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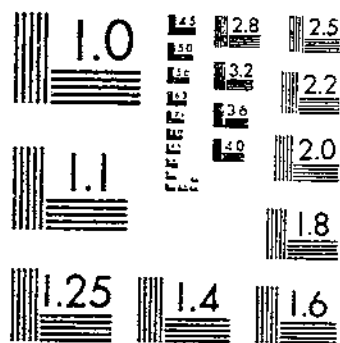
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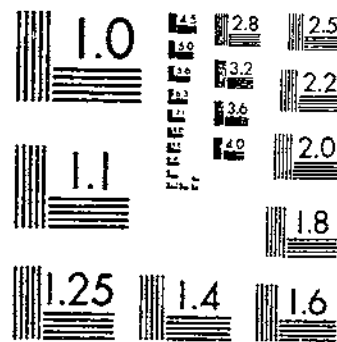
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A PARTIAL REVISION OF THE GENUS EUCELATORIA (DIPTERA, TACHINIDAE)  
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# A Partial Revision of the Genus *Eucelatoria* (Diptera, Tachinidae), Including Important Parasites of *Heliothis*

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## Abstract

Sabrosky, Curtis W. 1981. A Partial Revision of the Genus *Eucelatoria* (Diptera, Tachinidae), Including Important Parasites of *Heliothis*. U.S. Department of Agriculture, Technical Bulletin No. 1635, 18 pp.

Species of the New World tachinid genus *Eucelatoria* sensu stricto, which parasitize *Heliothis* and many other important lepidopterous pests, are divided into the *armigera* group and the *rubentis* group. Nine of the twelve already named species belong to the former, but only *E. armigera* (Coquillett), a widely misused name, is treated in detail to clarify its identity. A key is given to eight species of the *rubentis* group, including *E. rubentis* (Coquillett), *E. bigeminata* (Curran), and six described as new: *bryani* (Kansas and Iowa to Texas and Arizona, south to Nicaragua), *digitata* (Peru), *dominica* (Dominica), *guimaraesi* (Brazil), *heliothis* (Venezuela, Colombia, Honduras), and *teutonia* (Brazil, Argentina). A key to blondeliine genera with females having abdominal keel and piercer distinguishes *Eucelatoria* s. str. from genera with similar structure and habitus. Hosts of *Eucelatoria*, correction of published records, and variation in taxonomic characters are discussed briefly.

KEYWORDS: Diptera, *Eucelatoria*, *Heliothis*, Lepidoptera, Noctuidae, parasites, Tachinidae, taxonomy.

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## Contents

	Page
Hosts .....	1
The generic position of <i>Eucelatoria</i> .....	2
Synoptic key to blondeliine genera with females having abdominal keel and sharp, curved piercer .....	3
Genus <i>Eucelatoria</i> Townsend .....	4
Key to the species groups of <i>Eucelatoria</i> .....	6
Key to species of the <i>rubentis</i> group .....	6
The <i>armigera</i> group .....	8
<i>Eucelatoria armigera</i> (Coquillett) .....	8
The <i>rubentis</i> group .....	9
<i>Eucelatoria bigeminata</i> (Curran), n. comb. ....	9
<i>Eucelatoria bryani</i> , n. sp. ....	10
<i>Eucelatoria digitata</i> , n. sp. ....	11
<i>Eucelatoria dominica</i> , n. sp. ....	12
<i>Eucelatoria eucelatorioides</i> (Blanchard), n. comb. ....	12
<i>Eucelatoria guimaraesi</i> , n. sp. ....	12
<i>Eucelatoria heliothis</i> , n. sp. ....	13
<i>Eucelatoria rubentis</i> (Coquillett) .....	14
<i>Eucelatoria teutonia</i> , n. sp. ....	14
<i>Eucelatoria</i> sp. or spp. ....	15
References cited .....	15

