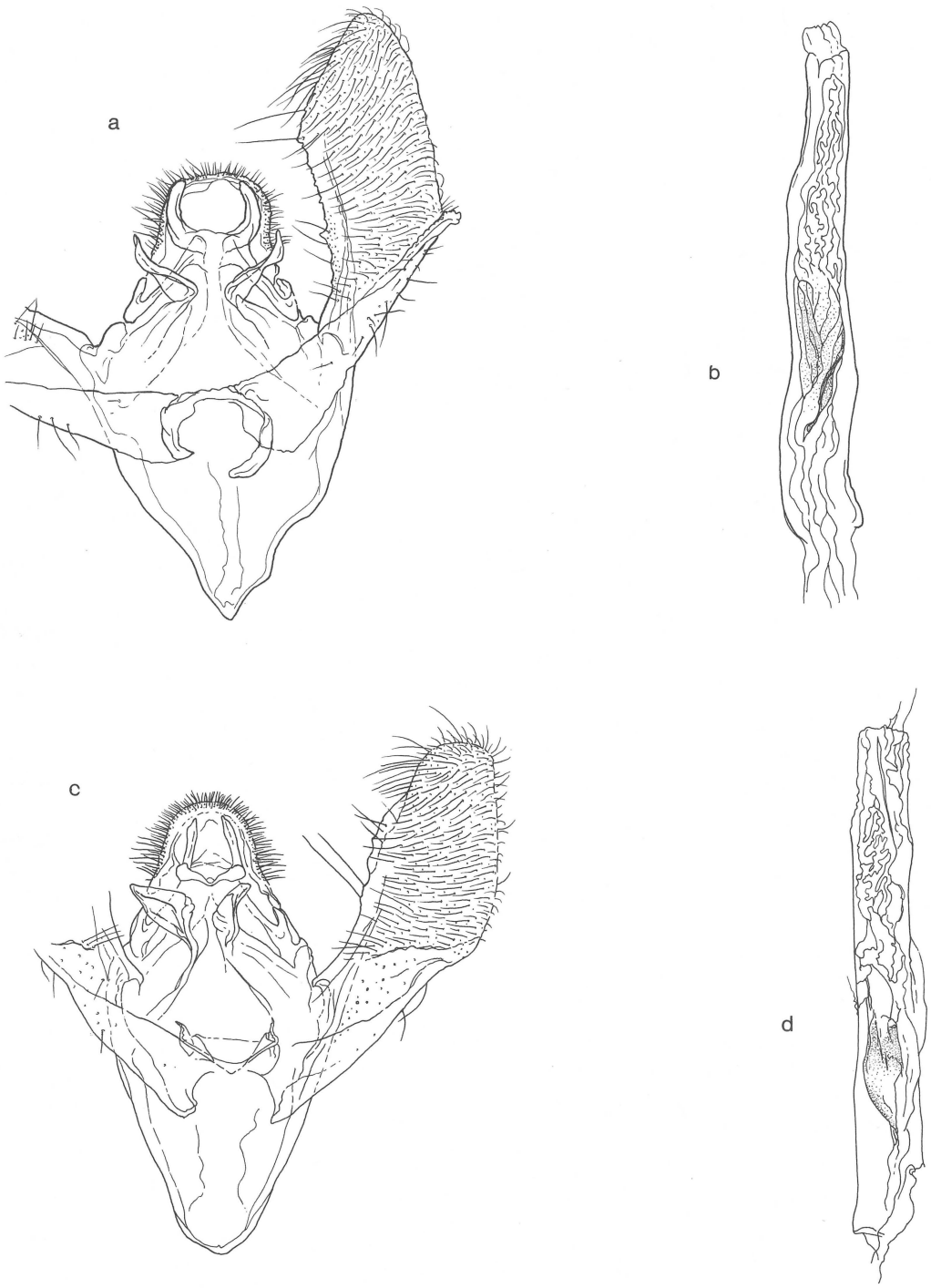


FIGURE 31: MALE GENITALIA OF *EPHESTIODES* SPECIES

a. E. monticolus, holotype (most of left valva and aedoeagus omitted; juxta inverted) (HHN 2213C); *b.* Aedoeagus; *c. E. griseus,* holotype (most of left valva and aedoeagus omitted) (JAP 4420); *d.* Aedoeagus.

The immature stages are unknown.

TYPES. Holotype: ♂. Chisos Basin, Big Bend, Nat'l Park, Brewster Co., Texas; collected by E. C. Knudson; 15-X-86; genitalia slide 2213C HHN. USNM. Paratype: 1 ♂. Texas: Same collection data as for holotype; genitalia slide 1398 ECK. ECK.

Ephestiodes erythrella Ragonot
PL. 2, FIGS. 29, 30 (RWH 6002).

Ephestiodes erythrella Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 16.
Type locality: California. [MNHP]

Eurythmia coloradella Hulst, 1900, *Can. Ent.,* **32**: 175.
Type locality: Colorado. [USNM]

Ephestiodes benjaminella Dyar, 1905, *Proc. U. S. Natl. Mus.,* **27**: 922.
Type locality: Kaslo, British Columbia. [USNM]

Adults of *erythrella* have numerous red scales on the forewing; the posterior ½ of the wing is mostly red. Some of the other species in the genus have red scales, but these scales are less abundant. The male genitalia of *erythrella* lack the transverse ridge of the cucullus projecting beyond the margin of the valva, and the apical elements of the gnathos are more elongate than in other species in America north of Mexico. See Heinrich (1956: figures 591 and 1074) for illustrations of the male and female genitalia. Wing length 5.0–7.0 mm.

The immature stages are unknown.

E. erythrella has been collected in western Canada and in the western United States. Dates of capture are: Manitoba (July); British Columbia (June–September); Washington (June–August); Oregon (July); Wyoming (June); Colorado (June); Utah (May–August); California (June–August).

Ephestiodes mignonella Dyar
PL. 2, FIGS. 32, 33 (RWH 6003).

Ephestiodes mignonella Dyar, 1908, *Proc. Ent. Soc. Washington,* **10**: 113.
Type locality: Kerrville, Texas. [USNM]

NOTE—Five specimens were included as cotypes in preparing the original description of *mignonella.* I hereby designate as lectotype the male bearing the following labels: 1. "Kerrville IV-12-07 TX"; 2. "at light"; 3. "F. C. Pratt collector"; 4. "Type No. 11848 U.S.N.M."; 5. "genitalia slide, 21 July 1934 C. H. # 2188"; 6. "LECTOTYPE *mignonella* Dyar by H. H. Neunzig."

E. mignonella is easily separated from other *Ephestiodes* in our fauna by the forewing that is grayish white with distinctly contrasting, black, transverse streaks. The transverse ridge of the cucullus of the male genitalia does not project beyond the lower margin of the valva (Heinrich, 1956: figure 592), and the female genitalia (Heinrich, 1956: figure 1075) are similar to those of *gilvescentella.* Wing length 6.0–7.5 mm.

The immature stages are unknown.

E. mignonella has only rarely been collected and appears to be restricted to central Texas. It apparently flies relatively early in the year. The few moths I have seen have been collected from late March to mid-April.

Ephestiodes griseus Neunzig, NEW SPECIES
PL. 2, FIG. 31. TEXT FIG. 31 *c, d.*

Ephestiodes griseus Neunzig
Type locality: 3 mi S Oceano, Dune Lakes, San Luis Obispo Co., California. [UCB]

DIAGNOSIS. *E. griseus* has male genitalia similar to those of *Ephestiodes erythrella* and *Ephestiodes mignonella* in that the transverse ridge of cucullus does not project beyond the margin of the valva. However, *griseus* is a gray-appearing, relatively uniformly marked species lacking the red scales of *erythrella* and the distinct black transverse markings of *mignonella.*

DESCRIPTION. Wing length 6.5–7.0 mm. Head: frons and vertex pale brown dusted with white; labial palpus brown to fuscous dusted with white. Thorax: collar and dorsum pale brown to brown with patches of fuscous. Forewing: ground color pale brown to brown, generally dusted with white, streak of pale-ochre scales on posterior ½; antemedial line indistinct, bordered distally by more or less distinct patch of white-tipped, fuscous to black scales; postmedial line indistinct; discal spots of white-tipped, fuscous to black scales. Hindwing: pale smoky fuscous. Male genitalia (text figure 31 *c, d*): with apical process of gnathos U-shaped; valva with costa produced into a low, irregular protuberance; transverse ridge of cucullus weakly developed, not projecting beyond lower margin of valva; transtilla with flaring apexes divergent.

The immature stages are unknown.

TYPES. Holotype: ♂. 3 mi S Oceano, Dune Lakes, San Luis Obispo Co., California; 11-V11-73, J. Powell, black light trap; genitalia slide 4420 JAP. UCB. Paratype: 1 ♂. California: same collection data as for holotype; genitalia slide 2478 HHN. UCB.

GENUS
Australephestiodes Neunzig, NEW GENUS

Gender: Masculine.
Type species: *Unadilla stictella* Hampson, 1901.

Australephestiodes contains two species; *stictella* is found principally on several islands in the Carib-

bean, but it also has been collected as far north as the Bahamas and recently has been taken in southern Florida and *indentella* (Dyar), NEW COMBINATION, that apparently is restricted to Bermuda. Adults of *Australephestiodes* are similar in appearance to moths of *Ephestiodes,* but the male and female genitalia differ. Specifically, the male genitalia of *Australephestiodes* have the uncus somewhat elongate, the transtilla with long, curving, sometimes asymmetrical distal arms, and the valva with sacculus produced into a strongly developed free clasperlike process, whereas in *Ephestiodes* the uncus is decidedly short and broad, the transtilla has short, symmetrical, distal elements, and the valva possesses a saccular ridge that only in some species extends beyond the margin of the valva, and then only a short distance. The female genitalia differ from those of *Ephestiodes* in having longer apophyses anteriores and, most importantly, in possessing a very characteristic eighth abdominal segment collar that is produced anteriorly into a tongue and posteriorly into curved, projecting arms.

Antenna simple; sensilla trichodea (cilia) of shaft of male moderately abundant, and at base of shaft about ½ as long as basal diameter of shaft. Frons convex, with anteriorly projecting scales. Labial palpus of male upturned, of female oblique, reaching about to vertex, third segment about as long as second. Maxillary palpus simple. Haustellum well developed. Ocellus present. Forewing of male (text figure 33 *a*) with costa slightly convex on basal ½; under surface with basal costal fold covering a patch of sex-scales. Forewing smooth scaled; with 10 veins; R_{3+4} and R_5 completely fused; M_1 from below upper angle of cell; M_2 and M_3 stalked for about ½ their lengths; CuA_1 from lower angle; CuA_2 from near lower angle of cell. Hindwing (text figure 33 *a*) with 6 or 7 veins; $Sc+R_1+Rs$ fused, or almost completely fused to costa; M_1 from upper angle of cell; M_{2+3} and CuA_1 stalked for slightly more than ½ their lengths; CuA_2 from before, but near lower angle of cell; cell about ½ length of wing. Eighth abdominal segment of male with paired dorsal scale tufts; appearance of tufts similar to those of *Ephestiodes.* Male genitalia (text figure 32 *a, b*) with uncus moderately elongate and rounded apically; gnathos with two elongate, slightly hooked processes; transtilla strongly developed, its two elements fused about midway from base and distally consisting of a pair of long, asymmetrical, curved arms; juxta a broad plate; valva with apex somewhat attenuated, broadly pointed, and sacculus produced into a distinct, clasperlike free arm; aedoeagus slender, with a thin, weakly formed cornutus; vinculum broadly triangular, shorter than its greatest width. Female genitalia with ductus bursae shorter than corpus bursae and sclerotized throughout most of its length; corpus bursae membranous with irregular, platelike signum and some scobinations surrounding signum; eighth abdominal segment (text figure 32 *c*) with narrow, flaring, sclerotized plate below genital opening, and with dorsal portion of collar produced anteriorly into a tongue and posteriorly into slightly curved, stout arms (these unique arms usually can be easily seen projecting slightly from the abdomen on pinned specimens, and might be mistaken by the untrained eye as male valvae).

The immature stages are unknown.

Australephestiodes stictella (Hampson), NEW COMBINATION

PL. 2, FIGS. 34–36. TEXT FIGS. 32 *a–c*; 33 *a.*

Unadilla stictella Hampson, 1901 *Ann. Mag. Nat. Hist.,* (7) **7**: 255.
Type locality: Nassau, Bahamas. [BMNH]

Ephestiodes uniformella Hampson, 1901, *Ann. Mag. Nat. Hist.,* (7) **7**: 256.
Type locality: Nassau, Bahamas. [BMNH]

Ephestiodes granulella Hampson, 1901, *Ann. Mag. Nat. Hist.,* (7) **7**: 256.
Type locality: Nassau, Bahamas. [BMNH]

Moths of *stictella* are small (wing length 4.5–6.0 mm) with the band immediately following the white antemedial line on the forewing broken into three dark patches of scales. The closely related *indentella* has this band more nearly complete; the apex of the gnathos is narrowly U-shaped in *stictella* and broadly U-shaped in indentella; and the collar of the female genitalia has the tongue longer than its basal width in *stictella* and shorter than its basal width in *indentella.* I have figured only the posterior part of the female genitalia of *stictella* (text figure 32 *c*); Heinrich (1956: figure 1082) illustrated the entire female genitalia.

In southern Florida, *stictella* has been collected in Lee, Manatee, Monroe, and Pinellas Counties in December, March, May, and October, respectively.

GENUS

Moodnodes Neunzig, NEW GENUS

Gender: Masculine.
Type species: *Ephestiodes plorella* Dyar, 1914.

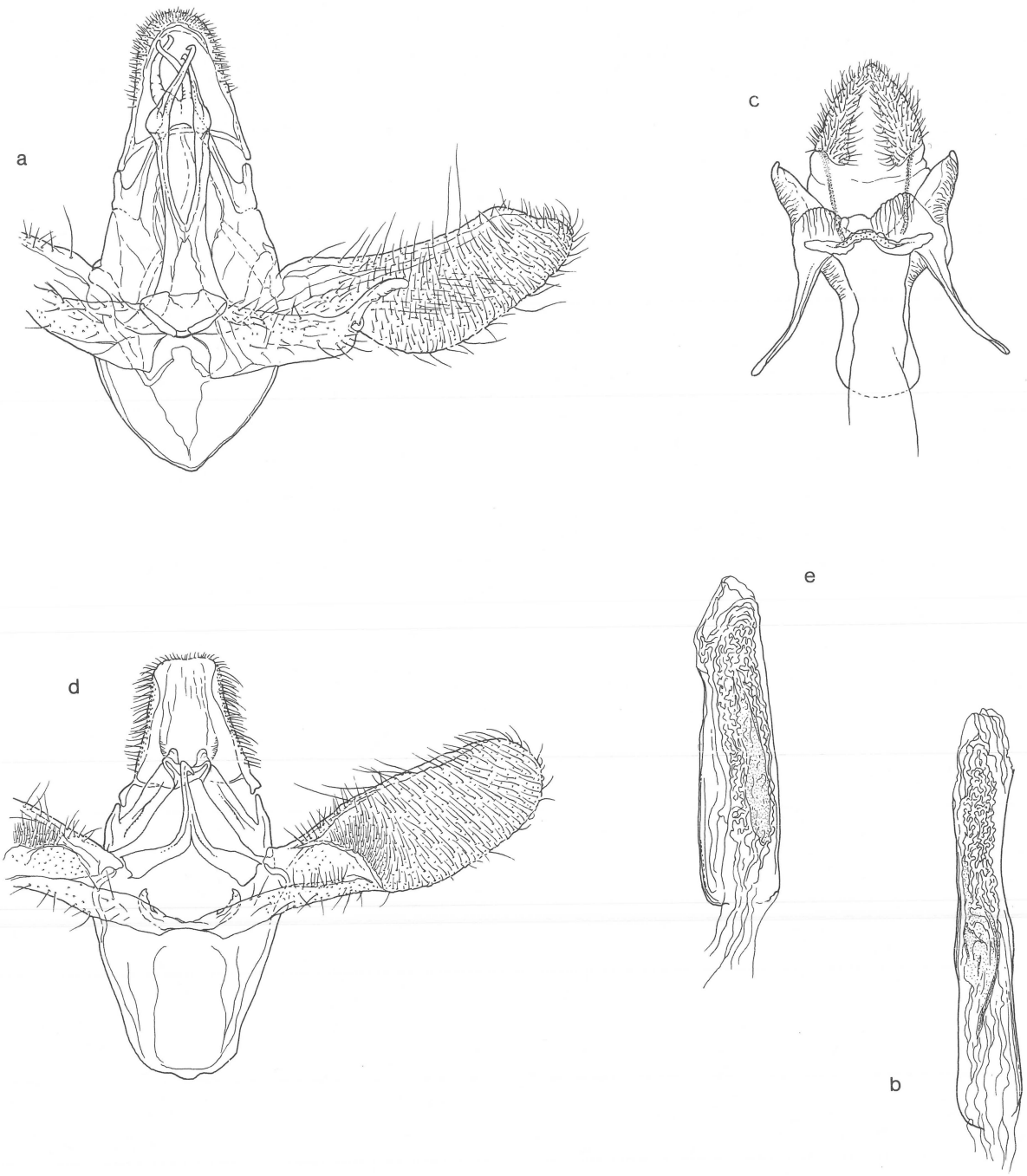


FIGURE 32: MALE AND FEMALE GENITALIA OF *AUSTRALEPHESTIODES STICTELLA* AND MALE GENITALIA OF *MOODNODES PLORELLA*

a. A. stictella, male genitalia (most of left valva and aedoeagus omitted) (HHN 1779); *b.* Aedoeagus; *c.* Posterior part of female genitalia (HHN 1411). *d. M. plorella* male genitalia (most of left valva and aedoeagus omitted) (HHN 1448); *e.* Aedoeagus.

Moodnodes is proposed for the single species *plorella.* The assignment of *plorella* to *Ephestiodes* by previous authors was based on a few females collected in Central America. Recent collecting in southern and central Florida has demonstrated that *plorella* also belongs to our fauna. Series of males and females have been examined, and it has become apparent that *plorella* is not an *Ephestiodes.* Some of the more obvious differences are the following: 1) The male of *Moodnodes* has a sinus near the base of the antenna; the male of *Ephestiodes* has a simple antenna (plate B, figure 2). 2) The uncus is somewhat

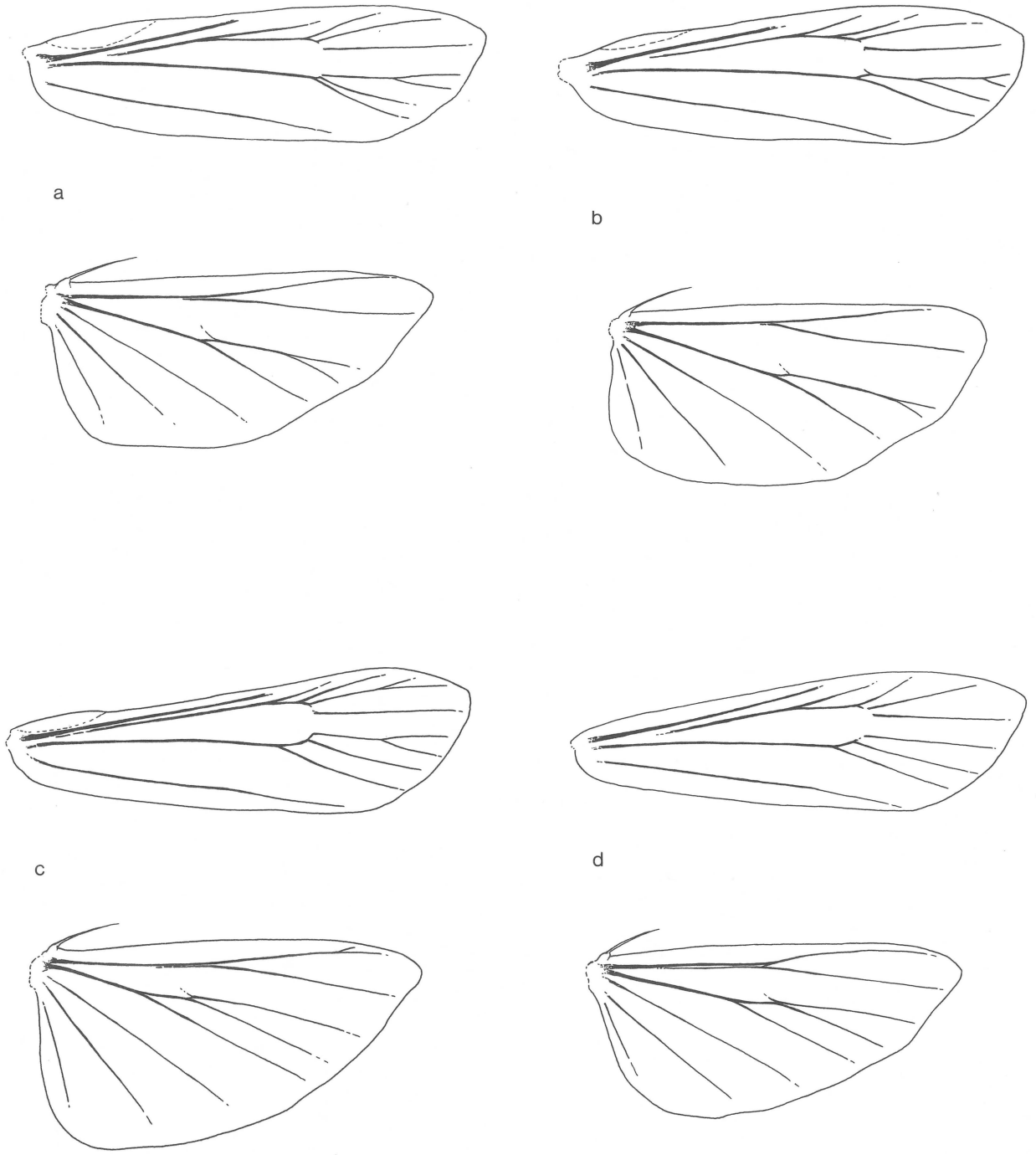


FIGURE 33: VENATION OF FOREWING AND HINDWING OF *AUSTRALEPHESTIODES, MOODNODES, VOLATICA,* AND *HEINRICHIESSA*

a. A. stictella, male; *b. M. plorella,* male; *c. V. gallivorella,* male; *d. H. sanpetella,* female.

elongate and the transtilla complete in *Moodnodes*; the uncus is broad and the transtilla incomplete in *Ephestiodes.* 3) The female genitalia of *Moodnodes* have the apophyses anteriores longer than the width of the ductus bursae at the genital opening, lack a sclerotized band below genital opening, and have the ductus bursae sclerotized for ½ its length; in *Ephestiodes,* the length of the apophyses anteriores is only about ½ the width of ductus bursae at the genital opening, a sclerotized band occurs near the genital opening, and the ductus bursae is sclerotized for about $^{9}/_{10}$ its length. Males of *Moodnodes* show

some similarities to the males of the genus *Moodna.* Both have a shallow sinus at the base of the antenna, and the genitalia appear generally similar.

Sensilla trichodea (cilia) of shaft of male antenna moderately abundant, and at base of shaft about ½ as long as basal diameter of shaft. Frons convex, with anteriorly produced scales. Labial palpus of male upturned, of female oblique, reaching slightly above vertex, third segment about as long as second. Maxillary palpus simple. Haustellum well developed. Ocellus present. Forewing of male (text figure 33 *b*) with costa convex on basal ½; under surface with costal fold and an associated cluster of exposed sex-scales. Forewing smooth scaled; with 10 veins; R_{3+4} and R_5 fused; M_1 from below upper angle of cell, slightly curved; M_2 and M_3 long stalked (about ⅗ their lengths); CuA_1 very closely approximate to, connate, or stalked with fused part of M_2 and M_3, CuA_2 from lower angle of cell. Hindwing (text figure 33 *b*) with 6 or 7 veins; $Sc+R_1$ and Rs fused, or almost completely fused, to costa; M_1 from upper angle of cell; M_{2+3} and CuA_1 stalked for over ⅔ their lengths; CuA_2 from before, but near lower angle of cell; cell about ½ length of wing. Eighth abdominal segment of male with paired dorsal scale tufts. Male genitalia (text figure 32 *d, e*) with uncus somewhat elongate, terminal margin straight to slightly concave; gnathos apically produced into two, short, rounded elements; transtilla complete with arms fused distally into a single, elongate hook; juxta broadly U-shaped; valva simple, base of cucullus with numerous small setae; aedoeagus relatively stout, with thin, rather long cornutus; vinculum slightly shorter than greatest width. Female genitalia with ductus bursae longer than corpus bursae, and sclerotized for ½ its length; no sclerotized band below genital opening; posterior margin of large sclerotized shield behind genital opening evenly rounded except for very slight narrow central notch; collar of eighth segment strongly sclerotized on dorsum, its produced anterior margin concave and with a small, shallow central notch; corpus bursae membranous with oval, platelike, partially serrate signum, and some scobinations near junction with ductus bursae; ductus seminalis arising from near signum (see Heinrich, 1956: figure 1080 for illustration).

The immature stages are unknown.

Moodnodes plorella (Dyar), NEW COMBINATION

PL. 2, FIGS. 37–40. TEXT FIGS. 32 *d, e*; 33 *b.*

Ephestiodes plorella Dyar, 1914, *Proc. U. S. Natl. Mus.*, **47**: 344.
Type locality: Corazal, Panama. [USNM]

Eurythmia vestilla Dyar, 1914, *Proc. U. S. Natl. Mus.*, **47**: 339.
Type locality: Corazal, Panama. [USNM]

The adult is similar in appearance and size (wing length 5.0–7.0 mm) to species of *Ephestiodes* and *Australephestiodes.* The dark, broad, outer band associated with the antemedial line of the forewing, and the shallow sinus near the base of the male antenna are useful in identification.

Male genitalia with transtilla complete, forming an elongate hook (text figure 32 *d*). Female genitalia with ductus bursae and corpus bursae inflated, with only ½ of ductus bursae sclerotized, and with rather large signum (Heinrich, 1956: figure 1080).

Most adults have been taken at lights in August in the Florida Keys. A few others have been captured at Orlando, Orange County, in central Florida, in February, April, and May.

GENUS
Moodna Hulst

Moodna Hulst, 1890, *Trans. Amer. Ent. Soc.*, **17**: 193.
Type species: *Moodna pelviculella* Hulst, 1890, considered to be a synonym of *Ephestia ostrinella* Clemens, 1860. Original designation.

I recognize three species in *Moodna,* all in the Americas. *M. ostrinella,* the most commonly collected, occurs throughout southeastern Canada and eastern United States; a second previously undescribed, paler species, has a similar but apparently more restricted distribution; and *bisinuella* Hampson occurs principally in Mexico, and Central America, but occasionally is found in the southern United States.

The males of all species can be recognized by the shallow sinus near the base of the antenna (plate B, figure 1), the costal fold on the forewing with its added distal tuft of exposed scales, and, most importantly, the pair of inner costal projections on the valva. The first two features *Moodna* shares with *Moodnodes.* Some species of *Caudellia* have the antennal sinus, costal fold, and a projection or two on the valva; however, *Caudellia* has fewer veins in the forewing. The females of *Moodna* usually have the corpus bursae appearing concentrically wrinkled in slide preparations (text figure 34 *d*).

Sensilla trichodea (cilia) of male antenna mod-

erately abundant, and at base of shaft about ¼ as long as basal diameter of shaft. Frons convex, with anteriorly projecting scales. Labial palpus of both sexes oblique, reaching vertex; third segment about as long as second. Maxillary palpus simple. Haustellum well developed. Ocellus present. Forewing of male (text figure 34 *a*) with costa convex at base; under surface with strong costal fold and associated distal tuft of exposed scales. Forewing smooth scaled; with 10 veins; Sc and R strongly curved near base; R_2 from cell, separated from R_{3+4+5} at base; M_1 from below upper angle of cell; M_2 and M_3 stalked for at least ½ their lengths; CuA_1 from lower angle of cell; CuA_2 from before lower angle of cell. Hindwing (text figure 34 *a*) with 6–7 veins; $Sc+R_1$ and Rs fused to, or almost to, costa (Sc usually present as a mere vestige, sometimes absent); M_1 from upper angle of cell; M_{2+3} and CuA_1 from lower angle, usually connate; CuA_2 from before lower angle of cell; cell about ½ length of wing. Eighth abdominal segment of male with paired dorsal scale tufts; each tuft consists of several clusters of simple scales. Tufts easily detached from abdomen and sometimes overlooked when genital slides made. Male genitalia (text figure 34 *b, c, e, f*) with uncus slightly elongate and truncate; apical process of gnathos a pointed hook; transtilla incomplete; juxta a narrow, semioval band; valva with two costal projections in the basal ½; aedoeagus simple; vinculum distinctly longer than greatest width. Female genitalia (text figure 34 *d*) with ductus bursae about twice as long as corpus bursae, sclerotized for about ⅛ its length near genital opening; corpus bursae membranous, usually appearing on a slide concentrically wrinkled, with signum composed of small cluster of short discs; ductus seminalis arising from corpus bursae near signum.

Last stage larvae of *Moodna* (*ostrinella* and *bisinuella*) have strongly formed SD1 pinaculum rings on the mesothorax and eighth abdominal segment. Head slightly roughened, with indistinct tonofibrillary platelets. Body somewhat darkened, with granular integument. Mandible simple. Maxilla with sensilla trichodea simple.

Larvae found outdoors, mainly feeding within developing, or dried, fruit, seeds (or clusters of seeds), or galls of the Anacardiaceae, Fagaceae, Pinaceae, Poaceae or Rosaceae.

KEY TO SPECIES OF *MOODNA*

1. Basal ⅓ of forewing brownish red and ochre (plate 3, figures 1–3); bases of costal projections of valva separated by distance exceeding length of inner projection (text figure 34 *b*) .... *pallidostrinella* p. 75

— Basal ⅓ of forewing fuscous and red (plate 2, figures 41–46); bases of costal projections of valva separated by distance equal to, or less than, length of inner projection (text figure 34 *e, f*) 2

2. Outer costal projection of valva projecting distally (text figure 34 *e*); widely distributed in southeastern Canada and eastern United States ..... *ostrinella* p. 73

— Outer costal projection of valva projecting basally (text figure 34 *f*) (sometimes more or less perpendicular to costa); predominately found in Mexico and Central America, occasionally in Texas and southeastern United States .... *bisinuella* p. 76

Moodna ostrinella (Clemens)

PL. 2, FIGS. 41–44; PL. B, FIG. 1. TEXT FIGS. 34 *a, e*; 35 (RWH 6005).

Ephestia ostrinella Clemens, 1860, *Proc. Acad. Nat. Sci. Philadelphia,* **12**: 206.
Type locality: Pennsylvania. [lost]

Hornigia obtusangulella Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 16.
Type locality: Texas. [MNHP]

Moodna pelviculella Hulst, 1890, *Trans. Amer. Ent. Soc.,* **17**: 194.
Type locality: Newburgh, New York. [?AMNH]
NOTE—Type said by Rindge (1955: 168) to be in the AMNH, but I could not locate it.

M. ostrinella is the commonly collected species in the genus. Wing length 5.0–8.5 mm. The location and shape of the costal projections of the male genitalia (text figure 34 *e*) are useful in identifying the species. Female genitalia (Heinrich, 1956: figure 1086) as described for the genus.

Last stage larva (text figure 35) 9–13 mm long. Head yellowish brown to reddish brown, darker near mouthparts, with indistinct pale-brown tonofibrillary platelets, and usually dark genal streak. Thoracic shield brownish yellow, usually dark brown posteriorly and with subdorsal cluster of dark platelets. Body mostly dark purplish brown with granular integument. SD1 pinaculum rings of mesothorax

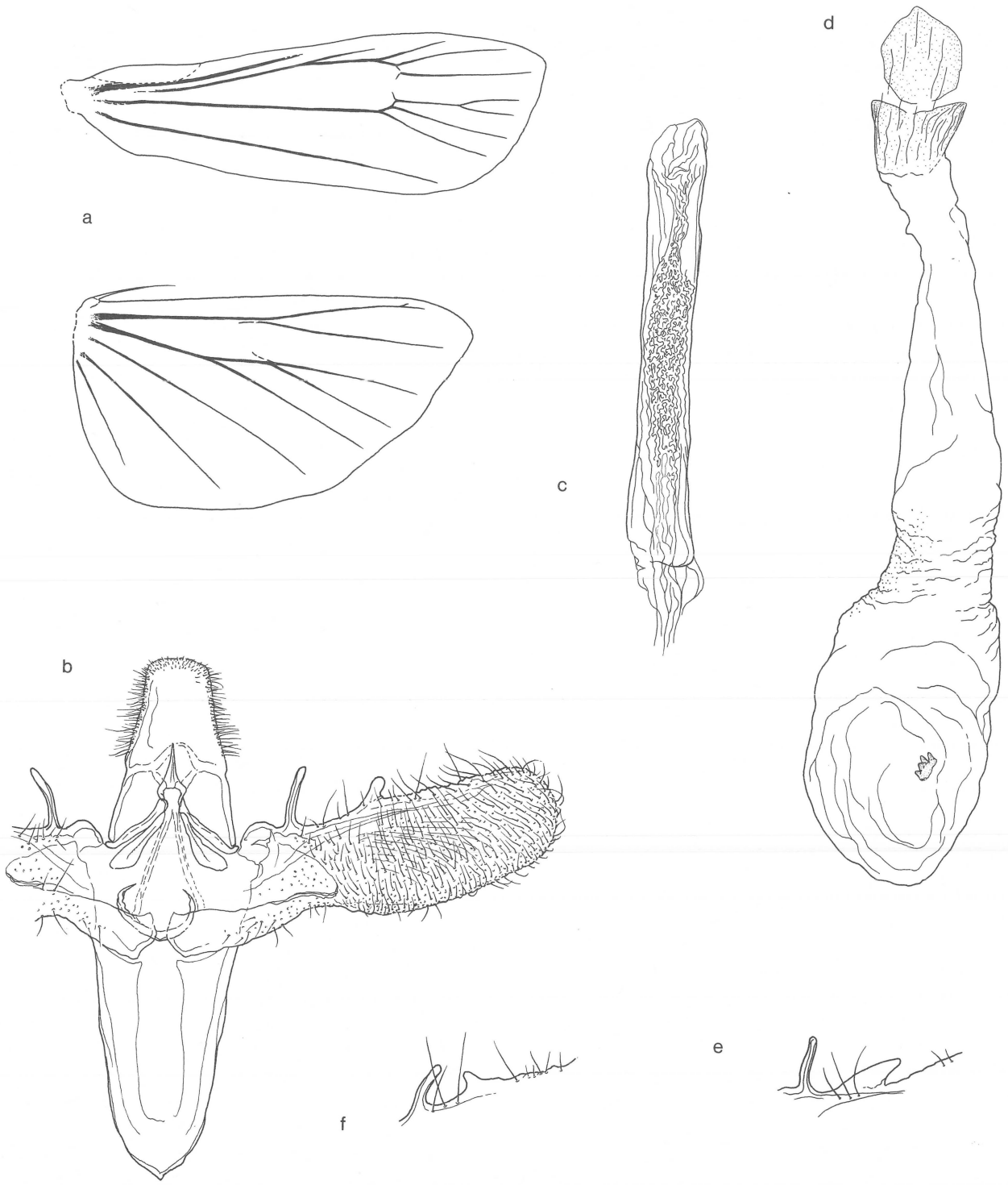


FIGURE 34: VENATION AND GENITALIA OF *MOODNA* SPECIES

a. M. ostrinella, male forewing and hindwing; *b. M. pallidostrinella,* holotype, male genitalia (most of left valva and aedoeagus omitted) (HHN 1291); *c.* Aedoeagus; *d.* Corpus bursae, ductus bursae, and ductus seminalis (HHN 2316); *e. M. ostrinella* basal part of costa of right valva (HHN 1665); *f. M. bisinuella,* basal part of costa of right valva (HHN 309).

and eighth abdominal segment dark with pale centers.

The pupa has not been described.

Heinrich (1956) listed apple (*Malus pumila* (L.) Miller), birch (*Betula*), cotton (*Gossypium hirsutum* L.), iris (*Iris*), loquat (*Eriobotrya japonica* Lindley), oak (*Quercus*), peach (*Prunus persica* (L.) Batsch), pear (*Pyrus communis* L.), pine (*Pinus*), rose (*Rosa*), and sumac (*Rhus*) as food plants of the larva. Sumac is a particularly common host. The dried fruits, or galled, or otherwise injured, parts of the plants, are infested. Plant materials stored indoors seldom harbor larvae. It is assumed that the larvae feed on the plant material and on associated fungi. Because *ostrinella* larvae are sometimes secondary feeders on insect injured fruit or other plant parts, some animal material possibly is occasionally consumed.

M. ostrinella occurs from Nova Scotia to southern Manitoba and south to southern Florida and central Texas. Flight dates range mostly from May to September. Some moths have been collected in Florida as early as March. February, March, and April are on some labels of specimens from northern United States and southern Canada, but these dates most likely apply to individuals emerging from host material brought indoors.

Moodna pallidostrinella Neunzig, NEW SPECIES

PL. 3, FIGS. 1–3. TEXT FIG. 34 *b–d.*

Moodna pallidostrinella Neunzig

Type locality: Big Pine Key, Florida. [USNM]

DIAGNOSIS. *M. pallidostrinella* is paler than other species of *Moodna.* The most obvious diagnostic features of the genitalia are the remote costal projections of the valva of the male, and the long apophyses of the female.

DESCRIPTION. Wing length 5.0–8.0 mm. Head: frons reddish ochre; vertex ochre to brownish red; labial palpus outwardly with basal segment a mixture of white and brownish-red scales, distal segments brownish red or ochre. Thorax: collar brownish red (sometimes with a few ochre scales); dorsum of thorax brownish red medially, tegulae ochre. Forewing: base brownish red becoming ochre near antemedial line; antemedial line moderately distinct, consisting of white-tipped fuscous scales; medial and terminal area fuscous with white dusting near discal spots and line of white-tipped scales near termen; postmedial line same color as antemedial line; discal spots fuscous to black, usually obscure.

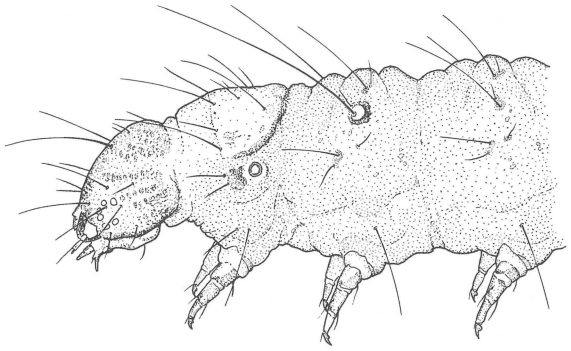


FIGURE 35: LAST STAGE LARVA OF *MOODNA OSTRINELLA* (LATERAL VIEW OF HEAD AND THORAX)

Forewing of male with brownish-red to ochre sex-scales associated with costal fold on undersurface. Hindwing: smoky brown. Male genitalia (text figure 34 *b, c*) as given in generic description, and with bases of costal projections of valva separated by distance exceeding length of inner projection. Female genitalia (text figure 34 *d*) as in generic description, with length of apophyses anteriores about 3× width of ductus bursae at genital opening and length of apophyses posteriores about 7× width of ductus bursae at genital opening.

An adult of *pallidostrinella* has been reared by Stephan from an insect injured, second year cone of shortleaf pine (*Pinus echinata* Miller). Nothing is known about the appearance of the immature stages.

TYPES. Holotype: ♂. Big Pine Key, Florida; 11 Jan '83; D. C. Ferguson; genitalia slide 1291 HHN, USNM. Paratypes: 13 ♂, 8 ♀. Florida: Same collection site as holotype, 5,6 IX 1974, H. H. Neunzig; genitalia slides 306, 2310 HHN (7 ♂, 1 ♀). Lake Worth; 10 IX 1974; H. H. Neunzig (1 ♀). Perry, Taylor Co.; 19 VIII 1984; H. D. Baggett; genitalia slide 1662 HHN (1 ♂). Torreya St. Pk., Liberty Co.; 4-VII-1986: leg. H. D. Baggett (1 ♀). No Name Key, Monroe Co.; 31-III-1986; H. D. Baggett (1 ♂, 1 ♀). Illinois: Sand Ridge St. For.; Pine Campground; Mason Co.; May 23 1985; G. Balogh (1 ♂). Massachusetts: Barnstable, VII 9 1943, July 5, 1950; C. P. Kimball (2 ♀). Michigan: Allegan Co., T2N R14W S18; July 5 1984. George Balogh; genitalia slide 2302 HHN (1 ♂). New Jersey: Wrangle Brook Rd., Lakehurst; 25 June 1964; J. G. Franclemont (1 ♂). North Carolina: Raleigh; 2 IX 1972; H. H. Neunzig; genitalia slide 215 (1 ♂). Raleigh, Wake Co.; emerged outdoors May 2, 1982; *Pinus echinata* ex dead 2nd-yr. cone [collected] March 18 [1982]; D. L. Stephan (1 ♀). Texas: Houston, Harris County; 7·V·79; A

& M E Blanchard; genitalia slide 4673 A.B. (1 ♀). CNC, GJB, FSCA, NCSU, USNM.

Moodna bisinuella Hampson

PL. 2, FIGS. 45, 46. TEXT FIG. 34*f* (RWH 6006).

Moodna bisinuella Hampson, 1901, *Mem. sur les Lépid.* **8**: 268.
Type locality: Orizaba, Mexico. [USNM]

M. bisinuella is similar to *ostrinella* in general appearance. Usually it is somewhat larger: wing length 8.0–9.5 mm. The two species are best separated by the male genitalia as indicated in the key. Predominantly a Mexican and Central American species, *bisinuella* is seldom collected in the United States. The female genitalia have the ductus bursae strongly sclerotized and striated toward the genital opening (Heinrich, 1956: figure 1087).

The last stage larva has been treated in detail by Neunzig (1985). The pupa has not been described. Most larvae of *bisinuella* have been collected from corn (*Zea mays* L.). Neunzig (1985) also found larvae feeding on gamagrass (*Tripsacum*). With both hosts, feeding occurs on well-developed, but more or less soft, seeds. Sometimes fungi such as ergot (*Claviceps*), growing on the host plant (*Tripsacum*), are also consumed. Pupation occurs within silk enclosures at or near the base of the hosts.

M. bisinuella has been reported from southeastern Texas (June, October). It also has temporarily occurred farther north in North Carolina (April, May), following importation of infested hosts.

GENUS
Caudellia Dyar

Caudellia Dyar, 1904, *Proc. Ent. Soc. Washington,* **6**: 116.

Type species: *Caudellia apyrella* Dyar, 1904. Designated by Heinrich, 1956, *U. S. Natl. Mus. Bull.,* **207**: 292.

Caudellia is a New World genus with six species. Moths closely resemble species of *Moodna. Caudellia* differs from *Moodna* in having fewer veins in the forewing (9 rather than 10). *Caudellia* also possesses a transtilla that usually has its elements enlarged (except *declivella* (Zeller)), whereas in *Moodna* the transtilla is simpler. The ductus bursae of the female genitalia is sclerotized for a considerable part of its length in *Caudellia* and for only a short distance in *Moodna.*

Antennal shaft of male (plate B, figure 3) with a shallow basal sinus; sensilla trichodea (cilia) moderately abundant and at base of shaft about ¼ as long as basal diameter of shaft (about ⅓ as long in *nigrella* (Hulst)). Frons convex, with anteriorly projecting scales. Labial palpus of both sexes usually oblique, reaching about to vertex, third segment shorter than second (palpus longer, more broadly scaled, and somewhat porrect in *apyrella* (text figure 37)). Maxillary palpus simple. Haustellum well developed. Ocellus present. Basal ½ of costa of forewing of male (text figure 36 *a*) more or less straight, under surface with costal fold enclosing a scale tuft and with attached distal tuft of exposed scales. Forewing smooth with 9 veins; Sc and R more or less straight near base; R_{3+4} and R_5 completely fused; M_1 from below upper angle of cell; M_{2+3} united somewhat close to CuA_1 at base; CuA_2 from before, but rather near lower angle of cell. Hindwing (text figure 36 *a*) with 6–7 veins; $Sc+R_1$ and Rs fused for most, or all, of their lengths (Sc when present very short); M_{2+3} and CuA_1 connate, rarely stalked; CuA_2 from well before lower angle of cell; cell ½ or slightly less than ½ length of wing. Eighth abdominal segment of male with paired dorsal scale tufts (text figure 40 *b*). Tufts easily detached when preparing genitalia for study; similar in appearance to those of *Moodna.* Male genitalia (text figures 36 *b, c*; 39 *a, b*) with uncus somewhat broadened, distal margin rounded; apical process of gnathos usually a short blunt hook (gnathos greatly broadened apically in *floridensis* Neunzig and *colorella* (Dyar)); transtilla usually incomplete with lateral arms broad and lightly fused with gnathos (complete in *declivella,* and strongly fused to gnathos in *colorella*); juxta a semicircular ring or plate; valva simple (*apyrella, declivella*) or with one or two costal projections; aedoeagus with a weakly developed, sclerotized, flattened cornutus; vinculum usually longer than greatest width (about as long as greatest width in *colorella*). Female genitalia (text figures 36 *d,* 39 *c*) with ductus bursae sclerotized for ⅓ or more of its length from genital opening; sclerotized part entirely or in part longitudinally wrinkled; a more or less triangular plate (lamella postvaginalis) posterior to genital opening; signum developed as cluster of small, bluntly rounded spines; ductus seminalis attached to corpus bursae adjacent to signum.

Last stage larva (based on *apyrella*; text figure 38) similar to *Moodna* larvae, with distinct pinaculum rings associated with SD1 setae on the mesothorax and eighth abdominal segment. Head slightly roughened with indistinct tonofibrillary platelets. Body darkened (somewhat darker than in *Moodna*) and

with granular integument. Mandible simple. Maxilla with sensilla trichodea simple.

Pupa (of *apyrella*) slightly wrinkled to rugulose. Thoracic spiracles present. Gibba absent on segment nine. Cremastral setae consisting of four centrally located, posteriorly directed, hooked spinose setae, and one to two pairs of additional, more ventrally located, usually hooked spinose setae.

The host association of only *apyrella* is known. It feeds as a larva on the seeds of dodder (*Cuscuta*) (Convolvulaceae).

KEY TO SPECIES OF *CAUDELLIA*

1. Valva with single, small costal projection; ductus bursae with sclerotized part longitudinally wrinkled for entire length; central and southern Texas to southern California ..... *nigrella* p. 79

— Valva with broad, two-cusped costal projection *or* costa simple; ductus bursae with sclerotized part not wrinkled for entire length (text figures 36 *d,* 39 *c*); eastern United States 2

2. Antemedial line of forewing perpendicular to costal margin (plate 3, figures 9–12); valva with costal projections (text figure 39 *a*); southern Florida ..... *floridensis* p. 78

— Antemedial line of forewing more angular with reference to costal margin (plate 3, figures 4, 5, 7, 8) (antemedial line sometimes completely obscured, or partially lacking (plate 3, figure 6)); valva with costa simple (text figure 36 *b*); eastern United States (including northern Florida) ..... *apyrella* p. 77

Caudellia apyrella Dyar

PL. 3, FIGS. 4–8; PL. B, FIG 3. TEXT FIGS. 36 *a–d*; 37, 38; 40 *b* (RWH 6012, 6013).

Caudellia apyrella Dyar, 1904, *Proc. Ent. Soc. Washington,* **6**: 116.
Type locality: Plummers Island, Maryland. [USNM]

NOTE—Described from two males. I hereby designate as lectotype the specimen bearing the following labels: 1. "Plummer's [sic] I Jun 1903 Md"; 2. "Aug Busck Collector"; 3. "Type No. 7852 U.S.N.M."; 4. "LECTOTYPE *apyrella* Dyar by H. H. Neunzig."

Caudellia albovittella Dyar, 1904, *Proc. Ent. Soc. Washington,* **6**: 116. NEW SYNONYMY
Type locality: Plummers Island, Maryland. [USNM]

NOTE—Described from one male and one female. I hereby designate as lectotype the female bearing the following labels: 1. "Plummer's [sic] I July 1903 Md"; 2. "Aug Busck collector"; 3. "Type No. 7853 U.S.N.M."; 4. "genitalia slide, 2 Sept. 31 C. H. #491"; 5. "LECTOTYPE *albovittella* Dyar by H. H. Neunzig."

Most moths of *apyrella* can be separated from close relatives by the distinct, angular antemedial line on the forewing. The species is variable, and a small percentage have the antemedial line completely obscured or only partially discernible. The simple costal margin of the valva is also diagnostic (*Caudellia declivella* (Zeller) of Central America also lacks projections on the costa of the valva). Wing length 5.0–7.0 mm.

