



## Three new species of *Eupithecia* Curtis from Arizona and New Mexico with discussion of associated species (Lepidoptera: Geometridae: Eupitheciini)

CLIFFORD D. FERRIS<sup>1,2</sup>

<sup>1</sup>5405 Bill Nye Ave., R.R. 3, Laramie, WY 82070, USA, [cdferris@uwyo.edu](mailto:cdferris@uwyo.edu)

<sup>2</sup>Research Associate: McGuire Center for Lepidoptera and Biodiversity, Florida Museum of Natural History, University of Florida, Gainesville, FL; C. P. Gillette Museum of Arthropod Diversity, Colorado State University, Ft. Collins, CO; Florida State Collection of Arthropods, Gainesville, FL.

### Abstract

*Eupithecia macfarlandi*, new species, and *Eupithecia penablanca*, new species, from southern Arizona, and *Eupithecia nonanticaria*, new species, from southwestern New Mexico, southeastern Arizona, and Chihuahua, Mexico are described. Adults and male and female genitalia are illustrated. *Eupithecia anticaria* Walker and *E. nonanticaria* are compared.

**Key words:** Arizona, *Eupithecia anticaria*, *Eupithecia macfarlandi*, *Eupithecia nonanticaria*, *Eupithecia penablanca*, Eupitheciini, Geometridae, Mexico, New Mexico, taxonomy

### Introduction

Three new species of *Eupithecia* are described from limited material that I collected at UV light and from additional specimens sent to me for identification. All appear to be uncommon with localized geographic distribution. A few specimens have resided in my collection since the late 1980s. Loan material was held for several years in the hope that the field seasons 2003–2006 would generate additional specimens and of better quality. A few additional examples of all three species were obtained, some by loan. Since it is now apparent that additional material will not be readily forthcoming, I have decided to describe these species.

Images of adults were taken with a Fuji S1 FinePix Pro digital SLR camera. Images of the genitalia were taken through an Olympus SZ60 stereozoom microscope using a Fuji S3 FinePix Pro camera body attached to the microscope photo tube. Image post-processing was accomplished with several versions of Adobe Photoshop®. Various stains were used to enhance genitalic features. In several instances, inverted images of female genitalia are presented to enhance the visibility of structural features and produce a degree of three-dimensionality.

Abbreviations and definitions used herein:

D, V—dorsal, ventral

DFW, DHW—dorsal forewing, dorsal hindwing

EME—Essig Museum of Entomology, University of California, Berkeley, CA

FW, HW—forewing, hindwing

GMAD—Gillette Museum of Arthropod Diversity, Colorado State University, Ft. Collins, CO

VFW, VHW—ventral forewing, ventral hindwing

USNM—United States National Museum, Washington, DC

Adterminal line – line immediately basad of terminal line

Caudal spur (female genitalia)—a short, sinuous, chitinized element arising on opposite edges near the proximal end of the dorsal plate of the eighth abdominal segment and curving caudioventrally to end on opposite ends of a thin chitinized strip; the mid-portion may be separated from the plate or embedded at the plate edge.

Genital plate (male genitalia)—ventral sclerite of abdominal segment VIII (eighth abdominal sternite)

Hair pencils (male genitalia)—brushlike structures attached to each side of abdominal segment IX

Subterminal line—line between adterminal line and postmedial band

Terminal (marginal) line—line at base of fringe

### ***Eupithecia macfarlandi* Ferris, New Species**

(Figs. 1–13)

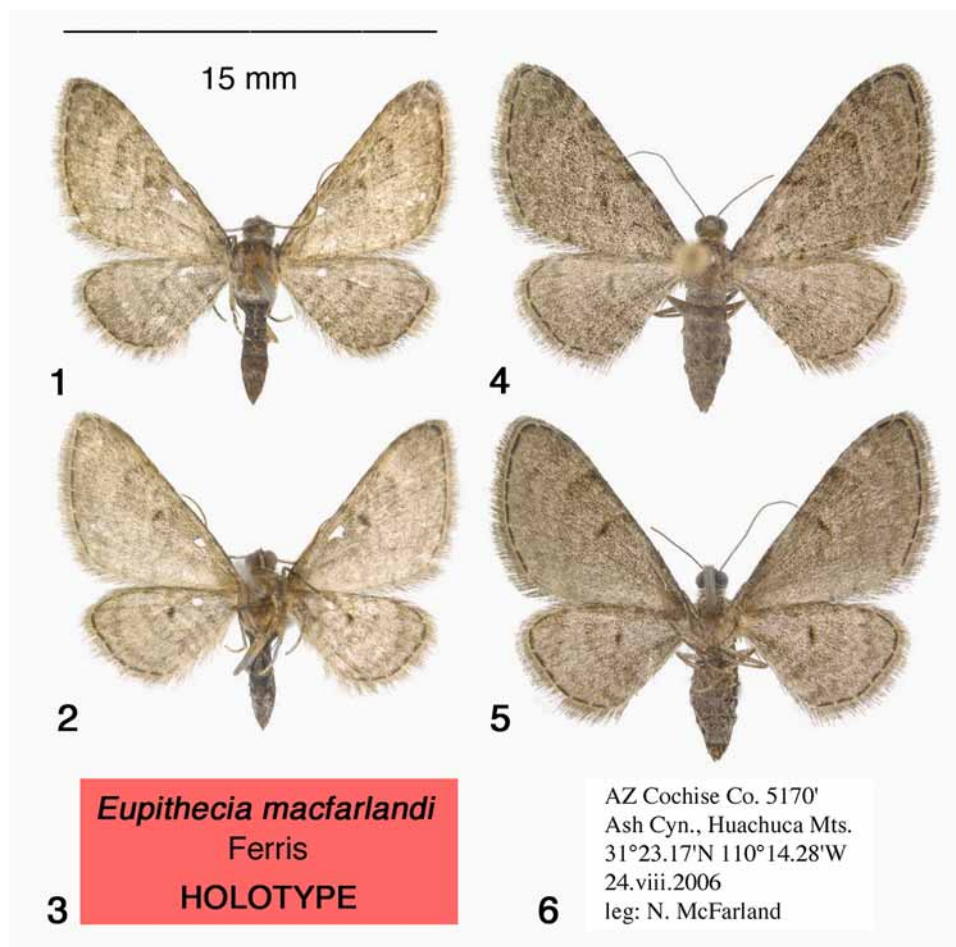
**Diagnosis.** This is the dullest and least maculated of the North America species, appearing almost uniformly brownish-gray when viewed from a distance; DFW and DHW discal spots are nearly obsolete, but visible ventrally. Maculation (D, V) consists of multiple obscurely defined, thin brownish transverse lines and bands.