Issued July 1981

# A Partial Revision of the Genus *Eucelatoria* (Diptera, Tachinidae), Including Important Parasites of *Heliothis*

By Curtis W. Sabrosky<sup>1</sup>

The New World tachinid genus *Eucelatoria* Townsend sensu stricto contains species that commonly parasitize species of the noctuid genus *Heliothis* as well as other important noctuid genera, such as *Spodoptera*, *Pseudaletia*, *Leucania*, *Mocis*, and *Trichoplusia*, and occasionally lepidopterous larvae of other families (Arnaud 1978; Sabrosky 1978).<sup>2</sup>

For many years the commonly used names were *Eucelatoria armigera* and *E. rubentis*, two species described by Coquillett, but a few years ago the former was recognized as being used for a complex of species (Sabrosky in Bryan et al. 1970). One of the most important parasites of *Heliothis*, which was investigated by Bryan and coworkers at the U.S. Department of Agriculture laboratory in Tucson, Ariz., has thus been referred to in recent years as *Eucelatoria* sp. or as *E. armigera* of authors, not Coquillett.

The purposes of this bulletin are to clarify the status of the species that have been identified as *armigera* and to revise the part of the genus containing the experimental parasite of the Arizona laboratory. The original purpose was to revise the entire genus, which occurs naturally only in the Western Hemisphere, but material from the Neotropical Region has accumulated slowly since 1970 and is still too scattered and limited to make a complete revision feasible. To some extent these limitations apply also to the part of the genus that is here being revised, but the distinctions between species in this part are sharper and the partial revision appears worthwhile, especially because it includes some species that have been studied as parasites of *Heliothis*.

## Hosts

The hosts of *Eucelatoria*, from both published and unpublished records, include many important pests, chiefly of the lepidopterous families Noctuidae (36 spp.) and Pyralidae (12 spp.), plus one each in the Arctiidae, Geometridae, Hesperidae, Pieridae, Tortricidae (subfamily Olethreutinae), and Yponomeutidae. There are two records from dipterid sawflies, undoubtedly aberrant hosts. Nine noctuids, three pyralids, and the geometrid are recorded as hosts only in Hawaii, where *Eucelatoria* has been introduced, but most of the others are hosts in the southern United States and the circum-Caribbean region. A high proportion of the available specimens has been reared from *Heliothis zea* (Boddie) and *H. virescens* (Fabricius), but this may be due largely to the amount of attention that has been given to parasites of these two species. There are also a number of specimens and records from various species of armyworms, cutworms, noctuid "loopers," and webworms. Twenty-two species of hosts are attacked by species of the *rubentis* group and 42 by species of the *armigera* group, but some of the published records of the latter are undoubtedly erroneous and will have to be shifted to some species of the *rubentis* group. The numbers of species are probably not significant because so many host records are based on a single isolated rearing. The principal hosts are attacked by species of both groups.

Some host specificity may exist, and this should be studied to determine whether attention can be directed to certain species of parasites for given hosts. For example, a small series from Hidalgo County, Tex., shows *E. bryani* reared from *Heliothis* larvae but *E. bigeminata* from "looper" larvae (a mixture of *Trichoplusia ni* (Hübner) and *Pseudoplusia includens* (Walker), cf. Harding 1976). From numerous other records, *E. bryani* is obviously a common parasite of *Heliothis*. Few other reared specimens of *E. bigeminata* are available, but these few are from *T. ni* and thus support the host difference suggested by the Texas rearings.

The numerous California records of *E. armigera* are undoubtedly correct and probably many of the Hawaiian records also. The following published records can be corrected from available material:

### *E. armigera*:

- Allende, Mexico, by Coquillett (1897, p. 106)  
= *E. bryani*, n. sp.
- Arizona, by Jackson et al. (1969)  
= *E. bryani*
- Oklahoma, by Bottrell (1968)  
= *E. bryani*
- Puerto Rico, by Wolcott (1936, p. 353)  
= *E. oppugnator* (Walton)

### *E. sp. near armigera*:

- Texas, by Harding (1976)  
= *E. bigeminata* (Curran)

### *E. sp.*:

- Arizona, by Bryan et al. (1970, 1972)  
= *E. bryani*

<sup>1</sup>Systematic Entomology Laboratory, Science and Education Administration, U.S. Department of Agriculture, c/o U.S. National Museum of Natural History, Washington, D.C. 20560.