Last stage larva (text figure 38) about 11–13 mm long.. Head dark reddish brown with dark genal patch. Thoracic shield brown to dark brown anteriorly becoming dark brown to black posteriorly. Body usually dark purple dorsally, purplish pink to pale brown ventrally, with granular integument. SD1 pinaculum rings on mesothorax and eighth abdominal segment dark brown to black. A detailed description of the larva was published by Corrette and Neunzig (1979).

Pupa 5.5–6.5 mm long, and pale reddish brown to yellowish brown. See description of genus, and Corrette and Neunzig (1979), for other features.

C. apyrella larvae live within the dried seed clusters of several species of the parasitic vine dodder (*Cuscuta compacta* Jussieu, and *Cuscuta gronovii* Willdenow ex Roemer and Schultes). Seeds are bored into; and, with continuous feeding, frass accumulates and loosely adheres with silk to the damaged seeds. Pupation occurs within the cluster.

Last stage larvae occur in North Carolina in May and August.

Adults of *apyrella* have been collected in Massachusetts (August), Illinois (September), Missouri (May, August), Maryland (June, July), North Carolina (June), and northwest Florida (late March).

Rearings of large series of *Caudellia* larvae feeding on dodder have consistently produced mostly adults with a distinct antemedial line on the upper surface of the forewings and a few individuals with completely obscured or partially obscured lines. The genitalia of these darker individuals are identical to those of the more common form. For this reason, I have synonymized *albovittella* with *apyrella.*

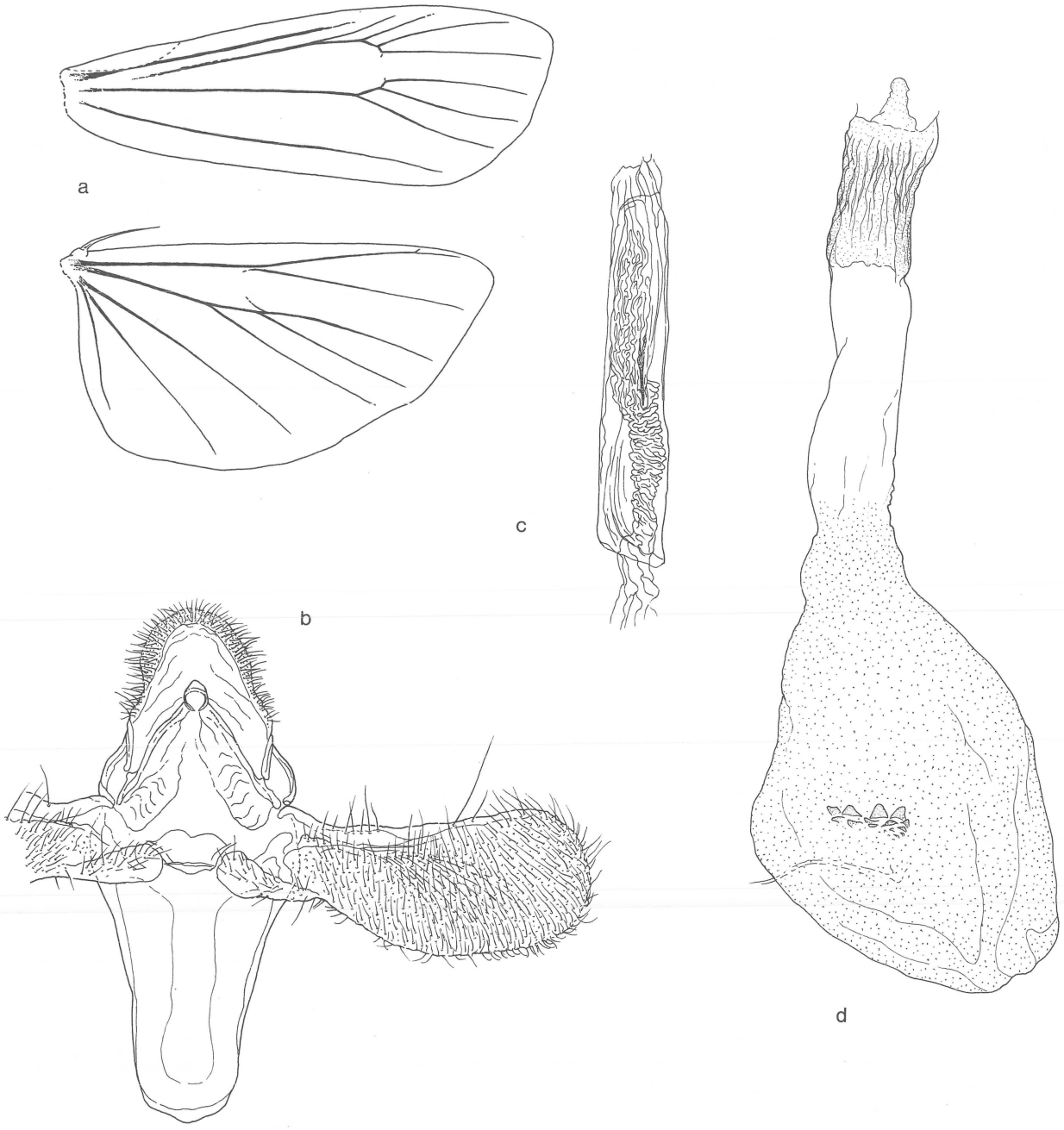


FIGURE 36: VENATION AND GENITALIA OF *CAUDELLIA APYRELLA*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 828); *c.* Aedoeagus; *d.* Corpus bursae, ductus bursae, and part of ductus seminalis (HHN 834).

Caudellia floridensis Neunzig, NEW SPECIES PL. 3, FIGS. 9–12. TEXT FIG. 39 *a–c.*

Caudellia floridensis Neunzig.
Type locality: Upper Key Largo, Florida. [USNM]

DIAGNOSIS. The adult of *floridensis* is most similar to *Caudellia colorella* (Dyar), of Central America. However, *floridensis* is a darker, mainly fuscous or black species with only a few red scales on the upper surface of the forewing; *colorella* has many red scales on the forewings. The male genitalia of the two species differ as follows: *floridensis* has the uncus about as long as its basal width; in *colorella* this structure is shorter than its basal width. The apical part of the gnathos of *floridensis* is developed into

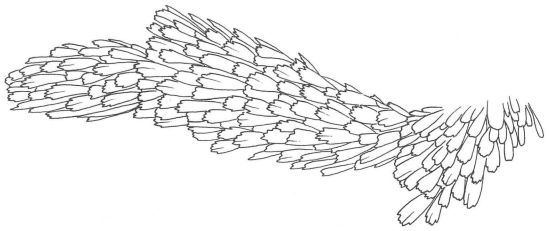


FIGURE 37: LABIAL PALPUS (LEFT SIDE) OF MALE *CAUDELLIA APYRELLA*

curved lateral processes, with the two processes of each side about equal in size; in *colorella,* the more posterior processes of the gnathos are distinctly more narrow. The valva of *floridensis* has a midcostal projection with sharply pointed teeth; this costal projection in *colorella* is blunt. The vinculum of *floridensis* is distinctly longer than its greatest width; *colorella* has a vinculum that is about as long as its greatest width.

DESCRIPTION. Wing length 5.0–7.5 mm. Head: frons brownish gray to fuscous; vertex gray; labial palpus brownish gray and fuscous dusted with white. Thorax: collar brownish gray, sometimes with a few fuscous scales; dorsum of thorax same as collar. Forewing: ground color fuscous; in some specimens a light subbasal dusting of white on costal half; antemedial line white, strongly developed, perpendicular to costal margin; an obscure dusting of white near discal spots; discal spots black, separate, usually indistinct; postmedial line white, weakly developed; most specimens (particularly females) with a few pale-red scales subbasally and distally on posterior ½; males with ochre patch at base on posterior ½; under surface of male with pale-red sex-scales at costal fold. Hindwing: smoky brown. Male genitalia (text figure 39 *a, b*): as described for genus and in diagnosis. Female genitalia (text figure 39 *c*): as described for genus; ductus bursae sclerotized for about ½ its length, and strongly twisted in membranous part.

The immature stages are unknown.

TYPES. Holotype: ♂. Upper Key Largo, Monroe Co., Florida; collected at mercury vapor lamp, 18 Jan. 1987 by Terhune S. Dickel; genitalia slide 1458 HHN. USNM. Paratypes: 6 ♂, 6 ♀. Florida: Same data as for holotype 18 Jan., 16 Feb. 1987 (1 ♂, 1 ♀). N. Key Largo, Monroe Co. 30-III-1986; H. D. Baggett (1 ♀). Key Largo; 11 Mar. 86; Dow; genitalia slide 1414 (1 ♀). Long Key, Monroe Co.; 31-III-84; Leg. H. D. Baggett (2 ♂). Long Key, Monroe Co.; 3 Mar. 1984; Terhune S. Dickel; genitalia slide 2161 HHN (1 ♂). Long Key Rec. Area, Long Key, Monroe Co.; 12 Dec. 1985; Terhune S. Dickel; genitalia slide 1459 HHN (1 ♀). Windley Key, Monroe Co.; 3 Jan. 1987; Terhune S. Dickel (1 ♀). No Name Key, Monroe Co.; 2 Apr. 1987; Mercury vapor lamp; Terhune S. Dickel (1 ♀). Collier Seminole State Park, Collier Co.; 2 Aug. 86; Linwood C. Dow (1 ♂). Terra Ceia, Manatee Co.; 28 April 86, L. C. Dow (1 ♂). FSCA, LCD, NCSU, TSD, USNM.

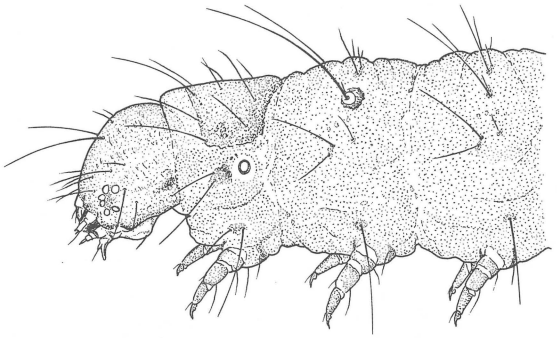


FIGURE 38: LAST STAGE LARVA OF *CAUDELLIA APYRELLA* (LATERAL VIEW OF HEAD AND THORAX)

Caudellia nigrella (Hulst)
PL. 3, FIGS. 13, 14 (RWH 6014).

Ephestia nigrella Hulst, 1890, *Trans Amer. Ent. Soc.,* **17**: 200.
Type locality: Blanco Co., Texas. [USNM]

Ephestia arizonella Walter, 1928, *Proc. Ent. Soc. Washington,* **30**: 141.
Type locality: Tempe, Arizona. [USNM]

C. nigrella superficially resembles *Moodna ostrinella* (Clemens), but in the former species the basal ½ of the forewing is usually paler and the distal ½ is less uniformly dark. The male genitalia of *nigrella,* particularly the short, digitate costal projection on the valva, will readily identify the species (Heinrich, 1956: figure 611). The female genitalia have the ductus bursae sclerotized for about ½ its length and the sclerotized part longitudinally wrinkled for its entire length (Heinrich, 1956: figure 1102). *C. nigrella* also is usually slightly larger than other species in *Caudellia* with a wing length of 6.5–8.5 mm, and is the only *Caudellia* in the western United States.

The immature stages are unknown.

C. nigrella is known from Texas (Blanco, Cameron, Hidalgo, and LaSalle Counties), February, March, May–September; Arizona (Maricopa, Mo-

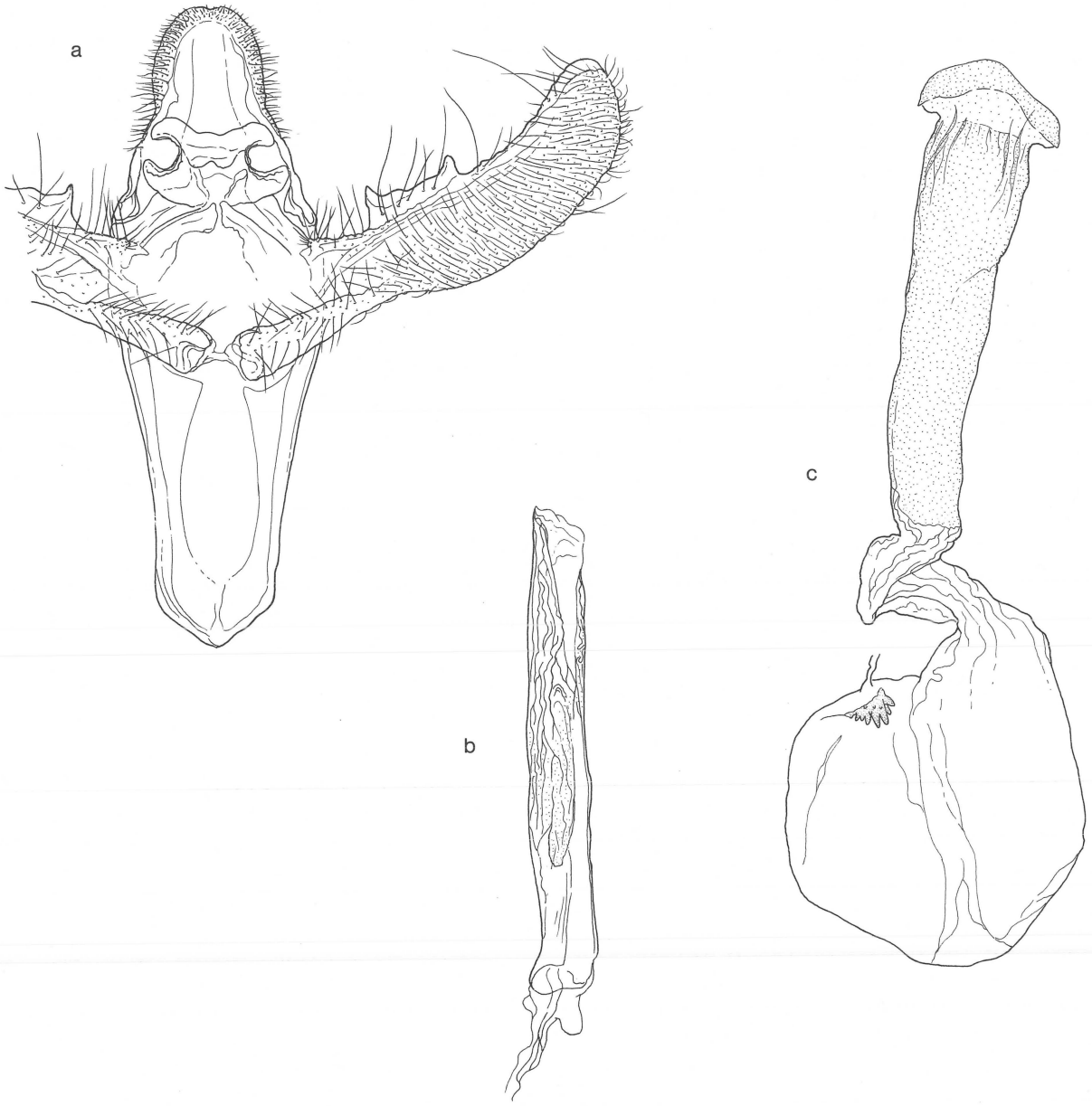


FIGURE 39: GENITALIA OF *CAUDELLIA FLORIDENSIS*

a. Male genitalia, holotype (most of left valva and aedoeagus omitted) (HHN 1458); *b.* Aedoeagus; *c.* Corpus bursae, ductus bursae, and part of ductus seminalis (HHN 1459).

have, Pima, and Yuma Counties), April, May, August, September; California (Inyo and Riverside Counties), March, April, July.

GENUS

Volatica Heinrich, REVISED STATUS

Volatica Heinrich, 1956, *U. S. Natl. Mus. Bull.*, **207**: 290.

Type species: *Zophodia pachytaeniella* Ragonot, 1888. Original designation.

Volatica is a small genus that is mostly South American. One species occurs in the southwestern United States. Based on male and female genitalia, *Volatica* species are closely allied with the better known genus *Vitula*. *Volatica* differs from *Vitula* by having 11 veins in the forewing; *Vitula* as 10 veins in the forewing. *Volatica* has an enlarged, porrect to oblique labial palpus that, in the female, extends forward beyond the head twice the length of the head; *Vitula* species have the labial palpus smaller and oblique to upturned.

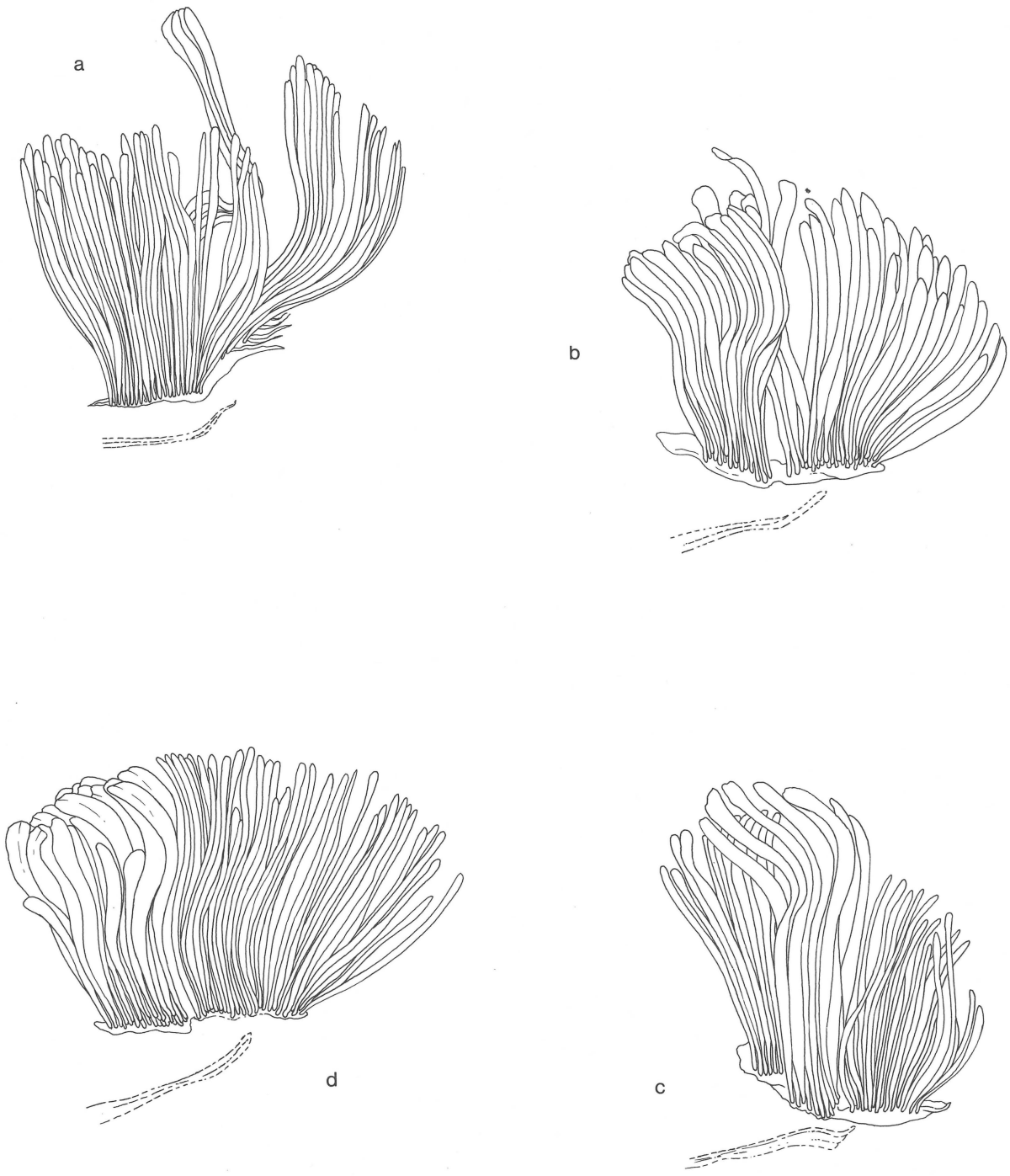


FIGURE 40: EIGHTH ABDOMINAL SCALE TUFTS (RIGHT SIDE) OF MALE *EPHESTIODES, CAUDELLIA, VITULA,* AND *SOSIPATRA*

a. Ephestiodes gilvescentella; b. Caudellia apyrella; c. Vitula edmandsii; d. Sosipatra rileyella.

Antennal shaft of both sexes simple. Sensilla trichodea (cilia) of male abundant and at base of shaft about ⅛ as long as basal diameter of shaft. Frons convex with anteriorly projecting scales. Labial palpus of both sexes porrect to oblique, particularly long in the female, third segment less than ½ length of second. Maxillary palpus simple. Haustellum well developed. Ocellus present. Basal half of costa of forewing of male (text figure 33 *c*) convex; under surface with costal fold. Forewing smooth scaled,

with 11 veins; R_{3+4} and R_5 stalked; M_1 from below upper angle of cell; M_2 and M_3 stalked for about ½ their length; CuA_1 from lower angle of cell; CuA_2 from before lower angle of cell. Hindwing (text figure 33 *c*) with 7 veins; $Sc+R_1+Rs$ fused for most of their lengths; M_1 from slightly below upper angle of cell; M_2 and M_3 completely fused, approximate to CuA_1 at base; CuA_2 from well before lower angle of cell; cell about ½ length of wing. Eighth abdominal segment of male with or without paired dorsal tufts. When present, each tuft consisting of three closely grouped clusters of spatulate scales and slightly longer, medially directed, falcate scales. Male genitalia (text figure 41 *a, b*) with uncus about as long as greatest width, terminal margin rounded; apical process of gnathos a blunt hook (about as long as wide to about twice as long as wide); transtilla complete, an angular bridge; juxta a U-shaped band with stout, setiferous lateral lobes; valva simple, with terminal margin evenly rounded or somewhat spatulate; aedoeagus with thin sclerotized plate; vinculum about as long as wide, sometimes (*pachytaeniella*) slightly constricted before saccus. Female genitalia (text figure 41 *c*) with ductus bursae sclerotized for about ½ to ⅘ its length; corpus bursae slightly shorter to slightly over twice as long as ductus bursae; corpus bursae membranous, with or without signum (signum, when present, one to several fused, blunt spines); ductus seminalis from corpus bursae near signum.

Last stage larvae (*gallivorella*) have distinct pinaculum rings associated with the SD1 setae of the mesothorax and eighth abdominal segment. Head slightly roughened. Body without stripes. Tonofibrillary platelets of body indistinct. Mandible simple. Maxilla with sensilla trichodea simple.

The pupa of *gallivorella* has the head minutely granular, thoracic spiracles distinct, and the gibba absent. Twelve spinose, hooked cremastral setae are present.

Larvae of *gallivorella* feed in cynipid oak apple galls on oak (*Quercus*).

Roesler (1973: 600) included *Volatica* as a junior synonum of *Vitula* Ragonot. I have not followed Roesler mainly because *Vitula* has fewer veins in the forewing.

Volatica gallivorella Neunzig, NEW SPECIES PL. 1, FIGS. 26–29. TEXT FIGS. 33 *c*; 41 *a–c*.

Volatica gallivorella Neunzig.
Type locality: Ft. Davis, Texas. [USNM]

DIAGNOSIS. *V. gallivorella* is a mostly fuscous-colored species; other *Volatica* are mainly white. The species is also easily separated from related *Vitula* species in that the antemedial line of the forewing of *gallivorella* is more strongly developed on the posterior ½ than the costal ½ (the solid white of the line at the former location strongly contrasts with the rest of the wing); *Vitula* species have the antemedial line uniformly developed and sometimes obscure over its entire length.

DESCRIPTION. Wing length 7.0–12.0 mm. Head: frons usually pale white, sometimes pale brown; vertex pale ochre to brown dusted with white; labial palpus porrect, long in female, basal segment usually pale brown dusted with white, distal segments chiefly pale ochre or ochre. Thorax: collar brown or fuscous, usually with some dark-red overtones and some scales tipped with white; dorsum of thorax similar to collar, but usually without red suffusions. Forewing: ground color fuscous with most scales dusted with white; base with patch of dark red; posterior ½ with few to many dark-red scales subbasally; antemedial line distinct, solid white, strongly developed on posterior ½; postmedial line relatively indistinct; terminal area usually with dark-red scales; discal spots black, fused. Hindwing: smoky brown to fuscous. Male genitalia (text figure 41 *a, b*): apical process of gnathos about as long as broad; valva somewhat slender with terminal margin evenly rounded; lateral elements of juxta rather robust; vinculum slightly longer than greatest width, not constricted toward terminal margin. Female genitalia (text figure 41 *c*): ductus bursae broad posteriorly, sclerotized for about ½ its length (sclerotized slightly beyond distal extremities of apophyses anteriores); corpus bursae about as long as ductus bursae, signum a single blunt spine.

Larvae of *gallivorella* feed in cynipid (*Atrusca* sp.) galls of the oak apple type. Based on an incorrect interpretation of information in Heinrich (1956), and an inaccurate figure in Ragonot and Hampson (1901), I mistakingly considered *gallivorella* to be *Vitula lugubrella* Ragonot and described the larvae and pupae and biology of *gallivorella* (Neunzig, 1976) under the name *lugubrella*; however, *lugubrella* is a junior synonym of the European *Vitula biviella* (Zeller). Small larvae of *gallivorella* feed just inside the outer covering of the gall on fibrous plant tissue. Larger larvae tunnel more deeply into the gall, frequently through the central chamber of the gall-making wasp. It is likely, therefore, that some animal as well as plant material is usually consumed.

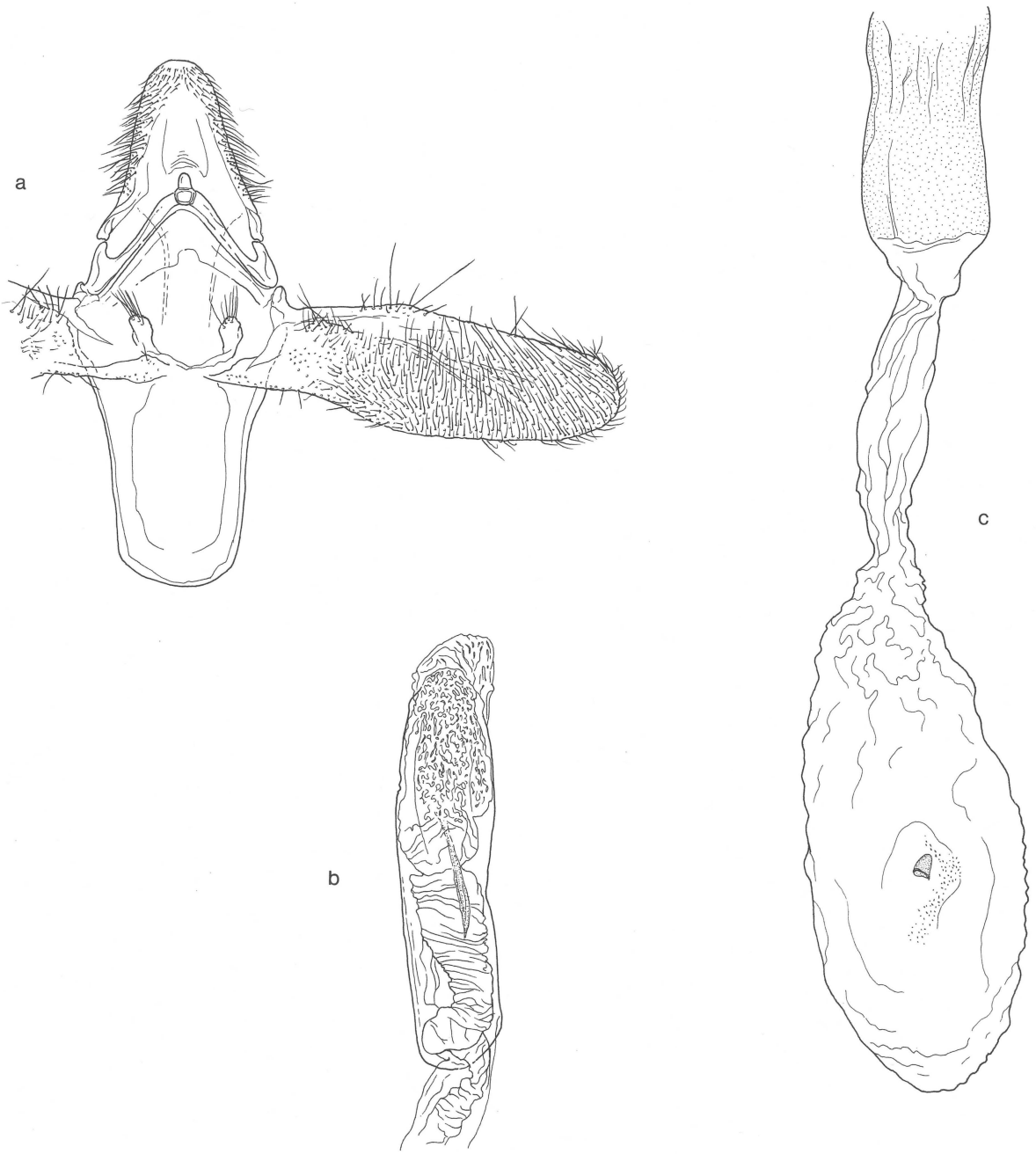


FIGURE 41: GENITALIA OF *VOLATICA GALLIVORELLA*

a. Male genitalia, holotype (most of left valva and aedoeagus omitted (HHN 832); *b.* Aedoeagus; *c.* Corpus bursae and ductus bursae (HHN 246).

Larvae pupate within the gall. Several generations occur each year. Adults have been reared from larvae infesting galls on gray oak (*Quercus grisea* Liebmann). Oak apple galls occurring on other species of oak may be infested by *gallivorella.*

TYPES. Holotype: ♂. Ft. Davis, Texas; larva collected 28-IV-74; gall on *Quercus*; H. H. Neunzig; genitalia slide 832 HHN. USNM. Paratypes: 6 ♂, 11 ♀. Arizona: Madera Canyon, 4880′, Santa Rita Mts., Santa Cruz Co., 21 April, 6, 9, 10, 11, 20, 22 May 1963, J. G. Franclemont; genitalia slides 2123, 2244 (3 ♂, 5 ♀). Texas: Same data as for holotype; genitalia slides 241, 246, 286, 287 HHN (2 ♂, 5 ♀). Ft. Davis; larva collected 28-IV-74, 27-IV-75; gall on *Quercus,* H.H. Neunzig (1 ♂, 1 ♀). NCSU, USNM.

GENUS
Vitula Ragonot

Vitula Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 14.
Type species: *Vitula dentosella* Ragonot, 1887, considered to be a synonym of *Nephopteryx* [sic] *edmandsii* Packard, 1864. Original designation.

Hornigia Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 16.
Type species: *Ephestia biviella* Zeller, 1848. Original designation.

NOTE—*Hornigia* Ragonot, 1887, is preoccupied by *Hornigia* Ragonot, 1885, in the Lepidoptera (Galleriinae).

Manhatta Hulst, 1890, *Trans. Amer. Ent. Soc.,* **17**: 196.
Type species: *Ephestia biviella* Zeller, 1848. Original designation.

Vitula has 12 species distributed in the Nearctic, Neotropical, and Palearctic Regions. Most are New World. It is closely related to *Volatica.* Salient features useful in separating the two groups are mentioned under the generic description of *Volatica.*

Antennal shaft of both sexes usually simple (*setonella* (McDunnough) with a very slight basal sinus). Sensilla trichodea (cilia) of male moderately abundant and at base of shaft about ¼ to ⅓ as long as basal diameter of shaft. Frons convex and with anteriorly projecting scales (apparently projecting weakly in *setonella*). Labial palpus of male upturned or oblique, third segment slightly less than, to less than ½, length of second segment; of female oblique. Maxillary palpus simple. Haustellum well developed. Ocellus present. Basal ½ of costa of forewing of male (text figure 42 *a*) slightly convex; under surface with costal fold containing tuft of scales and an associated distal cluster of uncovered scales. Forewing smooth scaled with 10 veins; R_{3+4} and R_5 completely united; M_1 from well below upper angle of cell; M_2 and M_3 stalked for about ½ their lengths; CuA_1 from lower angle of cell; CuA_2 from well before lower angle of cell. Hindwing (text figure 42 *a*) with 6–7 veins; Sc + Rs fused for most or all of their lengths; Sc, when present, very short; M_1 originating slightly below upper angle of cell; M_2 and M_3 completely fused and either approximate at base to CuA_1 or connate with CuA_1; CuA_2 from well before lower angle of cell; cell less than ½ length of wing. Eighth abdominal segment of male with paired dorsal scale tufts (text figure 40 *c*); each tuft consisting of several clusters of simple scales. Male genitalia (text figures 42 *b, c*; 44 *a–d*; 45 *a, b*) with uncus broad to somewhat narrow; terminal margin rounded; apical process of gnathos a short, bluntly pointed hook; transtilla complete, with lateral elements joined posteriorly into a somewhat triangular element; juxta a narrow, U-shaped band with very short, setiferous lateral lobes; valva simple, relatively broad, with costa well sclerotized except for distal region (*aegerella* has the valva somewhat slender, and *setonella* has the valva slender and its costa strongly sclerotized throughout and with a small, projecting distal element); aedoeagus usually with an elongate thin, sclerotized plate; vinculum about as long as greatest width, or distinctly longer than greatest width. Female genitalia (text figures 42 *d*; 46 *a–c*) with ductus bursae sclerotized for about ¼ to ½ its length, and sometimes with scobinations near its junction with corpus bursae; corpus bursae membranous with signum a blunt, disclike spine, or cluster of two or more disclike spines, and usually with a band, or partial band, of scobinations below signum; ductus seminalis attached to corpus bursae usually near the middle of corpus bursae.

Larvae of *edmandsii* (Packard) (text figure 43) and *serratilineella* Ragonot are known. They are very similar. In the last instar, distinct pinaculum rings are associated with the SD1 setae of the mesothorax and the eighth abdominal segment. Head slightly roughened. Body without stripes. Tonofibrillary platelets of body indistinct. Mandible simple. Maxilla with sensilla trichodea simple.

Vitula larvae feed as opportunistic detritivores on plant and animal materials. Some species occur primarily in bumble bee nests, feeding on pollen, wax, and inhabitants (mostly dead) of the nest. The same species have been collected from dried fruit, presumably feeding on a mixture of fruit and dead insects. Another *Vitula* has been reported from pine cones (Pinaceae), and it is likely that insect as well as plant substances were consumed.

Roesler (1973) has been followed in including *Manhatta* Hulst as a junior synonym of *Vitula.* Heinrich (1956) placed *biviella* Zeller (of Europe), *setonella,* and *broweri* (Heinrich) in *Manhatta* based on a minor difference in venation in the hindwing (connate vs approximate bases of fused veins M_2+M_3 and vein CuA_1). The male genitalia of *biviella* and *broweri* are like those of most *Vitula,* and this, and other similarities, strongly support including them in *Vitula.* The genitalia (male and female) of *setonella* differ somewhat from those of other *Vitula* and a new genus with *setonella* as the type species

possibly could be erected. Nevertheless, because the genital differences are minor, and until we know more about the immature stages and biology of the species under consideration, *setonella* is better placed in *Vitula.*

Ragonot (1887b) described *Hornigia lugubrella,* and gave the type locality as California. Heinrich (1956: 286) included *lugubrella* as an American species of *Vitula.* He examined the genitalia of a paratype, not the holotype or a moth in its entirety. Munroe (1983) and I (Neunzig, 1976) followed Heinrich's interpretation. I have recently made a more detailed investigation of *lugubrella,* including, through the very helpful assistance of Gérard Luquet and P. Viette of the Muséum National d'Histoire Naturelle, Paris, a study of the holotype. It is my opinion that *Hornigia lugubrella* is a synonym of the European *Vitula biviella.* The type closely matches moths of *biviella* I have seen, as well as the colored figure of *biviella* in Roesler (1973). The genitalia of the type agree with the figures of the genitalia of *biviella* (Heinrich, 1956: 457; Roesler, 1973: plate 88) The holotype has no locality label. Apparently, "California" was incorrectly supplied as the type locality in the original description. A blue label with the abbreviation "Walsm" is on the type pin. Lord Walsingham, in England, is known to have given phycitines to Ragonot (Ragonot 1887b: 1). Although the type of *lugubrella* appears to be a Walsingham specimen, it could have been collected in Europe or North America, because Walsingham acquired and worked on both Old and New World Lepidoptera. As far as I am aware, no moths matching Ragonot's description and holotype of *lugubrella* have been collected in California during the more than one hundred years since the species was described despite rather intensive collecting in the state in recent years.

KEY TO SPECIES OF *VITULA*

1. Forewing with antemedial and postmedial lines very distinctly outlined in black (plate 3, figures 41–43) ..... *pinei* p. 87

— Forewing with transverse lines not as distinctly outlined 2

2. Costa of valva strongly sclerotized throughout length and with projecting distal element; ductus bursae sclerotized beyond distal extremities of apophyses anteriores for a distance equal to about length of apophyses anteriores ... *setonella* p. 92

— Costa of valva with distal part unsclerotized and without distal element; ductus bursae not sclerotized beyond distal extremities of apophyses anteriores, *or* sclerotized for a maximum of a distance equal to about ½ length of apophyses anteriores 3

3. Forewing with median area shaded with black, in many specimens forming a broad, dark transverse band that contrasts with pale rest of wing (plate 3, figures 30–32) ..... *insula* p. 89

— Forewing not as above 4

4. Antemedial line of forewing bordered distally by distinct, relatively broad, black patch (plate 3, figures 27–29); valva relatively slender (text figure 44 *c*) ..... *aegerella* p. 89

— Antemedial line of forewing without broad, black patch as above; valva broader (text figures 42 *b,* 44 *a*) 5

5. Antemedial line of forewing distinct, straight or only slightly angulate (plate 3, figures 33–39); ductus bursae sclerotized slightly beyond distal extremities of apophyses anteriores 6

— Antemedial line of forewing obscure, defined chiefly by its narrow black border, distinctly angulate (plate 3, figures 15–22); ductus bursae not sclerotized to distal extremities of apophyses anteriores 7

6. Discal spots of forewing usually with associated, strongly developed patch of white scales (plate 3, figures 36–39); wing length 5.5–6.5 mm; southern Canada and eastern United States ..... *broweri* p. 92

— Discal spots of forewing with associated, weak patch of white scales (plate 3, figures 33–35); wing length 6.5–8.5 mm; Arizona .... *coconinoana* p. 90

7. Hindwing mostly white (plate 3, figures 19–22); western Canada and western United States (also Europe) ..... *serratilineella* p. 87

— Hindwing darker, with more fuscous scales (plate 3, figures 15–18); eastern Canada and eastern United States ..... *edmandsii* p. 85

Vitula edmandsii (Packard)

PL. 3, FIGS. 15–18. TEXT FIGS. 40 *c*; 42 *a–d*; 43 (RWH 6007).

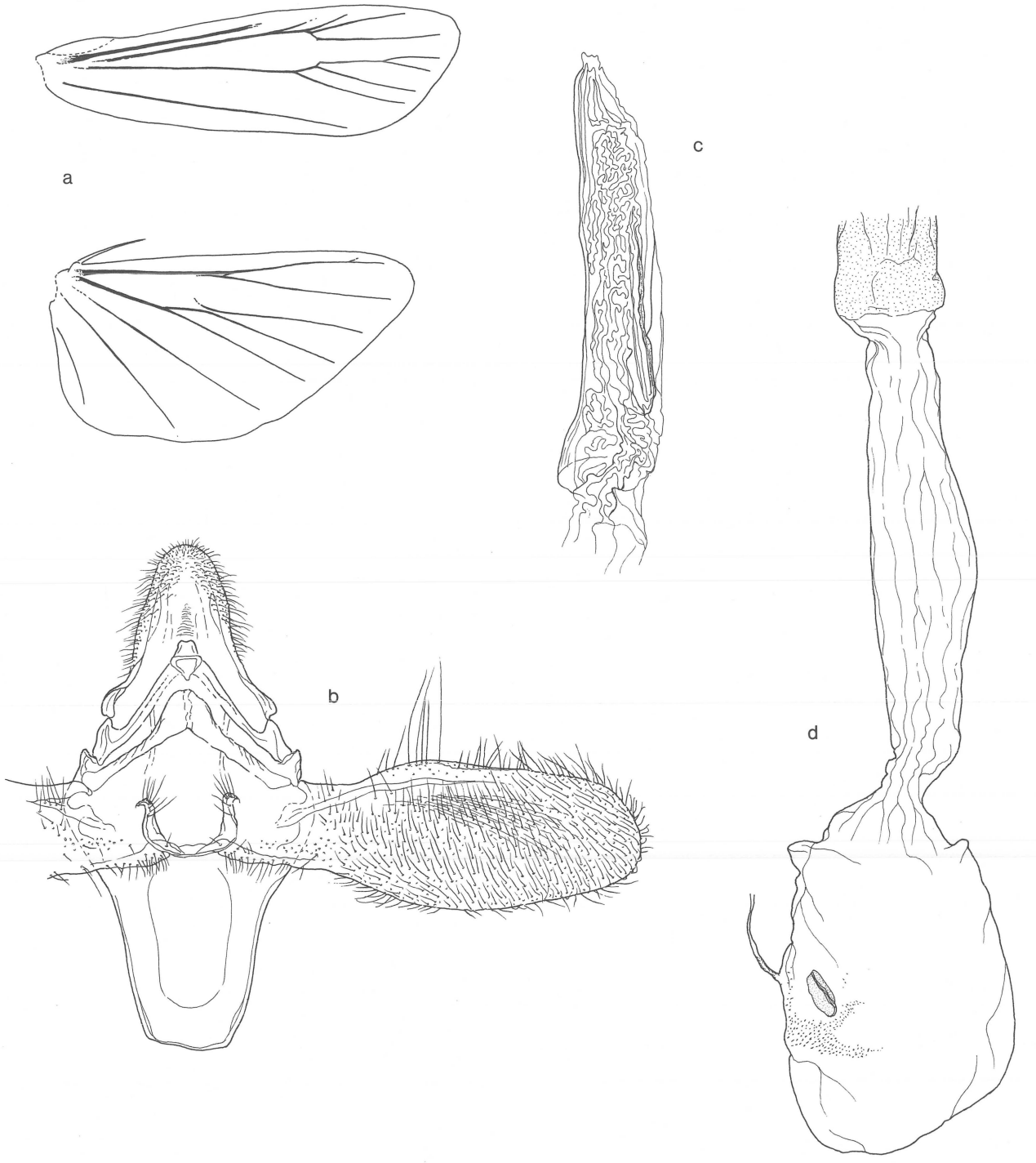


FIGURE 42: VENATION AND GENITALIA OF *VITULA EDMANDSII*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 264); *c.* Aedoeagus; *d.* Corpus bursae, ductus bursae, and part of ductus seminalis (HHN 1703).

Nephopteryx [sic] *edmandsii* Packard, 1865, *Proc. Essex Inst.,* **4**: 120.
Type locality: Bridport, Vermont. [MCZ]

Vitula dentosella Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 14.
Type locality: Florida. [MNHP]

There are only two species of *Vitula* in eastern North America, *edmandsii* and *broweri. V. edmandsii* with

a wing length of 8.5–10.0 mm is the larger of the two. The antemedial line on the forewing is obscure on *edmandsii* and much more distinct on *broweri.*

Male genitalia (text figure 42 *b, c*) with valva relatively broad, and vinculum about as long as greatest width. Female genitalia (text figure 42 *d*) with ductus bursae sclerotized for only about ¼ its length, the sclerotization not extending beyond distal extremities of apophyses anteriores.

Last stage larva (text figure 43) 15.0–18.0 mm long. Head reddish brown. Thoracic shield yellowish brown, darker near margins. Mesothoracic and eighth abdominal pinaculum rings brown to dark brown. Thorax and abdomen mainly white to pinkish white, without stripes. MacKay (1972) gave additional information on the larvae.

Based on studies by Frison (1926), larvae are found in the nests of bumble bees, honey bees, and possibly other Hymenoptera, particularly in colonies that are weak or poorly organized. The larvae form silk, tubelike protective enclosures in the nests, and feed mostly on pollen, honey, and immature Hymenoptera. Pupation occurs within silk enclosures made near the feeding sites. Several generations occur each year.

V. edmandsii is generally distributed throughout southeastern Canada and the eastern United States. Moths occur mostly from June through September. A few have been collected as early as March and as late as October.

Vitula serratilineella Ragonot, REVISED STATUS (Driedfruit Moth*)
PL. 3, FIGS. 19–22 (RWH 6007a).

Vitula serratilineella Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 15.
Type locality: N. America. [BMNH]

Moodna bombylicolella Amsel, 1955, *Mitt. Münchener ent. Ges.,* **44/45:** 487.
Type locality: Hamburg, Germany. [ZMUH]

NOTE—The taxonomic status of the names *serratilineella* and *bombylicolella* were clarified by Sattler (1989).

V. serratilineella is the western counterpart of the eastern *edmandsii.* The two species are very similar in general appearance and genitalia. However, the hindwings of *serratilineella* are clearly whiter with fewer fuscous scales. Wing length 8.5–11.0 mm.

The larvae and larval habits of *serratilineella* are similar to those of *edmandsii.* In addition to being found with bumble bees and honey bees, I have seen

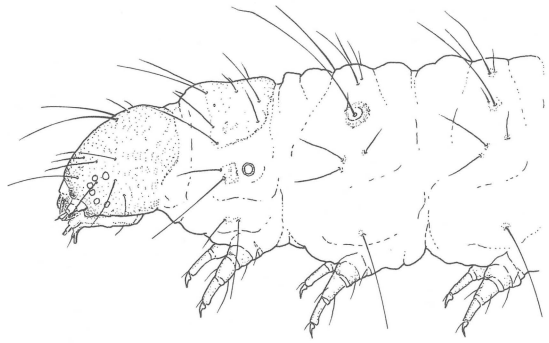


FIGURE 43: LAST STAGE LARVA OF *VITULA EDMANDSII* (LATERAL VIEW OF HEAD AND THORAX)

specimens of *serratilineella* reared from larvae associated with other Hymenoptera (*Vespula, Megachile, Xylocopa, Polistes*). Richards (1984: 28) stated that "The dried fruit moth . . . has increased . . . as a pest of the alfalfa leafcutter bee, *Megachile rotundata* (Fab.), in western Canada." *V. serratilineella* also has been reported as a pest of dried fruit, particularly apple (*Malus pumila* (L.) Miller), fig (*Ficus carica* L.), raisin (*Vitis vinifera* L.) and prune (*Prunus domestica* L.). Dyar (1903) briefly described the larva, and Okumura (1966) and Hasenfuss (1960) provided more detailed descriptions. The pupa has been figured by Okumura (1966).

V. serratilineella occurs in Canada in Alberta and British Columbia and in the United States from west Texas and Nebraska west to the coast. *V. serratilineella* has been inadvertantly taken to Europe (Amsel, 1955; Palm, 1986; Roesler, 1973; Sattler, 1989). In North America, *serratilineella* flies mainly from May to September. A few specimens have been collected in southern California as early as February and as late as December.

Vitula pinei Heinrich
PL. 3, FIGS. 40–42 (RWH 6009).

Vitula pinei Heinrich, 1956, *U. S. Natl. Mus. Bull.,* **207**: 286.
Type locality: Eureka, Utah. [USNM]

V. pinei is the most distinctively marked species in the genus. It is easily distinguished from other species by the sharply contrasted black lines on the forewing, including a black line bordering the inner edge of the antemedial line. Wing length 9.0–10.0 mm.