**Description.** MALE (Figs. 1–2): *Forewing length* (base to apex): 9.0–9.5 mm. *Head and Body:* Palpi length about eye width, porrect, triangular in side view with mixture of whitish and dark brownish-gray scales, dark scales at tips. Frons, head, thoracic collar, thorax, and tegulae with mixture of brownish-gray and whitish scales. Antennae finely and weakly ciliate, brown with dorsal dark patch on each segment, scape with dark brown ring. Abdominal segments dorsally grayish-brown, paler ventrally, not conspicuously ringed but with intersegmental paler scales. Legs broadly ringed with dark gray and whitish scales; upper pair of hind-tibial spurs well developed. *Wings:* DFW in gross appearance medium-to-dark gray; under magnification covered with mixture of light and dark brownish scales forming a pattern of very fine irregular transverse lines, diffuse postmedian paler band from costa to mid-wing; poorly developed small discal spot. Segmented brown adterminal line; fringes brown-gray, paler at tips. DHW colored as in forewings with alternating pale and dark banding; small dark discal spot present; fringes as in FW. Ventrally paler with more clearly defined maculation of alternating light and dark brownish-gray bands; discal spots repeated and better defined. Dorsal terminal lines and fringes repeated ventrally. *Genitalia* (Figs. 7–13) [2 dissections]: Hair pencils poorly developed (not illustrated). Valve basally broad, with very slightly irregular ventral margin, tapering to moderately narrow rounded tip (Fig. 7); uncus dorsoventrally bifid; socii well developed and typical. Aedoeagus (Fig. 8) broad (width one-third of length). Vesica (Fig. 9) pleated, stippled with small chitinous papillae, shagreened crown, one large half-cylinderlike chitinized plate with straight end. Genital plate (Fig. 10, 8th sternite at top) basally broad, tapering distally with expanded apical apex, apex with shallow cleft approximately one-third apical width.

FEMALE (3–4): *Forewing length* (base to apex): 9.5–11.0 mm. Color and maculation similar to male in all respects, except D and V discal spots less distinct. Legs paler than male with banding more diffuse. Antenna essentially filiform, only very weakly setose, colored as in male. *Genitalia* (Figs. 11–13) [5 dissections]: Papillae anales small, broadly oval and weakly setose; apophyses delicate and slender, anterior-to-posterior ratio ca. 0.6; caudal spurs weak and embedded in genital plate. Ostium bursae weakly sclerotized and wide mouthed tapering to very short ductus bursae above an open, moderately broad colliculum. Corpus bursae vertically ellipsoidal with narrow band of diffuse spines just below colliculum followed by a clear membranous band above the densely spinose fundus. Just below the colliculum, the basally broad tubular ductus

seminalis projects outward from the right ventral side of the corpus bursae, then curves downward crossing ventrally as it tapers sharply.

Other than wing length, there appears to be little variation in this species.



FIGURES 1–6. *Eupithecia macfarlandi*. 1, male holotype, D; 2, male holotype V; 3, holotype label; 4, female, D; 5, female, V; 6, holotype pin label.

**Holotype:** male: ARIZONA, Cochise Co., Ash Canyon, Huachuca Mts., 31°23.17'N, 110°14.28'W, 1575 m, 24.viii.2006, N. McFarland, to be deposited along with a female paratype in USNM.

**Paratypes:** 3m, 12f. ARIZONA, Cochise Co.: same locality as holotype, 10.ix.1992 (1f, McFarland collection), 25.viii.2006, N. McFarland (1f, USNM); 14.ix.2004 (2f), 24.viii.2006 (1m, 1f), 25.viii.2006 (1m, 4f), N. McFarland; 22.viii.2004 (1f) C. D. Ferris; Carr Canyon, Huachuca Mts., 31°26.38'N, 110°15.87'W, 1710 m, 21.viii.2004 (1m, 1f); 22.viii.2006(1m, 1f), C. D. Ferris. Except where indicated otherwise, all currently deposited in author's collection with eventual deposition in McGuire Center for Lepidoptera and Biodiversity, Gainesville, Florida.

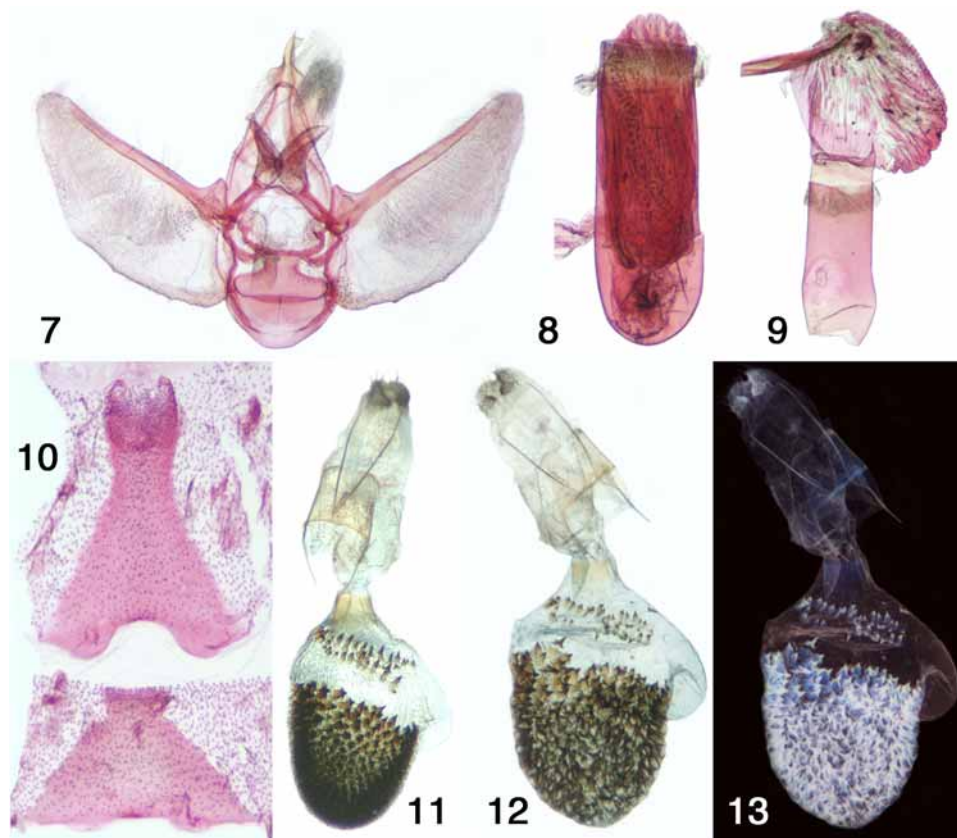
**Etymology.** I am pleased to name this species for Noel McFarland in recognition of his many contributions to the study of southeastern Arizona moths and in-depth study of South Australian geometrids (McFarland 1988).