<sup>2</sup>The year in *italic* after the author's name refers to References Cited, p. 15.



*E. australis*:

Puerto Rico, by Wolcott (1936, p. 354)  
= *E. oppugnator*

*E. sp. (dark rubentis)*:

Florida, by Patton (1958, p. 37)  
= *E. rubentis* (Coq.)

From the distribution, undoubtedly the records of "*Lydella*" *armigera* (Coquillett) from Kansas by Winburn and Painter (1932) and of *E. armigera* from Iowa by Jaques (1949) refer to *E. bryani*.

The genus *Eucelatoria* will ultimately be treated in a broader sense than in this publication when D. M. Wood has completed studies on the generic classification of the difficult tribe Blondeliini. For present purposes, the genus is here treated in a strict sense that can best be explained by the following key, which ignores possible future boundaries of *Eucelatoria* in the broad sense and the synonymy therein. *Eucelatoria* is the oldest of those names that would be included in it in the broad sense, and any later proposed synonymy will affect it only by extending the limits of its use.

Females of *Eucelatoria* and *Eucelatoria*-like blondeline tachinids are characterized by having a sharp, curved piercer (piercing sternotheca) and the intermediate abdominal terga (3 and 4) extended ventrally and compressed to form a keel. The margins of one or both terga may have one or more rows of short, closely set, stout spines. Thirty-seven described neotropical blondeline "genera" are based only on males, as far as I know, and in some instances one cannot be sure whether the females would show a piercer and keel and would fall in the group of genera in my key. However, almost all 37 have apical scutellar bristles or other characteristics, e.g., proclinate fronto-orbital bristles, that eliminate them from consideration in the *Eucelatoria* problem.

Ideally, one should always study series of associated males and females reared from one host species at the same place and time, but such a series is not always available. Females will be easiest to place to genus, or to subgenus if or when *Eucelatoria* is used in a broad sense. Males are not easily placed, nor even easily recognized as "*Eucelatoria*-like" unless they are associated with females and especially in a long reared series. The reddish-yellow band along the hindmargin of the fifth tergum, present in most species of *Eucelatoria* in the strict sense, will be a clue, as it is also for females. For females of all the genera, the combination of spined keel and no apical scutellar bristles will narrow the choice at once to *Eucelatoria*, *Heliodes*, *Machairomasicera*, *Ollachactia*, and *Incamiya*. The last three are peculiarly distinctive genera (see key), and thus one can pass quickly to the other two, for which more details are provided. Perhaps *Celatoria* should be added to the list of narrowed choices, but it has a different type of "keel" and will not be thought of in connection with *Eucelatoria*.

Several points of terminology need to be noted for clarity and to avoid repeated explanations. I use "tomentose" instead of "pollinose," and "postgonite" instead of "posterior gonapophysis." Terga 3 and 4 of the abdomen are often referred to as the intermediate terga, i.e., intermediate between the apparent first tergum (true 1 + 2) and the last tergum (5) of the preabdomen.