Male genitalia (Heinrich, 1956: figure 606) with valva relatively broad, basal half of costa of valva more broadly sclerotized than in *edmandsii* and

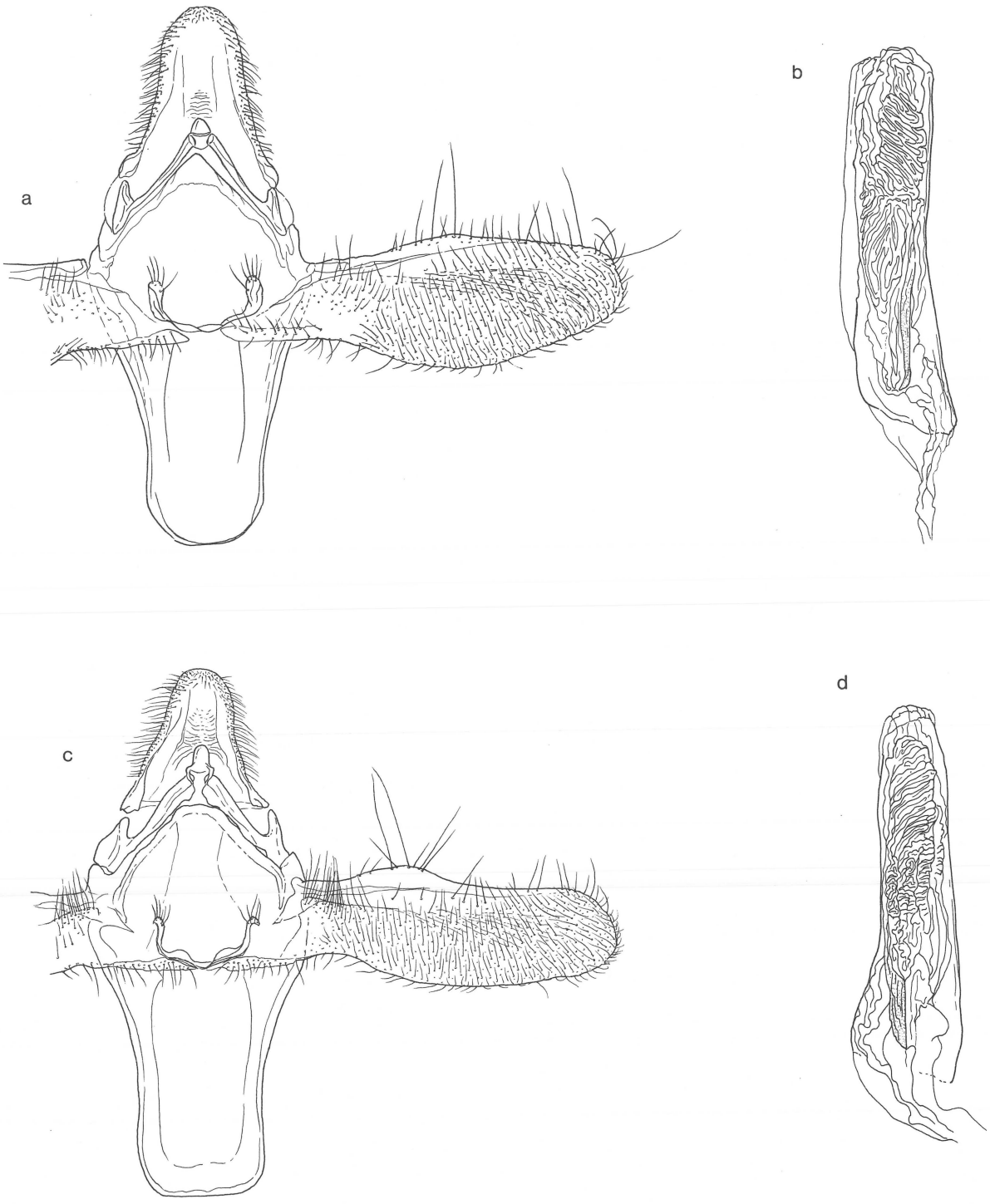


FIGURE 44: MALE GENITALIA OF *VITULA* SPECIES

a. V. coconinoana, holotype (most of left valva and aedoeagus omitted) (HHN 2305); *b.* aedoeagus; *c. V. aegerella,* holotype (most of left valva and aedoeagus omitted) (HHN 2130); *d.* aedoeagus.

serratilineella; vinculum longer than its greatest width; aedoeagus more robust than in *edmandsii* and *serratilineella.* Female genitalia with intersegmental area between ovipostior and eighth abdominal segment very long; ductus bursae sclerotized for about ⅓ its length, sclerotization extending beyond

distal extremities of apophyses anteriores for a distance equal to about ½ length of apophyses anteriores (Heinrich, 1956: figure 1090).

The immature stages are unknown.

Larvae of *pinei* have been found associated with cones of singleleaf pinyon pine (*Pinus monophylla* Torrey & Fremont) (Heinrich 1956). Based on the larval habits of other *Vitula,* they probably are secondary invaders, feeding in insect damaged cones on both plant and animal materials.

Known from Utah, Nevada, northwest California, and northern Arizona and New Mexico. Available flight dates are as follows: Utah (mid-July); Nevada (late May (reared) to June); California and Arizona (mid-June); New Mexico (late July).

Vitula aegerella Neunzig, NEW SPECIES
PL. 3, FIGS. 27–29. TEXT FIGS. 44 *c, d*; 46 *b.*

Vitula aegerella Neunzig.
Type locality: Madera Canyon, 5,600′, Santa Rita Mts., Santa Cruz Co., Arizona. [USNM]

DIAGNOSIS. Adults of *aegerella* are like *serratilineella,* particularly with regard to the pale hindwings. In contrast to *serratilineella,* the antemedial line of the upper surface of the forewing is only slightly angulate, and the black patch associated with the line distinct and broad in *aegerella.* The valva is narrower in *aegerella* than in *serratilineella,* and numerous distinct scobinations are present in the ductus bursae and corpus bursae of *aegerella* and absent in *serratilineella.*

DESCRIPTION. Wing length 8.0–9.0 mm. Head: frons pale brown to brown lightly dusted with white; vertex same as frons, at times more heavily dusted with white; labial palpus brown to fuscous, basal segments heavily dusted with white. Thorax: collar and dorsum pale brown to brown, scales of some specimens lightly dusted with pale gray or with small amount of red. Forewing: ground color brown dusted with white; posterior ½ with patch of pale brownish-red to red scales basally and subbasally (a few red scales sometimes on costal ½ basally and subbasally); antemedial line white, weakly to moderately well developed, bordered distally by broad, black patch; postmedial line white, usually weakly developed; discal spots black, usually fused; medial area with pale reddish-brown to red patch on posterior ½; terminal area with pale reddish-brown to red scales. Hindwing: pale white. Male genitalia (text figure 44 *c, d*): valva with cluster of setae near inner base, relatively slender with inner margin only slightly rounded and with costa strongly convex in basal ½; vinculum slightly longer than greatest width. Female genitalia (text figure 46 *b*): ductus bursae sclerotized for about ¼ its length (sclerotized about to distal extremities of apophyses anteriores), numerous, distinct scobinations or microspines extending into corpus bursae.

The immature stages are unknown.

TYPES. Holotype: ♂. Madera Canyon, 5,600′ Santa Rita Mts., Santa Cruz Co., Arizona; 9 May 1963; J. G. Franclemont; genitalia slide 2130 HHN. USNM. Paratypes: 3 ♂, 1 ♀. Arizona: Same location and collector as for holotype; 8 May 1963 (1 ♂). Madera Canyon, 4,880′ Santa Rita Mts., Santa Cruz Co., 8 April 1963, 3 May 1963; J. G. Franclemont; genitalia slide 2306 HHN (2 ♂, 1 ♀). USNM.

Vitula insula Neunzig, NEW SPECIES
PL. 3, FIGS. 30–32. TEXT FIGS. 45 *a, b*; 46 *c.*

Vitula insula Neunzig.
Type locality: Sta. Catalina Island [Avalon], Los Angeles Co., California. [UCB]

DIAGNOSIS. Many adults of *insula* have the median area of the forewing distinctly darker than the rest of the wing. In this respect, they resemble adults of some *Sosipatra* species; the genitalia, however, are definitely those of a *Vitula.* In male *insula,* the uncus is narrow and the valva relatively short and rounded on inner margin (text figure 45 *a*).

DESCRIPTION. Wing length 7.0–8.0 mm. Head: frons and vertex fuscous to brown dusted with white; labial palpus fuscous to brown dusted with white, white at base. Thorax: collar and dorsum fuscous to brown dusted with white. Forewing: ground color brown heavily dusted with white; base with small black patch; antemedial line white, its posterior margin difficult to detect, blending with nearby white-dusted subbasal area, its outer margin bordered with broad patch of black scales; postmedial line indistinct, its shape usually outlined by patch of black along its posterior margin; medial area sometimes almost completely black, because of the fusion of black patches associated with antemedial and postmedial lines, other specimens with medial area paler, with few to no black scales associated with postmedial line; discal spots obscure, or somewhat distinct, depending on color of medial area; some specimens with a few scattered red scales on inner ½. Hindwing: pale smoky brown. Male geni-

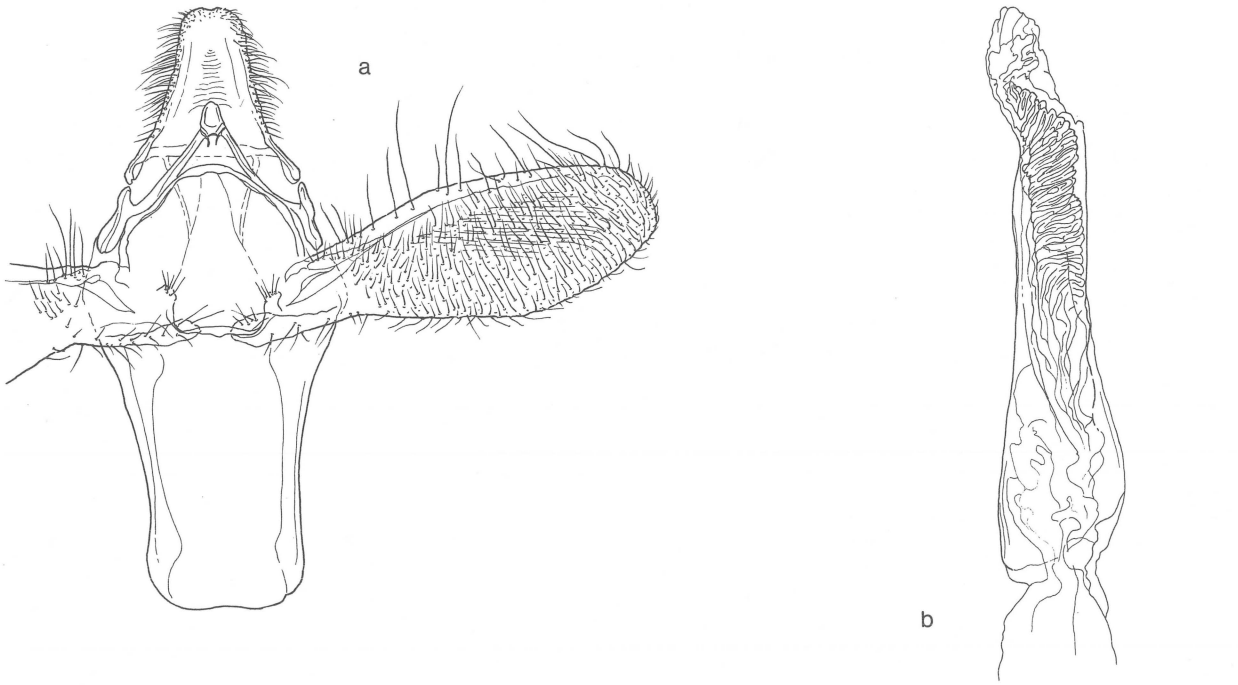


FIGURE 45: *MALE GENITALIA OF VITULA INSULA*
a. Genitalia, holotype (most of left valva and aedoeagus omitted) (HHN 2294); *b.* Aedoeagus.

talia (text figure 45 *a, b*): uncus somewhat narrow and truncate; valva relatively short and rounded on inner margin; vinculum slightly longer than greatest width. Female genitalia (text figure 46 *c*): ductus bursae sclerotized for ¼ its length (heavily to lightly sclerotized before distal extremities of apophyses anteriores), with numerous, distinct scobinations or microspines that extend into corpus bursae.

The immature stages of *insula* are unknown.

TYPES. Holotype: ♂. California, L. A. Co., [Avalon] Sta. Catalina Is., XII-19-1979, L. Randal and J. Powell; genitalia slide 2294 HHN. UCB. Paratypes: 28 ♂, 6 ♀. California: Same collection data as for holotype; genitalia slide 4560 JAP (3 ♂). Sta. Bar. Co., Santa Cruz Island, "Cascada," W end Central Valley, V-22/24-84, J. Powell (3 ♂, 1 ♀). Avalon Cyn., Sta. Catalina Is., III-31-68, J. Powell (5 ♂). Avalon, Sta. Catalina Is., III-31-68, P. A. Opler and J. Powell (8 ♂, 2 ♀). L. A. Co., Sta. Catalina Is., Middle Cyn., 500′, V-1/2-,V-3-1978, J. Powell, black light trap; genitalia slides 4562, 4590, 4591, 4593, 4595 JAP (5 ♂, 2 ♀). L. A. Co., Sta. Catalina Is., Middle Cyn. at black light, V-1/3-1978, J. A. Chemsak (1 ♂). Sta. Barb. Co., Santa Cruz Island, Field Station HQ, 21/24-V-84, Powell and DeBenedictis (1 ♂). Sta. Barb. Co., Santa Cruz Island, Field Station HQ, 21/24-V-84, blacklight trap, J. Powell, genitalia slide 2295 HHN (2 ♂, 1 ♀). NCSU, UCB.

Vitula coconinoana Neunzig, NEW SPECIES
PL. 3, FIGS. 33–35. TEXT FIGS. 44 *a, b*; 46 *a.*

Vitula coconinoana Neunzig.
Type locality: Hart Prairie, 8,500′, 10 mi NNW Flagstaff, Coconino Co., Arizona. [USNM]

DIAGNOSIS. Adult *coconinoana* resemble *broweri* in color and maculation of the forewing, but the white markings are more subtle in *coconinoana* (for example, the discal spots are less accented by white in *coconinoana*), and the transverse lines are less angulate in the latter species. *V. coconinoana* usually is larger than *broweri.*

DESCRIPTION. Wing length 6.5–8.5 mm. Head: frons pale brown to brown; vertex pale brown, sometimes lightly dusted with white; labial palpus brown to fuscous dusted with white, particularly basal segment. Thorax: collar pale brown; dorsum of thorax similar to collar, sometimes slightly red. Forewing: ground color fuscous dusted with white; posterior ½ with patch of red scales basally and subbasally; antemedial line white, distinct; postmedial line white, relatively distinct; discal spots



FIGURE 46: FEMALE GENITALIA OF *VITULA* SPECIES

a. V. coconinoana corpus bursae and ductus bursae (HHN 2150); *b. V. aegerella* corpus bursae, ductus bursae, and part of ductus seminalis (HHN 2306); *c. V. insula* corpus bursae and ductus bursae (HHN 2295).

black, fused, with weakly developed associated white patch; terminal area usually with a few red scales on posterior ½. Hindwing: smoky brown to fuscous. Male genitalia (text figure 44 *a, b*): valva with inner margin convex; vinculum slightly longer than greatest width. Female genitalia (text figure 46 *a*): ductus bursae sclerotized for slightly less than ¼ its length (sclerotized slightly beyond distal extremities of apophyses anteriores), with numerous, distinct scobinations or microspines that extend into corpus bursae.

The immature stages are unknown.

TYPES. Holotype: ♂. Hart Prairie, 8,500′, 10 mi NNW Flagstaff, Coconino Co., Arizona; 6 July 1964; J. G. Franclemont; genitalia slide 2305 HHN. USNM. Paratypes: 3 ♂, 8 ♀. Arizona: Same location as for holotype; 30 June 1961; Ronald W. Hodges; genitalia slide 2150 HHN (2 ♀). Fort Valley, 7,350′, 7½ mi NW Flagstaff, Coconino Co., Arizona; 22 June, 6 July 1961; Ronald W. Hodges (3 ♀); Rustler Park 8,500′, Chiricahua Mts., 12, 14, 20 July 1972, J. Powell (3 ♂, 3 ♀). UCB, NCSU, USNM.

Vitula broweri (Heinrich), NEW COMBINATION
PL. 3, FIGS. 36–39 (RWH 6011).

Manhatta broweri Heinrich, 1956, *U. S. Natl. Mus. Bull.,* **207**: 288.
Type locality: Bar Harbor, Maine. [USNM]

M. broweri is a relatively small species (wing length 5.5–6.5 mm) that has been collected infrequently in southern Canada and the eastern United States. Its small size and forewing, which is predominantly brown with relatively distinct white antemedial and postmedial lines and a white patch near the discal spots, distinguish it from other *Vitula.* Male genitalia with valva relatively broad and vinculum distinctly longer than greatest width. Female genitalia with ductus bursae sclerotized slightly beyond distal extremities of apophyses anteriores (Heinrich, 1956: figure 1094).

The immature stages are unknown.

V. broweri has been collected in southern Ontario, Quebec, and Alberta; and Maine and western North Carolina. Dates of capture are Ontario, 1–19 July; Quebec, 29 June; 5 July; Alberta, 20 July; Maine, 8–30 July; North Carolina, 25–30 June.

Vitula setonella (McDunnough), NEW COMBINATION
PL. 3, FIGS. 23–26 (RWH 6010).

Moodna setonella McDunnough, 1927, *Can. Ent.,* **59**: 270.
Type locality: Seton Lake, British Columbia. [CNC]

V. setonella is somewhat similar to *pinei,* but smaller (wing length 6.0–7.0 mm), and lacks a black line bordering the inner side of the antemedial line on the forewing found in *pinei.* Both male and female genitalia also separate *setonella* from other *Vitula.* Male genitalia of *setonella* have the costa of the valva strongly sclerotized throughout its length and with a projecting distal element (Heinrich 1956: figure 602); other *Vitula* have the distal part of the valva unsclerotized or weakly sclerotized, and without a projecting element. The female genitalia of *setonella* have the ductus bursae sclerotized for about 2× the length of the apophyses anteriores (Heinrich 1956: figure 1093); the sclerotized part of the ductus bursae is less in other members of the genus.

The immature stages of *setonella* are unknown.

V. setonella is known from the type locality in southern British Columbia (late June) and from White Pine County, Nevada (early August) and Sanpete and Garfield Counties, Utah (late June and late July).

GENUS
Sosipatra Heinrich, REVISED STATUS

Sosipatra Heinrich, 1956, *U. S. Natl. Mus. Bull.,* **207**: 294.
Type species: *Ephestia rileyella* Ragonot, 1887. Original designation.

Species of *Sosipatra* occur in the western United States, Mexico, and Central America. The genus is closely allied to *Vitula.* The morphological feature most useful in separating the two groups is the number of veins in the forewing; ten in *Vitula* and nine in *Sosipatra. Sosipatra* has two subgroups: 1) the costa of the valva is slightly directed ventrally near its apex and spined, and the eighth abdominal segment of the male has dorsal tufts; and 2) the costa of the valva is produced dorsally and is simple, and the male lacks scale tufts on the eighth abdominal segment.

Antennal shaft of both sexes simple. Sensilla trichodea (cilia) of male moderately abundant and at base of shaft about ⅓ as long as basal diameter of shaft. Frons convex and with anteriorly projecting scales. Labial palpus of both sexes upturned or oblique, third segment about ½ length of second segment. Maxillary palpus simple. Haustellum well developed. Ocellus present. Basal ½ of costa of forewing of male (text figure 47 *a*) slightly convex, under surface with costal fold containing tuft of scales and associated distal cluster of uncovered scales. Forewing and hindwing (text figure 47 *a*) smooth scaled, with 9 and 6–7 veins, respectively; arrangement of veins essentially as in *Vitula,* except in forewing M_2 and M_3 completely fused, and in hindwing M_{2+3} either connate or shortly stalked with CuA_1. Eighth abdominal segment of male with paired dorsal scale tufts (text figure 40 *d*), or without scale tufts; when present, each tuft consisting of several clusters of simple scales. Male genitalia (text figures 47 *b, c*; 48

a, b; 49 *a, b*) with uncus relatively broadly rounded distally; apical process of gnathos enlarged, knobbed, or looped; transtilla complete, an angulate bridge; juxta somewhat dumbbell or H-shaped, without setae; valva of two types, as described earlier; aedoeagus with an elongate, thin sclerotized plate; vinculum longer than greatest width. Female genitalia (text figures 47 *d,* 48 *c*) with ductus bursae sclerotized for ½, to slightly over ½, its length, with wrinkles and usually a raised, more or less horseshoe-shaped protuberance anterior to genital opening, and usually with microspines or scobinations (and sometimes very small sclerotized plates) near junction with corpus bursae; corpus bursae membranous, usually with a signum consisting of one or two small, blunt plates or discs (absent in *divergens* (Dyar)) and associated scobinations, located in posterior part of corpus bursae; ductus seminalis attached to corpus bursae near junction with ductus bursae.

Last stage larvae (based on specimens identified as *rileyella* in the National Museum of Natural History) with distinct pinaculum rings associated with SD1 setae on the mesothorax and eighth abdominal segment. Head slightly roughened. Body somewhat granulate, but not darkened as in *Ephestiodes, Moodna,* and *Caudellia.* Mandible simple. Maxilla with sensilla trichodea simple.

Larval habits are not well known. Several species have been reported as feeding in flowers, or seed pods. Plant associations include the Cactaceae, Fabaceae, Fagaceae, Liliaceae, and Malvaceae. At least some of the species probably feed on animal materials, as larvae of related genera are generalist detritivores.

Mainly on the basis of differences in number of veins in the forewing (ten in *Vitula*; nine in *Sosipatra*), I do not consider *Sosipatra* to be a synonym of *Vitula* as was done by Roesler (1973: 600). The male genitalia of the two groups also differ, particularly with regard to the distal part of the gnathos that is simple in *Vitula* and enlarged in *Sosipatra.*

KEY TO *SOSIPATRA* SPECIES

1. Forewing predominately creamy white, with small black spots (plate 3, figure 43; plate 4, figures 1–5) ..... *rileyella* p. 93

— Forewing predominately gray or grayish brown 2

2. Forewing with outer border of antemedial line and inner border of postmedial line black and strongly contrasting with most of rest of wing (plate 4, figures 15, 16) 3

— Forewing without strongly contrasting dark borders associated with transverse lines 4

3. Costa of valva produced dorsally near its apex into a broad, rounded lobe ..... *nonparilella* p. 97

— Costa of valva deflexed ventrally near its apex and with spinelike projection (text figure 49 *a*) ..... *knudsoni* p. 96

4. Forewing with broad, dark, median transverse band (plate 4, figures 13, 14) ..... *thurberiae* p. 95

— Forewing without broad, dark transverse band 5

5. Forewing with antemedial line bordered with black patch of scales (plate 4, figures 6–9) ... . *anthophila* p. 94

— Forewing without antemedial line and associated black patch (plate 4, figures 10–12) ... . *proximanthophila* p. 95

Sosipatra rileyella (Ragonot)

PL. 3, FIG. 43; PL. 4, FIGS. 1–5. TEXT FIGS. 40 *d*; 47 *a–d* (RWH 6015).

Ephestia rileyella Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 17. Type locality: Utah. [MNHP]

The predominately cream color of the forewing of *rileyella* makes this species difficult to confuse with others in the genus. Wing length 6.5–11.0 mm.

Last stage larva about 14 mm long. Head yellowish brown to reddish brown with slightly darker tonofibrillary platelets. Thoracic shield yellowish brown with broad, dark patch along caudal and lateral margins. Body white or yellowish white. SD1 pinaculum rings of mesothorax and eighth abdominal segment dark brown.

Adults have been reared from seed capsules of datil yucca (*Yucca baccata* Torrey), Joshuatree yucca (*Yucca brevifolia* Engelmann), Mohave yucca (*Yucca shidigera* Roezl ex Ortgies), Whipple's yucca (*Yucca whipplei* Torrey) and nolina (*Nolina* sp.) (Heinrich, 1956; Powell and Mackie, 1966).

S. rileyella is widely distributed in most of the western United States. Flight dates have been recorded as follows: Nebraska (June); Wyoming (July);

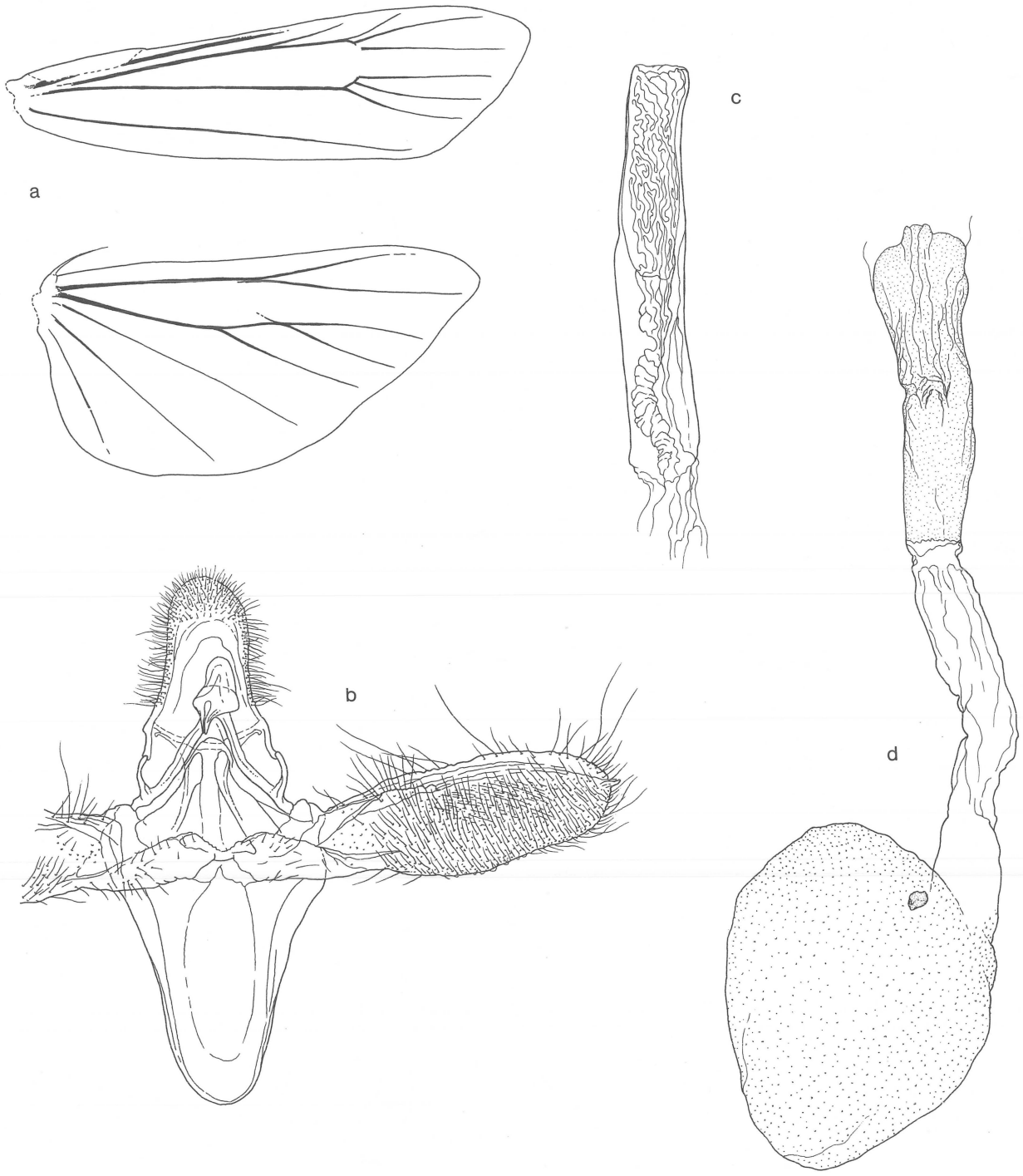


FIGURE 47: VENATION AND GENITALIA *SOSIPATRA RILEYELLA*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 943); *c.* Aedoeagus; *d.* corpus bursae and ductus bursae (HHN 1704).

Colorado (June, July); Utah (June); Nevada (June, July); California (March–October); Texas (April–June); New Mexico (July); Arizona (April–June, September, October). *S. rileyella* also occurs in northern Mexico.

Sosipatra anthophila (Dyar)

PL. 4, FIGS. 6–9 (RWH 6016).

Eurythmia anthophila Dyar, 1925, *Ins. Insc. Mens.*, **13**: 226.

Type locality: Uvalde, Texas. [USNM]

The forewing of *anthophila* is mostly gray or brownish gray with a broad, mostly white, streak along costa. The antemedial line is weakly developed, and its position and configuration are established principally by a patch of black scales along its outer border; the postmedial line is slightly more strongly developed than the antemedial line and outlined in black; some pale-brown or reddish-brown scales occur on posterior ½. The male genitalia are similar to the genitalia of *rileyella,* but have the enlarged apical part of the gnathos more slender (Heinrich, 1956: figure 618), and the female genitalia have the corpus bursae more strongly scobinate than in other *Sosipatra* (Heinrich, 1956: figure 1106). Wing length 6.0–8.0 mm.

The immature stages are unknown.

Larvae have been reported (Heinrich, 1956) to be associated with flowers of cactus (*Opuntia*).

S. anthophila is known from western Texas (24 March, 18 May, 2 October); New Mexico (10–22 May) and Arizona (24 April–24 August).

Sosipatra proximanthophila Neunzig, NEW SPECIES

PL. 4, FIGS. 10–12. TEXT FIG. 48 *a–c.*

Sosipatra proximanthophila Neunzig.
Type locality: W end Central Valley, "Cascada," Santa Cruz Island, Sta. Barbara Co., California. [UCB]

DIAGNOSIS. *S. proximanthophila* is similar in appearance to *anthophila.* However, the forewing of the former species lacks both the antemedial line and black patch of scales associated with the antemedial line. The platelike element bearing the hook at the apex of the gnathos of *proximanthophila* is not produced posteriorly beyond its point of attachment to the lateral arms of the gnathos, whereas in *anthophila* this same structure extends into the uncus.

DESCRIPTION. Wing length 6.5–7.5 mm. Head: frons dark gray to brownish gray; labial palpus outwardly mainly fuscous dusted with white, particularly basal segment. Thorax: collar brownish gray to pale brown (brownish-gray scales sometimes dusted with white); dorsum of thorax chiefly pale brown. Forewing: ground color gray or brownish gray; costa with broad, mostly white, streak; antemedial line absent; postmedial line mainly indistinct, sometimes moderately well developed near costal margin; posterior ½ with pale-brown or reddish-brown scales; distal spots indistinct. Hindwing: brownish white. Male genitalia (text figure 48 *a, b*) with median plate between arms of gnathos not expanded posteriorly; vinculum about 1½ times greatest width. Female genitalia (text figure 48 *c*) similar to those of *anthophila.*

The immature stages of *proximanthophila* are not known.

TYPES. Holotype: ♂. Sta. Cruz Island, "Cascada," W end Central Valley, Sta. Barb. Co., California; Bl. trap; V-23/24-84; J. Powell; genitalia slide 4587 JAP. UCB. Paratypes: 1 ♂, 2 ♀. California: Sta. Cruz Island, Prisoner's Harbor Cr., Sta. Barb. Co.; black lite trap, IX-25-78; J. Powell (2 ♀). Sta. Catalina Is., Middle Cyn., L. A. Co.; at black light; V-1/3-1978; J. A. Chemsak (1 ♂). UCB.

Sosipatra thurberiae (Dyar)

PL. 4, FIGS. 13, 14 (RWH 6017).

Eurythmia thurberiae Dyar, 1917, *Ins. Insc. Mens.,* **5**: 46.
Type locality: Bowie, Arizona. [USNM]

S. thurberiae has a dark, broad, transverse band between the antemedial and postmedial lines of the forewing. The species is somewhat similar in general appearance to *Vitula insula,* but *thurberiae* has the antemedial line straighter, and the terminal part of the wing darker (pale, same color as basal part in *insula*). *S. thurberiae* also resembles *Sosipatra nonparilella* (Dyar) and *Sosipatra knudsoni* Neunzig; however, the black borders of the transverse lines are strongly developed in the latter two species and not clearly defined in *thurberiae.* Wing length of *thurberiae* 5.0–9.0 mm. Male genitalia of *thurberiae* with the apical part of the gnathos only slightly enlarged (Heinrich, 1956: figure 619). The female genitalia with very slender signum (Heinrich, 1956: figure 1107).

The immature stages have not been described. According to Heinrich (1956), larvae have been collected from cynipid oak apple galls on *Quercus* spp. and seed pods of *Gossypium* (=*Thurberia*) sp. and California redbud (*Cercis occidentalis* Torrey ex Gray). They presumably feed on both plant structures and fragments of insects.

S. thurberiae has been collected in northern Arizona (June), northern California (April–September), southern Oregon (July, August) and northern Mexico (August).

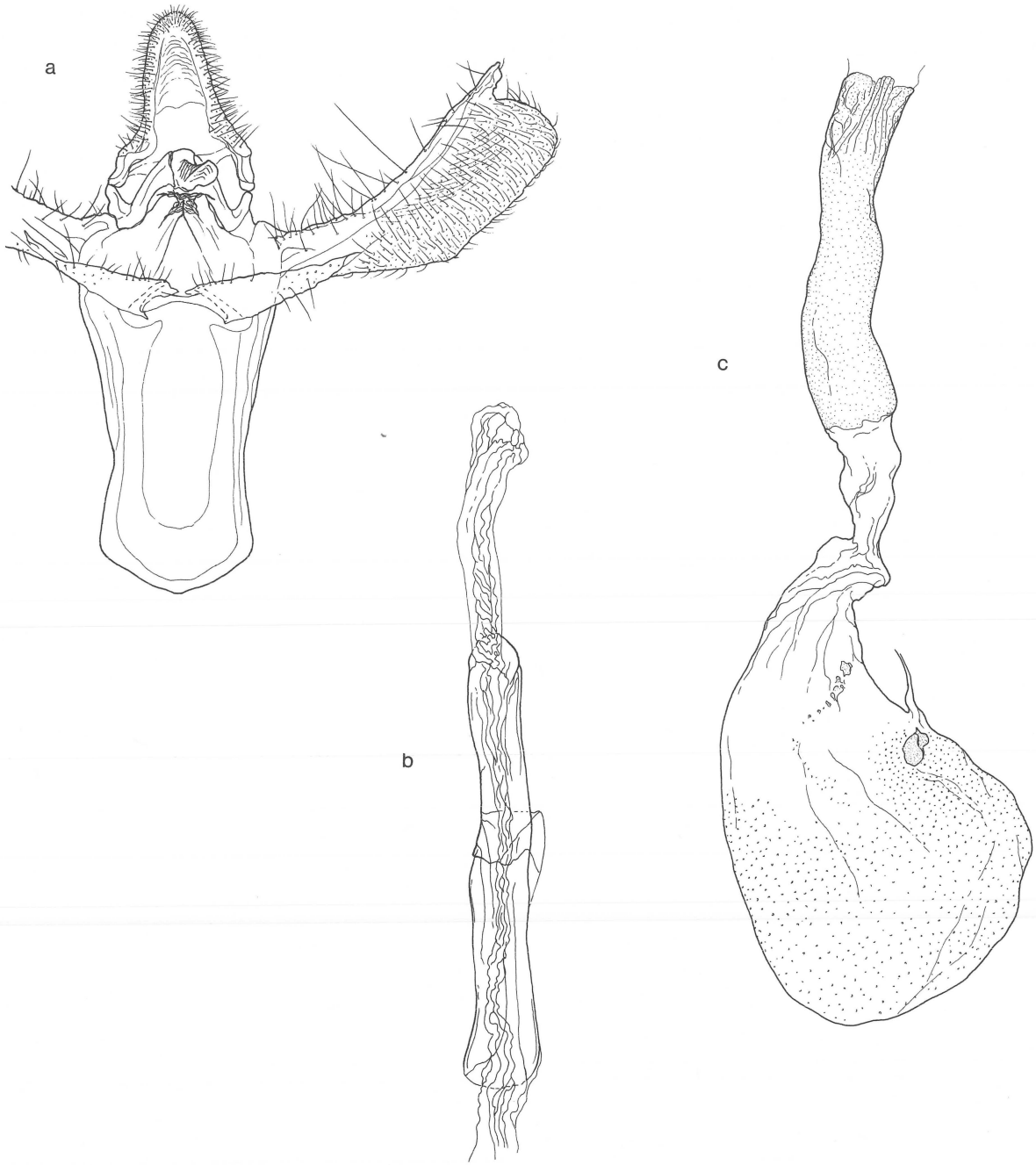


FIGURE 48: GENITALIA OF *SOSIPATRA PROXIMANTHOPHILA*

a. Male genitalia, holotype (most of left valva and aedoeagus omitted) (JAP 4587); *b.* Aedoeagus; *c.* Corpus bursae, ductus bursae, and part of ductus seminalis (J.A. DeB. 200).

Sosipatra knudsoni Neunzig, NEW SPECIES
PL. 4, FIG. 16. TEXT FIG. 49 *a, b.*

Sosipatra knudsoni Neunzig.
Type locality: Paint Gap Hills, Big Bend Nat'l Park, Brewster Co, Texas. [USNM]

DIAGNOSIS. Adults of *knudsoni* are easily mistaken for those of *Sosipatra nonparilella,* but the costa of the valva of *knudsoni* is slightly deflexed ventrally near its apex, whereas in *nonparilella* the costa of the valva near its apex is strongly lobed dorsally.

DESCRIPTION. Wing length 4.5–8.5 mm. Head: frons fuscous to black dusted with white; vertex fuscous dusted with white in female, fuscous, brown, pale brown, and white in male; labial palpus fuscous

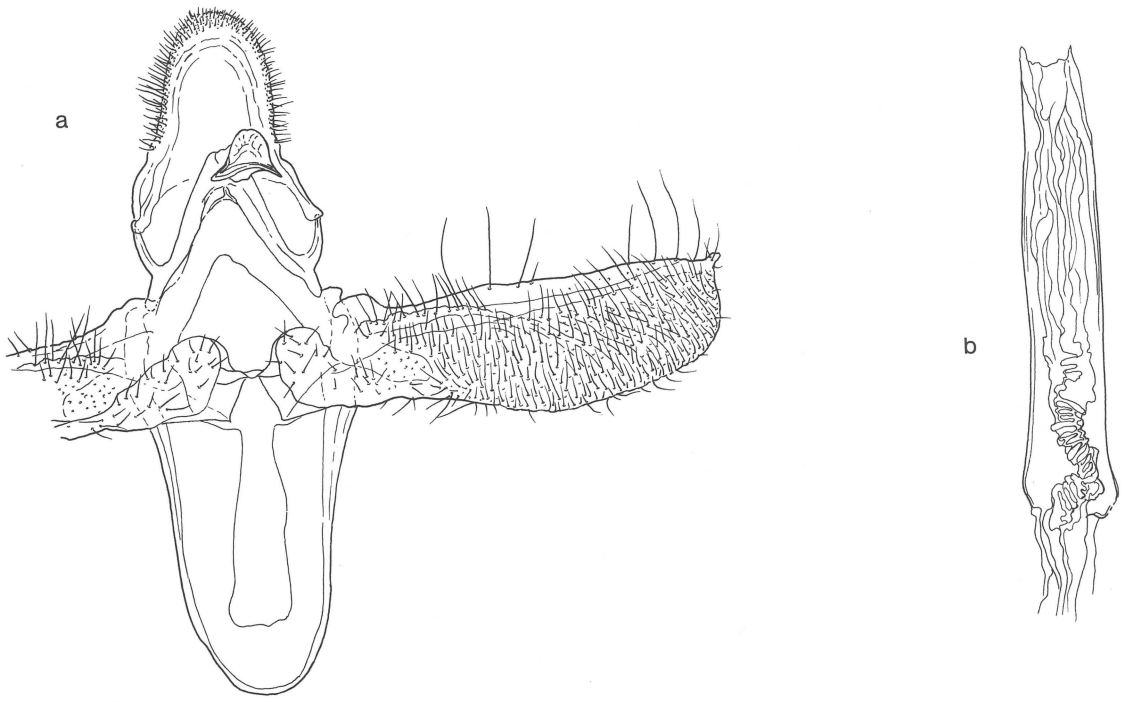


FIGURE 49: MALE GENITALIA OF *SOSIPATRA KNUDSONI*
a. Genitalia, holotype (most of left valva and aedoeagus omitted) (ECK 869); *b.* Aedoeagus.

to black dusted with white. Thorax: collar fuscous dusted with white; dorsum of thorax fuscous dusted with white anteriorly becoming pale brown dusted with white posteriorly. Forewing: ground color fuscous; basal and subbasal areas dusted with white, posterior ½ with subbasal patch of reddish brown (male) or pale brown (female); antemedial and postmedial lines white; medial area partly white, with a few reddish-brown or pale-brown scales, and with many black scales, particularly bordering antemedial and postmedial lines and along costa from antemedial line to discal spots; terminal area dusted with white and with scattered black and, sometimes (male), with a few reddish-brown scales, particularly on posterior ½. Hindwing: pale brown, darker along veins and at margin. Male genitalia (text figure 49 *a, b*) similar to those of *thurberiae*; apical process of gnathos of *knudsoni* larger than in *thurberiae,* and length of vinculum 1⅓ times greatest width in *knudsoni* and 1½ times greatest width in *thurberiae.* Female genitalia similar to those of *thurberiae.*

The immature stages of *knudsoni* are unknown.

TYPES. Holotype: ♂. Big Bend Nat'l Park, Paint Gap Hills, Brewster Co., Texas; 2-IV-84; E. Knudson; genitalia slide 869 ECK. USNM. Paratypes: 1 ♂, 4 ♀. Texas: Brewster Co., Big Bend National Park: Rio Grande Village; 6-IV-84; E. C. Knudson; genitalia slide 850 ECK. (3 ♀). 30-XI-85; E. C. Knudson; genitalia slide 2452 HHN (1 ♂). Hot Springs, 4-IV-84; E. C. Knudson (1 ♀). ECK, NCSU, USNM.

The species is named for E. C. Knudson who has been particularly helpful in providing specimens and information on Texas phycitines.

Sosipatra nonparilella (Dyar)

PL. 4, FIG. 15 (RWH 6018).

Ephestia nonparilella Dyar, 1904, *Proc. Ent. Soc. Washington,* **6**: 113.
Type locality: Santa Rita Mts, Arizona. [USNM]

The species is easily identified by examining the male genitalia that differ greatly from those of other *Sosipatra* in our fauna: the costa of the valva is produced dorsally near its apex into a broad, rounded lobe (Heinrich, 1956: figure 621). The wing length is 8.0–9.0 mm.

S. nonparilella has been collected in the Santa Rita and Chiricahua Mountains (Southwestern Research Station) of Arizona in June and May, respectively, and in west Texas (Brewster and Davis Counties) in May, August, and October.

GENUS
Heinrichiessa Neunzig, NEW GENUS

Gender: Feminine.
Type species: *Heinrichiessa sanpetella* Neunzig.

Heinrichiessa is established for the new species *sanpetella.* The genus is similar to *Sosipatra,* but differs in the following features: gnathos apically simple; valva relatively small; costa of valva with a sclerotized, subbasal, fingerlike structure and a distal, short, rounded, subapical projection; inner base of valva with distinct setiferous lobe; ductus bursae and corpus bursae small compared to rest of genitalia (compare text figure 50 *c* and 50 *d*); corpus bursae with sclerotized wrinkles near union with ductus bursae; signum of corpus a thin plate bearing several pointed spines.

Antenna simple in both sexes; sensilla trichodea (cilia) of shaft of male moderately abundant, and at base of shaft about ⅓ as long as basal diameter of shaft. Frons convex, with anteriorly projecting scales. Labial palpus of both sexes oblique, reaching almost to vertex, third segment about ⅔ as long as second. Maxillary palpus simple. Haustellum well developed. Ocellus present. Basal ½ of costa of forewing of male straight to slightly convex; under surface with costal fold enclosing tufts of sex-scales and with associated distally projecting cluster of exposed scales. Forewing without raised scales; with 9 veins; R_2 curved; R_{3+4} and R_5 completely united, base weak; M_1 with weak base; M_2 and M_3 completely fused; CuA_1 from lower angle of cell; CuA_2 from well before lower angle of cell. Hindwing (text figure 33 *d*) with 6 veins; $Sc+R_1+Rs$ completely fused; M_1 from upper angle of cell; M_{2+3} connate with CuA_1 at base; CuA_2 from well before lower angle of cell; cell about ½ length of wing. Eighth abdominal segment with paired dorsal tufts of scales; each tuft consisting of several clusters of simple, sometimes sinuous, scales. Male genitalia (text figure 50 *a, b*) with terminal margin of uncus slightly convex; gnathos simple, slightly knobbed apically; transtilla incomplete; juxta H-shaped; valva rather small, with setiferous protuberance near inner base, subbasal, dorsally projecting slender pointed element, and distal blunt projection on costa (distal projection before apex of valva); aedoeagus relatively slender, with an elongate, weakly formed cornutus; vinculum longer than greatest width. Female genitalia (text figure 50 *c, d*) with posterior ½ proportionately larger than anterior ½; collar of eighth segment with anterior margin strongly delineated; ductus bursae longer than corpus bursae and sclerotized for over ½ its length; posterior ½ of sclerotized section with longitudinal wrinkles; corpus bursae membranous with spine-bearing signum, a few microspines associated with signum, and some sclerotized wrinkled areas near junction with ductus bursae; ductus seminalis attached to corpus bursae near signum.

The immature stages of *Heinrichiessa* are unknown.

Heinrichiessa sanpetella Neunzig, NEW SPECIES
PL. 4, FIGS. 17–20. TEXT FIGS. 33 *d*; 50 *a–d.*

Heinrichiessa sanpetella Neunzig.
Type locality: Ephraim Can[yon], 5,600′, creek bottom in oak-pinyon-juniper zone, Sanpete Co., Utah. [USNM]

DIAGNOSIS. The male and female genitalia, as outlined in the description of the genus, and shown in text figure 50 *a–d,* are diagnostic for *sanpetella.*

DESCRIPTION. Wing length 6.0–7.5 mm. Head: frons pale brown to fuscous; vertex white, sometimes with some pale-brown scales; labial palpus with outer surface white at base, fuscous distally. Thorax: collar white; dorsum of thorax white, with fuscous scales mesially in some specimens. Forewing: ground color white with a few scattered black scales; base with black costal streak, adjacent, small, black, more or less circular spot and black streak near posterior margin; antemedial line white, indistinguishable from ground color, bordered distally by curved black line; postmedial line blending with ground color, bordered basally by angled black line; discal spots black, fused. Hindwing: mainly white with pale-brown border. Male and female genitalia (text figure 50 *a–d*) as in description of genus.

The immature stages of *sanpetella* are unknown.

TYPES. Holotype: ♂. Utah, Sanpete Co., Ephraim Can[yon], 5,600′, 30-VII-1981, Ronald W. Hodges, creek bottom in oak-pinyon-juniper zone; genitalia slide 775 HHN. USNM. Paratypes: 4 ♀. Utah: Same collection data as for holotype; genitalia slide 776 HHN (1 ♀). Sanpete Co., Ephraim Can[yon], 7,100′, Major's Flat, 3-VIII-1981, R. W. Hodges, oak-pinyon-juniper zone; genitalia slide 2308 HHN (2 ♀). Major's Flat, 7,100 ft., nr. Ephraim, Sanpete County, 31 July 1980, D. C. Ferguson (1 ♀). USNM.

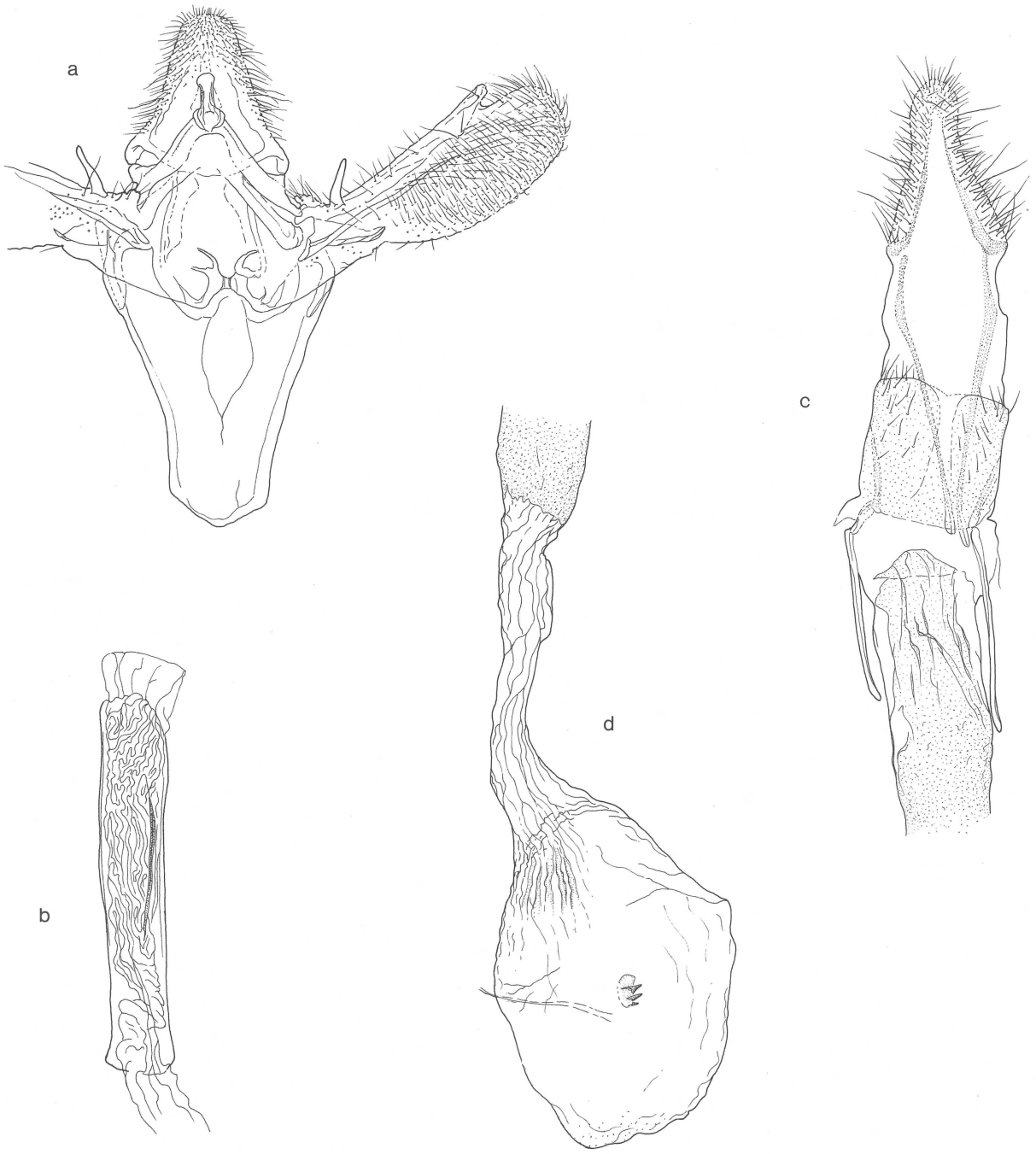


FIGURE 50: GENITALIA OF *HEINRICHIESSA SANPETELLA*

a. Male genitalia, holotype (most of left valva and aedoeagus omitted) (HHN 775); *b.* Aedoeagus; *c.* Posterior part of female genitalia (HHN 776); *d.* Anterior part of female genitalia (drawn to same scale as figure *c*) (HHN 776).