**Biology.** Unknown; found in oak and oak-conifer habitats (Figs. 57–58).

**Flight period.** Late August–mid-September.

**Distribution.** Canyons on the east side of the Huachuca Mountains, Cochise Co., Arizona.

**Discussion.** The male genitalia (valve, uncus, genital plate) and female genitalia (arrangement of spines on the bursa copulatrix and geometry of ductus seminalis) suggest affiliation of *E. macfarlandi* with *E. nimbicolor* (Hulst) and *E. stratonata* Packard. Placement is thus in the *satyrata* group (*sensu* Bolte, 1990).



**FIGURES 7–13.** *Eupithecia macfarlandi* genitalia. Male structures: 7, genitalia with aedeagus removed; 8, aedeagus; 9, lateral view of everted vesica; 10, 7th and 8th (top, genital plate) abdominal sternites. Female structures: 11–12, ventral view of entire genitalia (two preparations); 13, image-inverted view of fig. 12 to enhance structural features.

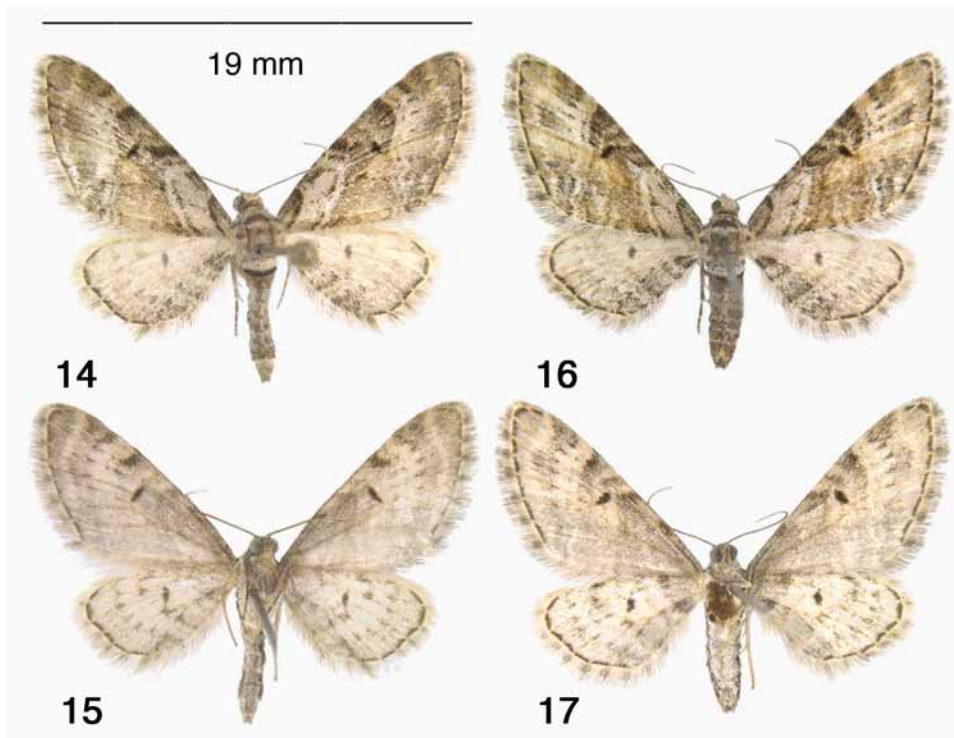
***Eupithecia anticaria* Walker (1862: 1241).**

(Figs. 14–24)

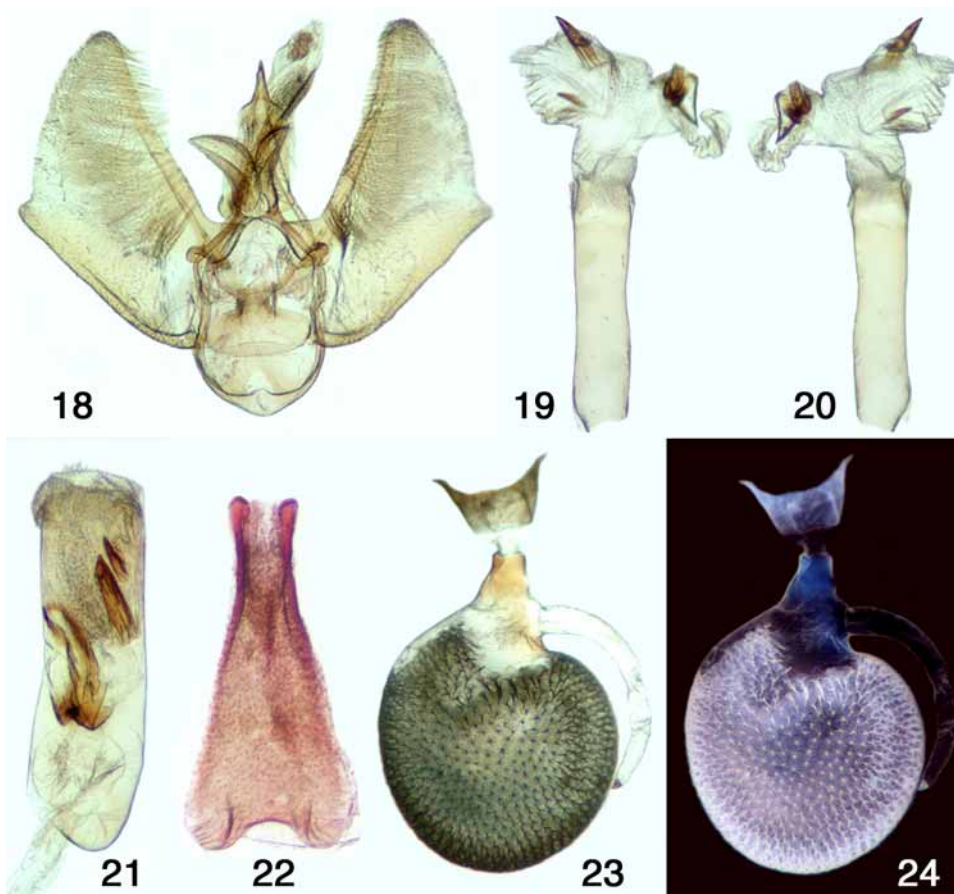
Type locality: Nova Scotia, Canada.