GENUS

Ribua Heinrich

Ribua Heinrich, 1940, *Proc. Ent. Soc. Washington,* **42**: 31.

Type species: *Ribua innoxia* Heinrich, 1940. Original designation.

Heinrich (1956) included three species in *Ribua.* All occur on islands in the Caribbean. Recently, an undescribed species was collected in Florida. *Ribua* is a close relative of *Plodia* Guenée. An easily observable feature common to females of both groups is the somewhat enlarged, nearly porrect, labial palpus. *Ribua* can be most easily distinguished from

Plodia by differences in the male genitalia; the asymmetrical, forked apex of the gnathos in *Ribua* is particularly diagnostic.

Antennal shaft of both sexes simple; sensilla trichodea (cilia) of male moderately abundant and at base of shaft about ½ as long as basal diameter of shaft. Frons convex and with anteriorly projecting scales. Labial palpus of both sexes porrect (text figure 52) or male palpus oblique and female palpus porrect; female labial palpus longer than male palpus. Maxillary palpus simple. Haustellum well developed. Ocellus present. Basal ½ of costa of forewing of male (text figure 51 *a*) slightly convex; under surface with costal fold containing tuft of scales. Forewing smooth scaled, with 9 veins; R_2 closely approximate to R_{3+4+5} for some distance from cell; M_1 from below upper angle of cell; M_2 and M_3 fused, closely approximate to CuA_1 at base; CuA_1 from lower angle of cell; CuA_2 from before lower angle. Hindwing (text figure 51 *a*) with 6(7) veins; $Sc+R_1$ and Rs usually completely fused (Sc rarely shortly free of Rs, represented as short spur at costa); M_1 from slightly below upper angle of cell; M_{2+3} and CuA_1 approximate at base; CuA_2 from well before lower angle of cell; cell less than ½ length of wing. Eighth abdominal segment of male with paired dorsolateral scale tufts; each tuft a single cluster of simple, thin, more or less straight scales. Male genitalia (text figure 51 *b, c*) with uncus somewhat narrow and rounded apically; apical process of gnathos asymmetrical, and bifurcate; transtilla a narrow band fused medially to gnathos; juxta a broad plate with short lateral arms; valva simple with sclerotized costa projecting just before apex; aedoeagus with weakly sclerotized element; vinculum longer than greatest width. Female genitalia (text figure 51 *d*) with ductus bursae longer than corpus bursae, sclerotized for over ½ its length; corpus bursae membranous, with or without a signum (when present, signum consists of one or two bluntly pointed discs); ductus seminalis attached near anterior end of corpus bursae.

Some information on the immatures was published by Heinrich (1940). Last stage *innoxia* larvae have distinct pinaculum rings associated with the SD1 setae of the mesothorax and eighth abdominal segment. Head only slightly roughened, with indistinct tonofibrillary platelets. Body with integument granulate and darkened. Tonofibrillary platelets on dorsum of body pale and rather conspicuous. Mandible simple. Maxilla with sensilla trichodea simple. *R. innoxia* pupae are easily identified. The last abdominal segment possesses a pair of short, very stout, ventrally curved cremastral setae (Heinrich, 1940: 40). The only other phycitine pupa that I am aware of with similar cremastral setae is that of *Ectomyelois ceratoniae. R. innoxia* pupae can be distinguished from pupae of *ceratoniae* because the former species lacks the dorsal thoracic and abdominal processes found on the pupa of the latter species, and the caudal setae of *innoxia* originate more ventrally than in the pupa of *ceratoniae.*

Larvae of *Ribua* are associated with fungi (Capnodiaceae) growing on decaying, or honey-dew covered, plant substrates (Heinrich 1940, 1956; Drooz and Neunzig, 1988).

Ribua droozi Neunzig, NEW SPECIES
PL. 4, FIGS. 21–24. TEXT FIGS. 51 *a–d*; 52.

Ribua droozi Neunzig.
Type locality: White Springs, Hamilton Co., Florida. [USNM]

DIAGNOSIS. The most obvious difference separating *droozi* from previously described *Ribua* is the complete absence in *droozi* of red or reddish-brown scales on the head, thorax, and forewing (only the costal fold of *droozi* males is edged in red). Other *Ribua* all have abundant red or reddish-brown scales on the body and wings. The male genitalia of *droozi* are similar to those of *innoxia,* but the vinculum of the former species is only slightly longer than its greatest width, whereas the vinculum is twice as long as its greatest width in the latter species.

DESCRIPTION. Wing length 5.5–7.0 mm. Head: frons fuscous; vertex pale brown to brown dusted with white; labial palpus porrect (text figure 52), white at base with 2nd and 3rd segments fuscous on the outer surface. Thorax: collar brown, or brown dusted with white; dorsum of thorax brown. Forewing: ground color fuscous; base lightly dusted with white; antemedial line obscure, consisting of a relatively broad patch of fuscous scales dusted with white; postmedial line similar to antemedial line, but narrower; medial area dusted with white; discal spots not evident; under surface of male with costal fold edged with red. Hindwing: pale white, edged with brown. Male genitalia (text figure 51 *b, c*): as given under description of genus; vinculum only slightly longer than greatest width. Female genitalia (text figure 51 *d*) as described for genus.

The immature stages of *droozi* have not been described.

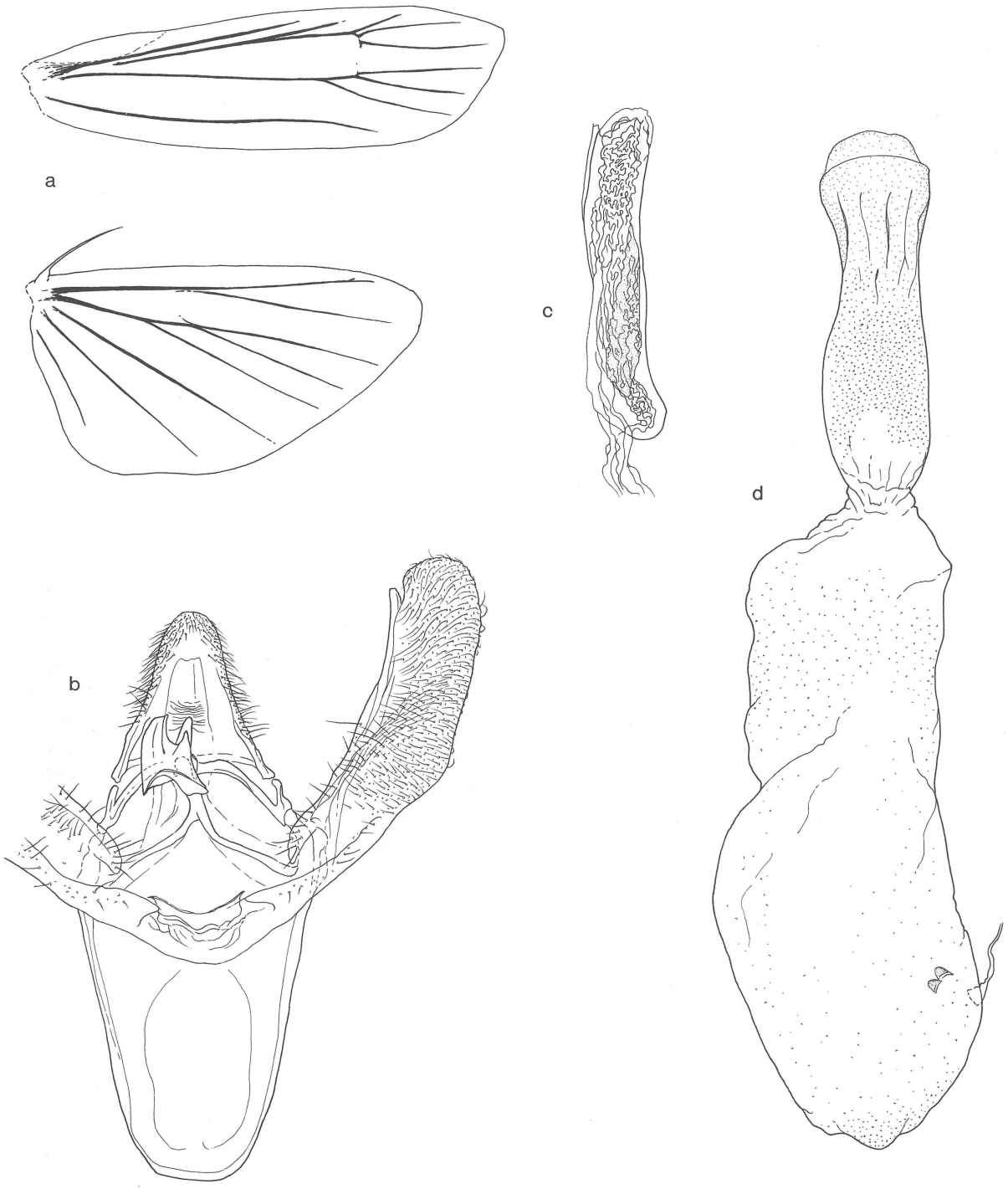


FIGURE 51: VENATION AND GENITALIA OF *RIBUA DROOZI*

a. Male forewing and hindwing; *b.* Male genitalia, holotype (most of left valva and aedoeagus omitted) (HHN 1163); *c.* Aedoeagus; *d.* Corpus bursae, ductus bursae, and part of ductus seminalis (HHN 1777).

In Florida, adult *droozi* (misidentified by me as *Ribua innoxia* in Drooz and Neunzig, 1988) have been reared from pine terminals covered with sooty mold (*Capnodium*) growing on honey-dew excreted by scale insects. It is very likely that the larvae feed on fungi, but this has not been demonstrated. *R. droozi* is known only from northern and central Florida.

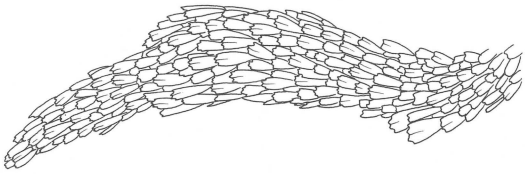


FIGURE 52: LABIAL PALPUS (LEFT SIDE) OF MALE *RIBUA DROOZI*

TYPES. Holotype: ♂. White Springs, Hamilton Co., Florida; reared from larva on pine terminals, collected Charles Lassiter, 30 Sept. 1986; genitalia slide 1163 HHN. USNM. Paratypes: 1 ♂, 6 ♀. Florida: Same data as for holotype; genitalia slide 1777 HHN (6 ♀). Moss Park, Orange Co., light trap, 4 Jan '86; genitalia slide 1410 HHN, L. C. Dow (1 ♂). NCSU, USNM.

R. droozi is named for Arnold T. Drooz, retired United States Department of Agriculture Forest Service entomologist.

GENUS
Plodia Guenée

Plodia Guenée, 1845, *Ann. Soc. ent. France,* **3**: 318.
Type species: *Tinea interpunctella* Hübner, [1813]. Monotypy.

Plodia is a small genus with two included species. *Plodia dolorosa* Dyar is apparently confined to Central America, but the well known Indianmeal moth, *Plodia interpunctella* (Hübner), is cosmopolitan. The close relationship of *Plodia* and *Ribua,* and the means for separating the two genera, are given under *Ribua.*

Antenna simple in both sexes; sensilla trichodea (cilia) of shaft of male moderately abundant, and at base of shaft about ⅓ as long as basal diameter of shaft. Frons convex, with anteriorly projecting scales. Labial palpus of both sexes porrect (text figure 54). Maxillary palpus simple. Haustellum well developed. Ocellus present. Forewing of male (text figure 53 *a*) with costa slightly convex at basal ½; under surface with costal fold covering tuft of sex-scales, and with an associated, distally directed, uncovered cluster of scales; forewing without distinctly raised scales (most dark scales of *interpunctella* very slightly curled and slightly raised above other scales); with 9 veins; R_2 separated from R_{3+4+5} at base; M_1 from below upper angle of cell; M_{2+3} well separated from CuA_1 at base; CuA_1 from lower angle of cell; CuA_2 from before, but near lower angle of cell. Hindwing (text figure 53 *a*) with 6 or 7 veins; $Sc+R_1+Rs$ completely fused, or almost completely fused, to costa; M_1 from upper angle of cell; M_{2+3} and CuA_1 connate; CuA_2 from well before lower outer angle of cell; cell about ½ length of wing. Eighth abdominal segment of male with paired, dorsal scale tufts; each tuft consisting of two to four clusters of simple, usually slightly curved scales. Male genitalia (text figure 53 *b, c*) with uncus relatively narrow, rounded apically; gnathos with apex a short, blunt hook; transtilla a narrow, curved band (sometimes (*dolorosa* Dyar) weakly united at their apexes); juxta a band or plate with short, lateral lobes; valva with low, rounded, projection at ½ length of costa and a weakly produced, more slender projection at apex of costa; aedoeagus with a weakly sclerotized element; vinculum about as long as broadest width. Female genitalia (text figure 53 *d*) with ductus bursae partly sclerotized and scobinate, inflated near its middle; corpus bursae membranous with many, relatively weakly developed, scobinations, and with signum a group of three to six small, blunt spines; ductus seminalis attached to corpus bursae at about its middle.

The immatures of only *interpunctella* are known. The last stage larva (text figure 55) has well-formed, but pale, pinaculum rings associated with SD1 setae of mesothorax and SD1 setae of eighth abdominal segment. Head slightly roughened. Body pale, without stripes. Mandible simple. Maxilla with sensilla trichodea entire.

Pupa (of *interpunctella*) with relatively smooth head and thorax; abdomen without punctures. Thoracic spiracles present. No gibba on segment 9. Cremastral setae consisting of four, spinose, central, loosely grouped, slightly hooked setae and two pair of additional, more lateral, slightly hooked, spinose setae.

Larvae of *interpunctella* are well known for their destruction of stored food products. The host relationships of *dolorosa* have not been determined.

Plodia interpunctella (Hübner) (Indianmeal Moth*; Pyrale Indienne de la Farine, f., Fr.)
PL. 4, FIGS. 25–34. TEXT FIGS. 53 *a–d*; 54; 55 (RWH 6019).

Tinea interpunctella Hübner, [1813], *Sammlung Europäischer Schmetterlinge, Lepidoptera* **8** Tineae: pl. 45, fig. 310.
Type locality: Europe. [lost]

Tinea zeae Fitch, 1856, *Trans. New York State Agric. Soc.,* **16**: 320.
Type locality: New York. [USNM]

Plodia interpunctella castaneella Reutti, 1898, *Ubersicht Lepidopteren-Fauna Grossherzogtums Baden,* 179.
Type locality: Speyer, Pflaz, Germany. [lost]

Unadilla latercula Hampson, 1901, *Ann. Mag. Nat. Hist.,* (7) **7**: 255.
Type locality: Nassau, Bahamas. [BMNH]

Ephestia glycinivora Matsumura, 1917, *Dai-Nippon Gaichyu Zensho,* 561.
Type locality: Hokkaido, Japan. [EIHU]

P. interpunctella is a pretty moth, but its attractiveness is not always appreciated because of its pest status. The forewings usually are contrasting reddish brown and white, ornamented with patches of shiny, metallic-appearing scales. The amount of red and the purity of the white varies (plate 4, figures 25–34). Wing length 5.0–8.5 mm.

Last stage larva (text figure 55) 9.0–15.0 mm long. Head brownish yellow, darker at adfrontals, frontoclypeus, and near mouthparts, with indistinct tonofibrillary platelets. Thoracic shield mainly brownish yellow. Body white (grayish white or yellowish white) to pink. SD1 pinaculum rings on mesothorax and on eighth abdominal segment pale brownish yellow. Of particular diagnostic importance is the absence of pigmented pinacula at the bases of other setae. Neunzig (1987) published a key for the separation of larvae of *interpunctella* from the larvae of other stored products phycitines.

Pupa 6.0–11.0 mm long and pale brown. Maxilla reaching or almost reaching caudal margin of wings (not—". . . never reaching the caudal margin. . . ." as stated in Mosher (1916: 75)). See description of the genus for other features.

P. interpunctella is a major pest of many stored foods. It usually infests seeds, or milled seeds, of grasses (wheat (*Triticum*), corn (*Zea*), oats (*Avena*), etc.), dried or processed fruits (apricot (*Prunus armeniaca* L.), peach (*Prunus persica* L. Batsch), date (*Phoenix dactylifera* L.), raisin (*Vitis vinifera* L.), chocolate (*Theobroma cacao* L.), etc.), or stored nuts (Persian walnut (*Juglans regia* L.), almond (*Prunus amygdalus* Batsch), peanut (*Arachis hypogaea* L.), etc.). Larvae also feed on dried insects, herbarium specimens, and many other materials. Furthermore, Abdel-Rahman et al. (1969) reported successful development of *interpunctella* larvae on the fungus *Aspergillus halophilicus* Sartory, Sartory, and Meyer, which grows on substrates with high sugar content. The ability of larvae of *interpunctella* to develop on this fungus appears to be similar to that of *Ribua* species that apparently also feed on fungus growing on sugar-rich substrates.

Considerable literature deals with the feeding habits and development of *interpunctella.* As mentioned by Heinrich (1956: 299) the most complete studies have been those of Richards and Thomson (1932) and Lehmensick and Liebers (1938). The biology of *interpunctella* has been studied in detail on dried fruit in California by Hamlin et al. (1931). Although *interpunctella* usually occurs in buildings, it has been taken out of doors at light, or at pheromone-baited traps, mainly during the summer months.

According to Heinrich (1956: 298) *interpunctella* is native to the New World, despite the fact that Hübner's description was based on moths collected in Europe. Its presence in Europe in the early nineteenth century was the result of the importation of infested materials. The existence of another species of *Plodia* (*dolorosa*), and the closely related genus *Ribua,* in the Americas, supports this conclusion.

GENUS
Ephestia Guenée

Ephestia Guenée, 1845, *Ann. Soc. ent. France,* **3**: 319.
Type species: *Tinea elutella* Hübner, 1796. Designated by Demarest, 1857, *In* Chenu, *Encyclopédie d'Histoire Naturelle,* 255.

Hyphantidium Scott, 1859, *Proc. Zool. Soc. London,* **27**: 207.
Type species: *Hyphantidium sericarium* Scott, 1859, considered to be a synonym of *Tinea elutella* Hübner, 1796. Monotypy.

Anagasta Heinrich, 1956, *U. S. Natl. Mus. Bull.,* **207**: 299. NEW SYNONYMY.
Type species: *Ephestia kühniella* [sic] Zeller, 1879. Original designation.

Ephestia contains about 12 species; most are restricted to the Palearctic Region. Two are cosmopolitan, well-known, stored products pests. The genus is most closely related to *Cadra* Walker. In *Ephestia* the papillae anales (ovipositor lobes) are normal in appearance, and there are no scale tufts on the lamella postvaginalis; *Cadra* has the papillae anales reduced and scale tufts associated with the lamella postvaginalis. Furthermore, *Ephestia* has the ductus bursae relatively simple (sometimes with scobinations), whereas in *Cadra* the ductus bursae has a longitudinal row of strongly sclerotized ridges forming a band, or a spiral of spines. The males of

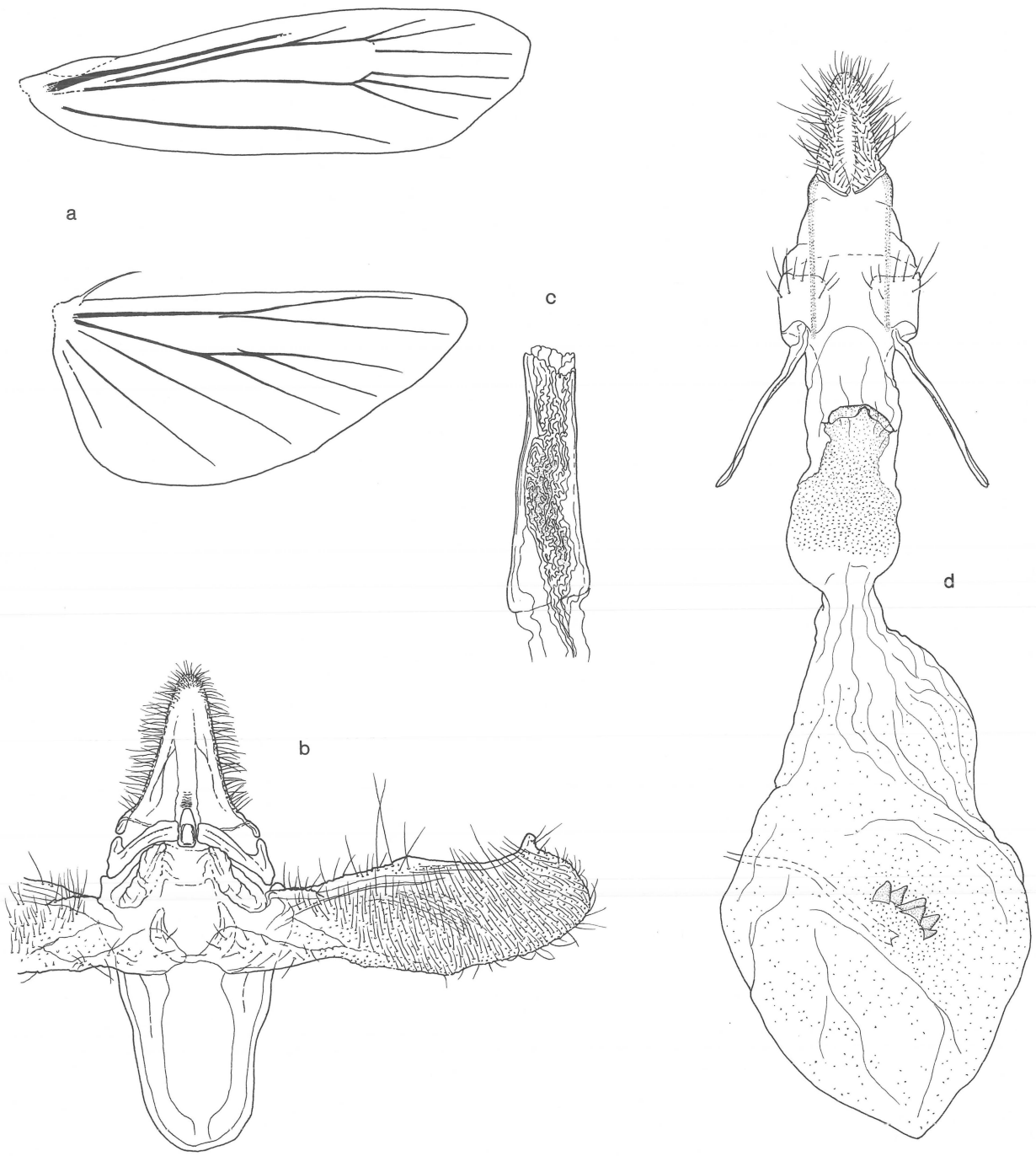


FIGURE 53: VENATION AND GENITALIA OF *PLODIA INTERPUNCTELLA*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 862); *c.* Aedoeagus; *d.* Female genitalia (HHN 1700).

Ephestia have the costa of the valva simple or with a distal extension of the costa (*parasitella* (Staudinger) with costal projection at about ½ distance to apex), the valva of *Cadra* species have costal projections located at ½ to ⅔ the distance to the apex of the valva. Of particular significance is the character separating the known larvae of *Ephestia* and *Cadra*; seta SD2 on abdominal segment eight is always distinctly more remote from the spiracle in *Ephestia* than in *Cadra.*

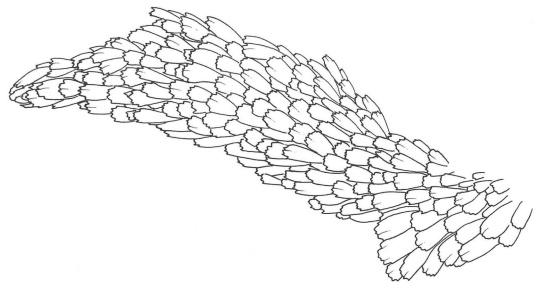


FIGURE 54: LABIAL PALPUS (LEFT SIDE) OF MALE *PLODIA INTERPUNCTELLA*

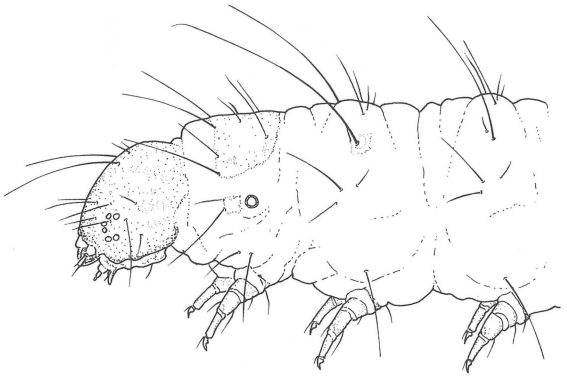


FIGURE 55: LAST STAGE LARVA OF *PLODIA INTERPUNCTELLA* (LATERAL VIEW OF HEAD AND THORAX)

Antenna of male simple, sensilla trichodea (cilia) of shaft moderately abundant and at base of shaft ⅓–½ as long as basal diameter of shaft. Frons convex, sometimes with anteriorly projecting scales. Labial palpus of both sexes upturned, reaching about to vertex, usually smoothly scaled (segments one and two broadly scaled in *columbiella* Neunzig, text figure 59 *e*). Maxillary palpus simple. Haustellum normal. Ocellus present. Basal ½ of costa of forewing of male (text figure 56 *a*) slightly convex, under surface usually with a costal fold (fold missing in *kuehniella* Zeller). Forewing smooth scaled, with 9 veins; R_2 separated from R_{3+4+5} at base; M_1 from just below upper angle of cell, sometimes free at base, slightly curved or straight; fused M_{2+3} well separated from, to connate with, CuA_1; CuA_2 from before lower angle of cell. Hindwing (text figure 56 *a*) with 6(7) veins; $Sc+R_1$ and Rs usually completely fused (Sc sometimes apparent as a small, distal spur from Rs); M_{2+3} and CuA_1 either approximate or shortly stalked at base; CuA_2 from cell, well before lower angle of cell; cell about ⅓ to ½ length of wing. Eighth abdominal segment of male usually with paired dorsal scale tufts (*inquietella* Zerny apparently without scale tufts); when present, each tuft consisting of one to three clusters of scales; scales of some tufts sometimes sinuate and second group of some species enlarged subbasally. Male genitalia (text figures 56 *b, c*; 58 *a, b*; 59 *a, b*) with uncus somewhat elongate to broad, with distal part rounded (or somewhat truncate); gnathos usually forked apically; transtilla incomplete or with elements weakly fused apically, apex of elements also sometimes with flaring projections; juxta a more or less U-shaped plate with setiferous lateral lobes; valva usually simple, sometimes with short costal projection (*kuehniella, parasitella, columbiella*); aedoeagus with sclerotized band or row of sclerotized wrinkles, or with a distinct cornutus, vinculum about as long as greatest width. Female genitalia (text figures 56 *d*; 58 *c*; 59 *c, d*) with ductus bursae and corpus bursae membranous, anterior ½ of ductus bursae usually with scobinations; apophyses posteriores sometimes greatly elongate (*kuehniella*); signum 1–15 well sclerotized, but very weakly pointed spines, scobinations near signum, or throughout corpus bursae; ductus seminalis attached to corpus bursae near middle of corpus bursae, approximate to signum.

Last stage *Ephestia* larvae with moderately distinct to distinct pinaculum rings associated with SD1 seta of mesothorax and eighth abdominal segment. Head only slightly roughened. Eighth abdominal segment with SD2 seta separated from spiracle by distance equal to 2.0–3.5× diameter of spiracle. Tonofibrillary platelets of body indistinct. Mandible simple. Maxilla with sensilla trichodea simple.

Pupae with head and thorax smooth to rugose; abdomen with or without punctures. Thoracic spiracles present. No gibba on segment 9. Cremastral setae consisting of 4 centrally located, spinose, slightly hooked setae and a few, more laterally situated, additional pairs of slightly hooked, similar setae.

Larvae of the most common species are pests of stored products, mostly cereals, fruits, and nuts.

The rationale for including *Anagasta* as a synonym under *Ephestia* is as follows: Heinrich in 1956 proposed *Anagasta,* for *Ephestia kuehniella* Zeller, primarily on differences he perceived in *kuehniella* males and males of other *Ephestia.* He pointed out that *kuehniella* lacks a costal fold, a structure common to other *Ephestia.* Although somewhat significant, this variation is similar to the situation in another phycitine genus, *Acrobasis,* in which costal modifications and sex-scaling are present in some species in the genus and not in others. The incomplete transtilla in *kuehniella* is not unusual in other

Ephestia species, as stated by Heinrich, but appears to be general (see text figure 56 *b* and Roesler, 1973: figures 288–296). It is true that in *kuehniella* the apexes of the lateral elements are not enlarged, as in some other *Ephestia,* but this seems to be a minor difference. Heinrich also indicated that the pupae of *kuehniella* have a rugose thorax, and other *Ephestia,* whose pupae are known, have a smooth thorax. I have examined pupae of *kuehniella* and several other *Ephestia* and this difference exists, but again, when other phycitine genera are examined, such as *Acrobasis,* differences in texture of pupal integument are not unusual within a group whose members otherwise are obviously congeneric.

KEY TO SPECIES OF *EPHESTIA*

1. Valva simple (text figure 56 *b*); signum of corpus bursae consisting of 9–12 flattened, weakly pointed spines (text figure 56 *d*) ..... *elutella* p. 106

— Valva with a short costal projection (text figures 58 *a*; 59 *a*); signum of corpus bursae consisting of 1–7 flattened, weakly pointed spines (text figures 58 *c*; 59 *d*) 2

2. Forewing of male with costal fold; male genitalia with juxta possessing relatively long lateral arms (text figure 59 *a*), and aedoeagus short and robust (text figure 59 *b*); apophyses posteriores only slightly longer than apophyses anteriores (text figure 59c) ..... *columbiella* p. 109

— Forewing of male without costal fold; male genitalia with juxta bearing short lateral arms (text figure 58 *a*), and aedoeagus slender (text figure 58 *b*); apophyses posteriores of female genitalia about 2× as long as apophyses anteriores ..... *kuehniella* p. 107

KEY TO LAST STAGE LARVAE OF *EPHESTIA* (*E. COLUMBIELLA UNKNOWN*)

1. Abdominal segment 8 with spiracle as large as, or slightly larger than, area enclosed by SD1 pinaculum ring ..... *kuehniella* p. 107

— Abdominal segment 8 with spiracle distinctly smaller, ⅔ or less as broad as area enclosed by SD1 pinaculum ring ..... *elutella* p. 106

Ephestia elutella (Hübner) (Tobacco Moth*; Pyrale du Tabac, f., Fr.)

PL. 4, FIGS. 35–37. TEXT FIGS. 56 *a–d*; 57 (RWH 6021).

Tinea aquella [Denis & Schiffermüller], 1775, *Ankündung* (sic) *eines Systematischen Werkes Von Den Schmetterlingen der Wienergegend,* 139.
Type locality: Austria. [lost]

NOTE—Kocak (1984 *a, b*) has proposed that *aquella* be used in place of *elutella.* Although *aquella* predates *elutella* by 21 years, the latter name has been in general use for about 150 years. According to Article 23(b) of the *International Code of Zoological Nomenclature* (third edition), if the application of the Principle of Priority upsets stability, existing usage is to be continued and the case referred to the International Commission on Zoological Nomenclature for a decision. Until a ruling is made, I retain the more familar name.

Tinea elutella Hübner, 1796, *Sammlung Europäischer Schmetterlinge, Lepidoptera* **8,** Tineae: pl. 24, fig. 163.
Type locality: Germany. [lost]

Phycis semirufa Haworth, 1811, *Lepidoptera Britannica,* 496.
Type locality: England [lost]

Phycis rufa Haworth, 1811, *Lepidoptera Britannica,* 497.
Type locality: England. [lost]

Phycis angusta Haworth, 1811, *Lepidoptera Britannica,* 497.
Type locality: England. [lost]

Hyphantidium sericarium Scott, 1859, *Proc. Zool. Soc. London,* **27**: 207.
Type locality: Australia. [BMNH]

Ephestia roxburghii Gregson, 1873, *Ent.,* **6**: 318.
Type locality: Liverpool, England. [BMNH]

Ephestia infumatella Ragonot, 1887, *Ann. Soc. ent. France,* **7**: 257.
Type locality: Chiclana, ? Spain. [HUMB]

Homoeosoma affusella Ragonot, 1888, *Nouveaux Genres et Espèces de Phycitidae & Galleriidae,* 34.
Type locality: Cordoba, Argentina. [MNHP]

Ephestia icosiella Ragonot, 1888, *Nouveaux Genres et Espèces de Phycitidae & Galleriidae,* 36.
Type locality: Sabdou, Algeria. [MNHP]

Ephestia amarella Dyar, 1904, *Proc. U. S. Natl. Mus.*, **27**: 921.
Type locality: Kalso, Kootenai District, British Columbia. [USNM]

Ephestia unicolorella uniformata Dufrane, 1942, *Bull. Mus. royale Histoire naturelle Belgium,* **18**: 2.
Type locality: Waterloo, Belgium. [Dufrane Col.]

Ephestia elutella pterogrisella Roesler, 1965, *Inaugural-Dissertation,* 130.
Type locality: Sardinia. [LNK]

The configuration of the enlarged apexes of the transtilla of the male genitalia (text figure 56 *b*) best identifies *elutella.* The forewing is somewhat variable in appearance, particularly number and intensity of the brown scales on the posterior ½ of the wing. Wing length 5.5–8.5 mm.

Last stage larva (text figure 57) 8.5–14.0 mm long. Head pale brownish yellow to brown, slightly darker at adfrontals, frontoclypeus, and near mouthparts. Thoracic shield pale brownish yellow to brown with slightly darker platelets. Body white, yellowish white, or pink. Pinacula pale brown to brown. SD1 pinaculum rings on mesothorax and eighth abdominal segment yellowish brown to brown. Abdominal segment eight with SD2 separated from spiracle by distance equal to 2.0–3.5 × diameter of spiracle, and with spiracle ⅔, or less, as broad as area enclosed by SD1 pinaculum ring.

Pupa 5.0–8.0 mm long, yellowish brown. Head, thorax, and abdomen smooth (Richards and Thomson, 1932: figures 129, 130).

E. elutella is well known in North America because of the damage it does to tobacco (*Nicotiana tabacum* L.) stored in warehouses. The insect also feeds on chocolate or cacao (*Theobroma cacao* L.), cereals, and many other stored plant materials. Carter (1984) mentioned that *elutella* occasionally occurs out of doors in Europe, and sometimes is abundant in old haystacks. In tropical and subtropical regions females sometimes oviposit on nearly ripe fruit still on the host. All North American moths of this species that I have seen have been collected indoors or reared from larvae feeding indoors.

Ephestia kuehniella Zeller, REVISED COMBINATION (Mediterranean Flour Moth*; Pyrale Mediterraneenne de la Farine, f., Fr.)
PL. 1, FIGS. 58–60; PL. 4, FIGS. 38, 39. TEXT FIG. 58 *a–c* (RWH 6020).

Ephestia kühniella [sic] Zeller, 1879, *Stettiner ent. Zeitung,* **40**: 466.
Type locality: Germany. [BMNH]
NOTE—A male lectotype was designated by Heinrich (1956: 301). Subsequently, Roesler (1973: 618) designated a lectotype.

Ephestia fuscofasciella Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 17.
Type locality: Texas. [MNHP]

Ephestia gitonella Druce, 1896, *Biologia Centrali-Americana, Lepidoptera-Heterocera,* **2**: 286.
Type locality: Durango, Mexico. [BMNH]

Homoeosoma ischnomorpha Meyrick, 1931, *Trans. Proc. New Zealand Inst.,* **62**: 94.
Type locality: Whangarei, New Zealand. [BMNH]

Moths of *kuehniella* are usually larger than their close relatives (wing length of *kuehniella* 7.5–13.0 mm). The most reliable method of identification is examination of the genitalia. The male has the valva with a costal projection and the juxta with short lateral elements (text figure 58 *a*), and the female has long apophyses posteriores (about 2 × as long as the apophyses anteriores). The male of *kuehniella* also lacks a costal fold, a feature that consistently occurs in males of closely related species. Most adults are mainly brownish gray with a few small patches of black scales, however, some (plate 1, figures 58–60) have the black markings on the forewings more distinct. Also, through selection, laboratory cultures of moths of *kuehniella* with varying amounts of black suffusions have been produced (Caspari and Gottlieb, 1975).

Last stage larva 14.5–19.0 mm long. Head mostly yellowish brown to brown with dark streaks posterolaterally, and with relatively indistinct brown to dark-brown platelets. Thoracic shield yellowish brown to brown, at times with indistinct, darker maculation. Body white, yellowish white, brownish white, or pinkish white. Pinacula pale brown to brown. SD1 pinaculum rings of mesothorax and eighth abdominal segment brown to dark brown. Eighth abdominal segment with SD2 separated from spiracle by distance equal to 2.0–3.5 × diameter of spiracle, and spiracle as large as, or slightly larger than, area enclosed by SD1 ring.

Pupa 9.0–14.5 mm long, mainly yellowish brown. Head and prothorax with dorsum somewhat rugose. Maxilla reaching slightly less than ¾ distance to

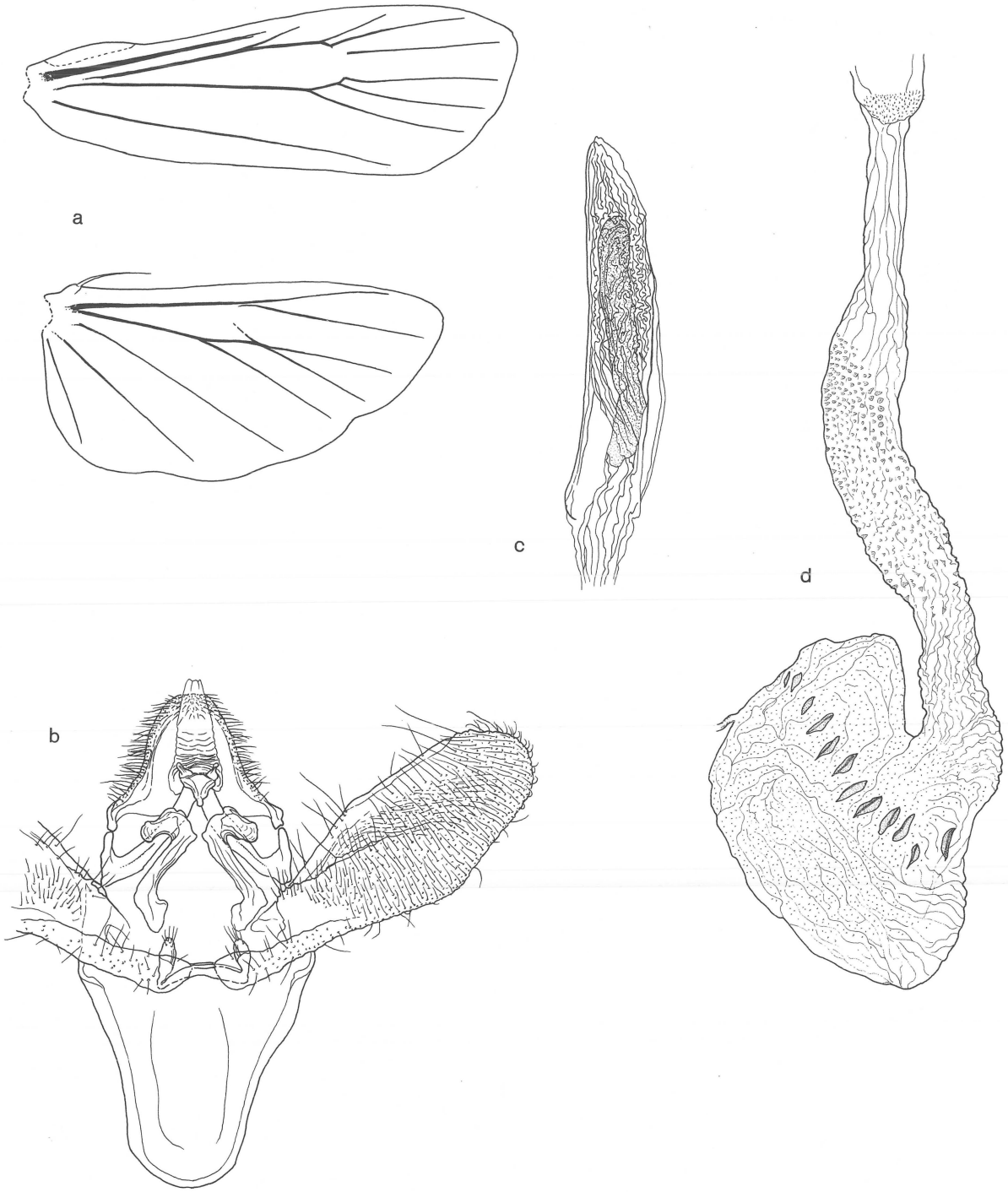


FIGURE 56: VENATION AND GENITALIA OF *EPHESTIA ELUTELLA*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 1333); *c.* Aedoeagus; *d.* Corpus bursae, ductus bursae, and part of ductus seminalis (HHN 1343).

caudal margin of wing. Dorsum of abdomen punctate. Additional information under description of genus.

E. kuehniella is an important pest in flour mills in countries with a temperate climate. Most common hosts are seeds of wheat (*Triticum*), barley (*Hordeum*), rye (*Secale*), oats (*Avena*), rice (*Oryza*), and corn (*Zea*). Richards and Thomson (1932:180)

provided an extensive list of stored materials fed upon by this species. As they noted, records associating *kuehniella* with dried fruit and nests of bees are probably based on misidentifications. *E. kuehniella* has been rather frequently collected out of doors at lights in the southern and southwestern United States. Vick et al. (1987), using pheromone-baited traps, found *kuehniella* to be as abundant in remote field environments as near storage facilities in Florida. Keifer (1932) and Powell (1968) in California, reared adults of *kuehniella* (plate 1, figure 60) from larvae found feeding on acorns stored by animals in woodpecker bores in logs. Also in California, Wharton, in 1974, obtained adults of *kuehniella* from larvae in acorns in an old oak log and in *Quercus Kelloggii* Newberry limbs (Powell, personal communication).

E. kuehniella is nearly cosmopolitan in distribution because of the activities of man. Richards and Thomson (1932: 179) noted the speculation as to the country of origin of the species. Based on fragmentary information in the literature, they concluded that it is ". . . more probable that it should be a native of the Mediterranean Basin than of America." Hence, I suppose, the common name Mediterranean flour moth. However, it is likely that the populations of *kuehniella* associated with acorns, and probably other seeds, accumulated by animals outdoors in the United States represent a natural insect-host relationship and that *kuehniella* is indigenous to North America. To date no very close ally of *kuehniella* had been discovered, but a new *Ephestia,* apparently native to the southeastern United States, is described herein. The male and female genitalia are very similar to those of *kuehniella.* Discovery of this species in the United States provides additional evidence that *kuehniella* is American.

Ephestia columbiella Neunzig, NEW SPECIES
PL. 4, FIGS. 40–44. TEXT FIG. 59 *a–e.*

Ephestia columbiella Neunzig.
Type locality: 17 km N of Raleigh, Wake Co., North Carolina. [USNM]

DIAGNOSIS. The male and female genitalia of *columbiella* (text figure 59 *a–d*) are similar to those of *kuehniella* (text figure 58 *a–c*). However, *columbiella* has the lateral arms of the anellus decidedly longer and the aedoeagus shorter and more robust, and has apophyses posteriores about as long as the apophyses anteriores (text figure 59 *c*); they are very long, about 2× as long as the apophyses anteriores, in *kuehniella* (Heinrich, 1956: figure 1124).

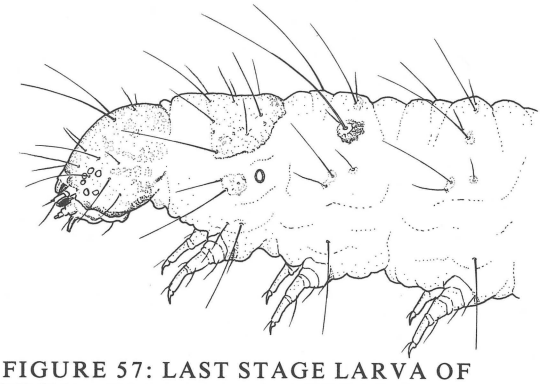


FIGURE 57: LAST STAGE LARVA OF *EPHESTIA ELUTELLA* (LATERAL VIEW OF HEAD AND THORAX)

DESCRIPTION. Wing length 4.5–6.0 mm. Head: frons and vertex brownish white to white; labial palpus outwardly mostly fuscous to brown with some white scales, particularly at base, curved upward, reaching vertex, first and second segment with triangular scale tufts ventrally (text figure 59 *e*). Thorax: collar and dorsum of thorax fuscous to brownish white. Forewing: ground color fuscous to pale brown; base dusted with white; antemedial line moderately distinct, white (formed by white-tipped scales); postmedial line similar to antemedial line; medial area with light dusting of white; discal spots brown to black, indistinct; terminal area with light dusting of white. Hindwing: smoky brown to brownish white. Male genitalia (text figure 59 *a, b*); uncus slightly tapered and somewhat truncate; gnathos with short, apical hook; transtilla incomplete, simple; valva narrow, with short, costal projection; juxta a U-shaped plate with relatively long, setiferous, lateral arms. Female genitalia (text figure 59 *c, d*): with ductus bursae and corpus bursae membranous; corpus bursae with weak scobinations anteriorly, and with signum consisting of 4–7 blunt, flattened spines.

The immature stages of *columbiella* are unknown.

TYPES. Holotype: ♂. North Carolina, Wake Co., 17 km N of Raleigh, 26-IV-1985, H. H. Neunzig, light trap; genitalia slide 1148 HHN. USNM. Paratypes 9 ♂, 7 ♀. Florida: Torreya S. P., 2 Oct 83, L. C. D. (Dow); genitalia slide 1428 HHN (1 ♀). Highlands Hammock St. Pk., Highlands Co., 19-II-1983, H. D. Baggett; genitalia slide 2514 HHN (2 ♂). Mississippi: 6 mi SW Starkville, Oktibbeha Co., 24 March 1986, 15 April 1986, R. L. and B. B. Brown; genitalia slide 2469 (2 ♂). North Carolina: Same collection data as for holotype, except 6-V-1985 (2 ♂). Wake Co., 18 km N of Raleigh, 10-V-1985, 12-V-1985; genitalia slide 1149 HHN. (2 ♂, 5 ♀). South Carolina: Cherry Hill Recrtn Area, Rte 107, 2,000′,

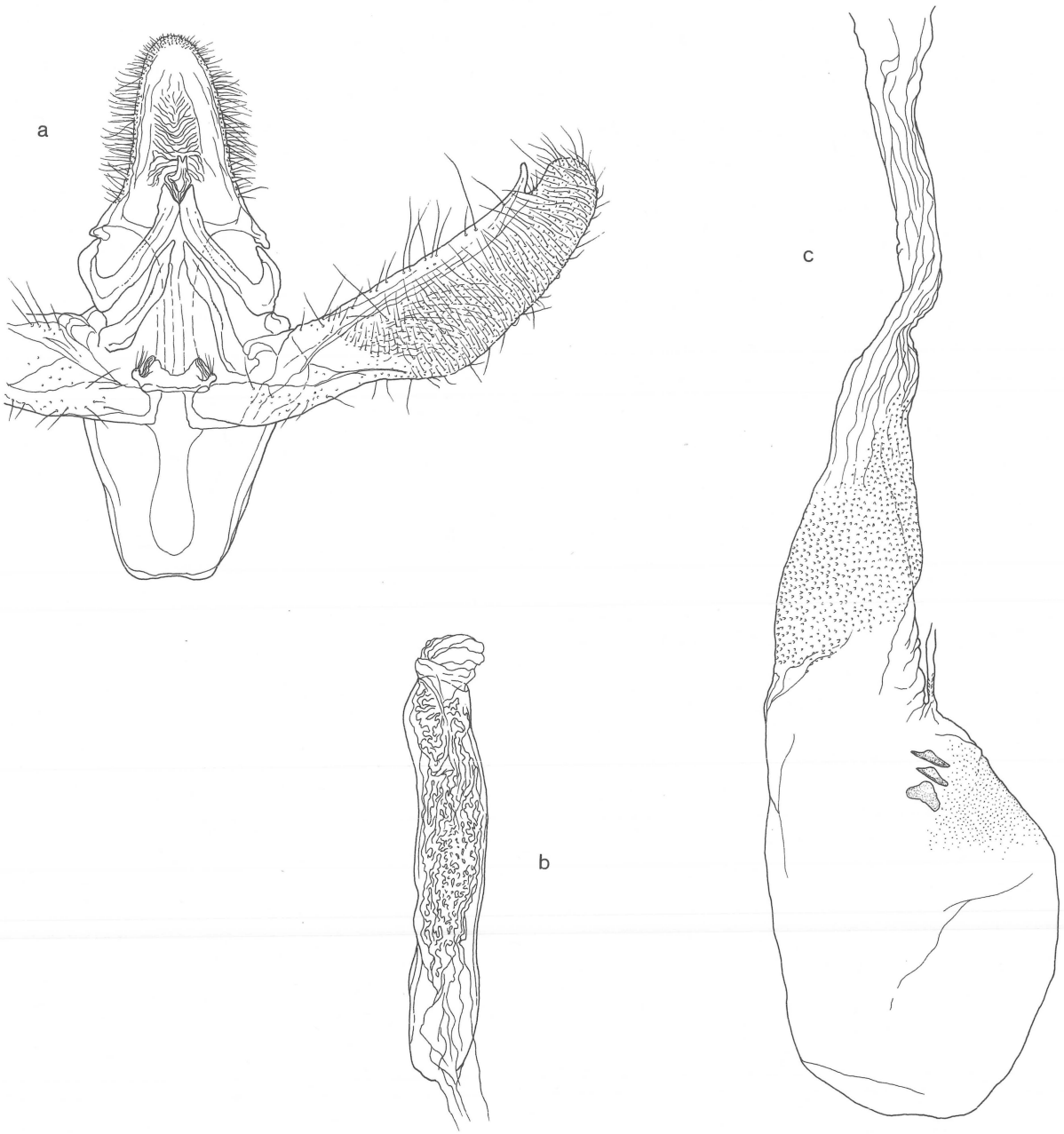


FIGURE 58: GENITALIA OF *EPHESTIA KUEHNIELLA*

a. Male genitalia (most of left valva and aedoeagus omitted) (HHN 835); *b.* Aedoeagus; *c.* Corpus bursae, ductus bursae, and part of ductus seminalis (HHN 836).

Oconee Co., 7 August 1958, R. W. Hodges; genitalia slide 2113 HHN. (1 ♂). Wedge Plantation, McClellanville, 22-IV-1974, D. C. Ferguson (1 ♀). FSCA, MEM, NCSU, USNM.

GENUS

Cadra Walker

Cadra Walker, 1864, *List of the Specimens of Lepidopterous Insects in the Collection of the British Museum,* **30**: 961.

Type species: *Cadra defectella* Walker, 1864, considered to be a synonym of *Pempelia cautella* Walker, 1863. Monotypy.

Xenephestia Gozmány, 1958, *Ann. Hist.-Nat. Mus. Natl. Hungaricae,* **9**: 223.

Type species: *Pempelia cautella* Walker, 1863. Original designation.

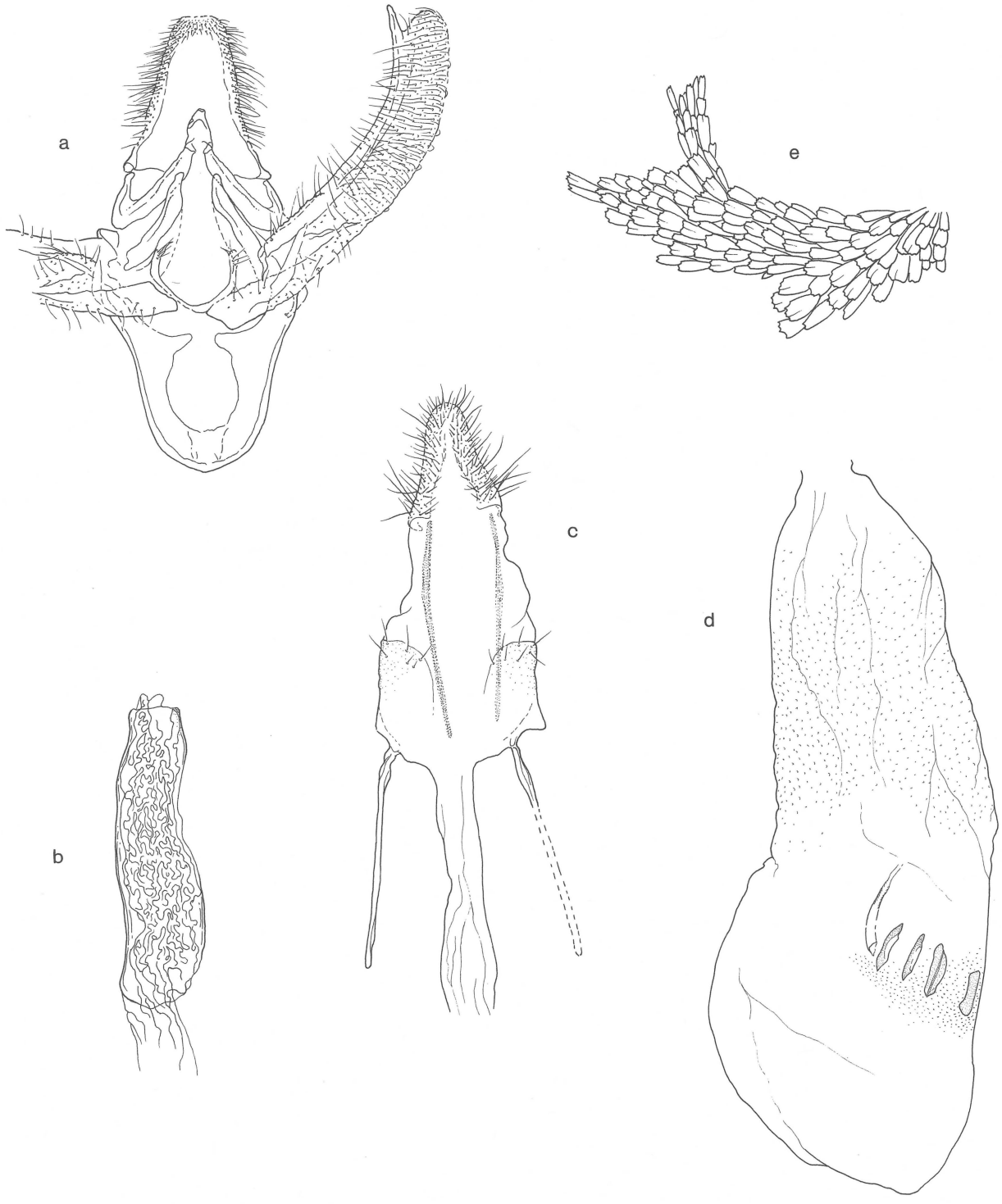


FIGURE 59: GENITALIA AND LABIAL PALPUS OF *EPHESTIA COLUMBIELLA*

a. Male genitalia, holotype (most of left valva and aedoeagus omitted) (HHN 1148); *b.* Aedoeagus; *c.* Posterior part of female genitalia (HHN 1149); *d.* Corpus bursae and part of ductus seminalis (HHN 1149); e. Left labial palpus.

Cadra, a genus of about eight species, is a close relative of *Ephestia,* and species belonging to *Cadra* are sometimes included under *Ephestia.* Features for separating the two genera are mentioned under *Ephestia.* As with *Ephestia,* some *Cadra* are widely distributed in the world, and two of them occur in our fauna.

Antenna of male simple, sensilla trichodea (cilia) of shaft moderately abundant and at base of shaft ¼–⅓ as long as basal diameter of shaft. Frons convex, smooth or with anteriorly projecting scales. Labial palpus of both sexes upturned. Maxillary palpus simple, small. Haustellum normal. Ocellus present. Basal ½ of costa of forewing of male slightly convex; under surface with costal fold. Forewing (text figure 60 *a*) smooth scaled, with 9 veins; R_2 well separated from R_{3+4+5} at base; M_1 from below upper angle of cell, sometimes free at base; M_{2+3} separated from CuA_1 at base; CuA_2 from well before lower angle of cell. Hindwing (text figure 60 *a*) with 6(7) veins; $Sc+R_1$ and Rs completely fused or Sc sometimes present as a small distal spur from Rs; M_{2+3} and CuA_1 either separated or shortly stalked at base; CuA_2 from cell well before lower angle; cell about ½ length of wing. Eighth abdominal segment of male with paired dorsal scale tufts; each tuft consisting of four fascicles of scales, some scales somewhat curved or sinuous. Male genitalia (text figure 60 *b, c, e*) with uncus usually rather broad and rounded apically (somewhat narrow in *glycyphloeas* (Meyrick), and with apex flared in *calidella* (Guenée)); gnathos forked apically; transtilla usually incomplete (broadly fused in *glycyphloeas*), sometimes with apexes broadened or enlarged; juxta a U-shaped plate with setiferous lateral lobes; valva with dorsally directed costal element located ½–⅔ distance to apex, aedoeagus usually without sclerotized structures; vinculum about as long as greatest width. Female genitalia (text figure 60 *d, f*) with papillae anales (ovipositor lobes) short and sometimes weakly developed (*cautella* (text figure 60 *d*) and *calidella*); lamella postvaginalis with a pair of scale tufts; ductus bursae mainly membranous, with a longitudinal row of strongly sclerotized ridges forming a band, or a spiral of short spines; corpus bursae mostly membranous, partly or completely scobinate or with microspines, and with signum consisting of row of 2–9 well-sclerotized, but very weakly pointed spines; ductus seminalis originating near middle of corpus bursae, approximate to signum.

Last stage *Cadra* larvae with distinct pinaculum rings associated with SD1 setae of mesothorax and SD1 setae of eighth abdominal segment. Head only slightly roughened. Eighth abdominal segment with SD2 seta separated from spiracle by distance distinctly less than, to slightly more than, diameter of spiracle. Tonofibrillary platelets of body indistinct. Mandible simple. Maxilla with sensilla trichodea simple.

Pupae with head and thorax smooth. Abdomen without punctures. Thoracic spiracles present. No gibba on segment 9. Cremaster with four centrally located, spinose, hooked setae and a few, more laterally situated, additional pairs of hooked similar setae.

Larvae of well-known species are primarily pests of stored plant products.

KEY TO SPECIES OF *CADRA*

1. Valva with short, midcostal projection (text figure 60 *b*); ductus bursae with fluted, sclerotized, longitudinal band near corpus bursae (text figure 60 *d*) ..... *cautella* p. 112
— Valva with long, digitate midcostal projection (text figure 60 *e*); ductus bursae with spiral of short spines near corpus bursae (text figure 60 *f*) ..... *figulilella* p. 113

KEY TO LAST STAGE LARVAE OF *CADRA*

1. Abdominal segment 8 with seta D2 only 2.0–2.5× as long as seta D1 ..... *cautella* p. 112
— Abdominal segment 8 with seta D2 3.0–5.5× as long as seta D1 ..... *figulilella* p. 113

Cadra cautella (Walker) (Almond Moth*; Pyrale Des Amandes, f., Fr.)
PL. 4, FIG. 45; PL. 5, FIGS. 1–4. TEXT FIG. 60 *a–d* (RWH 6022).

Pempelia cautella Walker, 1863, *List of the Specimens of Lepidopterous Insects in the Collection of the British Museum,* **27**: 73.
Type locality: Ceylon (=Sri Lanka). [BMNH]

Cadra defectella Walker, 1864, *List of the Specimens of Lepidopterous Insects in the Collection of the British Museum,* **30**: 962.
Type locality: Ceylon (=Sri Lanka). [BMNH]

Nephopteryx [sic] *desuetella* Walker, 1866, *List of the Specimens of Lepidopterous Insects in the Collection of the British Museum,* **35**: 1719.
Type locality: Moreton Bay, Queensland, Australia. [BMNH]

Ephestia passulella Barrett, 1875, *Ent. Mon. Mag.* **11**: 271.
Type locality: England. [BMNH]

Cryptoblabes formosella Wileman and South, 1918, *Ent.*, **51**: 219.
Type locality: Formosa (=Taiwan). [BMNH]

Ephestia rotundatella Turati, 1930, *Atti Soc. Italiana Sci. Nat.*, **69**: 68.
Type locality: Cyrenaika, Libya. [MSNM]

Ephestia irakella Amsel, 1959, *Bull. Soc. Ent. Egypte,* **43**: 46.
Type locality: Bagdad, Iraq. [LNK]

C. cautella is one of the most frequently encountered phycitines because of its association with many kinds of stored food. General appearance is of little help in identifying the species, but both male and female genitalia (text figure 60 *b–d*) are diagnostic. Wing length 5.0–9.0 mm.

Last stage larva 9.0–14.0 mm long. Head usually yellowish brown with some darker brown or reddish-brown pigmentation, particularly on posterolateral aspect of head. Thoracic shield yellowish brown with brown to dark-brown platelets or maculae. Body white, yellowish white, or pink. Pinacula brown to dark brown. SD1 pinaculum rings on mesothorax and on eighth abdominal segment brown to dark brown. Eighth abdominal segment with SD2 seta separated from spiracle by distance equal to, distinctly less than, or slightly more than diameter of spiracle, and D2 seta only 2.0–2.5× as long as D1 seta. Larva illustrated in Neunzig (1987).

Pupa 5.5–7.5 mm long, yellowish brown. Head, prothorax, and abdomen smooth, without rugosities or punctures.

Food of the larva is usually various stored plant materials. Preferred hosts are dried fruits, such as fig (*Ficus carica* L.), date (*Phoenix dactylifera* L.), and nuts (almond (*Prunus amygdalus* Batsch), peanut (*Arachis hypogaea* L.), and Persian walnut (*Juglans regia* L.)). Richards and Thomson (1932) provided a more comprehensive list of materials infested by *cautella.* In tropical parts of the world, eggs are sometimes laid on fruits, such as dates, while they are still on the tree. In our area, moths and larvae usually occur indoors, but adults sometimes can be collected in the field, particularly near storage facilities.

Cadra figulilella (Gregson) (Raisin Moth*; Pyrale Du Raisin, f., Fr.)

PL. 5, FIGS. 5, 6. TEXT FIG. 60 *e, f* (RWH 6023).

Ephestia figulilella Gregson, 1871, *Ent.*, **5**: 385.
Type locality: Liverpool, England. [BMNH]

Ephestia milleri Zeller, 1875, *Verhandlungen der K.-K. Zool.-bot. Gesellschaft Wein,* **25**: 339.
Type locality: Central America. [BMNH]

Ephestia gypsella Ragonot, 1887, *Ann. Soc. ent. France,* **7**: 256.
Type locality: Iran. [lost]

Ephestia venosella Turati, 1926, *Atti Soc. Italiana Sci. Nat.*, **65**: 58.
Type locality: Benghazi, Libya. [MSNM]

Ephestia ernestinella Turati, 1927, *Atti Soc. Italiana Sci. Nat.*, **66**: 330.
Type locality: Giarabub, Libya. [MSNM]

As with most of the other phycitines that infest stored products, it is necessary to examine the genitalia of *figulilella* for a positive identification. The valva of the male genitalia has a long digitate midcostal projection (text figure 60 *e*). The female genitalia possess a ductus bursae armed with a spiral of short spines near the corpus bursae (text figure 60 *f*). Wing length 5.5–8.5 mm.

Last stage larva 9.5–15.0 mm long. Head brown with indistinct, pale tonofibrillary platelets. Thoracic shield brown with slightly darker platelets. Body white to yellowish white, sometimes pink. Pinacula pale brown. SD1 pinaculum rings of mesothorax and eighth abdominal segment brown. Eighth abdominal segment with SD2 seta separated from spiracle by distance equal to, distinctly less than, or slightly more than diameter of spiracle, and D2 seta 3.0–5.5× longer than D1 seta. Larva illustrated by Neunzig (1987).

Pupa 5.0–7.0 mm long, yellowish brown. Head, prothorax, and abdomen smooth. Illustrated in Donohoe et al. (1949).

The raisin moth is common in California and Arizona. Its food and behavior are similar to those of *cautella.* Donohoe and Barnes (1934) and Donohoe et al. (1949) have published an excellent account of the biology of this species. In California the species has several generations from April to December. Early maturing, fallen fruit of plants such as mulberry (*Morus alba* L.) serves as early spring host material in the field for most larvae. Subsequent generations infest fruit such as raisin (*Vitis vinifera* L.) and apricot (*Prunus armeniaca* L.) during the drying and curing process on farms.

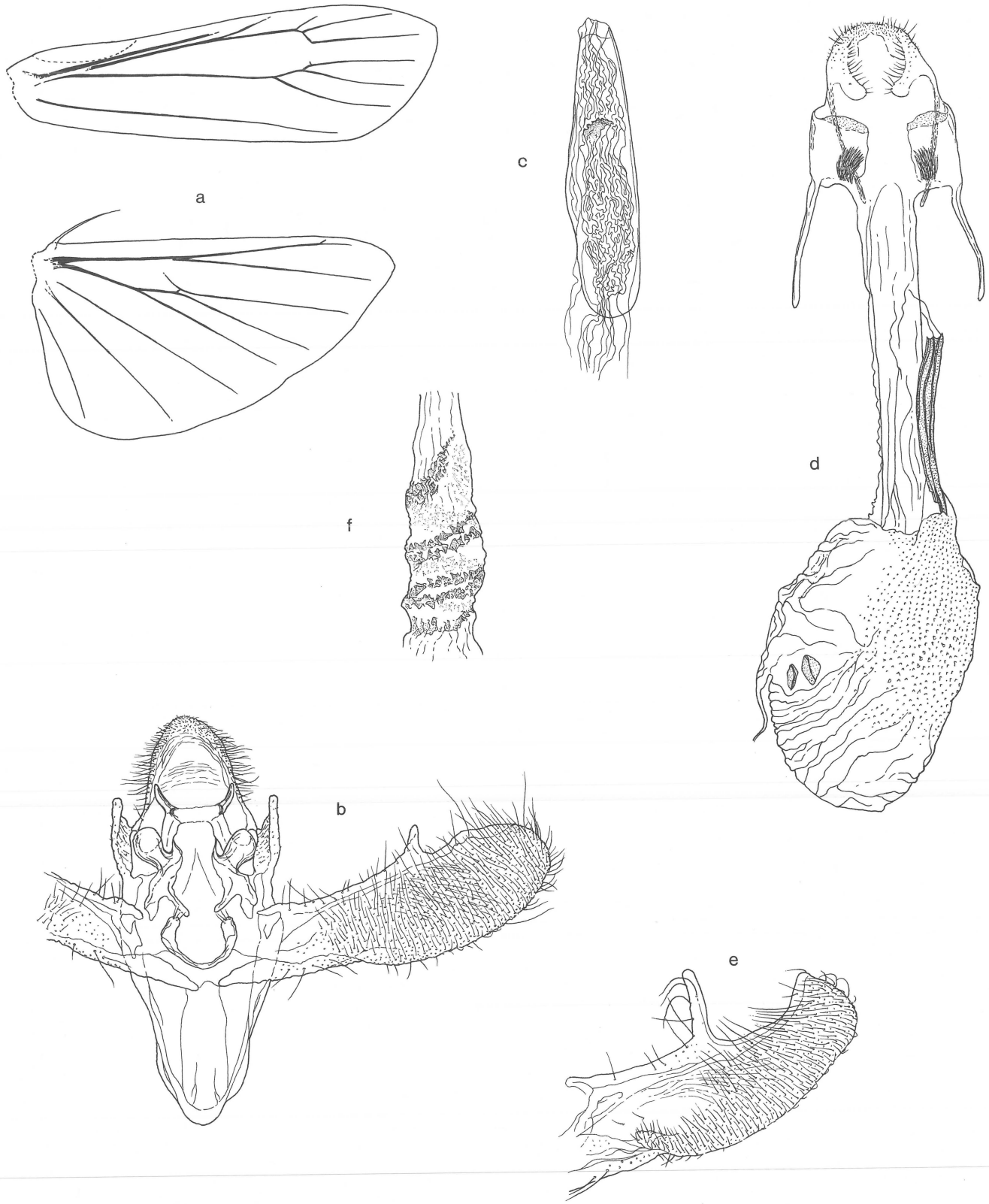


FIGURE 60: VENATION AND GENITALIA OF *CADRA* SPECIES

a. C. cautella, male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 1194); *c.* Aedoeagus; *d.* Female genitalia (HHN 1195); *e. C. figulilella,* right valva (HHN 2786); *f.* Ductus bursae (HHN 1832).

GENUS

Bandera Ragonot

Bandera Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 19.
Type species: *Anerastia binotella* Zeller, 1872. Original designation.

Nasutes Hampson, 1930, *Ann. Mag. Nat. Hist.,* (10) **5**: 53.
Type species: *Nasutes venata* Hampson, 1930, considered to be a synonym of *Bandera cupidinella* Hulst, 1888. Original designation.

Bandera is a small genus of three, possibly four, species. All are restricted to North America. The overall pale color of the forewing is helpful in tentatively identifying members of the genus. The reduced, but still obvious, haustellum, in combination with enlarged, porrect maxillary palpus, lack of ocellus, and valva with a cluster of setae with tuberculate bases on the inner basal and subbasal region, characterize the genus. Despite many differences, on the basis of the structure of the male and female genitalia, *Bandera* appears to be related to *Ephestia.*

Antenna simple in both sexes, sensilla trichodea (cilia) of male moderately abundant, and at base of shaft about ½ as long as basal diameter of shaft. Frons convex, with anteriorly projecting scales. Labial palpus of both sexes porrect, enlarged (text figure 62). Maxillary palpus simple. Haustellum considerably reduced, but usually visible between palpi. Ocellus absent. Basal ½ of costa of forewing of male (text figure 61 *a*) slightly convex; under surface without costal fold. Forewing smooth scaled with 9 veins; R_2 well removed at base from R_{3+4+5}; M_1 from below upper angle of cell, sometimes free at base; M_{2+3} well separated from CuA_1 at base; CuA_1 from lower angle of cell; CuA_2 from well before lower angle of cell. Hindwing (text figure 61 *a*) with 6 or 7 veins; $Sc+R_1+Rs$ completely fused, or almost completely fused to costa; M_1 from upper angle of cell; M_{2+3} and CuA_1 stalked for about ½ their lengths; CuA_2 from before lower angle of cell; cell about ½ length of wing. Eighth abdominal segment of male usually with paired dorsal scale tufts (absent in *cupidinella* Hulst); each tuft a single cluster of simple, more or less straight scales. Male genitalia (text figure 61 *b, c*) with uncus rounded apically; gnathos with apex a simple, small hook; transtilla incomplete or elements weakly fused medially; juxta U-shaped with setiferous lateral elements; valva simple, basally and subbasally with cluster of setae with tuberculate bases (tubercles strongly developed in *binotella* (Zeller), less pronounced in *cupidinella,* and somewhat weakly formed in *virginella* Dyar); aedoeagus simple; vinculum about as long as greatest width, truncate or rounded apically. Female genitalia (text figure 61 *d*) with ductus bursae and corpus bursae membranous; ductus bursae long and inflated anteriorly; signum of corpus bursae a row of 2–5, well-sclerotized, but very weakly pointed spines; ductus seminalis attached to corpus bursae approximate to signum.

The immature stages of *Bandera* are unknown.

KEY TO SPECIES OF *BANDERA*

1. Forewing with pale-yellow patch of scales at base near costa (plate 5, figures 14, 15); eighth abdominal segment of male without scale tuft ..... *cupidinella* p. 117
— Forewing with white scales at base near costa; eighth abdominal segment of male with scale tuft 2

2. Vinculum truncate (text figure 61 *b*) ..... *binotella* p. 115
— Vinculum rounded ..... *virginella* p. 117

Bandera binotella (Zeller)

PL. 5, FIGS. 7–10. TEXT FIG. 61 *a–d* (RWH 6024).

Anerastia binotella Zeller, 1872, *Verhandlungen der K.-K. Zool.-Bot. Gesellschaft Wein,* **22**: 554.
Type locality: Bosque Co., Texas. [BMNH]

Bandera subluteella Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 19.
Type locality: California. [MNHP]
NOTE—A male lectotype of *subluteella* was designated by Shaffer (1968: 70).

B. binotella has an eastern and a western North American population. Those in the East usually can be identified by the two, small, black spots on the posterior ½ of the forewing (plate 5, figures 7, 8). These spots are usually less obvious in western *binotella* (plate 5, figures 9, 10). Wing length 8.0–10.5 mm.

In the East, adults have been collected in Massachusetts (July–September), Connecticut (July, August), New Jersey (July, August) and Texas (Hidalgo Co.) (August). In the West, records for *binotella* are as follows: Alberta (August), British Columbia (Au-

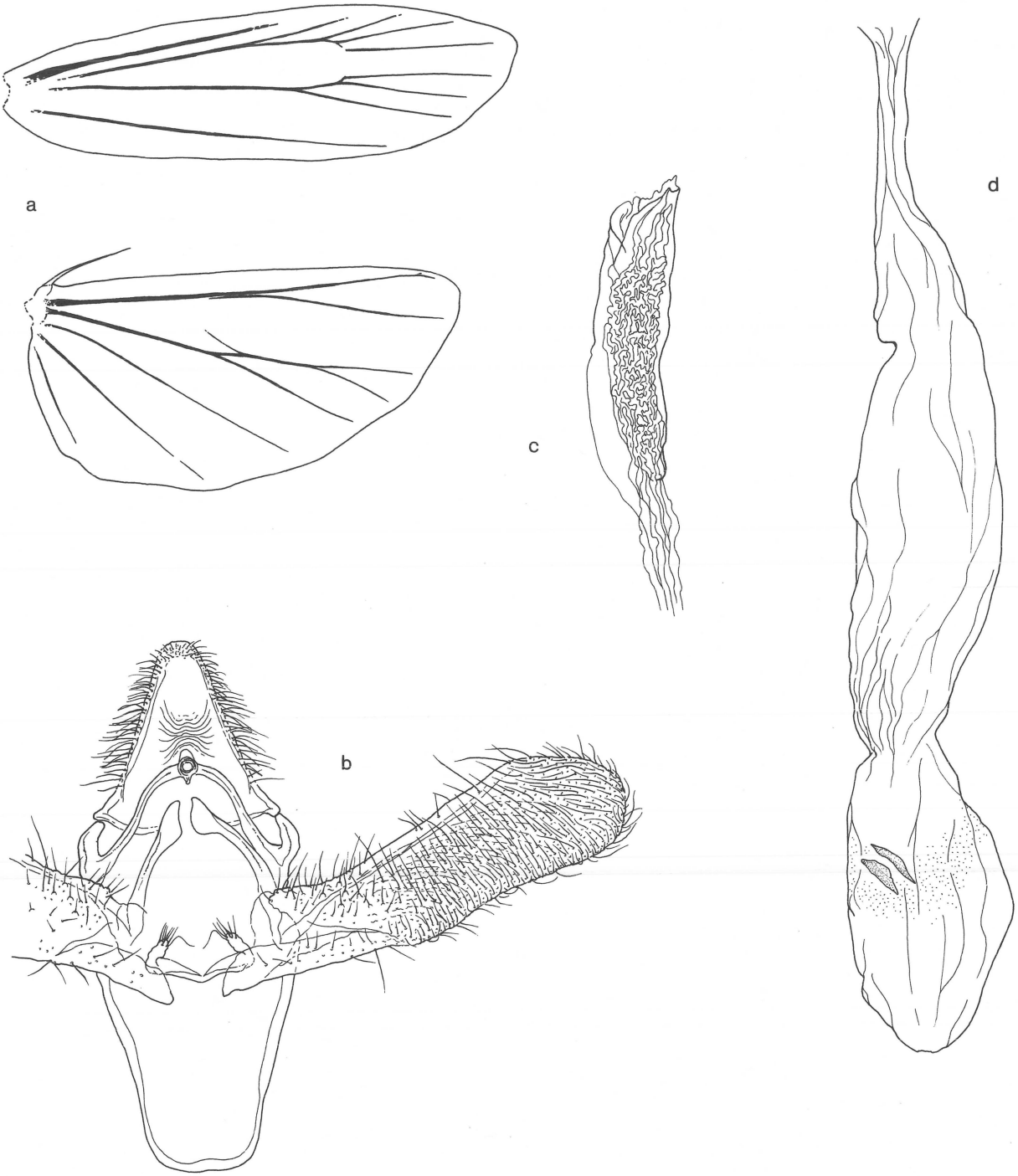


FIGURE 61: VENATION AND GENITALIA OF *BANDERA BINOTELLA*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 1750a); *c.* Aedoeagus; *d.* Corpus bursae and ductus bursae (HHN 1193).

gust, September), Washington (July, August), Montana (July), Colorado (August), Arizona (June, August), and New Mexico (June, July).

Shaffer (1968: 71) suggested that the eastern and western populations possibly represent two species. Additional collecting, particularly in eastern and western Texas, and further study, will be needed before this question can be resolved.

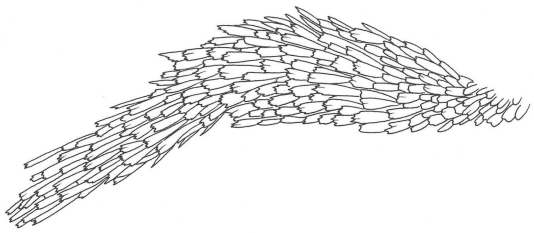


FIGURE 62: LABIAL PALPUS (LEFT SIDE) OF MALE *BANDERA BINOTELLA*

Bandera virginella Dyar
PL. 5, FIGS. 11–13 (RWH 6026).

Bandera virginella Dyar, 1908, *Proc. Ent. Soc. Washington,* **10**: 116.
Type locality: Pullman, Washington. [USNM]

B. virginella is similar to *binotella* but lacks the black spots on the posterior ½ of the forewing found on most specimens of *binotella.* The pale-yellow, longitudinal lines between the veins of the forewing of *virginella* are dusted with a few dark scales; these lines are pure yellow or pure brownish yellow in *binotella.* Male genitalia of *virginella* are similar to the genitalia of *binotella,* but with the vinculum broadly rounded, rather than truncate, in the saccal region (Shaffer, 1968: figure 138). Female genitalia (Shaffer, 1968: figure 173) are like the genitalia of *binotella.* Wing length 9.5–11.5 mm.

B. virginella occurs only in western North America. It has been collected in British Columbia in June–August; Alberta in June; Washington in April–July, September; Colorado in September; California mostly in June, but also in May, July, and August; Arizona in April and May; and New Mexico in May.

Bandera cupidinella Hulst
PL. 5, FIGS. 14, 15 (RWH 6025).

Bandera cupidinella Hulst, 1888, *Ent. Amer.,* **4**: 118.
Type locality: Colorado. [USNM]
NOTE—A male lectotype was designated by Shaffer (1968: 72).

Anerastia conspersella Ragonot, 1901, *Mem. Lep.,* **8**: 404.
Type locality: Colorado. [BMNH]

Nasutes venata Hampson, 1930, *Ann. Mag. Nat. Hist.,* (10) **5**: 54.
Type locality: Colorado. [BMNH]

The pale-yellow patch of scales at the base of the forewing near costa will separate *cupidinella* from other *Bandera.* The male and female genitalia of *cupidinella* (Shaffer, 1968: 137, 172) are like those of *virginella.* Wing length 9.5–11.0 mm.

B. cupidinella has been less frequently collected than other *Bandera.* It is known only from Texas (October), New Mexico (September), and Colorado (September).

GENUS
Wakulla Shaffer

Wakulla Shaffer, 1968, *U. S. Natl. Mus. Bull.,* **280**: 74.
Type species: *Bandera carneella* Barnes and McDunnough, 1913. Original designation.

The genus *Wakulla* contains the single species *carneella,* known only from Florida. The combination of greatly reduced haustellum, and a spatulate uncus, separates it from other phycitines.

Antennal shaft of both sexes simple. Sensilla trichodea (cilia) of male moderately abundant, and at base of shaft about ¼ as long as basal diameter of shaft. Frons convex with anteriorly projecting scales. Labial palpus of both sexes oblique, reaching slightly above vertex. Maxillary palpus simple. Haustellum considerably reduced. Ocellus minute. Basal ½ of costa of forewing of male slightly convex; under surface with costal fold containing tuft of scales and an associated distal cluster of uncovered scales. Forewing smooth scaled. Forewing and hindwing venation as for *Bandera.* Eighth abdominal segment of male with paired dorsal scale tufts; each tuft consisting of several clusters of simple, slightly curved, scales. Male genitalia (text figure 63 *a, b*) with distal part of uncus flared laterally, apex shallowly indented; apical process of gnathos bifurcate; transtilla incomplete; juxta broadly U-shaped with stout setiferous lateral lobes; valva with small projecting spinelike element just before apex; aedoeagus simple; vinculum about as long as greatest width. Female genitalia (Shaffer, 1968: figure 174) with ductus bursae and corpus bursae membranous; signum a row of several slender, distinctly pointed spines; ductus seminalis attached to corpus bursae approximate to signum.

The immature stages of *Wakulla* are unknown.

Wakulla carneella (Barnes and McDunnough)
PL. 5, FIGS. 18, 19. TEXT FIG. 63 *a, b* (RWH 6027).

Bandera carneella Barnes and McDunnough, 1913, *Contrib. Nat. Hist. Lep. N. Am.,* **2**: 184.

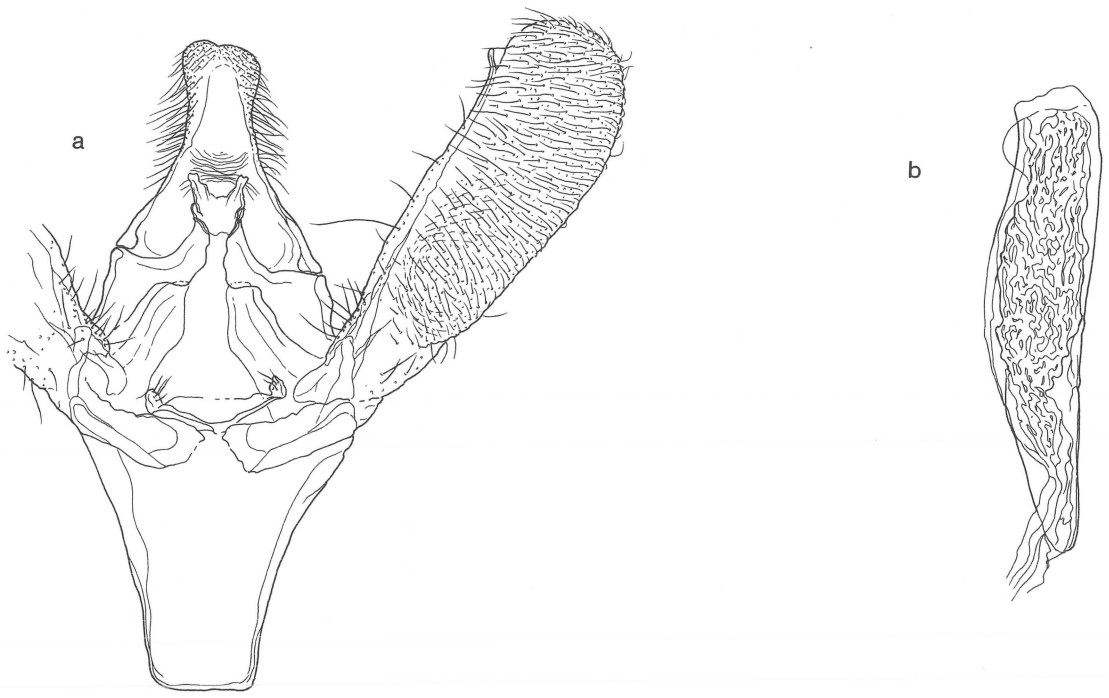


FIGURE 63: MALE GENITALIA OF *WAKULLA CARNEELLA*
a. Genitalia (most of left valva and aedoeagus omitted) (HHN 1578); *b.* Aedoeagus.

Type locality: Everglades, Florida. [USNM]

Moths of *carneella* usually have the forewings pink or beige and white suffused with brown. The costal region characteristically has more white scaling. Some individuals lack the pink or beige scales. Males can be identified by the dark, contrasting, costal fold of the underside of the forewing and the spatulate uncus. Wing length 5.5–7.5 mm.

The few moths of this species that are in collections are all from south Florida and were collected at lights in February, March, August, and November.

GENUS
Tampa Ragonot

Tampa Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 19.
Type species: *Tampa dimediatella* Ragonot, 1887. Monotypy.

Tampa is the only North American phycitine with 8 veins in the forewing. The single species in the genus occurs in the southeastern United States. *Tampa* probably is related to *Bandera* and *Wakulla,* based on the appearance of moths, the reduced haustellum, and similar male and female genitalia.

Antennal shaft of both sexes simple. Sensilla trichodea (cilia) of male antenna moderately abundant, and at base of shaft about ½ as long as basal diameter of shaft. Frons convex with anteriorly projecting scales. Labial palpus of both sexes porrect to slightly oblique (text figure 65). Maxillary palpus simple. Haustellum reduced, but usually visible between palpi. Ocellus absent. Basal ½ of costa of male forewing slightly convex; under surface without costal fold or contrasting sex-scaling. Forewing (text figure 64 *a*) smooth scaled; with 8 veins; R_1 from before, but somewhat near upper angle of cell; Rs ($R_{2+3+4+5}$) from upper angle of cell; M_1 from below upper angle of cell, sometimes free at base; M_2 and M_3 completely fused; CuA_1 from lower angle of cell; CuA_2 from well before lower angle of cell. Hindwing (text figure 64 *a*) with 7 veins; $Sc+R_1$ and Rs fused almost to costa; M_1 from upper angle of cell, M_{2+3} and CuA_1 fused almost to costa; CuA_2 from just before lower angle of cell; cell about ½ length of wing. Eighth abdominal segment of male without scale tufts. Male genitalia (text figure 64 *b, c*) with uncus broadly rounded apically; distal process of gnathos a bifurcate, relatively short hook; transtilla complete, a simple arch; juxta U-shaped with short,

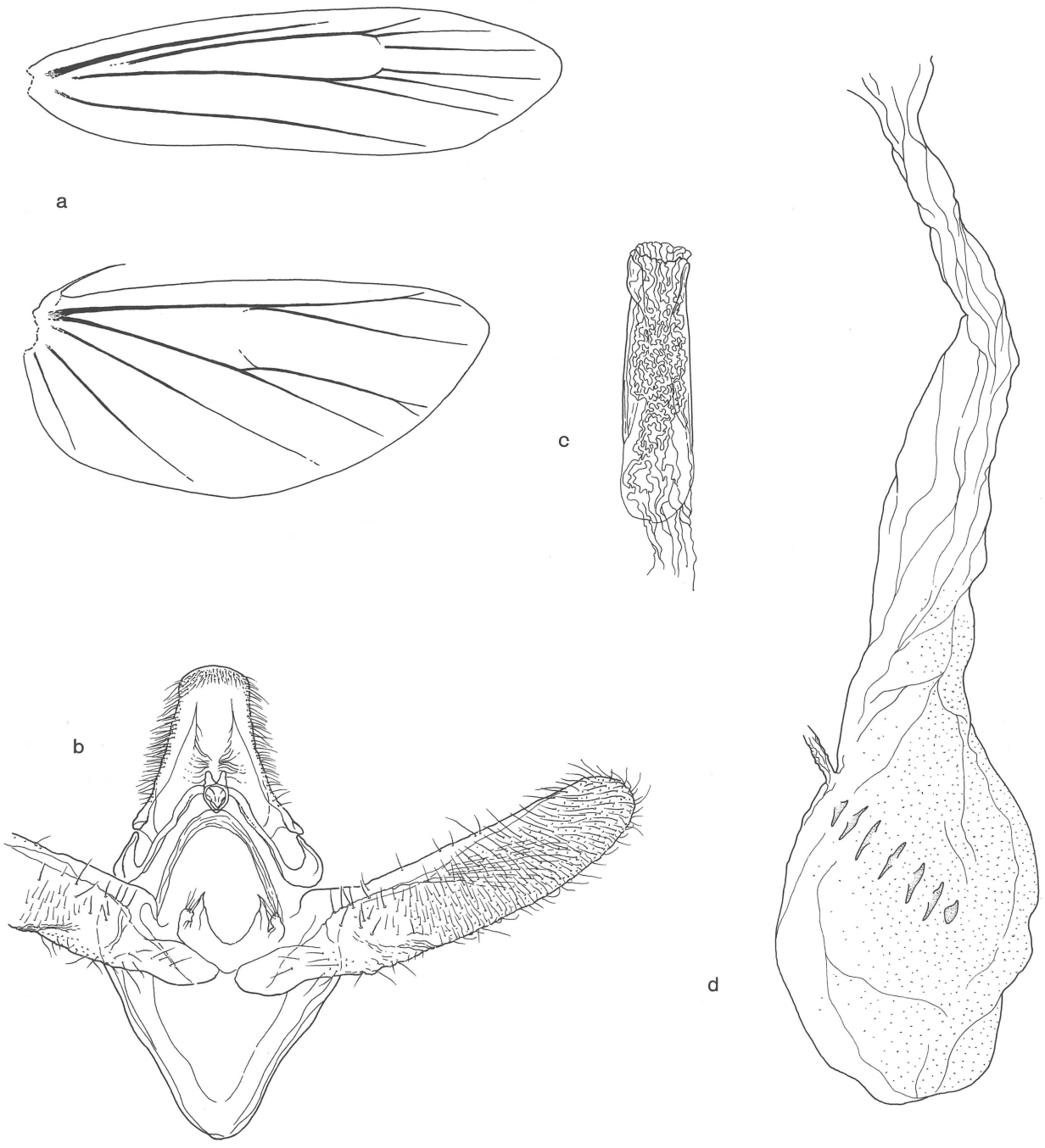


FIGURE 64: VENATION AND GENITALIA OF *TAMPA DIMEDIATELLA*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 1187); *c.* Aedoeagus; *d.* Corpus bursae, ductus bursae, and part of ductus seminalis (HHN 1188).

lateral setose elements; valva simple, distinctly elongate, with group of slightly more robust setae near inner base; aedoeagus rather short, simple; vinculum shorter than greatest width. Female genitalia (text figure 64 *d*) with ductus bursae and corpus bursae membranous, ductus bursae with scobinations near junction with corpus bursae, scobinations continuing into most of corpus bursae; signum a row of about seven, well-sclerotized, but very weakly pointed, spines; ductus seminalis attached to corpus bursae approximate to signum.

The immature stages are unknown.

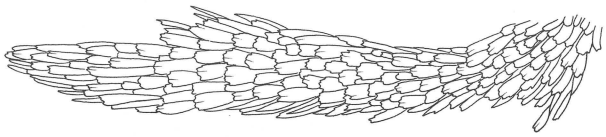


FIGURE 65: LABIAL PALPUS (LEFT SIDE) OF MALE *TAMPA DIMEDIATELLA*

Tampa dimediatella Ragonot
PL. 5, FIGS. 16, 17. TEXT FIGS. 64 *a–d*; 65 (RWH 6028).

Tampa dimediatella Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 20.
Type locality: Florida. [MNHP]
NOTE—A male lectotype was designated by Shaffer (1968: 77).

The contrastingly colored costal and posterior halves of the forewing will preliminarily identify this species. The presence of eight veins in the forewing is diagnostic for *dimediatella.* Wing length 7.0–8.5 mm.

T. dimediatella occurs in the eastern United States in the coastal plain region from Virginia to eastern Texas, and including the Mississippi Valley north to Missouri. Most moths have been collected at light in Florida (all months) and Texas (late April to early September).

GENUS
Varneria Dyar

Varneria Dyar, 1904, *Proc. Ent. Soc. Washington,* **6**: 114.
Type species: *Varneria postremella* Dyar, 1904, Monotypy.

Varneria contains four nominal species. Two occur in the United States, and two are neotropical. Adults, particularly *postremella* Dyar, usually can be recognized by their small size and the attractive, dark-red ground color of the forewing. Males have not been collected for all species, but, where known, their genitalia have a characteristic, distally bifurcate gnathos and a valva with a fingerlike costal projection (text figure 66 *b*).

Antenna with scape and shaft simple in both sexes, sometimes in male with a slight bend near base of shaft. Sensilla trichodea (cilia) of male antenna moderately abundant, and at base of shaft about ⅓ as long as basal diameter of shaft. Frons convex with anteriorly directed scales. Labial palpus of both sexes oblique to upturned, third segment about ½ as long as second. Maxillary palpus simple. Haustellum well developed. Ocellus present. Basal ½ of male forewing (text figure 66 *a*) with costa slightly convex; under surface with costal fold and associated distal tuft of exposed scales. Forewing smooth scaled; with 9 veins; R_2 separated from R_{3+4+5}; R_{3+4+5} from upper angle of cell; M_1 from below upper angle, sometimes with free base; fused M_2 + M_3 and CuA_1 stalked for about ½ their lengths; CuA_2 from before lower angle of cell, or connate with stalk of fused M_{2+3} and CuA_1. Hindwing (text figure 66 *a*) with 6 veins, $Sc+R_1$ and Rs completely fused; fused M_{2+3} and CuA_1 stalked for over ½ their lengths; CuA_2 from before, but somewhat close to, lower angle of cell; cell about ½ length of wing. Eighth abdominal segment of male with paired dorsal scale tufts; each tuft consisting of four clusters of simple scales; second cluster somewhat sinuous, and third pair curved laterally. Male genitalia (text figure 66 *b, c*) with uncus somewhat elongate, distal margin rounded; apical process of gnathos strongly bifurcate; transtilla complete, a narrow curved band; juxta a U-shaped plate; valva with fingerlike costal projection near base; aedoeagus with thin, very weakly sclerotized plate; vinculum about as long as, or slightly shorter than, greatest width. Female genitalia (text figure 66 *d*) with ductus bursae sclerotized and flattened for more than ½ its length; pointed, or truncate, dorsal shield posterior of genital opening; corpus bursae membranous, more or less oval; signum present or absent, when present consisting of fused cluster of dull spines; ductus seminalis attached near middle of corpus bursae.

The immature stages of *Varneria* are unknown.

KEY TO SPECIES OF *VARNERIA*

1. Forewing without antemedial and postmedial lines (plate 5, figures 20–23); signum present (text figure 66 *d*) ..... *postremella* p. 120
— Forewing with antemedial and postmedial lines (sometimes weakly developed) (plate 5, figure 24); signum absent ..... *atrifasciella* p. 122

Varneria postremella Dyar
PL. 5, FIGS. 20–23. TEXT FIG. 66 *a–d* (RWH 6029).