Diagnosis and description by McDunnough, 1949:672–673; pl. 31 figs. 23–24 adult; text fig. 17D male and female genitalia. Redescription by Bolte, 1990:653–654; figs. 33 map; 123 male; 124 female; 191a–b male antenna; 202a–b female antenna; 212i–j lateral view adult head; 221c–d pupal terminal segment ; 258 genitalia.

**Discussion.** This species is included so that comparisons can be made to *E. nonanticaria* described subsequently. Adults (Figs. 14–17), male genitalia (Figs. 18–22), and female genitalia (Figs. 23–24) are illustrated. Not illustrated in the male genitalia are the well-developed hairpencils and dorsoventrally bifid uncus. *E. anticaria* occurs from eastern Newfoundland across Canada to western British Columbia, south to northern New Mexico and Apache and Coconino counties, Arizona, with adults from mid-May into July. Bolte (1990) placed *anticaria* and *graefi* (Hulst) in his revised *mutata* group, while McDunnough (1949) included *anticaria* in his undesignated species-group, but associated with *graefi*.



**FIGURES 14–17.** *Epithecia anticaria*. 14, male, D; 15 male, V; 16, female, D; 17, female, V. Specimens from Albany Co., Wyoming, C. D. Ferris coll.

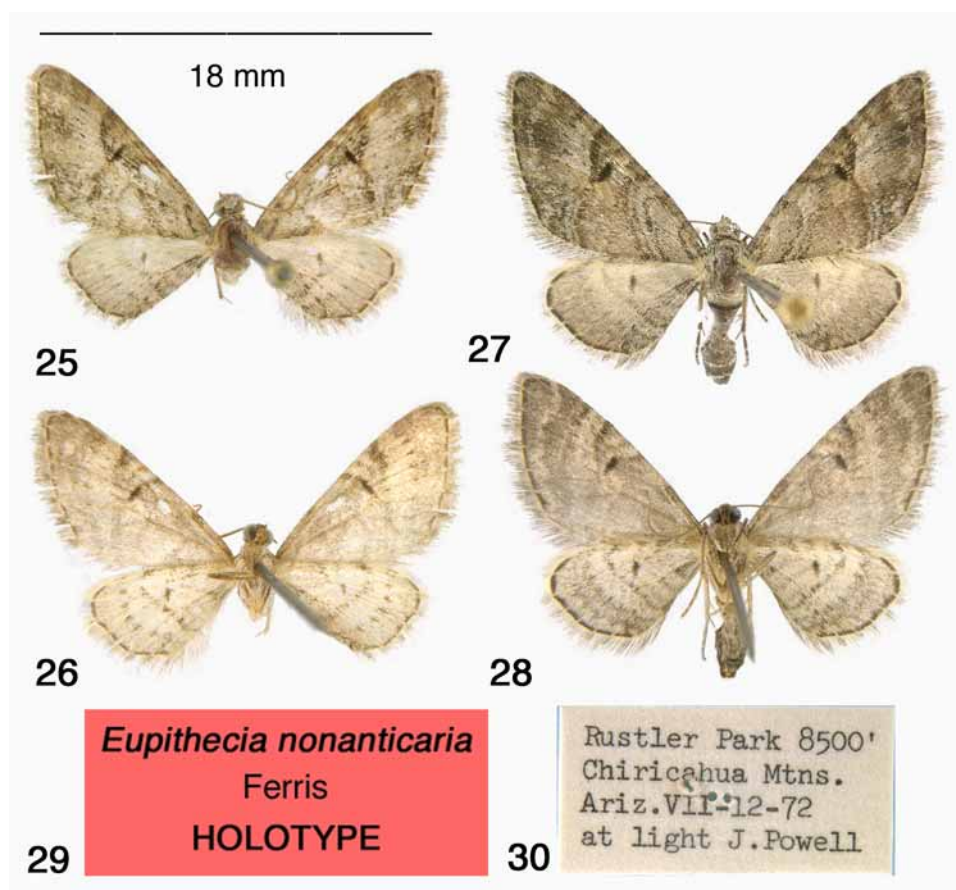


**FIGURES 18–24.** *Eupithecia anticaria* genitalia. Male structures: 18, genitalia with aedeagus removed; 19–20, lateral views of everted vesica; 21, aedeagus; 22, genital plate. Female structures: 23 ventral view of bursa copulatrix; 24, image-inverted view of fig. 24 to enhance structural features.