Varneria postremella Dyar, 1904, *Proc. Ent. Soc. Washington,* **6**: 115.
Type locality: Kentucky. [USNM]

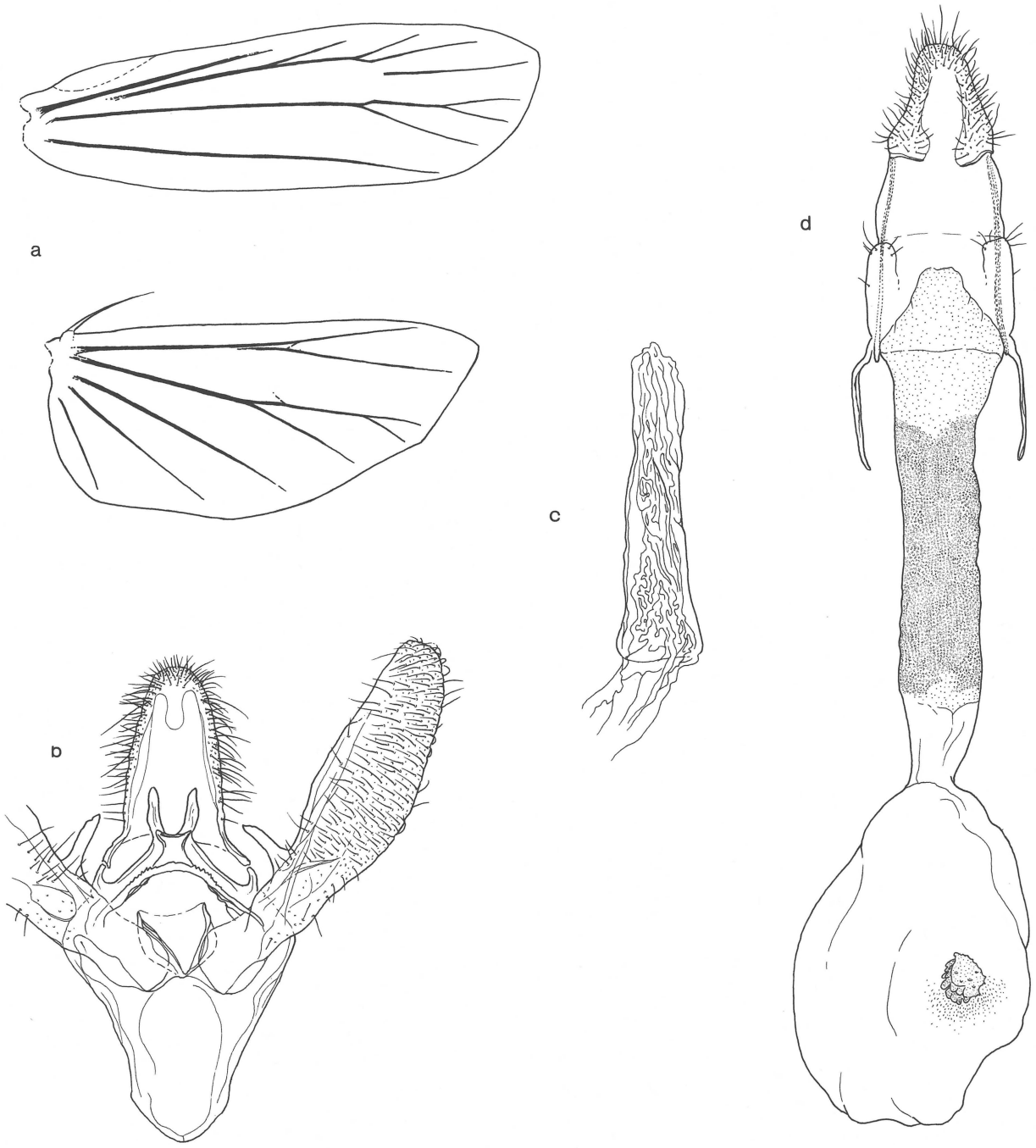


FIGURE 66: VENATION AND GENITALIA OF *VARNERIA POSTREMELLA*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 1702); *c.* Aedoeagus; *d.* Female genitalia (HHN 1172).

The relatively uniform, dark-red color of the upper surface of the forewing makes *postremella* easy to identify. It is a small moth with a wing length of only 3.5–5.0 mm.

Moths of *postremella* are collected rather infrequently. The species, however, appears to have a wide distribution in the eastern United States. It has been collected as individuals or in small series in the following states: Maine (July), Massachusetts (August), Connecticut (July), Wisconsin (June), Missouri (June, July), Kentucky (July), Arkansas (May), Maryland (July, August), Virginia (July), South Carolina (April), and north and central Florida (August, September).

Varneria atrifasciella Barnes and McDunnough

PL. 5, FIG. 24 (RWH 6030).

Varneria atrifasciella Barnes and McDunnough, 1913, *Contrib. Nat. Hist. Lep. N. Am.*, 2: 184.

Type locality: Everglades, Florida. [USNM]

V. atrifasciella has white antemedial and postmedial lines on the forewing, a feature absent in *postremella.* These lines are not well developed, incomplete, and barely discernible in some specimens. The male genitalia of *atrifasciella* are similar to those of *postremella.* The female genitalia are without a signum in the corpus bursae and have the projecting shield posterior to the genital opening large and approximately square (Heinrich, 1956: figure 1112). Wing length 3.5–4.5 mm.

Heinrich had only two females (holotype and paratype) upon which to base his treatment of *atrifasciella.* I have seen three additional females of this species. The two types, and the subsequent material, were all collected in south and central Florida. Collection dates: April in Everglades, and late September in Citrus Co.

GENUS

Eurythmia Ragonot

Eurythmia Ragonot, 1887, *Diagnoses of North American Phycitidae and Galleriidae,* 16.

Type species: *Ephestia hospitella* Zeller, 1875. Original designation.

The genus *Eurythmia* is known only from America north of Mexico. It is impossible at this time to determine how many species belong to the group. On the basis of apparent disjunct distributions of some populations, and possible minor differences in size and color patterns, several species exist. However, male and female genitalia, except for minor variations, are rather uniform throughout the genus. Additional collecting and information on the biology and immature stages is needed. I have mainly followed Heinrich's (1956) tentative treatment and recognize five species. The male and female genitalia, particularly the spiral band of spines of the aedoeagus, easily serve to identify the genus.

Antenna with scape and shaft simple in male. Sensilla trichodea (cilia) moderately abundant, at base of shaft about ½ as long as basal diameter of shaft. Frons slightly convex with anteriorly directed scales. Labial palpus of both sexes oblique to upturned, reaching slightly above vertex. Maxillary palpus simple. Haustellum well developed. Ocellus present. Forewing of male (text figure 67 *a*) with costa slightly convex at base, undersurface with costal fold. Forewing smooth scaled; with 9 veins; R_{3+4} and R_5 completely fused; M_1 from below upper angle of cell; fused M_2 and M_3 stalked with CuA_1 for about ⅓ their lengths; CuA_2 from very close to lower angle of cell. Hindwing (text figure 67 *a*) with 6(7) veins; $Sc+R_1$ and Rs usually completely fused, Rs sometimes evident as a costal spur; M_1 from upper angle of cell; M_{2+3} and CuA_1 stalked for about ½ their lengths; CuA_2 from close to lower angle of cell; cell less than ½ length of wing. Eighth abdominal segment of male without scale tufts. Male genitalia (text figure 67 *b, c*) with uncus truncate; gnathos apically shallowly bifurcate; transtilla complete, apical ½ of elements fused into a stalk, bearing forked projection with small, usually blunt, central spur; juxta a U-shaped plate with setiferous lateral processes; valva with costa strongly sclerotized for about ½ its length and with sclerotized part terminating in short dorsal spur; aedoeagus distinctly enlarged at base and with very characteristic, long spiral of saw-toothed spines; vinculum about as long as greatest width. Female genitalia (text figure 67 *d*) with ductus bursae and corpus bursae membranous; ductus bursae with cluster of 10–18 small, broad-based spines near junction with corpus bursae; corpus bursae with longitudinal row of 3–6 much larger, similar spines on one side and single spine in opposite wall; ductus seminalis attached to corpus bursae near larger spines.

The immature stages are unknown.

KEY TO SPECIES OF *EURYTHMIA*

1. White transverse lines of forewing very broad (plate 5, figure 46) ..... *furnella* p. 123
— White transverse lines of forewing narrow, sometimes almost completely obscured 2

2. Wing length, 4.0–6.0 mm 3
— Wing length 7.0–9.0 mm 4

3. Antemedial line angled distally for about same distance on costal and posterior ½ of forewing (plate 5, figures 25–32); southeastern United States ..... *hospitella* p. 123
— Antemedial line more strongly produced distally on costal ½ of forewing (plate 5, figures 43, 44); southwestern Canada and northwestern United States ..... *spaldingella* p. 123

4. Transverse lines usually with borders distinct (plate 5, figures 39, 41, 42); southeastern Canada and northeastern and northcentral United States ..... *angulella* p. 123

— Transverse lines with borders obscure (plate 5, figure 45); southwestern United States .. *yavapaella* p. 124

Eurythmia hospitella (Zeller)
PL. 5, FIGS. 25–32. TEXT FIG. 67 *a–d* (RWH 6031).

Ephestia hospitella Zeller, 1875, *Verhandlungen der K.-K. Zool.-Bot. Gesellschaft Wein,* **25**: 338.
Type locality: Bosque County, Texas. [BMNH]
NOTE—Heinrich (1956: 307) designated a female lectotype.

The color of the forewing of *hospitella* is variable (plate 5, figures 25–32); some specimens are distinctly darker than others. The sharply angled, dark-bordered, antemedial line usually is present. This line is strongly produced distally on the costal ½ of the wing and again on the posterior ½. Wing length 4.0–6.0 mm.

E. hospitella occurs in the United States from Florida to central Texas. Flight records are as follows: Florida (May, July, September, October), North Carolina (September), Alabama (September), Missouri (June), Oklahoma (July), Texas (June, July). North Carolina (coastal Carteret Co.) and Missouri (near Arkansas and Oklahoma border) are the most northern records.

Eurythmia angulella Ely
PL. 5, FIGS. 39–42 (RWH 6032).

Eurythmia angulella Ely, 1910, *Proc. Ent. Soc. Washington,* **12**: 202.
Type locality: East River, Connecticut. [USNM]

Eurythmia diffusella Ely, 1910, *Proc. Ent. Soc. Washington,* **12**: 202.
Type locality: East River, Connecticut. [USNM]

E. angulella is slightly larger and usually darker than *hospitella*; wing length 7.0–8.0 mm. Heinrich (1956: figure 1132) illustrated the female genitalia.

E. angulella is known from Ontario (July, August), Maine (July), Massachusetts (June, July), Connecticut (July), New Jersey (June), Michigan (August), Illinois (June–September), and North Dakota (July).

Additional collecting and study may show that *angulella* is a northern population of *hospitella,* but the two appear to have allopatric distributions.

Eurythmia furnella Ely
PL. 5, FIG. 46 (RWH 6033).

Eurythmia furnella Ely, 1910, *Proc. Ent. Soc. Washington,* **12**: 202.
Type locality: East River, Connecticut. [USNM]
NOTE—Misspelled as *fumella* in Heinrich (1956) and Munroe (1983).

E. furnella is most similar to *angulella* and possibly is only a more contrastingly marked form of *angulella* (or *hospitella*). The forewing has the white antemedial and postmedial lines appearing broad, and the area between the lines distinctly dark. Wing length 6.5–7.5 mm.

I have seen only Ely's type and one other specimen (plate 5, figure 46), both females. Heinrich (1956: figure 1133) illustrated (as *fumella* [sic]) the genitalia of the holotype. Obviously, additional collecting and study is needed to establish the status of the name *furnella.*

Ely's type was collected in Connecticut in July. Ferguson took the other moth in a light trap in Nova Scotia in early August. Both collection sites are along the coast.

Eurythmia spaldingella Dyar, REVISED STATUS
PL. 5, FIGS. 43, 44 (RWH 6031).

Eurythmia spaldingella Dyar, 1905, *Proc. Ent. Soc. Washington,* **7**: 39.
Type locality: Stockton, Utah. [USNM]
NOTE—Dyar's description of *spaldingella* was based on four specimens. I hereby designate as lectotype the male in the USNM bearing the following labels: 1. "IX-4-4"; 2. "Stockton Utah Tom Spalding"; 3. "Type No. 8183 U.S.N.M."; 4. "*Eurythmia spaldingella* Dyar type"; 5. "genitalia slide, 26 July 1934 C. H. # 2204"; 6. "LECTOTYPE *spaldingella* Dyar by H. H. Neunzig."

E. spaldingella is most similar in size and general appearance to *hospitella.* The former species, however, has the antemedial line more strongly produced distally in the costal ½ of the forewing. *E. spaldingella* is restricted to southwestern Canada and the northwestern United States. Wing length 4.0–6.0 mm.

I have seen moths that appear to be this species from southern British Columbia (July, August), northern Utah (August, September), and northern California (May–August).

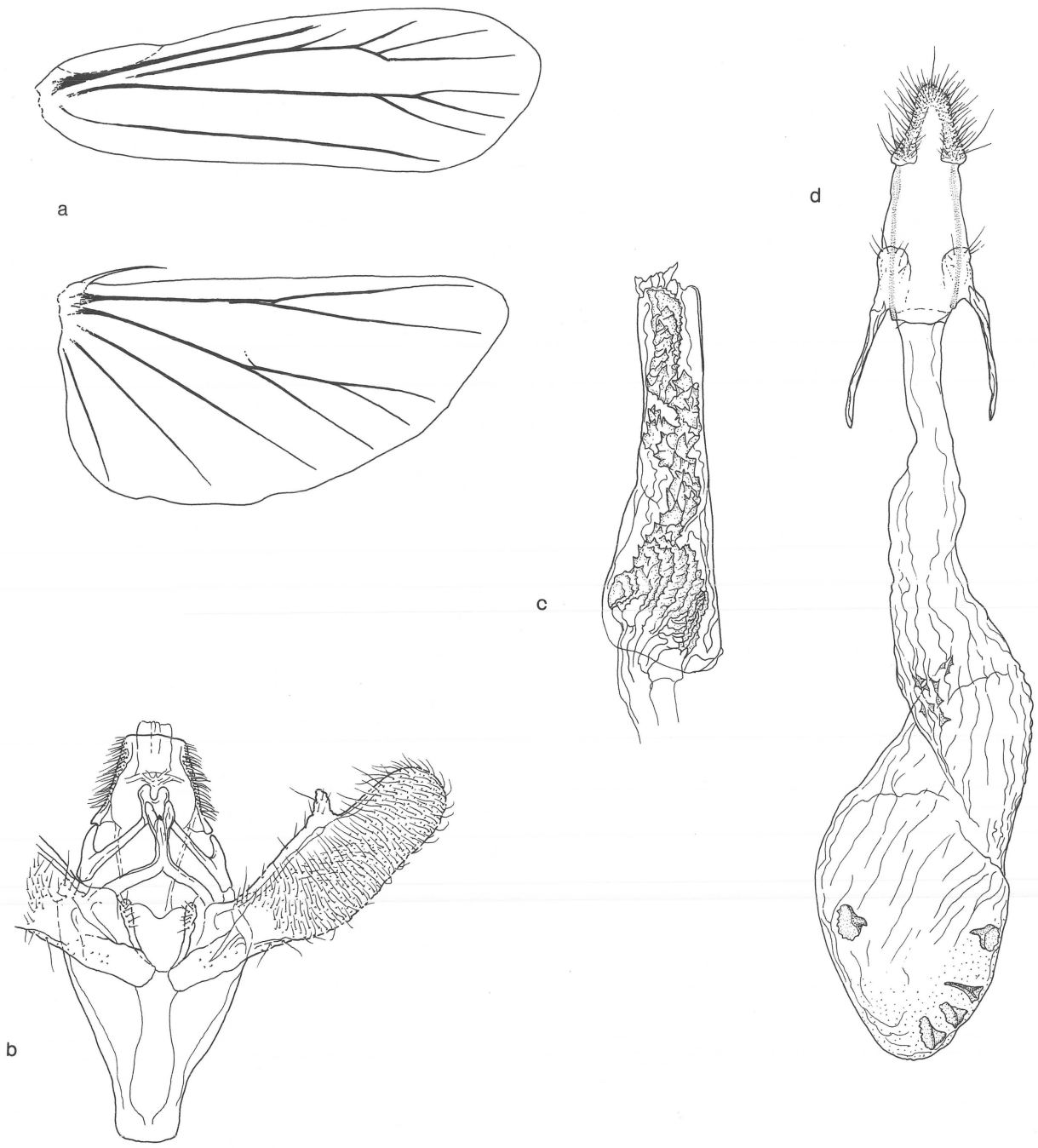


FIGURE 67: VENATION AND GENITALIA OF *EURYTHMIA HOSPITELLA*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 1020); *c.* Aedoeagus; *d.* Female genitalia (HHN 1311).

Eurythmia yavapaella Dyar, REVISED STATUS

PL. 5, FIG. 45 (RWH 6031a).

Eurythmia yavapaella Dyar, 1906, *Jour. New York Ent. Soc.,* **14**: 108.

Type locality: Yavapai Co., Arizona. [USNM]

E. yavapaella is similar to *angulella,* but averages slightly larger (wing length 7.5–9.0 mm). The borders of the transverse lines are always obscure in *yavapaella* and usually distinct in *angulella.* The female genitalia of *yavapaella* (Heinrich, 1956: figures 1131, 1131a) are like those of *angulella.* The distribution of the two species differs; *yavapaella*

occurs in the southwestern United States (central-coastal and southern California and westcentral Arizona), whereas *angulella* is found in southeastern Canada and the northeastern and northcentral United States.

Collection dates for *yavapaella* are as follows: California, Contra Costa County (August), San Luis Obispo County (May), San Diego (May, July). (The types from Arizona are without a date).

GENUS

Erelieva Heinrich

Erelieva Heinrich, 1956, *U. S. Natl. Mus. Bull.,* **207**: 308.
Type species: *Pempelia quantulella* Hulst, 1887. Original designation.

Erelieva, a small genus of two, possibly three, species, contains both nearctic and neotropical members. It is a close relative of *Eurythmia,* differing principally in the male and female genitalia. In *Erelieva* the distal parts of the gnathos are fused into a rather large subanal plate, whereas in *Eurythmia* the distal element of the gnathos is a short, forked process; the aedoeagus is simple in *Erelieva,* but has a distinct, spiral cornutus in *Eurythmia*; the corpus bursae is uniformly scobinate, the signum a more or less continuous row of spines, and the small spines of ductus bursae, when present, arranged in a spiral in *Erelieva*; whereas the corpus bursae has few scobinations, the signum consists of two distinct groups of spines, and the spines of ductus bursae are clustered in *Eurythmia.* Antennal shaft of both sexes simple. Sensilla trichodea (cilia) of male moderately abundant and at base of shaft about ¼ as long as basal diameter of shaft. Frons convex with anteriorly projecting scales. Labial palpus of both sexes oblique to upturned, reaching above vertex. Maxillary palpus simple. Haustellum well developed. Ocellus present. Forewing of male (text figure 68 *a*) with costa convex at base; under surface with costal fold. Forewing smooth scaled; with 9 veins; venation as in *Eurythmia* except fused M_2 and M_3 stalked with CuA_1 for about ½ their lengths. Hindwing (text figure 68 *a*) with 6 or 7 veins; as in *Eurythmia,* except M_{2+3} and CuA_1 stalked for about ⅔ their lengths; cell less than ½ length of wing. Eighth abdominal segment of male with paired dorsal scale tufts; each tuft consisting of two or several clusters of scales. Male genitalia (text figure 68 *b, c*) with uncus truncate; gnathos without apical process, lateral arms fused medially into a sclerotized plate, transtilla complete, lateral elements fused apically into a stout, wrinkled, widely forked projection; juxta a U-shaped plate with lateral, setiferous processes; valva with costa strongly sclerotized for slightly over ½ its length and with sclerotized edge ending in a raised, humplike projection or blunt tooth; aedoeagus simple; vinculum longer than greatest width. Female genitalia (text figure 68 *d*) with ductus bursae and corpus bursae membranous; ductus bursae with or without spiral of small spines near junction with corpus bursae; signum a single elongate, sometimes curved, row of 5–14 thornlike spines; ductus seminalis attached to corpus bursae near signum.

The immature stages of *Erelieva* are unknown.

Heinrich (1956: 308), for *quantulella,* stated "The larvae are evidently flower or seed feeders . . . ." Hosts include members of the Cactaceae, Poaceae, and Solanaceae.

KEY TO SPECIES OF *ERELIEVA*

1. Forewing with postmedial line indistinct (plate 5, figures 35, 36); signum consisting of 5–7 spines, and spiral of small spines in ductus bursae; Nova Scotia and southern Manitoba south to New York and Illinois ..... *parvulella* p. 126

— Forewing with postmedial line more strongly developed (plate 5, figures 33, 34); signum consisting of 10–14 spines, and no small spines in ductus bursae (text figure 68 *d*); Texas (and Neotropics) ..... *quantulella* p. 125

Erelieva quantulella (Hulst)

PL. 5, FIGS. 33, 34. TEXT FIG. 68 *a–d* (RWH 6034).

Pempelia quantulella Hulst, 1887, *Ent. Americana,* **3**: 134.
Type locality: Blanco Co., Texas. [AMNH]

Eurythmia santiagella Dyar, 1919, *Ins. Insc. Mens.,* **7**: 62.
Type locality: Santiago, Cuba. [USNM]

E. quantulella is an infrequently encountered phycitine in America north of Mexico. Only a few specimens have been collected in Texas. The species appears to be more common on several islands in the Caribbean. The moths are rather nondescript, and reference should be made to the female genitalia for positive identification (text figure 68 *d*). Wing length 5.0–6.0 mm.

Larvae of *quantulella* apparently feed on the flowers, seeds, or both of prickly pear (*Opuntia*), bell

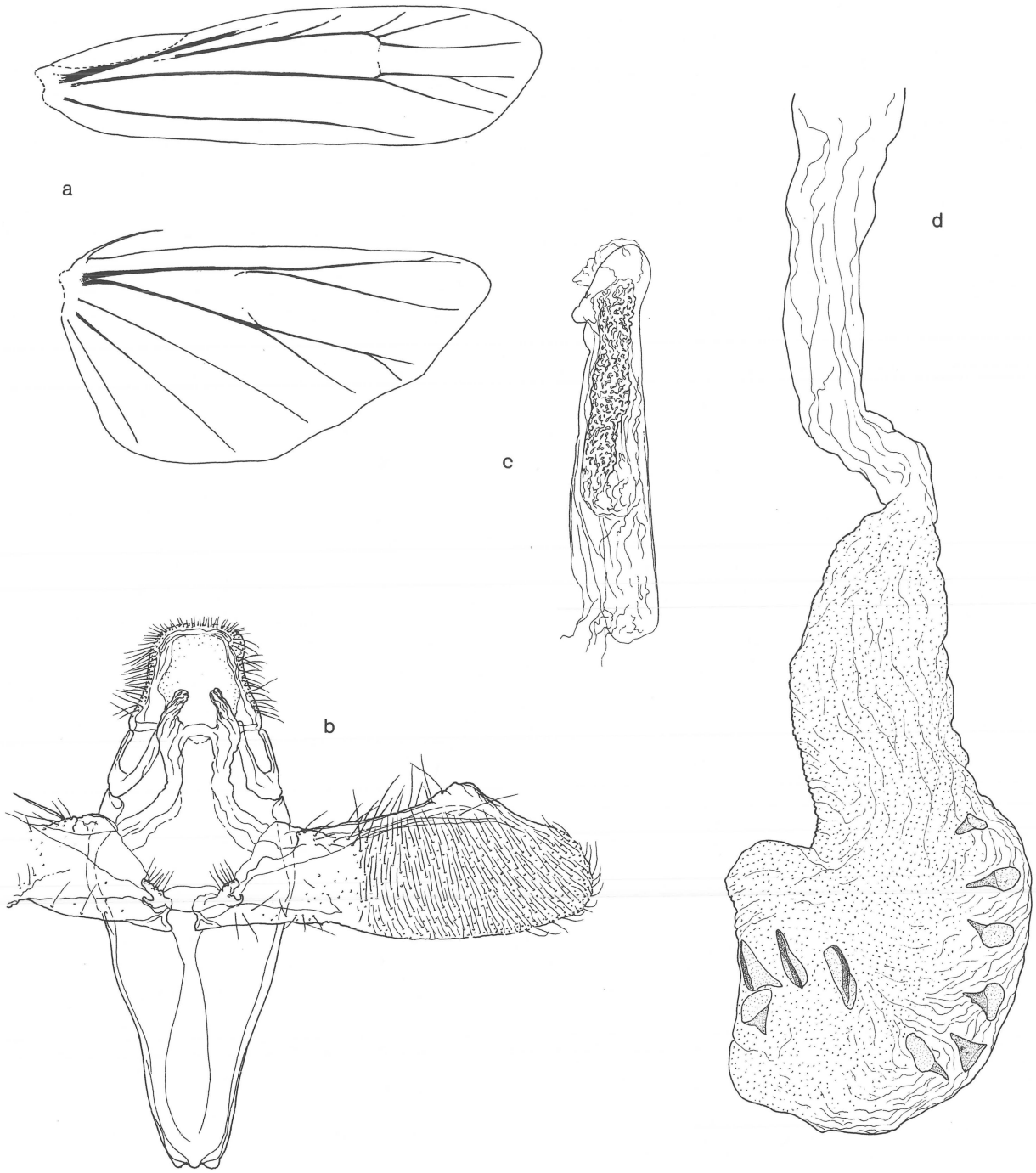


FIGURE 68: VENATION AND GENITALIA OF *ERELIEVA QUANTULELLA*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (HHN 967); *c.* Aedoeagus; *d.* Corpus bursae and ductus bursae (HHN 1768).

pepper (*Capsicum annuum* L.), and sorghum (*Sorghum vulgare* Persoon) (Heinrich, 1956).

Specimens were collected at light in southcentral Texas, in August. Moths reared in southeastern Texas have emerged in June or October.

Erelieva parvulella (Ely)
PL. 5, FIGS. 35, 36 (RWH 6035).

Eurythmia parvulella Ely, 1910, *Proc. Ent. Soc. Washington,* **12**: 202.

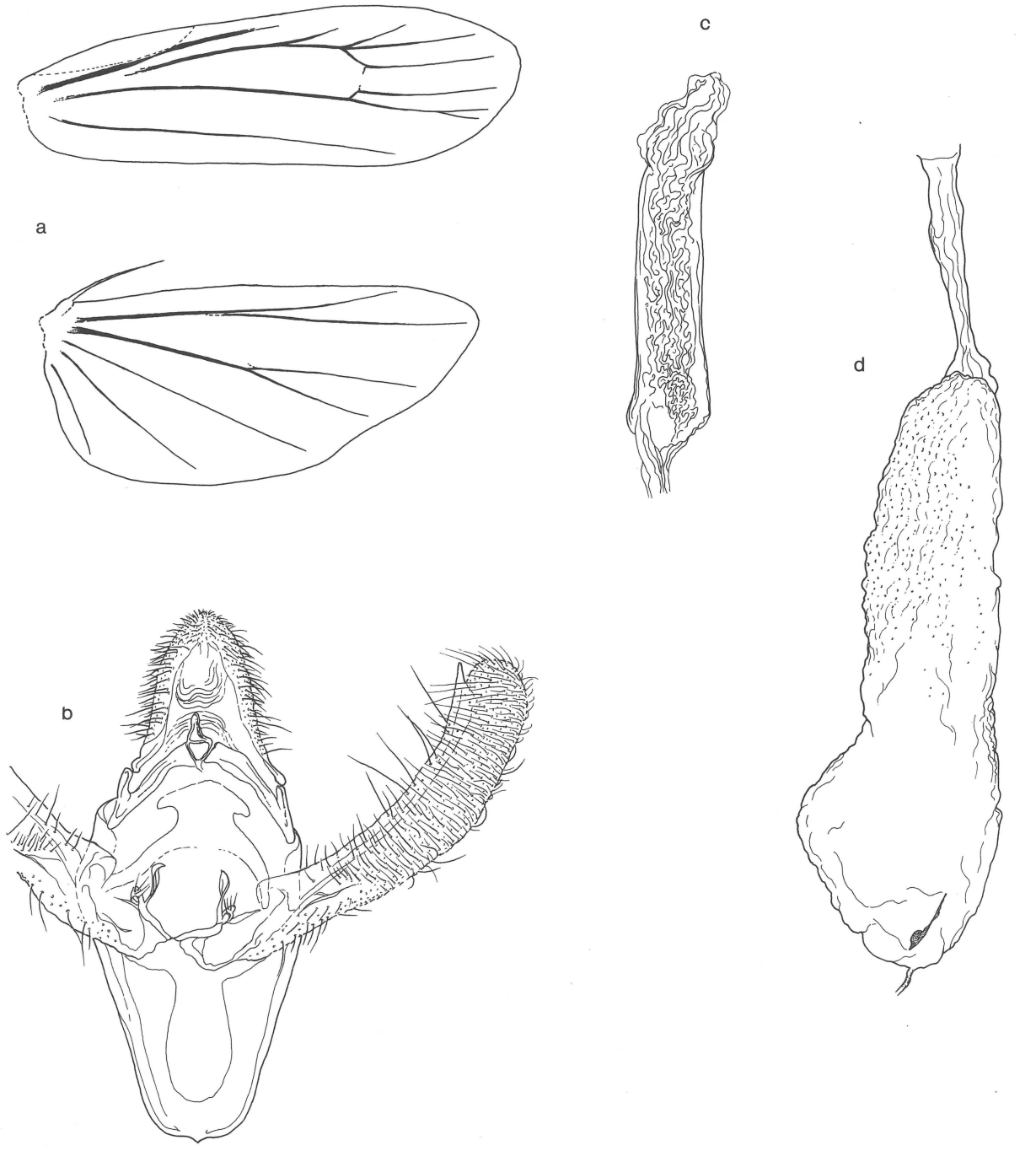


FIGURE 69: VENATION AND GENITALIA OF *CABNIA MYRONELLA*

a. Male forewing and hindwing; *b.* Male genitalia (most of left valva and aedoeagus omitted) (CH 3429); *c.* Aedoeagus; *d.* Corpus bursae, ductus bursae, and part of ductus seminalis (CH 3428).

Type locality: East River, Connecticut. [USNM]

E. parvulella is similar to *quantulella,* but has the postmedial line of the forewing less distinct. The more northern distribution of *parvulella* helps to identify the species. Differences in female genitalia, as mentioned in the key, will also separate the species; see text figure 68 *d* of *quantulella,* and Heinrich (1956: figure 1135) for an illustration of the genitalia of *parvulella.* Wing length 5.0–6.0 mm.

The immature stages of *parvulella* are unknown. Heinrich (1956: 309) knew *parvulella* from one

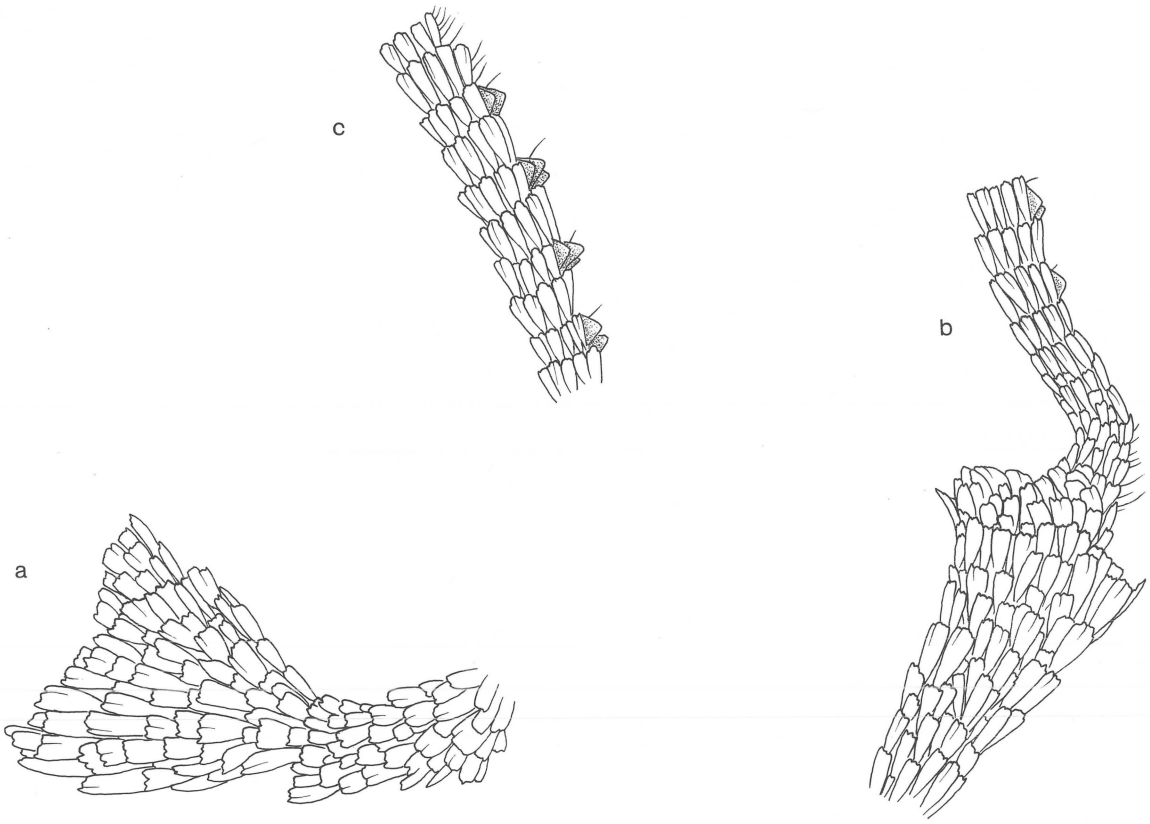


FIGURE 70: LABIAL PALPUS AND ANTENNA OF *CABNIA MYRONELLA*
a. Labial palpus (left side) of male; *b.* Scape and base of shaft of male antenna (left side); *c.* Subbasal part of shaft of male antenna (left side).

location in Connecticut. He thought that the species occurred sporadically in the northeastern United States but had its main population center much farther south in the tropics. Subsequent collecting has shown that *parvulella,* although not frequently collected, has a northern distribution: Nova Scotia (July), southern Quebec (July), southern Manitoba (July), Massachusetts (July, August), Connecticut (July), New York (July), and Illinois (late June, July).

GENUS
Cabnia Dyar

> *Cabnia* Dyar, 1904, *Jour. New York Ent. Soc.,* **12**: 108.
> Type species: *Cabnia myronella* Dyar, 1904. Monotypy.

Cabnia is a monotypic genus that can be distinguished from other phycitines in our fauna by the reduced venation of the hindwing (5 veins). It appears to be a resident of the East Coast from Massachusetts south to Florida and west to Mississippi.

Antenna of male (text figure 70 *b, c*) with scape simple, somewhat broadly scaled distally, base of shaft with short, deep indentation or sinus, subbasal segments of shaft with groups of broad, low sensilla. Sensilla trichodea (cilia) moderately abundant, and at base of shaft about ⅓–½ as long as basal diameter of shaft. Frons slightly convex, more or less smoothly scaled. Labial palpus of both sexes (text figure 70 *a*) upturned, short, not reaching vertex, second segment with triangular scale tuft, third segment much shorter than second segment. Maxillary palpus simple, small. Haustellum reduced. Ocellus present. Basal ½ of costa of forewing of male (text figure 69 *a*) slightly convex; under surface with costal fold. Forewing smooth scaled; with 9 veins; R_2 sometimes connate with R_{3+4+5}; M_1 from below upper angle of cell, usually slightly curved; M_2 and M_3 completely fused; CuA_1 and CuA_2 stalked for about ⅔ their lengths, originating from lower angle of cell. Hindwing (text figure 69 *a*) with 5 veins; $Sc+R_1$ and Rs completely fused, from upper angle of cell; CuA_2 with base near, or a short distance from lower angle of cell; cell about ½ length of wing. Eighth abdominal segment of male without scale tufts. Male

genitalia (text figure 69 *b, c*) with uncus rounded apically; gnathos with small mesial hook; transtilla complete, platelike with weak lateral lobes mesially; juxta U-shaped with short setiferous lateral elements; valva with short, subapical costal spines; aedoeagus simple; vinculum about as long as greatest width. Female genitalia (text figure 69 *d*) with ductus bursae and corpus bursae membranous; posterior half of corpus bursae with numerous scobinations; signum a pair of usually fused, blunt spines at anterior end of corpus bursae; ductus seminalis originating near signum.

The immature stages of *Cabnia* are unknown.

Cabnia myronella Dyar

PL. 5, FIGS. 37, 38. TEXT FIGS. 69 *a–d*; 70 *a–c* (RWH 6037).

Cabnia myronella Dyar, 1904, *Jour. New York Ent. Soc.*, **12**: 108.
Type locality: Washington, D.C. [USNM]

C. myronella is a small (wing length 3.5–5.0 mm), dark moth that is best recognized by its reduced hindwing venation (5 veins) (text figure 69 *a*), and the broadly scaled basal segment, and deep sinus in the base of the shaft, of the male antenna (text figure 70 *b, c*).

Few *myronella* are in collections. Small series, or individual specimens, have been collected in southeastern Massachusetts in August, and in Washington, D.C. in June. In northern and central Florida the species appears to be somewhat more abundant, having been taken at lights in May–September and December and January (most frequently in August). R. L. and B. B. Brown in northcentral Mississippi have recently collected two adults in May and July.

LITERATURE

ABDEL-RAHMAN, H. A., C. M. CHRISTENSEN, and A. C. HODSON. 1969. The relationship between *Plodia interpunctella* (Hb.) (Lepidoptera, Phycitidae) and stored-grain fungi. *Jour. Stored Products Res.,* **4**: 331–337.

AGENJO, R. 1959. La polilla de las garrofas, plaga actual de las naranjas (Lep. Phycit.). *Graellsia,* **17**: 7–17.

AMSEL, H. G. 1949. On the microlepidoptera collected by E. P. Wiltshire in Irak and Iran in the years 1935 to 1938. *Bull. Soc. Fouad Ier Ent.,* **33**: 271–351.

AMSEL, H. G. 1955(1954/55). Eine neue, deutsche Hummelnester bewohnende *Moodna*-Art (Lepidoptera: Pyralidae). *Mitteil. Münchener ent. Ges.,* **44/45**: 486–491.

AMSEL, H. G. 1956. Microlepidoptera Venezolana I. *Bol. Ent. Venezolana,* **10**: 1–336.

AMSEL, H. G. 1957. Microlepidoptera Venezolana II. *Bol. Ent. Venezolana,* **10**: TABLES I–CX.

AMSEL, H. G. 1959. Irakische Kleinschmetterlinge, II, *Bull. Soc. ent. Égypte,* **43**: 41–83.

BALACHOWSKY, A., and L. MESNIL. 1935. *Les Insectes Nuisibles aux Plantes Cultivées.* 1. 1137 pp. Paris: Busson.

BARNES, W., and J. H. MCDUNNOUGH. 1913. Some apparently new Lepidoptera from southern Florida. *Contrib. Nat. Hist. Lep. N. Am.,* **2**: 166–194.

BARNES, W., and J. H. MCDUNNOUGH. 1916. Synonymic notes on North American Heterocera. *Contrib. Nat. Hist. Lep. N. Am.,* **3**: 157–208.

BARNES, W., and J. H. MCDUNNOUGH. 1917a. A few remarks on Grossbeck's list of Florida Lepidoptera with descriptions of new species. *Contrib. Nat. Hist. Lep. N. Am.,* **3**: 217–223.

BARNES, W., and J. H. MCDUNNOUGH. 1917b. New North American Phycitinae. *Can. Ent.,* **49**: 404–406.

BARRETT, C. G. 1875. On the species of *Ephestia* occurring in Britain. *Ent. Mo. Mag.,* **11**: 269–273.

BEIRNE, B. P. 1952. *British Pyralid and Plume Moths.* 208 pp. London: Warne and Co.

BLAKESLEE, E. B. 1915. American plum borer. *Agric. Bull., U. S. Dept. Agric.,* **261**: 1–13.

BLANCHARD, A. 1976. A new species of the genus *Bertelia* B. & McD. (Pyralidae). *Jour. Lep. Soc.,* **30**: 211–213.

BODENHEIMER, F. S. 1930. *Die Schaedlingsfauna Palastinas.* 438 pp. Berlin.

CAPPS, H. W. 1964. Description of a new species of *Euzophora* [sic] Zeller attacking magnolias and note on two related species (Lepidoptera: Phycitidae). *Florida Ent.,* **47**: 49–52.

CARTER, D. J. 1984. *Pest Lepidoptera of Europe with Special Reference to the British Isles.* 431 pp. Dordrecht: W. Junk.

CASPARI, E. W., and F. J. GOTTLIEB. 1975. The Mediterranean meal moth, *Ephestia kuhniella* [sic]. *In* KING, R. C., *Handbook of Genetics,* 3. 874 pp. New York: Plenum Press.

CLEMENS, B. 1860. Contributions to American lepidopterology. 5. *Proc. Acad. Nat. Sci. Philadelphia,* **12**: 203–221.

CORRETTE, K. B., and H. H. NEUNZIG. 1979. Descriptions of and notes on larval habits of four immature phycitines in the southeastern United States (Lepidoptera: Pyralidae). *Ann. Ent. Soc. Amer.,* **72**: 690–699.

[DENIS, J. N. C. M., and I. SCHIFFERMÜLLER]. 1775. *Ankündung* [sic] *eines systematischen Werkes von den Schmetterlingen der Wienergegend herausgegeben von einigen Lehrern am k. k. Theresianum.* 323 pp., 3 tables. Vienna: Bernardi.

DONOHOE, H. C., and D. F. BARNES. 1934. Notes on host materials of *Ephestia figulilella* Gregson. *Jour. Econ. Ent.,* **28**: 1075–1077.

DONOHOE, H. C., P. SIMMONS, D. F. BARNES, G. H. KALOOSTIAN, C. K. FISHER, and C. HEINRICH. 1949. Biology of the raisin moth. *Technical Bull., U. S. Dept. Agric.,* **994**: 1–23.

DROOZ, A. T., and H. H. NEUNZIG. 1988. Notes on the biology of two phycitines (Lepidoptera: Pyralidae) associated with *Toumeyella pini* (Homoptera: Coccidae) on pine. *Proc. Ent. Soc. Washington,* **90**: 44–46.

DRUCE, H. 1891–1900. *In* GODMAN, F. D. and O. SALVIN, *Biologia Centrali-Americana, Insecta. Lepidoptera-Heterocera,* **2**: 1–622.

DURRANT, J. H. 1915a. *Myelois neophanes* sp. n., an addition to the British list. *Ent. Mon. Mag.,* **51**: 302.

DURRANT, J. H. 1915b. *Myelois phoenicis,* sp. n., bred from dates in Algeria and in England (Lep. Pyralidae). *Ent. Mon. Mag.,* **51**: 303–304.

DYAR, H. G. 1903. Note on a Californian fruitworm. *Proc. Ent. Soc. Washington,* **5**: 104.

DYAR, H. G. 1904a. New Lepidoptera from the United States. *Jour. New York Ent. Soc.,* **12**: 105–108.

DYAR, H. G. 1904b. Additions to the list of North American Lepidoptera, No. 2. *Proc. Ent. Soc. Washington,* **6**: 103–117.

DYAR, H. G. 1905a. New North American Lepidoptera and synonymical notes. *Proc. Ent. Soc. Washington,* **7**: 29–39.

DYAR, H. G. 1905b. The Lepidoptera of the Kootenai district of British Columbia. *Proc. U. S. Natl. Mus.,* **27**: 779–938.

DYAR, H. G. 1906. Descriptions of four new species of North American moths. *Jour. New York Ent. Soc.,* **14**: 107–108.

DYAR, H. G. 1908. Description of eleven new North American Pyralidae, with notes on a few others (Lepidoptera). *Proc. Ent. Soc. Washington,* **10**: 112–118.

DYAR, H. G. 1913. Descriptions of new Lepidoptera, chiefly from Mexico. *Proc. U. S. Natl. Mus.,* **44**: 279–324.

DYAR, H. G. 1914a. Report on the Lepidoptera of the Smithsonian Biological Survey of the Panama Canal Zone. *Proc. U. S. Natl. Mus.,* **47**: 139–350.

DYAR, H. G. 1914b. Descriptions of new species and genera of Lepidoptera from Mexico. *Proc. U. S. Natl. Mus.,* **47**: 365–409.

DYAR, H. G. 1917a. Three new North American Phycitinae (Lepidoptera, Pyralidae). *Ins. Insc. Mens.,* **5**: 45–46.

DYAR, H. G. 1917b. Seven new pyralids from British Guiana (Lepidoptera, Pyralidae). *Ins. Insc. Mens.,* **5**: 88–92.

DYAR, H. G. 1919. Some tropical American Phycitinae (Lepidoptera, Pyralidae). *Ins. Insc. Mens.,* **7**: 40–63.

DYAR, H. G. 1922. New American moths (Lepidoptera). *Ins. Insc. Mens.,* **10**: 166–173.

DYAR, H. G. 1925a. Some new American moths (Lepidoptera). *Ins. Insc. Mens.,* **13**: 1–19.

DYAR, H. G. 1925b. Notes on some American Phycitinae (Lepidoptera, Pyralidae). *Ins. Insc. Mens.,* 13: 220–226.

ELY, C. 1910. New Phycitinae and Crambinae (Lepidoptera: Pyralidae). *Proc. Ent. Soc. Washington,* **12**: 202–204.

FISCHER VON RÖSLERSTAMM, J. E. 1834–1843. *Abbildungen zur Berichtigung und Ergänzung der Schmetterlingskunde, besonders der Microlepidopterologie.* v + 304 pp., 100 pl. Leipzig: J. C. Hinrich'schen.

FITCH, A. 1856. Report on the noxious, beneficial, and other insects of the state of New York. *Trans. New York State Agric. Soc.,* **16**: 315–490.

FRISON, T. H. 1926. Contributions to the knowledge of the interrelationships of the bumblebees of Illinois with their animate environment. *Ann. Ent. Soc. Amer.,* **19**: 203–235.

GOATER, B. 1986. *British Pyralid Moths. A guide to Their Identification.* 175 pp. Colchester: Harley Books.

GOTHILF, S. 1970. The biology of the carob moth *Ectomyelois ceratoniae* (Zell.) in Israel. III. Phenology on various hosts. *Israel Jour. Ent.,* **5**: 161–175.

GOZMÁNY, L. 1958. Notes on Hungarian Phycitidae (Lepidoptera). *Annales Historico-Naturales Musei Nationalis Hungarici,* **9**: 223–225.

GREGSON, C. S. 1871. Description of an *Ephestia* new to science. *Entomologist,* **5**: 385.

GUENÉE, M. A. 1845. Essai sur une nouvelle classification de microlépidoptères. *Ann. Soc. ent. France,* **3**: 297–323.

HAMLIN, J. C., W. D. REED, and M. E. PHILLIPS. 1931. Biology of the Indian-meal moth on dried fruits in California. *Technical Bull., U. S. Dept. Agric.,* **242**: 1–27.

HAMPSON, G. F. 1901. The Lepidoptera-Phalaenae of the Bahamas. *Ann. Mag. Nat. Hist.,* (7) **7**: 246–261.

HAMPSON, G. F. 1903. The moths of India. *Jour. Bombay Nat. Hist. Soc.,* **15**: 19–37.

HAMPSON, G. F. 1930. New genera and species of Phycitinae (Lepidoptera, Pyralidae). *Ann. Mag. Nat. Hist.,* (10) **5**: 50–80.

HASENFUSS, I. 1960. *Die Larvalsystematik der Zünsler.* 263 pp. Berlin: Akadamie-Verlag.

HAY, C. J. 1958. Life history and control of a root collar borer (*Euzophera ostricolorella* Hulst) in yellow poplar. *Jour. Econ. Ent.,* **51**: 251–252.

HEINRICH, C. 1920. On some forest Lepidoptera with descriptions of new species, larvae and pupae. *Proc. U. S. Natl. Mus.,* **57**: 53–96.

HEINRICH, C. 1940. Some new American Pyralidoid moths. *Proc. Ent. Soc. Washington,* **42**: 31–41.

HEINRICH, C. 1956. American moths of the subfamily Phycitinae. *U. S. Natl. Mus. Bull.,* **207**: [i]–viii, 1–581.

HOPE, J. H., and C. D. PLESS. 1979. Biology of *Euzophera ostricolorella* on yellow-poplar in Tennessee. *Ann. Ent. Soc. Amer.,* **72**: 1–4.

HÜBNER, J. 1796–[1836]. *Sammlung Europäischer Schmetterlinge.* **8**. Tineae 78 pp., 71 plates. Augsburg: Hübner.

HULST, G. D. 1887. New species of Pyralidae. *Ent. Americana,* **3**: 129–138.

HULST, G. D. 1888. New genera and species of Epipaschiae and Phycitidae. *Ent. Americana,* **4**: 113–118.

HULST, G. D. 1890. The Phycitidae of North America. *Trans. Amer. Ent. Soc.,* **17**: 93–228.

HULST, G. D. 1900a. Some new genera and species of Phycitinae. *Can. Ent.,* **32**: 169–176.

HULST, G. D. 1900b. New species of Lepidoptera. *Jour. New York Ent. Soc.,* **8**: 215–225.

JANZEN, D. H. 1987. How moths pass the dry season in a Costa Rican dry forest. *Insect. Sci. and Its Application,* **8**: 489–500.

KEIFER, H. H. 1932. *Ephestia kuehniella fuscofasciella* Rag. in California. *Pan-Pacific Ent.,* **8**: 156.

KERR, S. H., and J. E. BROGDON. 1958. A new pest of magnolias. *Florida Ent.,* **41**: 195.

KIMBALL, C. P. 1965. Lepidoptera of Florida. *Arthropods of Florida,* **1**: v + 1–363, pl. 1–26.

KOCAK, A. Ö. 1984a. On the validity of the species group names proposed by Denis & Schiffermüller, 1775 in Ankündung (sic!) eines systematischen Werkes von den Schmetterlingen der Wiener Gegend. *Priamus,* **3**: 133–154.

KOCAK, A. Ö. 1984b. More additions and corrections to the names published in "Systematic and Synonymic List of the Lepidoptera of France, Belgium and Corsica" by Leraut, 1980. *Priamus,* **3**: 155–168.

LEHMENSICK, R., and R. LIEBERS. 1938. Beiträge zur biologie der Mikrolepidopteren. (Untersuchungen an *Plodia interpunctella* Hb.). *Zeits. Angewandte Ent.,* **24**: 582–643.

MACKAY, M. R. 1972. Larval sketches of some Microlepidoptera, chiefly North American. *Mem. Ent. Soc. Canada,* **88**: 1–83.

MATSUMURA, S. 1917. Oyo-kinchyngaku. I. *Dai-Nippon Gaichyu Zensho.* 827 pp. Tokyo: Keiseisha.

MCDUNNOUGH, J. H. 1927. The Lepidoptera of the Seton Lake Region, British Columbia. *Can. Ent.,* **59**: 266–277.

MEYRICK, E. 1930–1936. *Exotic Microlepidoptera,* **4**. 642 pp. Marlborough: E. Meyrick.

MEYRICK, E. 1931. New species of New Zealand Lepidoptera. *Trans. Proc. New Zealand Inst.,* **62**: 92–97.

MOORE, F. 1884–1887. *The Lepidoptera of Ceylon,* **3**. 578 pp. London.

MUNROE, E. G. 1983. Pyralidae. *In* HODGES, R. W., et al. (ed.), *Check List of the Lepidoptera of America North of Mexico.* xxiv + 284 pp. London: E. W. Classey Ltd. and The Wedge Entomological Research Foundation.

NEUNZIG, H. H. 1976. Descriptions of the immature stages and biology of *Vitula lugubrella* (Ragonot) (Pyralidae: Phycitinae). *Jour. Lep. Soc.,* **30**: 133–137.

NEUNZIG, H. H. 1979. Systematics of immature phycitines (Lepidoptera: Pyralidae) associated with leguminous plants in the southern United States. *Technical Bull., U. S. Dept. Agric.,* **1539**: 1–119.

NEUNZIG, H. H. 1985. Notes on the larva and biology of *Moodna bisinuella* Hampson (Pyralidae: Phycitinae). *Jour. Lep. Soc.,* **39**: 9–12.

NEUNZIG, H. H. 1986. *In* DOMINICK, R. B., et al., Pyraloidea: Pyralidae (part) Phycitinae (part). *The Moths of America North of Mexico,* Fasc. **15.2**: xi + 1–114.

NEUNZIG, H. H. 1987. Pyralidae (Pyraloidea). *In* STEHR, F. W., *Immature Insects.* 754 pp. Dubuque: Kendall/Hunt.

OKUMURA, G. T. 1966. The driedfruit moth (*Vitula edmandsae serratilineella* Ragonot), pest of dried fruits and honey combs. *California Dept. Agric. Bull.,* **55**: 180–186.

PALM, E. 1986. *Nordeuropas Pyralider—Med Saerligt Henblik pa den Danske Fauna (Lepidoptera: Pyralidae).* 287 pp. Copenhagen: Faunabøger.

PALMONI, Y. 1969. The Pyralidae of the Lake Tiberias Region. *Israel Jour. Ent.,* **4**: 293–321.

POWELL, J. A. 1967. *Apomyelois bistriatella*: a moth which feeds in an Ascomycete fungus (Lepidoptera: Pyralidae). *Jour. New York Ent. Soc.,* **75**: 190–194.

POWELL, J. A., and R. A. MACKIE. 1966. Biological interrelationships of moths and *Yucca whipplei* (Lepidoptera: Gelechiidae, Blastobasidae, Prodoxidae). *Univ. California Publications Ent.* **42**: 1–46.

RAGONOT, E. L. 1887a. Diagnoses d'espèces nouvelles de Phycitidae d'Europe et des Pays limitrophes. *Ann. Soc. ent. France,* **7**: 225–260.

RAGONOT, E. L. 1887b. *Diagnoses of North American Phycitidae and Galleriidae.* 20 pp. Paris.

RAGONOT, E. L. 1888. *Nouveaux genres et espèces de Phycitidae & Galleriidae.* 52 pp. Paris.

RAGONOT, E. L. 1889. Phycitidae and Galleriidae of North America. Some new species and a general catalogue. *Ent. Americana,* **5**: 113–117.

RAGONOT, E. L. 1893. Monographie des Phycitinae et des Galleriinae. *Mémoires sur les Lépidoptères,* **7**: 1–658, pl. 1–23.

RAGONOT, E. L., and (completed by) G. F. HAMPSON. 1901. Monographie des Phycitinae et des Galleriinae. *Mémoires sur les Lépidoptères,* **8**: 1–602, pl. 24–67.

RAMIREZ-SANCHEZ, J. 1964. Investigación preliminar sobre biología ecología y control de *Hypsipyla grandella* Zeller. *Bol. Inst. Forestal Latino-Americano de Investigación y Capacitación,* **16**: 54–57.

REUTTI, C. 1898. *Übersicht der lepidopteren-Fauna des Grossherzogtums Baden und der anstossenden Länder.* 361 pp. Berlin.

RICE, R. E. 1978. Navel orangeworm: a pest of pistachio nuts in California. *Jour. Econ. Ent.,* **71**: 822–824.

RICHARDS, K. W. 1984. Food preference, growth, and development of larvae of the driedfruit moth, *Vitula edmandsae serratilineella,* Ragonot (Lepidoptera: Pyralidae). *Jour. Kansas Ent. Soc.,* **57**: 28–33.

RICHARDS, O. W., and W. S. THOMSON. 1932. A contribution to the study of the genera *Ephestia,* Gn. (including *Strymax,* Dyar), and *Plodia,* Gn. (Lepidoptera, Phycitidae), with notes on parasites of the larvae. *Trans. ent. Soc. London,* **80**: 169–250.

RINDGE, F. H. 1955. The type material in the J. B. Smith and G. D. Hulst collections of Lepidoptera. *Bull. Amer. Mus. Nat. Hist.,* **106**: 95–172.

ROESLER, R. U. 1965. Untersuchungen über die Systematik und Chorologie des *Homoeosoma-Ephestia*-Komplexes (Lepidoptera: Phycitinae). Inaugural Dissertation. 265 pp., 342 figs. Saarbrücken University.

ROESLER, R. U. 1968. Das neue systematische Verzeichnis der deutschen Phycitinae (Lepidoptera, Pyralidae). *Nachrichtenblatt Bayerischen Ent.,* **17**: 1–9, 25–28.

ROESLER, R. U. 1973. Phycitinae. *In* AMSEL, H. G., F. GREGOR, and H. REISSER, *Microlepidoptera Palaearctica,* 4: 1–752 (text); 1–137, pl. 1–170 (text and illustrations). Vienna: Georg Fromme.

ROESLER, R. U., and P. V. KÜPPERS. 1981. Die Phycitinae (Lepidoptera: Pyralidae) von Sumatras; Taxonomie Teil B, Ökologie und Geobiologie. *Beitr. Naturkundlichen Forschung Südwest Deutschland,* **4**: 3–282.

ROOVERS, M. 1971. Observationes sobre el ciclo de vida de *Hypsipyla grandella* Zeller en Barinitas, Venezuela. *Bol. Inst. Forestal Latino-Americano de Investigación y Capacitación,* **38**: 1–46.

SATTLER, K. 1989. The correct name of the North American dried fruit moth in Europe (Lepidoptera: Pyralidae). *Ent. Scandinavica,* **19**: 455–458.

SCOTT, A. W. 1859. On a new lepidopterous insect from Australia. *Proc. Zool. Soc. London.,* **27**: 207–209.

SCOTT, C. D., M. L. WINSTON, K. N. SLESSOR, G. G. S. KING, and G. G. GRANT. 1984. The biology and pheromone-based monitoring of the driedfruit moth, *Vitula edmandsae serratilineella* (Lepidoptera: Pyralidae). *Can. Ent.,* **116**: 1007–1013.

SHAFFER, J. C. 1968. A revision of the Peoriinae and Anerastiinae (auctorum) of America north of Mexico (Lepidoptera: Pyralidae). *U. S. Natl. Mus. Bull.,* **280**: [i]–vi, 1–124.

SORHAGAN, L. 1881. Zwei neue Pyraliden. *Berlin Ent. Zeits.,* **25**: 103–104.

TURATI, E. 1926. Novita di lepidotterologia in Cirenaica. *Atti Soc. Italiana Sci. Nat.,* **65**: 25–83.

TURATI, E. 1927. Novita di lepidotterologia in Cirenaica. *Atti Soc. Italiana Sci. Nat.,* **66**: 313–344.

TURATI, E. 1930. Novita di lepidotterologia in Cirenaica. *Atti Soc. Italiana Sci. Nat.,* **69**: 46–92.

VAUGHAN, H. 1870. Descriptions of three species of Phycidae (from Britain) new to science. *Ent. Mo. Mag.,* **7**: 130–132.

VICK, K. W., J. A. COFFELT, and W. A. WEAVER. 1987. Presence of four species of stored-product moths in storage and field situations in north-central Florida as determined with sex pheromone-baited traps. *Florida Ent.,* **70**: 488–492.

WADE, W. H. 1961. Biology of the navel orangeworm, *Paramyelois transitella* (Walker) on almonds and walnuts in northern California. *Hilgardia,* **31**: 129–171.

WALKER, F. 1863. *List of the Specimens of Lepidopterous Insects in the Collection of the British Museum,* **27**: 1–286.

WALKER, F. 1864. *List of the Specimens of Lepidopterous Insects in the Collection of the British Museum,* **30**: 837–1096.

WALKER, F. 1866. *List of the Specimens of Lepidopterous Insects in the Collection of the British Museum,* **35**, supplement 5: 1535–2040.

WALTER, E. V. 1928. Some new moths from Arizona. *Proc. Ent. Soc. Washington,* **30**: 137–141.

WHALLEY, P. E. S. 1963. The status of *Myelois neophanes* (Phycitinae) in England. *Jour. Lep. Soc.,* **17**: 39.

WILEMAN, A. E., and R. SOUTH. 1918. New species of Pyralidae from Formosa. *Entomologist,* **51**: 217–219.

ZELLER, P. C. 1839. Versuch einer naturgemässen Eintheilung der Schaben. *Isis von Oken,* **32**: 167–220.

ZELLER, P. C. 1848. Exotische Phyciden. *Isis von Oken,* **41**: 857–890.

ZELLER, P. C. 1867. Crambina, Pterophorina and Alucitina, collected in Palestine, by the Rev. O. P. Cambridge, March to May, 1865. *Trans. ent. Soc. London,* **5**: 453–460.

ZELLER, P. C. 1872. Beiträge zur Kenntniss der Nordamerikanischen Nachtfalter, besonders der Mikrolepidopteren. *Verh. K.-K. Zool.-Bot. Ges. Wien,* **22**: 447–566.

ZELLER, P. C. 1875. Beiträge zur Kenntniss der Nordamerikanischen Nachtfalter, besonders der Mikrolepidopteren. *Verh. K.-K. Zool.-Bot. Ges. Wien,* **25**: 207–360.

ZELLER, P. C. 1879. Lepidopterologische Bemerkungen. *Stettiner ent. Zeitung,* **40**: 466.

ZELLER, P. C. 1881. Columbische, Chiloniden, Crambiden und Phycideen. *Hor. Soc. Ent. Ross.* **16**: 154–256.

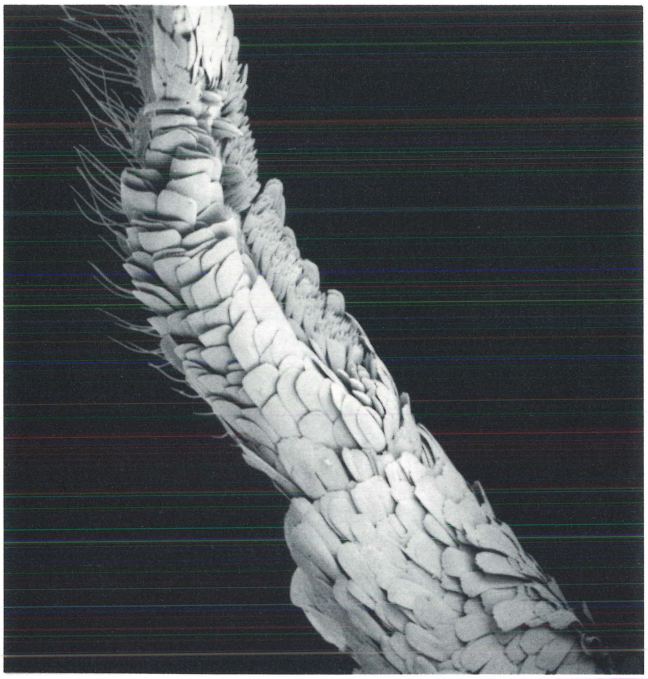
MONOCHROME PLATES

PLATE A: MALE ANTENNAE OF PHYCITINAE

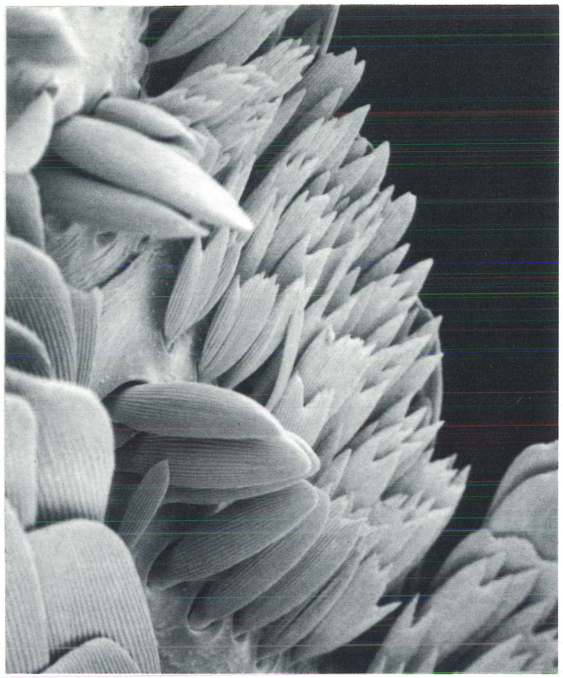
1. *Cuniberta subtinctella* (Ragonot), base of left antenna (caudal view); 2. Enlarged spinelike sensilla in upper part of sinus in shaft (caudal view); 3. *Crocidomera imitata* Neunzig, base of right antenna (caudal view); 4. Enlarged compact cluster of sensilla at basal segment of shaft (caudal view).

PLATE B: MALE ANTENNAE OF PHYCITINAE

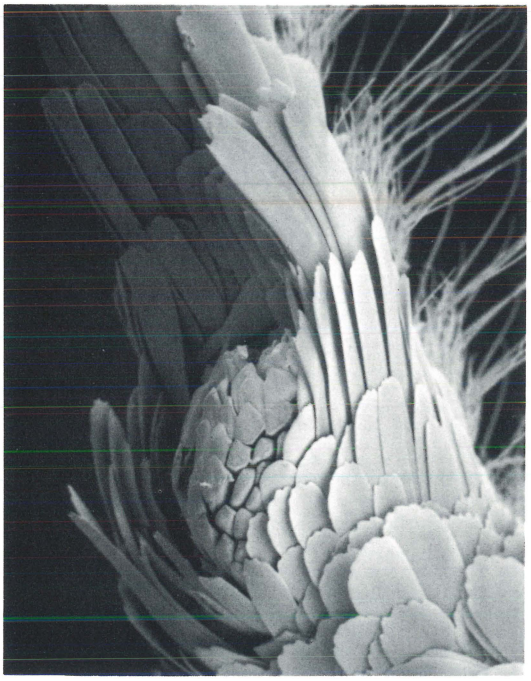
1. *Moodna ostrinella* (Clemens), base of left antenna (caudal view); 2. *Ephestiodes gilvescentella* Ragonot, base of right antenna (caudal view); 3. *Caudellia apyrella* Dyar, base of left antenna (caudal view).



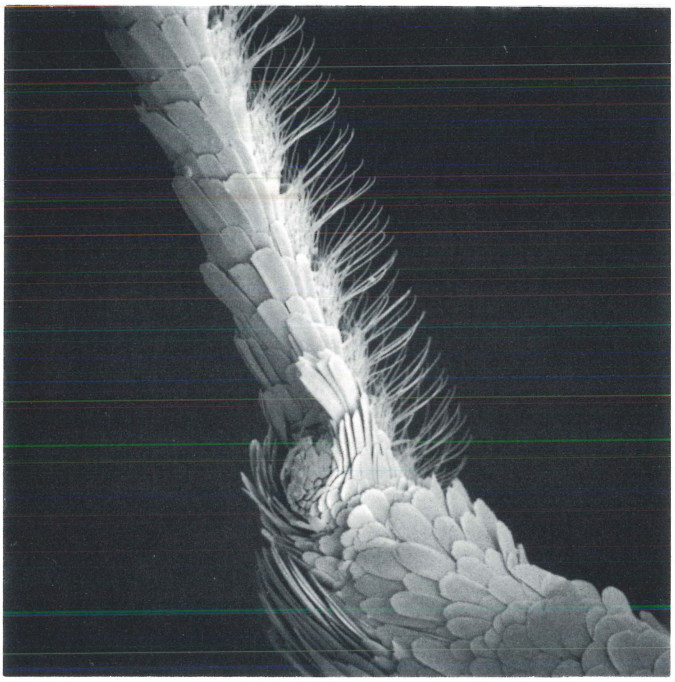
1



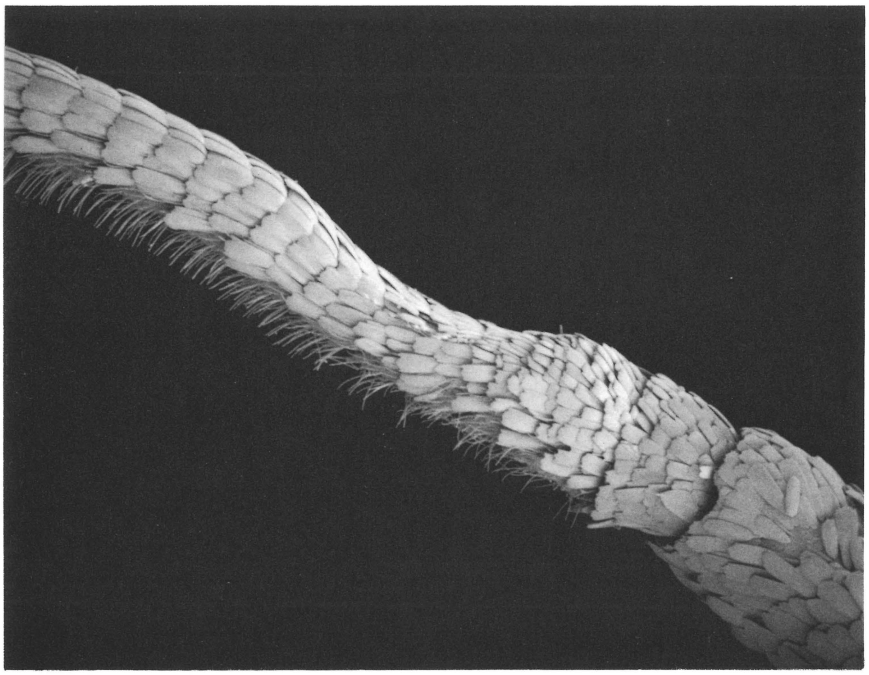
2



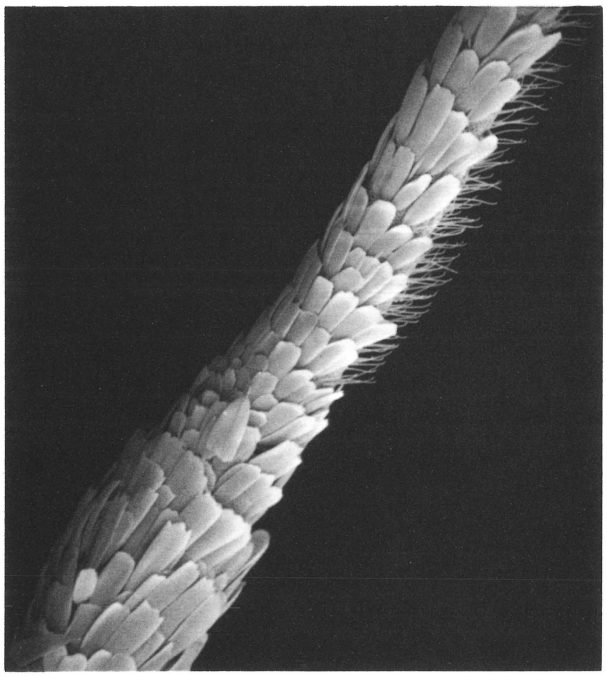
4



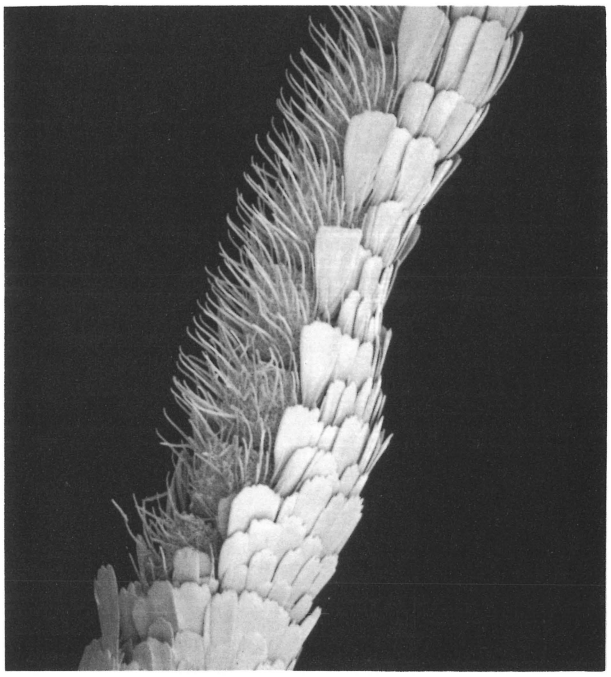
3



1



2



3

COLOR PLATES

Pyraloidea

PLATE 1

Pyraloidea

PYRALIDAE

figs. 1–68

NATURAL SIZE 1:1

1. *Bertelia grisella* B. & McD., ♂. Redington, Arizona (USNM). (p. 25).
2. *Bertelia grisella* B. & McD., ♀. Redington, Arizona (USNM). (p. 25).
3. *Bertelia dupla* Blanchard, ♂. Holotype. Shafter, Presidio Co., Texas, 19 October 1973, A. & M. E. Blanchard (USNM). (p. 25).
4. *Bertelia dupla* Blanchard, ♀. Paratype. Shafter, Presidio Co., Texas, 15 October 1969, A. & M. E. Blanchard (USNM). (p. 25).
5. *Cuniberta subtinctella* (Rag.), ♂. Great Basin Exp. Sta., 8,850′, nr. Ephraim, Sanpete Co., Utah, 1 August 1981, D. C. Ferguson (USNM). (p. 20).
6. *Cuniberta subtinctella* (Rag.), ♂. Priest R. Exp. For., 2,500′, Bonner Co., Idaho, 19 June 1979, D. C. Ferguson (USNM). (p. 20).
7. *Cuniberta subtinctella* (Rag.), ♀. Priest R. Exp. For., 2,500′, Bonner Co., Idaho, 19 June 1979, D. C. Ferguson (USNM). (p. 20).
8. *Myelopsis immundella* (Hulst), ♂. Mt. Locke, 6,700′, Jeff Davis Co., Texas, 26 April 1981, E. C. Knudson (ECK). (p. 35).
9. *Myelopsis immundella* (Hulst), ♀. San Antonio, Bexar Co., Texas, 6 May 1978, E. C. Knudson (ECK). (p. 35).
10. *Myelopsis alatella* (Hulst), ♂. Palm Springs, Riverside Co., California, 2 April 1954, A. H. Rindge (AMNH). (p. 36).
11. *Myelopsis alatella* (Hulst), ♂. Crooked Cr. Lab., 10,150′, White Mts., Mono Co., 3 airline mi N Inyo Co. line, California, 22 June 1961, J. A. Powell (UCB). (p. 36).
12. *Myelopsis alatella* (Hulst), ♂. Monachee Mdws., 8,000′, Tulare Co., California, 8/14 July (USNM). (p. 36).
13. *Myelopsis alatella* (Hulst), ♂. Zapata Ranch, 9,600′, Alamosa Co., Colorado, 27 June 1982, D. C. Ferguson (USNM). (p. 36).
14. *Myelopsis alatella* (Hulst), ♂. Laguna Park, Bosque Co., Texas, 28 March 1973, A. & M. E. Blanchard (USNM). (p. 36).
15. *Myelopsis subtetricella* (Rag.), ♂. Ft. Niobrara Natl. Wildlife Refuge, Cherry Co., Nebraska, 6 June 1983, R. W. Hodges (USNM). (p. 35).
16. *Myelopsis subtetricella* (Rag.), ♂. Zapata Ranch, 8,200′, Alamosa Co., Colorado, 19 June 1982, D. C. Ferguson (USNM). (p. 35).
17. *Adanarsa intransitella* (Dyar), ♀. Bumble Bee Rest Area, Rte 17, Yavapai Co., Arizona, 4 August 1986, A. H. Porter (UCD). (p. 18).
18. *Adanarsa intransitella* (Dyar), ♀. Mayer, Arizona, 28 April 1959, M. O. Glenn (INHS). (p. 18).

19. *Chararica annuliferella* (Dyar), ♀. Mayer, Arizona, 12 May 1959, M. O. Glenn (INHS). (p. 32).
20. *Chararica bicolorella* B. & McD., ♂. Paratype. Christmas, Gila Co., Arizona (USNM). (p. 32).
21. *Chararica bicolorella* B. & McD., ♂. Mayer, Arizona, 30 May 1959, M. O. Glenn (INHS). (p. 32).
22. *Chararica hystriculella* (Hulst), ♀. Laguna Atascosa, Cameron Co., Texas, 9 March 1975, A. & M. E. Blanchard (USNM). (p. 32).
23. *Chararica hystriculella* (Hulst), ♀. Dugout Wells, Big Bend Natl. Park., Texas, 3 October 1966, A. & M. E. Blanchard (USNM). (p. 32).
24. *Chararica hystriculella* (Hulst), ♀. Dugout Wells, 2,850′, Big Bend Natl. Park, Brewster Co., Texas, 1 May 1972, J. G. Franclemont (USNM). (p. 32).
25. *Chararica hystriculella* (Hulst), ♂. Mercedes, Hidalgo Co., Texas, 16 September 1958, H. Smalzried (AMNH). (p. 32).
26. *Volatica gallivorella* Neunzig, ♂. Holotype. Ft. Davis, Texas, larva collected 28 April 1974, gall on oak, adult emerged 25 May 1974, H. H. Neunzig (USNM). (p. 82).
27. *Volatica gallivorella* Neunzig, ♀. Paratype. Ft. Davis, Texas, larva collected 27 April 1975, gall on oak, adult emerged 26 May 1975, H. H. Neunzig (USNM). (p. 82).
28. *Volatica gallivorella* Neunzig, ♀. Paratype. Ft. Davis, Texas, larva collected 9 September 1973, gall on oak, adult emerged 28 September 1973, H. H. Neunzig (NCSU). (p. 82).
29. *Volatica gallivorella* Neunzig, ♀. Paratype. Ft. Davis, Texas, larva collected 9 September 1973, gall on oak, adult emerged 2 October 1973, H. H. Neunzig (NCSU). (p. 82).
30. *Euzophera semifuneralis* (Wlk.), ♀. University Reserve, Welaka, Putnam Co., Florida, 8 April 1972, D. C. Ferguson (USNM). (p. 54).
31. *Euzophera semifuneralis* (Wlk.), ♀. Six Mile Creek, Ithaca, New York, 26 May 1957. J. G. Franclemont (USNM). (p. 54).
32. *Euzophera semifuneralis* (Wlk.), ♂. 18 km N of Raleigh, Wake Co., North Carolina, 12 May 1983, H. H. Neunzig (NCSU). (p. 54).
33. *Euzophera semifuneralis* (Wlk.), ♀. Warren, Tyler Co., Texas, 17 April 1971, A. & M. E. Blanchard (USNM). (p. 54).
34. *Euzophera habrella* Neunzig, ♂. Holotype. Spruce Knob Lake, 4,000′, Randolph Co., West Virginia, 10 July 1983, Opler and Powell (UCB). (p. 56).
35. *Euzophera habrella* Neunzig, ♀. Paratype. Six Mile Creek, Ithaca, New York, 9 June 1954, J. G. Franclemont (USNM). (p. 56).
36. *Euzophera habrella* Neunzig, ♀. Paratype. Six Mile Creek, Ithaca, New York, 29 May 1959, J. G. Franclemont (USNM). (p. 56).
37. *Euzophera aglaeella* Rag., ♀. S.W.R.S. 5 mi W of Portal, Cochise Co., Arizona, 12 May 1956, M. Statham (AMNH). (p. 56).
38. *Euzophera aglaeella* Rag., ♀. Sinton, Welder Wildlife Foundation, San Patricio Co, Texas, 20 March 1969, A. & M. E. Blanchard (USNM). (p. 56).
39. *Euzophera aglaeella* Rag., ♂. Sinton, Welder Wildlife Foundation, San Patricio Co., Texas, 20 March 1969, A. & M. E. Blanchard (USNM). (p. 56).
40. *Euzophera vinnulella* Neunzig, ♂. Holotype. Seton Lake, British Columbia, 1 August 1933, J. McDunnough (CNC). (p. 58).
41. *Euzophera vinnulella* Neunzig, ♀. Paratype. Seton Lake, British Columbia, 4 August 1933, J. McDunnough (CNC). (p. 58).
42. *Euzophera magnolialis* Capps, ♂. Kinston, North Carolina, larva collected 25 October 1976, *Magnolia grandiflora,* reared outdoors, adult emerged 28 April 1977, N. Lapp (NCSU). (p. 59).
43. *Euzophera magnolialis* Capps, ♀. Archbold Biol. Sta., L. Placid, Highlands Co., Florida., 5 April 1959, J. G. Franclemont (USNM). (p. 59).
44. *Euzophera nigricantella* Rag., ♀. Madera Canyon, Santa Rita Mts., Pima Co., Arizona, 17 September 1950, C. W. Kirkwood (USNM). (p. 59).
45. *Pseudocabima arizonensis* Heinr., ♀. Redington, Pima Co., Arizona (USNM). (p. 42).
46. *Crocidomera imitata* Neunzig, ♂. Holotype. Key Largo, Monroe Co., Florida, 25 October 1965, Mrs. Spencer Kemp (USNM). (p. 23).
47. *Crocidomera imitata* Neunzig, ♂. Paratype. Laguna Atascosa, Cameron Co., Texas, 12 September 1974, A. & M. E. Blanchard (USNM). (p. 23).
48. *Crocidomera imitata* Neunzig, ♀. Paratype. Laguna Atascosa, Cameron Co., Texas, 16 November 1973, A. & M. E. Blanchard (USNM). (p. 23).
49. *Amyelois transitella* (Wlk.), ♂. Walnut Creek, Contra Costa Co., California, 13 November 1966, J. A. Powell (UCB). (p. 51).
50. *Amyelois transitella* (Wlk.), ♂. Davis, California, 5 May 1961, J. S. Buckett (UCD). (p. 51).
51. *Amyelois transitella* (Wlk.), ♀. Houston, Harris Co., Texas, 14 April 1979, A. & M. E. Blanchard (USNM). (p. 51).
52. *Ectomyelois ceratoniae* (Zell.), ♀. Key West, Monroe Co., Florida, in fallen pods of *Tamarindus indicus* [sic], 28 February 1984, W. E. Steiner, A. G. Gerberich, and J. E. Lowry (USNM). (p. 47).
53. *Ectomyelois ceratoniae* (Zell.), ♀. Key West, Monroe Co., Florida, in fallen pods of *Tamarindus indicus* [sic], 28 February 1984, W. E. Steiner, A. G. Gerberich, and J. E. Lowry (USNM). (p. 47).
54. *Apomyelois bistriatella* (Hulst), ♂. Lac Mondor, Ste. Flore Pk., Quebec, 29 May 1951, E. G. Munroe (CNC). (p. 44).
55. *Apomyelois bistriatella* (Hulst), ♀. 5 mi W Lone Pine, Inyo Co., California, larva collected 13 June 1965, *Hypoxylon,* adult emerged 6/26 July 1965, J. Doyen (UCB). (p. 44).
56. *Apomyelois bistriatella* (Hulst), ♀. 5 mi W Lone Pine, Inyo Co., California, larva collected 13 June 1965, *Hypoxylon,* adult emerged 6/26 July 1965, J. Doyen (UCB). (p. 44).
57. *Apomyelois bistriatella* (Hulst), ♂. T38N R2W S35, Cheboygan Co., Michigan, 9 August 1986, G. Balogh (GJB). (p. 44).
58. *Ephestia kuehniella* Zell., ♀. Wedge Plantation, McClellanville, South Carolina, 22 March 1968, D. C. Ferguson (USNM). (p. 107).
59. *Ephestia kuehniella* Zell., ♀. Madera Canyon, 5,600′, Santa Rita Mts., Santa Cruz Co., Arizona, 3 May 1963, J. G. Franclemont (USNM). (p. 107).
60. *Ephestia kuehniella* Zell., ♂. Walnut Creek, Contra Costa Co., California, reared from log with imbedded acorns, adult emerged 1/12 September 1968, J. A. Powell (UCB). (p. 107).
61. *Anypsipyla univitella* Dyar, ♀. Key Largo, Florida, 11 March 1986, L. C. Dow (NCSU). (p. 31).
62. *Hypsipyla grandella* (Zell.), ♀. N Key Largo, Monroe Co., Florida, 29 March 1986, H. D. Baggett (NCSU). (p. 27).
63. *Hypsipyla grandella* (Zell.), ♂. Key Largo, Florida, 11 March 1986, L. C. Dow (NCSU). (p. 27).
64. *Hypsipyla grandella* (Zell.), ♀. Key Largo, Florida, 11 March 1986, L. C. Dow (NCSU). (p. 27).
65. *Euzophera ostricolorella* Hulst, ♀. Wedge Plantation, McClellanville, South Carolina, 3 June 1978, D. C. Ferguson (USNM). (p. 59).
66. *Euzophera ostricolorella* Hulst, ♀. Six Mile Creek, Ithaca, New York, 10 August 1957, J. G. Franclemont (USNM). (p. 59).
67. *Euzophera ostricolorella* Hulst, ♀. 18 km N of Raleigh, North Carolina, 1 October 1981, H. H. Neunzig (NCSU). (p. 59).
68. *Euzophera ostricolorella* Hulst, ♀. Colesville, Montgomery Co., Maryland, 11 October 1980, D. C. Ferguson (USNM). (p. 59).

PYRALOIDEA: PLATE 1



PLATE 2

Pyraloidea

PYRALIDAE

figs. 1–46

TWICE NATURAL SIZE 2:1

1. *Myelopsis minutularia* (Hulst), ♀. Smith Canyon, Guadalupe Mts., Culberson Co., 5,750′, Texas, 22 May 1973, R. W. Hodges (USNM). (p. 34).
2. *Myelopsis minutularia* (Hulst), ♀. Madera Canyon, 5,600′ Santa Rita Mts., Santa Cruz Co., Arizona, 21 April 1963, J. G. Franclemont (USNM). (p. 34).
3. *Myelopsis minutularia* (Hulst), ♂. 7 ¾ mi N Big Timber, nr. Big Timber Creek, Sweet Grass Co., Montana, 23 July 1969, J. G. Franclemont (USNM). (p. 34).
4. *Myelopsis minutularia* (Hulst), ♀. Lower Ephraim Canyon, 6,300′, Sanpete Co., Utah, 6 August 1981, D. C. Ferguson (USNM). (p. 34).
5. *Selga arizonella* (Hulst), ♂. Mayer, Yavapai Co., Arizona, 5 June 1959, M. O. Glenn (INHS). (p. 40).
6. *Selga californica* Neunzig, ♂. Holotype. Cronise Valley, San Bernardino Co., California, 29 April 1956, J. Powell (UCB). (p. 40).
7. *Amyelois transitella* (Wlk.), ♂. Raleigh, North Carolina, larva collected spring 1983, *Gleditsia,* H. H. Neunzig (NCSU). (p. 51).
8. *Amyelois transitella* (Wlk.), ♀. Raleigh, North Carolina, larva collected spring 1983, *Gleditsia,* H. H. Neunzig (NCSU). (p. 51).
9. *Eulogia ochrifrontella* (Zell.), ♀. Halifax, Nova Scotia, 21 June 1976, D. C. Ferguson (USNM). (p. 61).
10. *Eulogia ochrifrontella* (Zell.), ♀. Ocqueoc Lake, Presque Isle Co., Michigan, 27 July 1974, E. & R. Hodges (USNM). (p. 61).
11. *Eulogia ochrifrontella* (Zell.), ♂. Ft. Niobrara Natl. Wildlife Refuge, Cherry Co., Nebraska, 19 June 1983, R. W. Hodges (USNM). (p. 61).
12. *Eulogia ochrifrontella* (Zell.), ♀. Deutschburg, Jackson Co., Texas, 14 March 1974, A. & M. E. Blanchard (USNM). (p. 61).
13. *Eulogia ochrifrontella* (Zell.), ♂. Orlando, Florida, 21 May 1986, L. C. Dow (NCSU). (p. 61).
14. *Ephestiodes gilvescentella* Rag., ♂. 2 mi W of Paso Robles, San Luis Obispo Co., California, 25 April 1968, J. A. Chemsak and J. A. Powell (UCB). (p. 64).
15. *Ephestiodes gilvescentella* Rag., ♂. Cuyama River, 3 mi NW Ozena G. S., Ventura Co., California, larva collected 6 October 1967, *Chrysothamnus* sp., [Root Crown] adult emerged 27 October 1967, J. A. Powell (UCB). (p. 64).
16. *Ephestiodes gilvescentella* Rag., ♂. 4 mi S of Creston, San Luis Obispo Co., California, larva collected 13 April 1967, *Senecio blochmaniae,* [Root Crown] adult emerged 10 May 1967, J. A. Powell and P. A. Rude (UCB). (p. 64).
17. *Ephestiodes gilvescentella* Rag., ♀. Smith Canyon, 5,750 ft., Guadalupe Mts., Culberson Co., Texas, 22 May 1973, D. C. Ferguson (USNM). (p. 64).
18. *Ephestiodes gilvescentella* Rag., ♂. 2 mi W of Paso Robles, San Luis Obispo Co., California, 25 April 1968, J. A. Chemsak and J. A. Powell (UCB). (p. 64).
19. *Ephestiodes gilvescentella* Rag., ♀. Madera Canyon, 4,880′, Santa Rita Mts., Santa Cruz Co., Arizona, 9 April 1963, J. G. Franclemont (USNM). (p. 64).
20. *Ephestiodes erasus* Heinr., ♂. Terra Ceia, Manatee Co., Florida, 14 June 1986, L. C. Dow (NCSU). (p. 64).
21. *Ephestiodes infimella* Rag., ♀. 1 km W Tunner Falls, Arbuckle Mts., Murray Co., Oklahoma, 28 June/2 July 1984, Don & Mignon Davis (USNM). (p. 65).
22. *Ephestiodes infimella* Rag., ♀. 18 km N of Raleigh, Wake Co., North Carolina, reared as larva on *Smilax* seed spr.-sum. 1985, adult emerged 8 July 1985, H. H. Neunzig (NCSU). (p. 65).
23. *Ephestiodes infimella* Rag., ♀. Highlands, 3,865′, Macon Co., North Carolina, 9 August 1958, R. W. Hodges (USNM). (p. 65).
24. *Ephestiodes infimella* Rag., ♂. 6 air miles W of Atlantic Beach, Carteret Co., North Carolina, 18 October 1982, D. L. Stephan (NCSU). (p. 65).
25. *Ephestiodes infimella* Rag., ♂. Cherry Hill Rectn. Area, Rt. 107, 2,000′, Oconee Co., South Carolina, 7 August 1958, R. W. Hodges (USNM). (p. 65).
26. *Ephestiodes infimella* Rag., ♀. Devil's Den St. Pk., Washington Co., Arkansas, 19 July 1966, R. W. Hodges (USNM). (p. 65).
27. *Ephestiodes infimella* Rag., ♀. Martha's Vineyard, Massachusetts, 22 August, F. M. Jones (USNM). (p. 65).
28. *Ephestiodes monticolus* Neunzig, ♂. Holotype. Chisos Basin, Big Bend Natl. Pk., Brewster Co., Texas, 15 October 1986, E. C. Knudson (USNM). (p. 66).
29. *Ephestiodes erythrella* Rag., ♂. Willow Creek Trail, 7,000′, Ephraim Canyon, Sanpete Co., Utah, 31 July 1981, R. W. Hodges (USNM). (p. 67).
30. *Ephestiodes erythrella* Rag., ♀. Mt. Shasta City, Siskiyou Co., California, 3 August 1958, J. A. Powell (UCB). (p. 67).
31. *Ephestiodes griseus* Neunzig, ♂. Holotype. Dune Lakes, 3 mi S of Oceano, San Luis Obispo Co., California, 11 July 1973, J. Powell (UCB). (p. 68).
32. *Ephestiodes mignonella* Dyar, ♀. Kerrville, Texas, 11 April 1907, F. C. Pratt (USNM). (p. 68).
33. *Ephestiodes mignonella* Dyar, ♂. 10 mi W of Hunt, Kerr Co., Texas, 31 March 1984, E. C. Knudson (ECK). (p. 68).
34. *Australephestiodes stictella* (Hamp.), ♀. Terra Ceia, Manatee Co., Florida, 7 March 1986, L. C. Dow (NCSU). (p. 69).
35. *Australephestiodes stictella* (Hamp.), ♀. Dunedin, Hammock Pk., Pinellas Co., Florida, 18 October 1986, L. C. Dow (NCSU). (p. 69).
36. *Australephestiodes stictella* (Hamp.), ♀. Key Largo, Florida, 30 August 1986, L. C. Dow (NCSU). (p. 69).
37. *Moodnodes plorella* (Dyar), ♂. No Name Key, Monroe Co., Florida, 21 April 1987, T. S. Dickel (NCSU). (p. 72).
38. *Moodnodes plorella* (Dyar), ♀. Fuchs Hammock, near Homestead, Dade Co., Florida, 16 April 1987, T. S. Dickel (NCSU). (p. 72).
39. *Moodnodes plorella* (Dyar), ♀. Moss Park, Orange Co., Florida, 16 August 1986, L. C. Dow (NCSU). (p. 72).
40. *Moodnodes plorella* (Dyar), ♀. Orlando, Florida, 7 April 1986, L. C. Dow (NCSU). (p. 72).
41. *Moodna ostrinella* (Clem.), ♀. Devil's Den St. Pk., Washington Co., Arkansas, 20 May 1966, R. W. Hodges (USNM). (p. 73).
42. *Moodna ostrinella* (Clem.), ♂. The Wedge, McClellanville, South Carolina, 22 March 1968, R. W. Hodges (USNM). (p. 73).
43. *Moodna ostrinella* (Clem.), ♀. Six Mile Creek, Ithaca, New York, 26 May 1957, J. G. Franclemont (USNM). (p. 73).
44. *Moodna ostrinella* (Clem.), ♀. Wolfville, Nova Scotia, Bred ex larva, food sumach, 7 May 1960, J. H. McDunnough (NSM). (p. 73).
45. *Moodna bisinuella* Hamp., ♀. San Diego, Guatemala, larva collected 2 May 1980, in ear of corn (*Zea mays*), adult emerged 25 May 1980, T. Hunt (NCSU). (p. 76).
46. *Moodna bisinuella* Hamp., ♂. San Andres, El Salvador, 29 May 1952, S. R. G. (USNM). (p. 76).