*Eupithecia nonanticaria* Ferris, New Species

(Figs. 25–43)

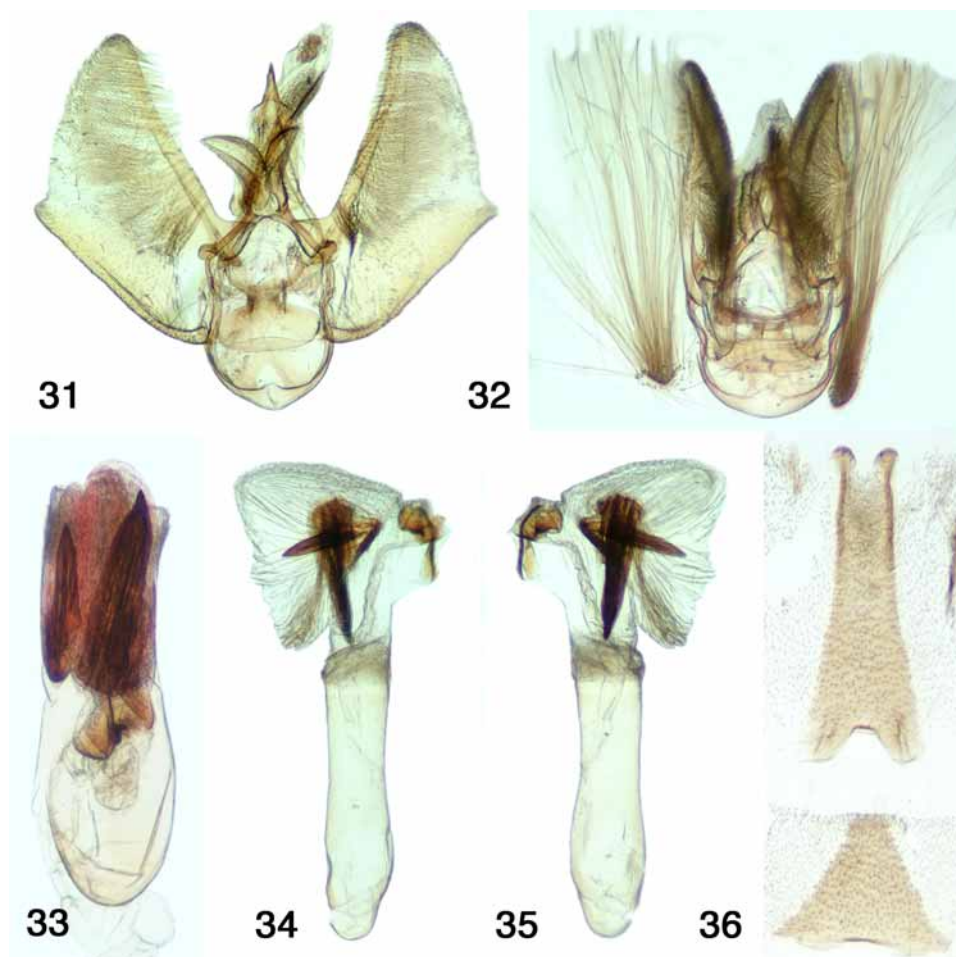
**Diagnosis.** This species is nearly identical in habitus to *E. anticaria* but is grayer with more subdued coloration and muted maculation; positive separation requires the examination of the genitalia. This species apparently replaces *anticaria* in the mountains of southeastern Arizona and southwestern New Mexico.



**FIGURES 25–30.** *Eupithecia nonanticaria*. 25, male holotype, D; 26, male holotype V; 27, female, D; 28, female, V; 29, holotype label; 30, holotype pin label.

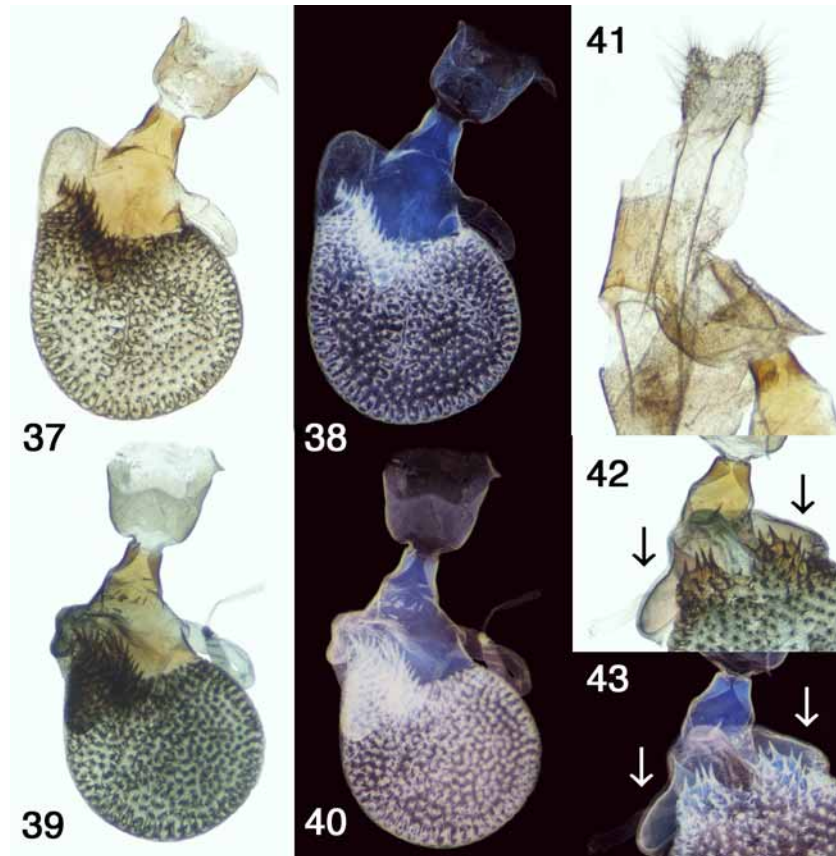
**Description.** MALE (Figs. 25–26): *Forewing length* (base to apex): 9.5–11.0 mm. *Head and Body*: Palpi length ca. 1.5 times eye width, laterally broad, dully checkered brown and whitish scales long and loosely compacted. Frons, head, thoracic collar, thorax, and tegulae with mixture of pale and darker brownish-gray scales. Antennae finely and evenly ciliate, light brown with dorsal darker patch on each segment, pedicel and scape concolorous with head. Abdominal segment I whitish basally with narrow black band along posterior margin (as in *anticaria*); remaining segments are medium-to-dark brown, slightly paler ventrally. Legs pale brownish-gray, not noticeably ringed, paler scales at distal ends of segments; hind-tibial spurs small and poorly developed. *Wings*: Ground color pale grayish-white but overlying darker scales generate an overall medium gray habitus. DFW: double areole in venation (as in *anticaria*); prominent oblong dark brown discal spot; narrow dark basal line; lower portion of dark-edged broad median band with ruddy suffusion; narrow pale band beyond median extending from costa to mid-wing; outer wing area dusky with patchy shading; pale crenulate subterminal line; broad segmented brown adterminal line; fringes grayish-brown with pale tips. DHW basal and median areas pale, darker toward margin; prominent dark discal spot; weak postmedian line; prominent adterminal line; fringes as in DFW. Wings paler ventrally with dorsal maculation repeated, lighter