PYRALOIDEA: PLATE 2

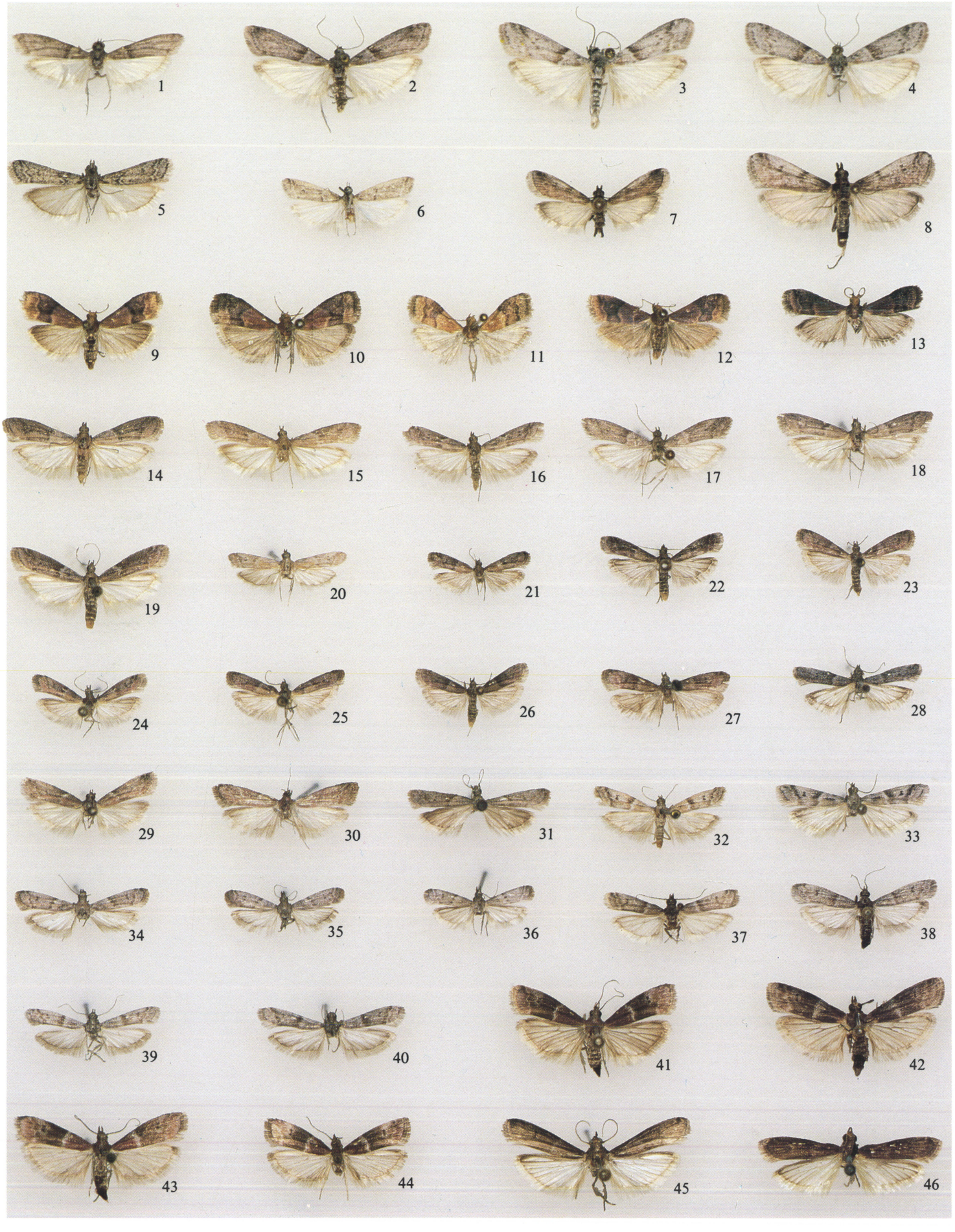


PLATE 3

Pyraloidea

PYRALIDAE

figs. 1–43

TWICE NATURAL SIZE 2:1

1. *Moodna pallidostrinella* Neunzig, ♂. Holotype. Big Pine Key, Florida, 11 January 1983, D. C. Ferguson (USNM). (p. 75).
2. *Moodna pallidostrinella* Neunzig, ♀. Paratype. Torreya St. Pk., Liberty Co., Florida, 4 July 1986, H. D. Baggett (FSCA). (p. 75).
3. *Moodna pallidostrinella* Neunzig, ♀. Paratype. Raleigh, Wake Co., North Carolina, larva collected 18 March 1982, in dead 2nd year cone of *Pinus echinata,* reared outdoors, adult emerged 2 May 1982, D. L. Stephan (NCSU). (p. 75).
4. *Caudellia apyrella* Dyar, ♂. Archer Rd. Lab., 3 mi SW Gainesville, Alachua Co., Florida, 27 November 1975, J. B. Heppner (FSCA). (p. 77).
5. *Caudellia apyrella* Dyar, ♀. Castle Hayne, New Hanover Co., North Carolina, larva collected 24 March 1978, dodder, adult emerged 4 June 1978, K. B. Corrette (NCSU). (p. 77).
6. *Caudellia apyrella* Dyar, ♀. Horticultural Crops Res. Sta., Castle Hayne, North Carolina, larva collected 19 February 1976, dodder, reared indoors, adult emerged 15 March 1976, H. H. Neunzig (NCSU). (p. 77).
7. *Caudellia apyrella* Dyar, ♂. Camp Strake, Montgomery Co., Texas, 4 April 1976, A. & M. E. Blanchard (USNM). (p. 77).
8. *Caudellia apyrella* Dyar, ♀. Holts Lake, Johnson Co., North Carolina, larva collected 9 April 1978, dodder, adult emerged 4 May 1978, K. B. Corrette (NCSU). (p. 77).
9. *Caudellia floridensis* Neunzig, ♂. Holotype. Upper Key Largo, Monroe Co., Florida, 18 January 1987, T. S. Dickel (USNM). (p. 78).
10. *Caudellia floridensis* Neunzig, ♀. Paratype. Windley Key, Monroe Co., Florida, 3 January 1987, T. S. Dickel (USNM). (p. 78).
11. *Caudellia floridensis* Neunzig, ♀. Paratype. No Name Key, Monroe Co., Florida, 21 April 1987, T. S. Dickel (USNM). (p. 78).
12. *Caudellia floridensis* Neunzig, ♀. Paratype. Upper Key Largo, Monroe Co., Florida, 16 February 1987, T. S. Dickel (NCSU). (p. 78).
13. *Caudellia nigrella* (Hulst), ♂. Santa Ana Refuge, Hidalgo Co., Texas, 5 March 1973, A. & M. E. Blanchard (USNM). (p. 79).
14. Caudellia nigrella (Hulst), ♀. Santa Ana Refuge, Hidalgo Co., Texas, 9 March 1973, A. & M. E. Blanchard (USNM). (p. 79).
15. *Vitula edmandsii* (Pack.), ♂. Six Mile Creek, Ithaca, New York, 25 July 1957, J. G. Franclemont (USNM). (p. 85).
16. *Vitula edmandsii* (Pack.), ♀. Six Mile Creek, Ithaca, New York, 2 August 1953, J. G. Franclemont (USNM). (p. 85).
17. *Vitula edmandsii* (Pack.), ♂. Colesville, Montgomery Co., Maryland, 9 September 1980, D. C. Ferguson (USNM). (p. 85).
18. *Vitula edmandsii* (Pack.), ♂. Colesville, Montgomery Co., Maryland., 18 June 1975, D. C. Ferguson (USNM). (p. 85).
19. *Vitula serratilineella* Rag., ♂. Great Basin Exp. Sta., 8,850′, nr. Ephraim, Sanpete Co., Utah, 19 July 1981, D. C. Ferguson (USNM). (p. 87).
20. *Vitula serratilineella* Rag., ♂. Fort Davis, Jeff Davis Co., Texas, 23 October 1973, A. & M. E. Blanchard (USNM). (p. 87).
21. *Vitula serratilineella* Rag., ♂. Ft. Niobrara Natl. Wildlife Refuge, Cherry Co., Nebraska, 14 June 1983, R. W. Hodges (USNM). (p. 87).
22. *Vitula serratilineella* Rag., ♀. Lamar, Colorado, 24 September 1945, E. C. Johnston (USNM). (p. 87).
23. *Vitula setonella* (McD.), ♂. Eureka, Utah, 18 July 1911, T. Spalding (USNM). (p. 92).
24. *Vitula setonella* (McD.), ♀. Seton Lake, British Columbia, 1 August 1933, J. McDunnough (CNC). (p. 92).
25. *Vitula setonella* (McD.), ♀. Ephraim Canyon, 5,600′, creek bottom in oak-pinyon-juniper zone, Sanpete Co., Utah, 30 July 1981, R. W. Hodges (USNM). (p. 92).
26. *Vitula setonella* (McD.), ♀. Ephraim Canyon, 5,600′, creek bottom in oak-pinyon-juniper zone, Sanpete Co., Utah, 30 July 1981, R. W. Hodges (USNM). (p. 92).
27. *Vitula aegerella* Neunzig, ♂. Holotype. Madera Canyon, 5,600′, Santa Rita Mts., Santa Cruz Co., Arizona, 9 May 1963, J. G. Franclemont (USNM). (p. 89).
28. *Vitula aegerella* Neunzig, ♂. Paratype. Madera Canyon, 4,880′, Santa Rita Mts., Santa Cruz Co., Arizona, 3 May 1963, J. G. Franclemont (USNM). (p. 89).
29. *Vitula aegerella* Neunzig, ♀. Paratype. Madera Canyon, 4,880′, Santa Rita Mts., Santa Cruz Co., Arizona, 8 April 1963, J. G. Franclemont (USNM). (p. 89).
30. *Vitula insula* Neunzig, ♂. Holotype. [Avalon], Santa Catalina Island, Los Angeles Co., California, 19 December 1979, L. Randal & J. A. Powell (UCB). (p. 89).
31. *Vitula insula* Neunzig, ♂. Paratype. Field Station HQ, Santa Cruz Island, Santa Barbara Co., California, 21/24 May 1984, J. A. Powell & J. De Benedictis (UCB). (p. 89).
32. *Vitula insula* Neunzig, ♂. Paratype. Avalon, Santa Catalina Island, California, 31 March 1968, P. A. Opler (UCB). (p. 89).
33. *Vitula coconinoana* Neunzig, ♂. Holotype. Hart Prairie, 8,500′, 10 mi NNW Flagstaff, Coconino Co., Arizona, 6 July 1964, J. G. Franclemont (USNM). (p. 90).
34. *Vitula coconinoana* Neunzig, ♀. Paratype. Hart Prairie, 8,500′, 10 mi NNW Flagstaff, Coconino Co., Arizona, 30 June 1961, R. W. Hodges (USNM). (p. 90).
35. *Vitula coconinoana* Neunzig, ♀. Paratype. Fort Valley, 7,350′, 7½ mi NW Flagstaff, Coconino Co., Arizona, 22 June 1961, R. W. Hodges (USNM). (p. 90).
36. *Vitula broweri* (Heinr.), ♂. Highlands, 3,865′, Macon Co., North Carolina, 30 June 1958, R. W. Hodges (USNM). (p. 92).
37. *Vitula broweri* (Heinr.), ♀. Highlands, 3,865′, Macon Co., North Carolina, 29 June 1958, R. W. Hodges (USNM). (p. 92).
38. *Vitula broweri* (Heinr.), ♂. Highlands, 3,865′, Macon Co., North Carolina, 29 June 1958, R. W. Hodges (USNM). (p. 92).
39. *Vitula broweri* (Heinr.), ♂. Edmonton, Alberta, 20 July 1938 (CNC). (p. 92).
40. *Vitula pinei* Heinr., ♂. 10 mi NE Santa Fe, 9,500′, Santa Fe Co., New Mexico, 29 July 1964, F., P. and M. Rindge (AMNH). (p. 87).
41. *Vitula pinei* Heinr., ♀. Fort Valley, 7,350′, 7½ mi NW Flagstaff, Coconino Co., Arizona, 22 June 1961, R. W. Hodges (USNM). (p. 87).
42. *Vitula pinei* Heinr., ♀. Hwy 395, W of Mono Lake, Mono Co., California, 21 June 1986, A. H. Porter (UCD). (p. 87).
43. *Sosipatra rileyella* (Rag.), ♀. El Paso, Texas, larva collected 24 April 1975, yucca, H. H. Neunzig (NCSU). (p. 93).

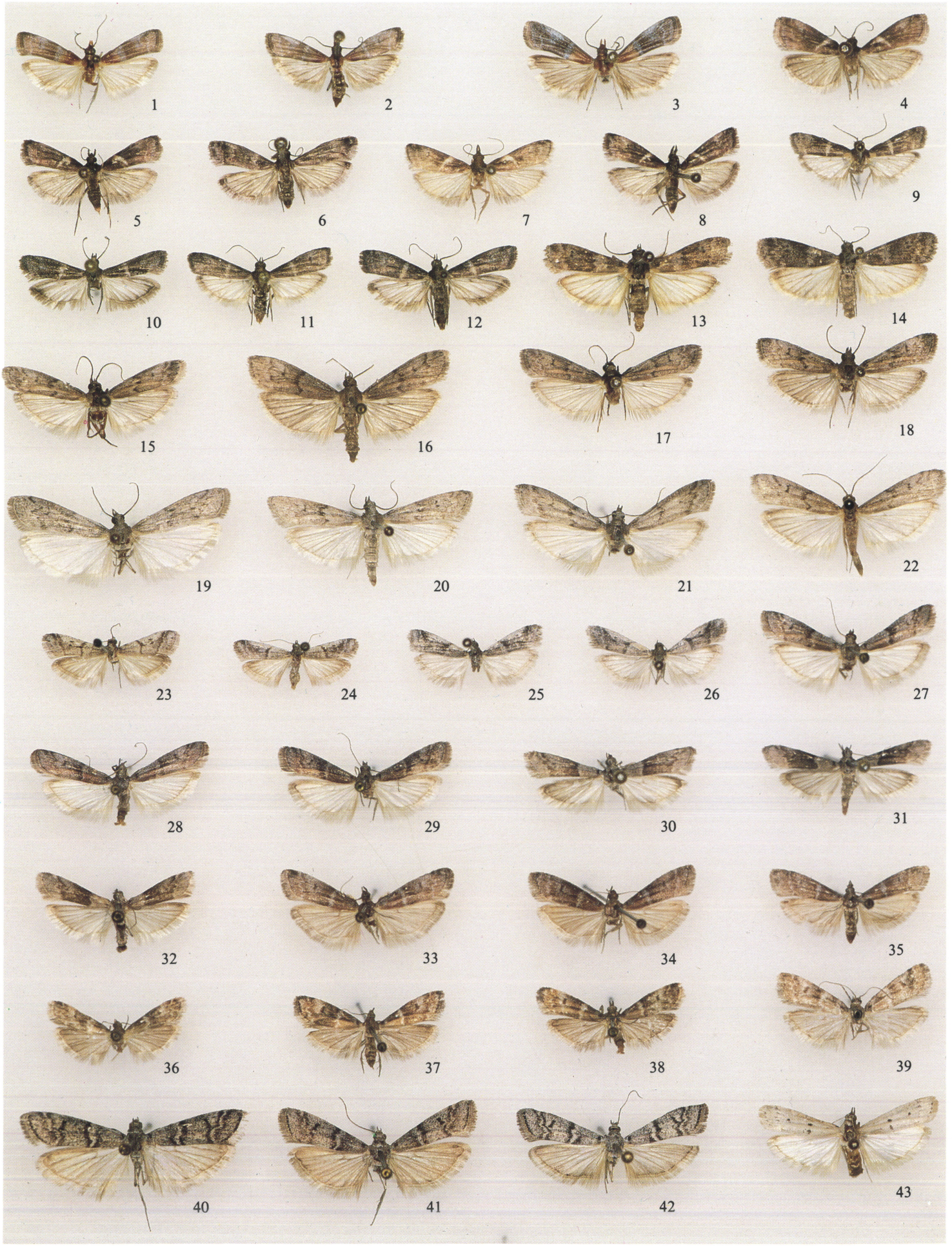

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43

PLATE 4

Pyraloidea

PYRALIDAE

figs. 1–45

TWICE NATURAL SIZE 2:1

1. *Sosipatra rileyella* (Rag.), ♀. Sierra Diablo Wildlife Mgt. Area, 6,000′, Culberson Co., Texas, 6 June 1969, A. & M. E. Blanchard (USNM). (p. 93).
2. *Sosipatra rileyella* (Rag.), ♂. Fort Davis, Jeff Davis Co., Texas, 23 October 1973, A. & M. E. Blanchard (USNM). (p. 93).
3. *Sosipatra rileyella* (Rag.), ♂. Guadalupe Mts., McKittrick Canyon, 5,000′, Culberson Co., Texas, 23 May 1973, R. W. Hodges (USNM). (p. 93).
4. *Sosipatra rileyella* (Rag.), ♀. 4 mi W Jacumba, San Diego Co., California, larva collected 14 March 1963, *Yucca schidigera* pods, adult emerged 15 April 1963, J. A. Chemsak & J. A. Powell (UCB). (p. 93).
5. *Sosipatra rileyella* (Rag.), ♀. 21 mi E Gorman, Los Angeles Co., California, larva collected 11 March 1963, *Yucca brevifolia* pods, adult emerged 1 April 1963, J. A. Chemsak & J. A. Powell (UCB). (p. 93).
6. *Sosipatra anthophila* (Dyar), ♀. Fort Davis, 5,000′, Jeff Davis Co., Texas, 18 May 1971, A. & M. E. Blanchard (USNM). (p. 94).
7. *Sosipatra anthophila* (Dyar), ♀. Big Bend Natl. Park, Croton Spring, Texas, 24 March 1971, A. & M. E. Blanchard (USNM). (p. 94).
8. *Sosipatra anthophila* (Dyar), ♀. Walnut Canyon, 6,500′, 6⅓ mi ESE Flagstaff, Coconino Co., Arizona, 25 August 1964, J. G. Franclemont (USNM). (p. 94).
9. *Sosipatra anthophila* (Dyar), ♂. White City, Eddy Co., New Mexico, 15 May 1950, E. C. Johnston (CNC). (p. 94).
10. *Sosipatra proximanthophila* Neunzig, ♂. Holotype. "Cascada," W end Central Valley, Santa Cruz Island, Santa Barbara Co., California, 22/24 May 1984, J. A. Powell (UCB). (p. 95).
11. *Sosipatra proximanthophila* Neunzig, ♀. Paratype. Prisoner's Harbor, Santa Cruz Island, Santa Barbara Co., California, 25 September 1978, J. A. Powell (UCB). (p. 95).
12. *Sosipatra proximanthophila* Neunzig, ♀. Paratype. Prisoner's Harbor, Santa Cruz Island, Santa Barbara Co., California, 25 September 1978, J. A. Powell (UCB). (p. 95).
13. *Sosipatra thurberiae* (Dyar), ♀. Applegate, California, ex oak apple gall, 25 July 1940, S. M. Dohanian (UCB). (p. 95).
14. *Sosipatra thurberiae* (Dyar), ♀. Gasquet, California, ex oak apple gall, 22 July 1940, S. M. Dohanian (UCB). (p. 95).
15. *Sosipatra nonparilella* (Dyar), ♂. S. W. R. S., 5 mi W Portal, 5,400′, Cochise Co., Arizona, 24 May 1956, Cazier and Ordway (AMNH). (p. 97).
16. *Sosipatra knudsoni* Neunzig, ♂. Holotype. Big Bend Natl. Pk., Paint Gap Hills, Brewster Co., Texas, 2 April 1984, E. Knudson (USNM). (p. 96).
17. *Heinrichiessa sanpetella* Neunzig, ♂. Holotype. Ephraim Canyon, 5,600′, creek bottom in oak-pinyon-juniper zone, Sanpete Co., Utah, 30 July 1981, R. W. Hodges (USNM). (p. 98).
18. *Heinrichiessa sanpetella* Neunzig, ♀. Paratype. Ephraim Canyon, 5,600′, creek bottom in oak-pinyon-juniper zone, Sanpete Co., Utah, 30 July 1981, R. W. Hodges (USNM). (p. 98).
19. *Heinrichiessa sanpetella* Neunzig, ♀. Paratype. Ephraim Canyon, 7,100′, oak-pinyon-juniper zone, Sanpete Co., Utah, 3 August 1981, R. W. Hodges (USNM). (p. 98).
20. *Heinrichiessa sanpetella* Neunzig, ♀. Paratype. Major's Flat, 7,100′, nr. Ephraim, Sanpete Co., Utah, 31 July 1980, D. C. Ferguson (USNM). (p. 98).
21. *Ribua droozi* Neunzig, ♂. Holotype. White Springs, Hamilton Co., Florida, larva collected 30 September 1986, pine terminals, adult emerged 5 November 1986, C. Lassiter (USNM). (p. 100).
22. *Ribua droozi* Neunzig, ♀. Paratype. White Springs, Hamilton Co., Florida, larva collected 30 September 1986, pine terminals, adult emerged 9 November 1986, C. Lassiter (USNM). (p. 100).
23. *Ribua droozi* Neunzig, ♀. Paratype. White Springs, Hamilton Co., Florida, larva collected 30 September 1986, pine terminals, adult emerged 10 November 1986, C. Lassiter (USNM). (p. 100).
24. *Ribua droozi* Neunzig, ♀. Paratype. White Springs, Hamilton Co., Florida, larva collected 30 September 1986, pine terminals, adult emerged 4 November 1986, C. Lassiter (USNM). (p. 100).
25. *Plodia interpunctella* (Hbn.), ♀. Halifax, Nova Scotia, ex larva in rolled oats, adult 20 November 1975, B. Wright (NSM). (p. 102).
26. *Plodia interpunctella* (Hbn.), ♂. Cornell Campus, Ithaca, New York, 12 January 1961, D. R. Davis (USNM). (p. 102).
27. *Plodia interpunctella* (Hbn.), ♀. Colesville, Montgomery Co., Maryland, indoors, 1 September 1975, D. C. Ferguson (USNM). (p. 102).
28. *Plodia interpunctella* (Hbn.), ♂. Raleigh, Wake Co., North Carolina, reared from larva in instant oatmeal, June 1985, H. H. Neunzig (NCSU). (p. 102).
29. *Plodia interpunctella* (Hbn.), ♂. Raleigh, Wake Co., North Carolina, reared from larva in instant oatmeal, June 1985, H. H. Neunzig (NCSU). (p. 102).
30. *Plodia interpunctella* (Hbn.), ♂. Raleigh, Wake Co., North Carolina, reared from larva in instant oatmeal, June 1985, H. H. Neunzig (NCSU). (p. 102).
31. *Plodia interpunctella* (Hbn.), ♂. Valentine Natl. Wildlife Refuge, Hackberry Lake, Cherry Co., Nebraska, 24 June 1983, R. W. Hodges (USNM). (p. 102).
32. *Plodia interpunctella* (Hbn.), ♀. Madera Canyon, 4,880′, Santa Rita Mts., Santa Cruz Co., Arizona, 18 May 1963, J. G. Franclemont (USNM). (p. 102).
33. *Plodia interpunctella* (Hbn.), ♂. Shafter, Presidio Co., Texas, 16 October 1973, A. & M. E. Blanchard (USNM). (p. 102).
34. *Plodia interpunctella* (Hbn.), ♀. Miller Canyon, 5,000′, Huachuca Mts., Cochise Co., Arizona, 5 July 1974, J. G. Franclemont (USNM). (p. 102).
35. *Ephestia elutella* (Hbn.), ♂. Oxford Tobacco Res. Sta., Oxford, North Carolina, 1986, D. W. Keever (NCSU). (p. 106).
36. *Ephestia elutella* (Hbn.), ♂. Oxford Tobacco Res. Sta., Oxford, North Carolina, 1986, D. W. Keever (NCSU). (p. 106).
37. *Ephestia elutella* (Hbn.), ♀. Oxford Tobacco Res. Sta., Oxford, North Carolina, 1986, D. W. Keever (NCSU). (p. 106).
38. *Ephestia kuehniella* Zell., ♀. Rocky Mt., Nash Co., North Carolina, larva collected 18 June 1982, in stored feed, mostly corn, adult 5 July 1982, H. Alhunsen (NCSU). (p. 107).
39. *Ephestia kuehniella* Zell., ♀. Duke University, Durham, Durham Co., North Carolina, ex. lab. culture, 12 July 1984, A. D. Taylor (NCSU). (p. 107).
40. *Ephestia columbiella* Neunzig, ♂. Holotype. 17 km N of Raleigh, Wake Co., North Carolina, 26 April 1985, H. H. Neunzig (USNM). (p. 109).
41. *Ephestia columbiella* Neunzig, ♀. Paratype. 18 km N of Raleigh, Wake Co., North Carolina, 10 May 1985, H. H. Neunzig (USNM). (p. 109).
42. *Ephestia columbiella* Neunzig, ♂. Paratype. 18 km N of Raleigh, Wake Co., North Carolina, 10 May 1985, H. H. Neunzig (USNM). (p. 109).
43. *Ephestia columbiella* Neunzig, ♂. Paratype. Cherry Hill Recrtn. Area, Rte 107, 2,000′, Oconee Co., South Carolina, 7 August 1958, R. W. Hodges (USNM). (p. 109).
44. *Ephestia columbiella* Neunzig, ♀. Paratype. Wedge Plantation, McClellanville, South Carolina, 22 April 1974, D. C. Ferguson (USNM). (p. 109).
45. *Cadra cautella* (Wlk.), ♀. Del Cerro Safeway, San Diego Co., California, 26 May 1982, Faulkner & Brown (SDNH). (p. 112).

PYRALOIDEA: PLATE 4



PLATE 5

Pyraloidea

PYRALIDAE

figs. 1–46

TWICE NATURAL SIZE 2:1

1. *Cadra cautella* (Wlk.), ♀. Del Cerro Safeway, San Diego Co., California, 26 May 1982, Faulkner & Brown (SDNH). (p. 112).
2. *Cadra cautella* (Wlk.), ♀. Del Cerro Safeway, San Diego Co., California, 26 May 1982, Faulkner & Brown (SDNH). (p. 112).
3. *Cadra cautella* (Wlk.), ♀. Largo, Pinellas Co., Florida, emerged from corn cob, L. C. Dow (NCSU). (p. 112).
4. *Cadra cautella* (Wlk.), ♀. Chicago, Illinois, Candy Factory, 1 February 1915, A. Kwiat (INHS). (p. 112).
5. *Cadra figulilella* (Gregson), ♀. Fresno Co., California, larva collected 14 August 1931, grapes, adult emerged 21 September 1931, E. Gammon. (UCD) (p. 113).
6. *Cadra figulilella* (Gregson), ♀. Forsey, Fresno Co., California, 14 September 1931, H. H. Keifer (UCD). (p. 113).
7. *Bandera binotella* (Zell.), ♂. Oakland, New Jersey, 14 August 1948, C. P. Kimball (MCZ). (p. 115).
8. *Bandera binotella* (Zell.), ♂. N Padre Island, Nueces Co., Texas, 6 April 1978, A. & M. E. Blanchard (USNM). (p. 115).
9. *Bandera binotella* (Zell.), ♂. Estes Pk., 7,800′, Larimer Co., Colorado, 4 August 1968, A. Blanchard (USNM). (p. 115).
10. *Bandera binotella* (Zell.), ♂. Rocky Mt. Natl. Park, Colorado, 15 August 1937, A. B. Klots (AMNH). (p. 115).
11. *Bandera virginella* Dyar, ♂. Prescott, Yavapai Co., Arizona, 6 May 1950, E. C. Johnston (CNC). (p. 117).
12. *Bandera virginella* Dyar, ♂. Prescott, Yavapai Co., Arizona, 6 May 1950, E. C. Johnston (CNC). (p. 117).
13. *Bandera virginella* Dyar, ♂. Satus Creek, Yakima Co., Washington, 16 September 1949, E. C. Johnston (CNC). (p. 117).
14. *Bandera cupidinella* Hulst, ♂. Lamar, Colorado, 24 September 1945, E. C. Johnston (CNC). (p. 117).
15. *Bandera cupidinella* Hulst, ♂. Lamar, Colorado, 24 September 1945, E. C. Johnston (CNC). (p. 117).
16. *Tampa dimediatella* Rag., ♂. Eagle Lake, Colorado Co., Texas, 5 July 1978, A. & M. E. Blanchard (USNM). (p. 120).
17. *Tampa dimediatella* Rag., ♂. Eagle Lake, Colorado Co., Texas, 27 April 1978, A. & M. E. Blanchard (USNM). (p. 120).
18. *Wakulla carneella* B. & McD., ♂. Homestead, Florida, 31 March 1959, D. O. Wolfenbarger (MCZ). (p. 117).
19. *Wakulla carneella* B. & McD., ♂. Siesta Key, Sarasota Co., Florida, 13 February 1951, C. P. Kimball (MCZ). (p. 117).
20. *Varneria postremella* Dyar, ♂. Devil's Den St. Pk., Wash. Co., Arkansas, 28 May 1966, R. W. Hodges (USNM). (p. 120).
21. *Varneria postremella* Dyar, ♂. Devil's Den St. Pk., Wash. Co., Arkansas, 30 May 1966, R. W. Hodges (USNM). (p. 120).
22. *Varneria postremella* Dyar, ♂. Devil's Den St. Pk., Wash. Co., Arkansas, 23 May 1966, R. W. Hodges (USNM). (p. 120).
23. *Varneria postremella* Dyar, ♀. Wedge Plantation, McClellanville, South Carolina, 21 April 1974, D. C. Ferguson (USNM). (p. 120).
24. *Varneria atrifasciella* B. & McD., ♀. 8 mi W of Floral City, Citrus Co., Florida, 28 September 1986, L. C. Dow (NCSU). (p. 122).
25. *Eurythmia hospitella* (Zell.), ♀. Arlington, Tarrant Co., Texas, 24 June 1969, B. Wright (NSM). (p. 123).
26. *Eurythmia hospitella* (Zell.), ♂. Wedge Plantation, McClellanville, South Carolina, 3 June 1978, D. C. Ferguson (USNM). (p. 123).
27. *Eurythmia hospitella* (Zell.), ♀. Aspalaga Landing, Gadsden, Florida, 26 September 1986, L. C. Dow (NCSU). (p. 123).
28. *Eurythmia hospitella* (Zell.), ♀. 1 mi W of Bristol, Calhoun Bridge, Liberty Co., Florida, 27 September 1986, L. C. Dow (NCSU). (p. 123).
29. *Eurythmia hospitella* (Zell.), ♀. Withlacoochee St. Forest, vicinity Kirk Hill, Hernando Co., Florida, 6 September 1986, L. C. Dow (NCSU). (p. 123).
30. *Eurythmia hospitella* (Zell.), ♀. Withlacoochee St. Forest, vicinity Kirk Hill, Hernando Co., Florida, 6 September 1986, L. C. Dow (NCSU). (p. 123).
31. *Eurythmia hospitella* (Zell.), ♀. Wichita Mts. Natl. Wildlife Refuge, The Narrows, Comanche Co., Oklahoma, 10/18 July 1984, D. & M. Davis (USNM). (p. 123).
32. *Eurythmia hospitella* (Zell.), ♂. Withlacoochee St. Forest, vicinity Kirk Hill, Hernando Co., Florida, 21 September 1986, L. C. Dow (NCSU). (p. 123).
33. *Erelieva quantulella* (Hulst), ♀. Grande Savane, Dominica, 10 April 1965, D. R. Davis (USNM). (p. 125).
34. *Erelieva quantulella* (Hulst), ♀. Grande Savane, Dominica, 11 June 1965, D. R. Davis (USNM). (p. 125).
35. *Erelieva parvulella* (Ely), ♂. Putnam Co., Illinois, 24 June 1962, M. O. Glenn (INHS). (p. 126).
36. *Erelieva parvulella* (Ely), ♀. Putnam Co., Illinois, 3 July 1973, M. O. Glenn (INHS). (p. 126).
37. *Cabnia myronella* Dyar, ♂. Withlacoochee St. Forest, vicinity Kirk Hill, Hernando Co., Florida, 6 September 1986, L. C. Dow (NCSU). (p. 129).
38. *Cabnia myronella* Dyar, ♂. Dunedin, Pinellas Co., Florida, 17 January 1986, L. C. Dow (NCSU). (p. 129).
39. *Eurythmia angulella* Ely, ♀. Putnam Co., Illinois, 25 June 1975, M. O. Glenn (INHS). (p. 123).
40. *Eurythmia angulella* Ely, ♂. Putnam Co., Illinois, 27 August 1965, M. O. Glenn (INHS). (p. 123).
41. *Eurythmia angulella* Ely, ♀. T. K. Lawless Co. Park, Cass Co., Michigan, 23 August 1985, G. Balogh (GJB). (p. 123).
42. *Eurythmia angulella* Ely, ♀. Putnam Co., Illinois, 24 June 1963, M. O. Glenn (INHS). (p. 123).
43. *Eurythmia spaldingella* Dyar, ♂. Lectotype. Stockton, Tooele Co., Utah, 4 September 1904, Tom Spalding (USNM). (p. 123).
44. *Eurythmia spaldingella* Dyar, ♀. Paralectotype. Stockton, Tooele Co., Utah, 16 August 1904, Tom Spalding (USNM). (p. 123).
45. *Eurythmia yavapaella* Dyar, ♂. 3 mi S Oceano, Dune Lakes, San Luis Obispo Co., California, 2 May 1974, J. A. Powell (UCB). (p. 124).
46. *Eurythmia furnella* Ely, ♀. Peggy's Cove, Halifax Co., Nova Scotia, 3 August 1983, D. C. Ferguson (USNM). (p. 123).

PYRALOIDEA: PLATE 5



NOTES

1. ABBREVIATIONS FOR COLLECTORS AND COLLECTIONS

AMNH	American Museum of Natural History, New York
ANSP	Academy of Natural Sciences, Philadelphia
BMNH	British Museum (Natural History), London
CAS	California Academy of Sciences, San Francisco
CM	Carnegie Museum, Pittsburgh
CNC	Canadian National Collection, Ottawa
ECK	Edward C. Knudson
EIHU	Entomological Institute Hokkaido University, Sapporo
FMNH	Field Museum of Natural History, Chicago
FSCA	Florida State Collection of Arthropods, Gainesville
GJB	George J. Balogh
HUMB	Museum Alexander Humboldt, Berlin
INHS	Illinois Natural History Survey, Champaign
JRH	J. Richard Heitzman
LACM	Los Angeles County Museum of Natural History
LCD	Linwood C. Dow
LNK	Landessammlungen für Naturkunde, Karlsruhe
MCZ	Museum of Comparative Zoology, Cambridge
MNHP	Muséum National d'Histoire Naturelle, Paris
MSNM	Museo Civico di Storia Naturale, Milan
NCSU	North Carolina State University, Raleigh
NSM	Nova Scotia Museum, Halifax
SDNH	San Diego Natural History Museum
TSD	Terhune S. Dickel
UCB	University of California, Berkeley
UCD	University of California, Davis
USNM	National Museum of Natural History, Washington
ZMUH	Zoologisches Museum der Universität, Hamburg

2. COMMON NAMES

The use of an asterisk "*" in the text denotes a name listed in *Common Names of Insects & Related Organisms 1982* published by the Entomological Society of America.

French-language common names have been taken from Benoit, P. et al., 1975, *French Names of Insects in Canada,* published for the Quebec Society for the Protection of Plants, Quebec. The abbreviation "m." after name indicates that it is masculine, "f." that it is feminine.

3. CITATIONS OF AUTHORITIES

Authors' names without parentheses indicate that the specific name is associated with the genus in which it was described.

Authors' names in parentheses indicate that the specific name has been transferred from the genus in which it was described to another genus.

4. WING LENGTH

Wing length is the measurement in millimeters from the base to the apex of the forewing.

5. LOCATION OF TYPE SPECIMEN

The current location of the type specimen is given by the appropriate abbreviation in square brackets immediately following the type locality. The word "lost" indicates that it no longer exists. If no information is given, a type may exist; but its present location was not determined.

6. NOMENCLATURE FOR LARVAL SETAE

Hinton's 1946 terminology is used to refer to larval setae.

7. PLANT NAMES

Names follow *National List of Plant Names,* 1982, USDA Soil Cons. Serv. T. P. 159.

INDEX TO ANIMAL NAMES

Principal entries are given in bold face.
Plate references are given as (1:5).

Generic names cited only in combination with specific names, whether in synonymy or text, are not given in the index. Look for such entries under the specific name. For example, *Plodia interpunctella* will be found under *interpunctella,* but not under *Plodia.*

Acrobasis 9, 105, 106
Adanarsa 14, 15, **17**
aegerella 84, 85, 89 (3:27–29)
affusella 106
aglaeella 54, **56** (1:37–39)
Ahwazia 52
alatella 34, **36** (1:10–14), 39, 40
albicostalis 52
albocostalis 52
albovittella 77
amarella 107
Amyelois 9, 14, 15, **48**
Anagasta 103, 105
angulella **123** (5:39–42), 124, 125
angusta 106
annuliferella 31, **32** (1:19)
anthophila 93, **94** (4:6–9), 95
Anypsipyla 14, 16, **29**
Apomyelois 14, 16, **44**, 46, 48
apyrella 76, **77** (3:4–8; B:3)
aquella 106
arizonella (Hulst) **40** (2:5), 41
arizonella Walter 79
arizonensis **42** (1:45), 43, 44
artonoma 44, 46, 47
atrifasciella **122** (5:24)
Atrusca 82
Australephestiodes 14, 16, **68**, 69, 72
Azaera 63

Bandera 15, 17, **115**, 117, 118
bee 109
bee, alfalfa leafcutter 87
bee, bumble 84, 87
bee, honey 87
benjaminella 68
Bertelia 13, 15, 18, 20, **23**, 24, 25
bicolorella 31, **32** (1:20, 21)
bilineatella 44
binotella **115** (5:7–10), 117
bisinuella 72, 73, **76** (2:45, 46)
bistriatella **44** (1:54–57), 45, 46
biviella 82, 84
bombylicolella 87
borer, American plum 54
borer, magnolia 59
borer, tulip-tree 59
broweri 84, 85, 86, 87, 90, **92** (3:36–39)

*Cabnia*13, 17, **128**, 129
Cadra 15, 17, 103, 104, **110**, 112
calidella 112
californica **40** (2:6), 41, 42
carneella **117** (5:18, 19), 118
cassiae 51
castaneella 103
Caudellia 13, 17, 63, 72, **76**, 77, 79, 93
cautella 110, **112** (4:45; 5:1–4), 113
ceratoniae 46, **47** (1:52, 53), 48, 100
ceratoniella 48
Chararica 14, 15, **31**
cinerosella 52
cnabella 27
Cnidaria 52
coconinoana 85, **90** (3:33–35)
coloradella 68
colorella 76, 78, 79
columbiella 105, 106, **109** (4:40–44)
coniella 32, 34, 35
conspersella 117
cornutella 52
Crocidomera 14, 15, **20**, 23
Crustacea 52
Cuniberta 13, 16, 17, **18**, 20, 23
cupidinella 115, **117** (5:14, 15)

declivella 76, 77
decolor 46
defectella 110, 112
dentosella 84, 86
desuetella 112
Diatomocera 42
diffusella 123
dimediatella 118, **120** (5:16, 17)
divergens 93
dolorosa 102, 103
dorsimacula 25
droozi **100** (4:21–24), 101, 102
dupla **25** (1:3, 4)
duplipunctella 51

Ectomyelois 9, 14, 16, 44, **46**, 47, 48
edmandsae 87
edmandsii 84, **85** (3:15–18), 86, 87, 88
elutella 103, **106**, (4:35–37), 107
Entmemacornis 42
Ephestia 15, 17, **103**, 104, 105, 106, 109, 112, 115
Ephestiodes 14, 16, **63**, 64, 68, 69, 70, 71, 72, 93
erasa 63, 64
erasus 63, **64** (2:20), 65
Erelieva 15, 17, **125**
ernestinella 113
erythrella 64, **67** (2:29, 30), 68
Eulogia 14, 16, **61**
Eurythmia 15, 17, **122**, 125
Euzophera 9, 14, 16, **52**, 53, 54, 56, 57, 61, 62
euzopherella 42
expunctrix 42

ferralis 25
ferruginella 61
figulilella 112, **113** (5:5, 6)
fissuralis 23
floridensis 76, 77, **78** (3:9–12), 79
formosella 113
fragilella 38
fuliginosella 53
fumella 123
furnella 122, **123** (5:46)
furvidorsella 46
fuscofasciella 107

Galleriinae 84
gallivorella **82** (1:26–29), 83
gilvescentella 63, **64** (2:14–19; B:2), 65, 68
gitonella 107
glycinivora 103
glycyphloeas 112
grandella **27** (1:62–64), 29
granulella 69
griselda 60
grisella 23, **25** (1:1, 2)
griseus 64, **68** (2:31)
gypsella 113

habrella 54, **56** (1:34–36), 57
Heinrichiessa 15, 16, **98**
Hornigia Ragonot, 1885 84
Hornigia Ragonot, 1887 84
hospitella 112, **123** (5:23–32)
Hymenoptera 87
Hyphantidium 103
Hypsipyla 14, 16, **25**
hystriculella 31, **32** (1:22–25)

icosiella 106
imitata 20, **23** (1:46–48; A:3, 4)
immundella 34, **35** (1:8, 9)
indentella 69
infimella 63, 64, **65** (2:21–27), 66
infumatella 106
innoxia 99, 100, 101
inquietella 105
insect, scale 101
insula 85, **89** (3:30–32), 90, 95
interpunctella **102** (4:25–34), 103

intransitella 17, **18** (1:17–18)
irakella 113
ischnomorpha 107

knudsoni 93, 95, **96** (4:16), 97
kuehniella 105, 106, **107** (1:58–60; 4:38, 39), 108, 109
kühniella 103, 107

latercula 103
Lepidoptera 52, 84
Longignathia 52
lugubrella 82, 85

Magiria
magnolialis 53, 54, **59** (1:42, 43)
Manhatta 84
Megachile 87
Melia Bosc 52
Melia Curtis 52
Melia Heinemann 52
mignonella 64, 66, **68** (2:32, 33)
milleri 113
minutularia 32, **34** (2:1–4), 35
minutulella 34
monticolus 64, **66** (2:28)
Moodna 14, 16, **72**, 73, 75, 76, 93
Moodnodes 14, 16, **69**, 70, 71, 72
moth 85, 113
moth, almond 112
moth, carob 47
moth, driedfruit 87
moth, Indianmeal 102
moth, Mediterranean flour 107, 109
moth, raisin 113
moth, tobacco 106
muriscis 46
Mussidia 9
Myelois 44
Myelopsis 14, 16, **32**, 34, 40
myronella 128, **129** (5:37, 38)

Nasutes 115
nefas 34
neophanes 44, 45, 46
nigrella 64, 76, 77, **79** (3:13, 14)
nigricantella 52, 53, **59** (1:44), 60, 61
nonparilella 93, 95, 96, **97** (4:15)
notatalis 51

obnupsella 35
obtusangulella 73
ochrifrontella **61** (2:9–13), 62, 63
oporedestella 48
orangeworm, naval 51
ostricolorella 53, 54, **59** (1:65–68)
ostrinella 72, **73** (2:41–44; B:1), 75, 76, 79

pachytaeniella 80, 82
pagodella 25
pallidostrinella 73, **75** (3:1–3)
pallulella 54
Paramyelois 48
parasitella 104, 105
parvulella 125, **126** (5:35, 36), 127, 128
passulella 113
pelviculella 72, 73
phoenicis 48
Phycitinae 9, 13
phycitine 9, 23, 25, 31, 46, 85, 97, 100, 103, 105, 118, 125, 128
piazzella 38
pinei 85, **87** (3:40–42), 89, 92
Plodia 15, 17, 99, 100, **102**, 103
plorella 69, 70, **72** (2:37–40)
Polistes 87
postremella **120** (5:20–23), 121, 122
proximanthophila 93, **95** (4:10–12)
pryerella 48
psarella 48
Pseudocabima 14, 16, 40, **42**
pterogrisella 107
pyrale des amandes 112
pyrale du raisin 113
pyrale du tabac 106
pyrale indienne de la farine 102
pyrale mediterraneenne de la farine 107
Pyralidae 13, 52
Pyraloidea 13

quantulella **125** (5:33, 34), 127

rectistrigella 38
Ribua 15, 17, **99**, 100, 102, 103
rileyella 92, **93** (3:43; 4:1–5), 94, 95
robusta 25, 27
rotundata 87
rotundatella 113
roxburghii 106
rubrizonalis 42
rufa 106

sanpetella **98** (4:17–20)
santiagella 125
Selga 14, 16, **40**, 42
Sematoneura 25
semifuneralis 53, **54** (1:30–33), 55, 56, 57
semirufa 106
sericarium 103, 106
serratilineella 84, 85, **87** (3:19–22), 88, 89
setonella 84, 85, **90** (3:23–26)
shootborer, mahogany 27
solitella 48, 51
sordidella 52
Sosipatra 15, 17, 63, 89, **92**, 93, 95, 97, 98
spaldingella 122, **123** (5:43, 44)
Spectrobates 44, 46, 47
stenopteryx 23
Stenoptycha Agassiz 52
Stenoptycha Heinemann 52
Stenoptycha Zeller 52
stictella 68, **69** (2:34–36)
subcribrella 52
subluteella 115
subtetricella 34, **35** (1:15, 16), 36
subtinctella 18, **20** (1:5–7; A:1,2)

Tampa 15, 17, **118**
tetricella 32, 34
thurberiae 93, **95** (4:13, 14), 97
Trachycera 17
transitella 48, **51** (1:49–51; 2:7, 8), 52
tuerckheimiella 48
turbidella 20, 22, 23

ultimella 53
unicolorella 107
uniformata 107
uniformella 69
univitella 29, **31** (1:61)

Varneria 15, 17, **120**
venata 115, 117
venipars 48, 51
venosella 113
Vespula 87
vestilla 72
vinnulella 54, **57** (1:40, 41)
virginella 115, **117** (5:11–13)
Vitula 14, 16, 63, 80, 82, **84**, 85, 86, 89, 92, 93
Volatica 14, 16, **80**, 82, 84

Wakulla 15, 17, **117**, 118

Xenephestia 110
Xylocopa 87

yavapaella 123, **124** (5:45), 125

zeae 102
zellerella 48
zeteki 46
zonulella 35

INDEX TO PLANT AND FUNGUS NAMES

Acacia farnesiana 48, 52
acacia, sweet 48, 52
acorns 109
almond 52, 54, 103, 113
Ambrosia 66
Anacardiaceae 51, 73
Andira inermis 31
angelintree, cabbage 31
Annonaceae 46
apes-earring, ebony 52
Apocynaceae 46
apple 52, 56, 62, 75, 87
apricot 56, 103, 113
Arachis hypogaea 103, 113
Arctostaphylos 40
Arctostaphylos insularis 40
Arecaceae 46, 51
ash, American mountain 55
Ascomycetes 55
Aspergillus halophilicus 103
Asteraceae 53, 63, 64
Avena 103, 108

barley 108
Betula 45, 75
birch 45, 75

cacao 107
Cactaceae 93, 125
cactus 95
Capnodiaceae 100
Capnodium 101
Capsicum annuum 126
Carapa 29
Carissa grandiflora 48
carob 48
Carya illinoensis 54, 56
cassia 48
Cassia bicapsularis 48
Cassia brasiliana 31
Cassia grandis 52
Castanea sativa 48
cedar, cigar box 29
cedar, Spanish 29
Cedrela 29
cedrela, Mexican 29
Cedrela mexicana 29
Cedrela odorata 29
Ceratonia siliqua 48
Cercis occidentalis 95
cherry 54, 56
cherry, wild 66
chestnut, European 48
chocolate 103, 107
Chrysothamnus 64
citrus 48
Citrus 48
Citrus paradisi 52
Citrus sinensis 52
Claviceps 76
Clusiaceae 46
Convolvulaceae 53, 77
corn 76, 103, 108
cotton 56, 64, 75
crabwood 29
Cuscuta 77
Cuscuta compacta 77
Cuscuta gronovii 77
Cydonia oblonga 48

Daldinia 44
date 48, 52, 103, 113
Dibotryon morbosum 55
Diospyros virginiana 56
dodder 77

Ebenaceae 53
ergot 76
Eriobotrya japonica 48, 75

Fabaceae 31, 46, 51, 53, 93
Fagaceae, 46, 61, 73, 93
Ficus carica 48, 52, 87, 113
fig 48, 52, 87, 113
fungus 44, 45, 75, 76, 100, 101, 103

gamagrass 76
gaura 64
Gaura parviflora 64
ginkgo 56
Ginkgo biloba 56
Ginkgoaceae 53
Gleditsia triacanthos 52
gorse 44
Gossypium 95
Gossypium hirsutum 56, 64, 75
grapefruit 52
grass 103
greenbrier 66
groundsel 64
Guarea 29
gum, sweet 56
Gutierrezia sarothrae 64

Hamamelidaceae 53
Haplopappus 64
Hordeum 108
Hypoxylon 44

Ipomoea batatas 55
iris 75
Iris 75

Juglandaceae 51, 53, 61
Juglans 54, 56
Juglans regia 52, 103, 113
jujube 48

khaya 29
Khaya 29

Liliaceae 63, 93
linden 56
Liquidambar styraciflua 56
Liriodendron tulipifera 54, 59
Livistona chinensis 48
locust 48, 52
locust, honey 52
loquat 48, 75

magnolia, southern 54, 59
Magnolia grandiflora 54, 59
Magnoliaceae 53
mahogany 29
mahogany, Honduras 29
mahogany, West Indian 29
Malus pumila 52, 56, 75, 87
Malvaceae 53, 63, 93
manzanita, island 39
matchweed 64
Meliaceae 27
mesquite 61
mold, sooty 101
Moraceae 46, 51, 53
Morus alba 56, 113
mulberry 56, 113
muskwood 29

Nicotiana tabacum 107
nolina 93
Nolina 93

oak 44, 62, 75, 82, 83, 109
oak, gray 83
oats 103, 108
Olea europaea 56
Oleaceae 53
olive 56
Onagraceae 63
Opuntia 95, 125
orange 52
Oryza 108

palm, fan 48
peach 52, 54, 56, 75, 103
peanut 103, 113
pear 56, 75
pear, prickly 125
pecan 54, 56, 62
pepper, bell 125
persimmon 56
Phoenix dactylifera 48, 52, 103, 113
Pinaceae 73, 84

pine 75, 101, 102
pine, shortleaf 75
pine, singleleaf pinyon 89
Pinus 75
Pinus echinata 75
Pinus monophylla 89
pistachio 52
Pistacia vera 52
Pithecellobium flexicaule 52
Pithecellobium saman 31
plum 54, 56
plum, Natal 48
Poaceae 53, 73, 125
pomegranate 48
poplar 44, 56
Populus 44, 56
potato, sweet 55
Prosopis 61
prune 87
Prunus 54, 56
Prunus armeniaca 56, 103, 113
Prunus amygdalus 52, 54, 103, 113
Prunus domestica 54, 56, 87
Prunus persica 52, 54, 56, 75, 103
Punica granatum 48
Punicaceae 46
Pyrus communis 56, 75

Quercus 44, 75, 82, 83, 95
Quercus grisea 83
Quercus Kelloggii 109
quince 48

rabbitbrush 64
raintree 31
raisin 64, 87, 103, 113
redbud, California 95
Rhamnaceae 46
Rhus 75
rice 108
Robinia 48, 52
Rosa 75
Rosaceae 46, 51, 53, 61, 63, 73
rose 75
Rutaceae 46, 51
rye 108

Salicaceae 34, 53
saman 31
Secale 108
Senecio blochmanae 64
senna, Brazilian 31
senna, pinkshower 52
Smilax rotundifolia 66
Solanaceae 53, 125
Sorbus americana 56
sorghum 126
Sorghum vulgare 126
Sterculiaceae 46
sumac 75
Swietenia macrophylla 29
Swietenia mahagoni 29

tamarind 48
Tamarindus indica 48
Theobroma cacao 103, 107
Thurberia 95
Tilia americana 56
Tiliaceae 53
tobacco 107
tree, leguminous 42
Tripsacum 76
Triticum 103, 108
trompillo 29
tulip-tree 54, 59

Ulex europaeus 44

Vitaceae 63
Vitis vinifera 64, 87, 103, 113

walnut 54, 56
walnut, Persian 52, 103, 113
wheat 103, 108

Xylariaceae 44

yucca, datil 93
yucca, Joshuatree 93
yucca, Mohave 93
yucca, Whipple's 93
Yucca baccata 93
Yucca brevifolia 93
Yucca shidigera 93
Yucca whipplei 93

Zea 103, 108
Zea mays 76
Zizyphus 48