on VFW, darker on VHW. Dorsal terminal lines and fringes repeated ventrally. *Genitalia* (Figs. 31–36) [4 dissections]: Hair pencils well developed (Fig. 32). Valve (Fig. 31) trigonate tapering to narrow rounded apex, blunt triangular projection from mid-ventral margin. Uncus short, dorsoventrally bifid with well-defined widely separated cusps; socii well-developed and typical. Aedoeagus (Fig. 33) length-to-width ratio ca. 3.5. Everted vesica hatchet shaped in lateral profile, cornuti two large mutually perpendicular spikes with “mushroom” or “umbrella” heads, and large convoluted folded-over piece. Genital plate (Fig. 36, 8<sup>th</sup> sternite at top) similar to *anticaria* but more elongate.



**FIGURES 31–36.** *Eupithecia nonanticaria* male genital structures. 31, genitalia with aedoeagus removed; 32 genitalia (less aedoeagus) showing hair pencils; 33, aedoeagus; 34–35, lateral views of everted vesica; 36, 7th and 8th (top, genital plate) abdominal sternites.

**FEMALE** (Figs. 27–28): *Forewing length* (base to apex): 9.0–11.0 mm. Color and maculation similar to male. Legs are paler than male with banding more diffuse. Antennae weakly setose, colored as in male. *Genitalia* (Figs. 11–13) [8 dissections]: Papillae anales moderately long, oval, diffuse long setae; apophyses slender, anterior-to-posterior ratio ca. 0.5; caudal spurs weak and embedded in genital plate. Ostium bursae weakly sclerotized, cup-like, very short membranous ductus bursae above open moderately broad colliculum. Corpus bursae globular (Figs. 37–40) with two lightly chitinized flange-like projections (Figs. 42–43) just below and on either side of colliculum base (when compressed, as on a slide, they generate a shoulder-like hump on the side opposite to the ductus seminalis); upper portion lightly chitinized without spines; the relatively narrow tubular ductus seminalis projects outward from the right ventral side of the corpus bursae, then curves downward crossing ventrad as it tapers sharply; remainder of corpus bursae densely spined, patch of long robust spines originating at ventral middle of upper border curving to the left and dorsad (Figs. 42–43).



**FIGURES 37–43.** *Eupithecia nonanticaria* female genital structures. 37–38, normal (37) and inverted (38) ventral images of bursa copulatrix – preparation 1; 39–40, normal (39) and inverted (40) ventral images of bursa copulatrix – preparation 2; 41, papillae anales and apophyses; 42–43, normal (42) and inverted (43) images of top of bursa copulatrix showing side lobes (arrows).

Based on the material examined, other than wing length, there appears to be little variation in this species.

**Holotype:** male: **ARIZONA**, Cochise Co., Chiricahua Mts., Rustler Park, 8500' (2590 m), 12.vii.1972, J. Powell, deposited in EME.

**Paratypes:** 4m, 16f. **ARIZONA**, Cochise Co., Chiricahua Mts., Rustler Park, 2.viii.1973, J. Powell & S. Szerlip (3f, EME); Onion Saddle, 30.vii–1.viii.1999, E. Buckner & P. A. Opler (3f, GMAD, 1m, author's collection); Upper Pinery Canyon C.G., 2135 m, 30.vii–1.viii.1999, E. Buckner & P. A. Opler (1m, 3f, GMAD, 1f, author's collection); Upper Pinery Canyon C.G., 2135 m, 15.viii.2006, C. D. Ferris (1f, author's collection); Pinery Canyon, 2075 m, 9.viii.1964, R. Leuschner (1f, R. Leuschner collection), 13.viii.1964, R. Leuschner (2f, R. Leuschner collection). **NEW MEXICO**, Grant Co., Black Range, Lower Gallinas Canyon, 2040 m, 14.viii.1980, C. D. Ferris (1m, author's collection), 30–31.vii.1989, C. D. Ferris (1f, author's collection); Pinos Altos Mts., Cherry Creek Canyon, 2075 m, 5.viii.1989, C. D. Ferris (1m, author's collection). **MEXICO**, Chihuahua, 14 mi. W. of Cuauhtemoc, 28.402°N, 107.074°W, 2235m, 2.viii.1998, P. M. Jump (1f, R. Leuschner collection, 1f, G. J. Balogh collection).

**Etymology.** The adjectival prefix “*non*” is added to the name *anticaria* to denote similarity of the two species.

**Biology.** Unknown; found in mixed coniferous–deciduous forest above 1760 m (Figs. 59–61).

**Flight period.** Late July to mid-August.

**Distribution.** Grant County, New Mexico (Pinos Altos Mts.; Black Range) and Cochise County, Arizona (Chiricahua Mts.); Chihuahua, Mexico.

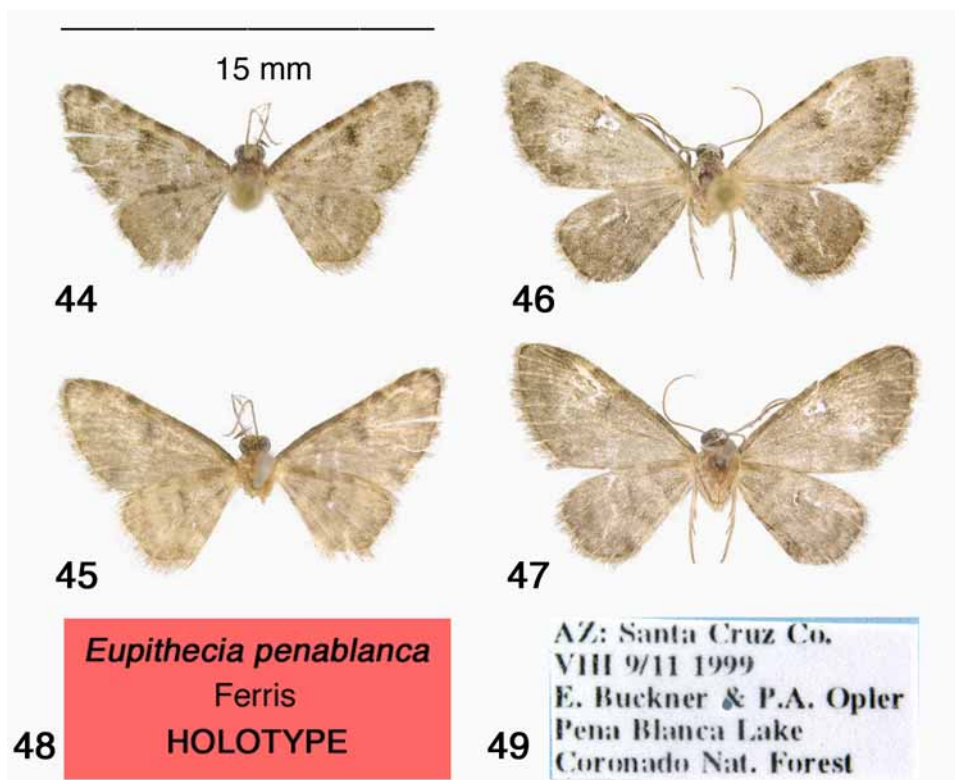


**Discussion.** Based on habitus, presence of the double areole in the DFW venation, and male genitalic characters, *E. nonanticaria* is affiliated with the *mutata* group (*sensu* Bolte, 1990).

***Eupithecia penablanca* Ferris, New Species**

(Figs. 44–56)

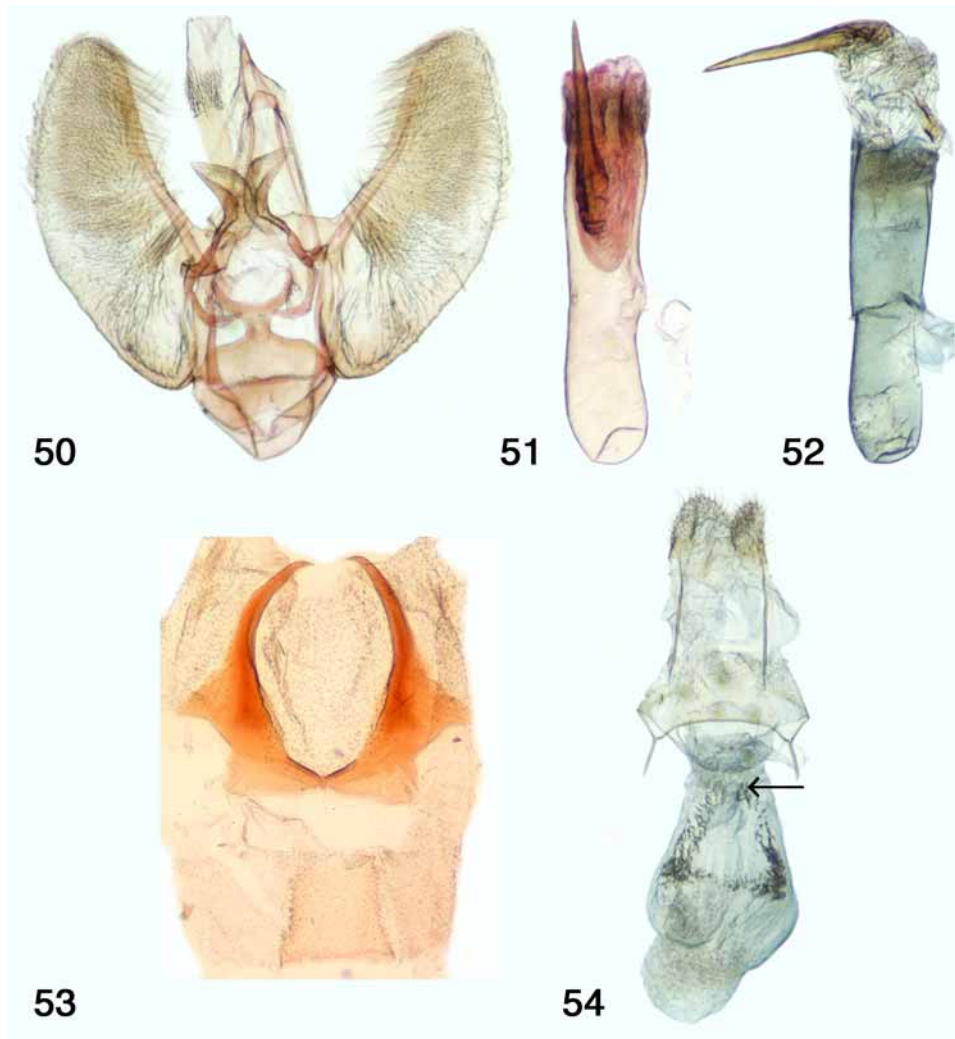
**Diagnosis.** Because of the poor condition of available specimens only a limited diagnosis is possible. General color is gray-brown, separated from other North American species by the large diffuse DFW discal spot and three submarginal dark patches (costa, above midline, tornus); positive identification requires examination of the genitalia.



**FIGURES 44–49.** *Eupithecia penablanca*. 44, male holotype, D; 45, male holotype V; 46, female, D; 47, female, V; 48, holotype label; 49, holotype pin label.

**Description.** MALE (Figs. 44–45, 55): *Forewing length* (base to apex): 7.0–8.0 mm. *Head and Body:* Palpi length ca. 0.9 width of eye, porrect, medium width, speckled brownish, paler at tips. Frons, head, thoracic collar, thorax, and tegulae brownish-gray. Antennae finely setose, brownish-tan with brown dorsal patch on each segment, scape brownish-tan. Abdominal segments brownish-tan scales with pale scales at tip of terminal segment. Legs pale brownish-tan, not noticeably ringed; hind-tibial spurs well developed. *Wings:* Ground color pale gray-brown. DFW: dark brown large diffuse discal spot; series of alternate short and long brown bars along costa with larger patch near apex; dark median area below discal spot; dark brown patch near tornus and submarginally above wing mid-line; brown segmented adterminal line; pale grayish-brown fringe. DHW: mottled aspect; indistinct discal spot; indistinct median band; adterminal line and fringe as in DFW. Ventrally paler; D pattern repeated, more contrasted on VHW. *Genitalia* (Figs. 50–53) [3 dissections]: Medium hair pencils (not illustrated). Valve uniformly broad with rounded apex (Fig. 50); uncus dorsoventrally bifid; socii well-developed and typical. Aedoeagus (Fig. 51) very narrow, length-to-width ratio ca. 5.4;

prominent spine projects from tip. Aedoeagus diameter too narrow to accommodate available hypodermic needles, making possible only partial vesica eversion (Fig. 52). Vesica armed with one very large, long (ca. 0.6 aedoeagus length) tapered spine and small irregular chitinous piece. Genital plate caliper-like (Fig. 53, 8th sternite at top) with triangular lateral projections unique in North American *Eupithecia*.



**FIGURES 50–54.** *Eupithecia penablanca* genitalia. Male structures: 50, genitalia with aedoeagus removed; 51, aedoeagus; 52, lateral view of partially everted vesica; 53, 7th and 8<sup>th</sup> (top, genital plate) abdominal sternites. 54, ventral view of entire female genitalia, arrow points to point of origin of ductus seminalis.



**FIGURES 55–56.** *Eupithecia penablanca*. 55, male, SW Peña Blanca Lake; 56, female, Carr Canyon.

FEMALE (Figs. 46–47, 56): *Forewing length* (base to apex): 7.0–9.0 mm. Color and maculation similar to male. Legs as in male. Antenna nearly filiform, very slightly setose; colored as in male. *Genitalia* (Fig. 54) [4 dissections]: Papillae anales short appearing semicircular, lightly setose; apophyses slender, anterior-to-posterior ratio ca. 0.25; caudal spurs weak and embedded in genital plate. Ostium bursae very weakly sclerotized, nearly membranous, cup-like; ductus bursae membranous, short, broad with no visible colliculum, thus giving the false impression that ostium appears to open directly into corpus bursae. Corpus bursae with lobed aspect and hemispherical fundus; ventral linear triangular array of spines; narrow tubular ductus seminalis projects outward at apex of triangle.

Based on the limited number of specimens available for examination and their generally poor condition, variation cannot be assessed.

**Holotype:** male: **ARIZONA**, Santa Cruz Co., Peña Blanca Lake, 1170 m, Coronado N.F., 9,11.viii.1999, E. Buckner & P. A. Opler, GMAD.

**Paratypes:** 4m, 4f. **ARIZONA**, Cochise Co., Huachuca Mts., Carr Cyn., 1710 m, 15.viii.1999, D. C. Ferguson (1f, USNM); Santa Cruz Co., Peña Blanca Lake, 1170 m, Coronado N.F., 9,11.viii.1999, E. Buckner & P. A. Opler (2m, 1f, GMAD, 1m, author's collection), 19.viii.1971, L. M. Martin (1f, G. J. Balogh collection); just south of Peña Blanca Lake, SW of Upper Thumb Butte, 31.vii.2005, J. & E. Adams & D. Yanega (1m, 1f, J. Adams collection).

**Etymology.** The specific epithet *penablanca* is a noun in apposition denoting the type locality.

**Biology.** Unknown; oak chaparral habitat (Figs. 58, 62).

**Flight period.** August.

**Distribution.** Known from type locality and Carr Canyon.



FIGURES 57–58. *Eupithecia macfarlandi* habitats, Huachuca Mts., Cochise Co., Arizona; 57, Ash Canyon (type locality), 1575 m; 58, Carr Canyon, 1710 m.



FIGURES 59–60. *Eupithecia nonanticaria* habitats, Grant Co., New Mexico. 59, Cherry Creek Canyon, Pinos Altos Mts., 2075 m; 60, Lower Gallinas Canyon, Black Range, 2040 m.



**FIGURES 61–62.** *Eupithecia* habitats. 61, *E. nonanticaria*, Upper Pinery Canyon, Chiricahua Mts., 2135 m, Cochise Co., Arizona; 62, *E. penablanca*, Peña Blanca Canyon, ca. 2130 m, Santa Cruz Co., Arizona.

**Discussion.** In his revision of North American *Eupithecia*, McDunnough (1949: 638) stated: “The conclusion of the *filmata* group leaves us with a large number of species, mostly of western and southwestern origin, that cannot apparently be arranged in any compact groups either among themselves or in connection with groups that have already been discussed.” *E. penablanca* falls into this category. The female genitalia are unlike other known North American species. The male genital plate bears some similarity to the Chilean species *E. atacama* (Vojnits) and *E. seatacama* Rindge, 1987, but both lack the side projection from the caliper arms. In other features, these two species do not resemble *E. penablanca*.

### Acknowledgments

I am grateful to the following individuals: Patricia Gentili-Poole, USNM, for specimen searches; Noel McFarland, Hereford, Arizona, for many courtesies, information, and specimens; Rosemary and Ralph Snapp for their hospitality during my visits to Carr Canyon; Paul A. Opler, GMAD, for study material; Jerry A. Powell, EME, for study material; Ron Leuschner, Manhattan Beach, California, study material; and George J. Balogh, Portage, Michigan, for study material and critical suggestions as an external reviewer. An additional anonymous reviewer provided helpful comments.

### Literature cited

- Bolte, K. B. (1990) Guide to the Geometridae of Canada (Lepidoptera) VI. Subfamily Larentiinae 1. Revision of the genus *Eupithecia*. *Memoirs of the Entomological Society of Canada*, No. 151, 1–253.
- McDunnough, J. (1949) Revision of the North American species of the genus *Eupithecia* (Lepidoptera, Geometridae). *Bulletin of the American Museum of Natural History*, vol. 93, Art. 8, pp. 533–728, plates 26–32.
- McFarland, N. (1988) Portraits of South Australian Geometrid Moths. Allen Press, Lawrence Kansas. 400 pp + illustrations.
- Rindge, F. H. (1987) The *Eupithecia* (Lepidoptera, Geometridae) of Chile. *Bulletin of the American Museum of Natural History*, vol. 186, Art. 3, pp. 269–363, figs. 1–199.
- Walker, F. (1862) Catalogue of the Lepidoptera Heterocera in the British Museum, part 24, pp. 1021–1280.