**Synoptic Key to Blondelline Genera With Females  
Having Abdominal Keel and Sharp, Curved Piercer**

1. No apical scutellar bristles ..... 2  
Apical scutellar bristles present ..... Many genera:  
*Blondellia* Robineau-Desvoidy, *Compsilura* Bouché,  
*Eucelatoriopsis* Townsend, *Spathimeigenia* Townsend,  
*Tinalydelia* Townsend, etc.
2. Mesonotum with 4 narrow black stripes ..... 3  
Mesonotum with 2 broad black stripes, each formed by  
fusion of a lateral and sublateral stripe ..... *Incamiya*  
Townsend, *Spathimylia* Townsend
3. Midtibia with 1 median anterodorsal bristle; foretibia with  
1 median posterior bristle; eyes bare or at most with  
very short, sparse hairs ..... 4  
Midtibia with 2 to several strong anterodorsal bristles;  
foretibia with 2 median posterior bristles; eyes densely  
long haired ..... *Ollachactia* Townsend
4. Palpi black, enlarged distally, especially in female; keel  
without a row of spines, with 1 stout spine at each  
posterior corner of 3d and 4th terga .....  
..... *Lydellohoughia* Townsend  
Palpi yellow, slender; keel not so ..... 5
5. Tergum 3 (apparent 2d) in female with long, compressed  
ventral development crowned with dense tuft of short  
spines (cf. Walton 1914; Clausen 1940); tergum 4  
without spines ..... *Celatoria* Coquillett  
Not so, both terga 3 and 4 in female equally compressed  
ventrally to form a keel; tergum 4 often with spines ..... 6
6. Abdomen of female with short, closely set spines on keel,  
at least on tergum 4; foretibia with median posterior  
bristle, but no posterodorsal bristles ..... 7  
Abdomen of female without spines on keel, but with ordi-  
nary bristles; foretibia with both posterior and postero-  
dorsal bristles, the latter much shorter than the former  
but distinct from clothing hairs ..... *Heliolydella* Townsend,  
*Hemilydella* Townsend, *Xiphomyia* Townsend (including  
*Urodexodes* Townsend)
7. Third vein ( $R_{4+5}$ ) with setae only on node, usually 2 or 3;  
abdominal terga with median discal bristles on terga  
3-5 in male and on 1 or more of these in female,  
stronger and more erect in male than female ..... 8  
Third vein with setae three-fourths way to anterior cross-  
vein ( $r-m$ ); abdominal terga without median discal  
bristles (only female holotype known but total absence  
of discal bristles suggests that male will also lack  
them); short, closely set spines only on keel of 4th  
tergum, that on 3d with long and slender bristles .....  
..... *Machairomasicera* Townsend
8. Gena narrow, genal dilation with only 1 row of fine hairs  
(sometimes irregular but never as 2 distinct rows),  
usually as a continuation of the postocular cilia; keel  
of female abdomen with stout, closely set, curved  
spines only on segment 4, 3 with long ordinary bristles;  
apical cell of wing closed at margin to very short  
petiolate; facial ridge chiefly bare, only a few slender  
bristles above vibrissa; intermediate abdominal terga  
(3 and 4) broadly shining black on posterior half to two-  
thirds, the marginal and discal bristles strong and  
erect in both sexes ..... *Heliodexodes* Thompson

Gena broader, with 2 to several rows of fine hairs; keel  
of female abdomen with short, stout, closely set,  
curved spines on 4th segment, the 3d with similar  
spines or with 3-4 stout but longer spines; apical cell  
typically open, occasionally narrowly so, closed at  
margin only in *E. cora* (Bigot) and occasional  
specimens of *E. armigera*; facial ridge typically with  
strong erect bristles on lower half or more, with few  
bristles in only a few species; intermediate abdominal  
segments usually predominantly dull and densely  
tomentose, narrowly black along posterior margins ex-  
cept in *E. dominica*, n. sp., often with changeable pat-  
tern of blackish, forwardly pointed sublateral triangles,  
and typically with bristles reduced and decumbent in  
female ..... *Eucelatoria* Townsend

## Genus EUCELATORIA Townsend

*Eucelatoria* Townsend, 1909, Ent. Soc. Amer. Ann. 2: 249. Type-species, *Tachina armigera* Coquillett, by monotypy.  
*Celatoriopsis* Blanchard, 1963, Rev. Invest. Agr. 17: 228. Type-species, *C. eucelatorioides* Blanchard, by original designation. **New synonymy.**

Species of *Eucelatoria* s. str. have a very uniform habitus, sharing the following characteristics:

Heavily gray to yellowish-gray tomentose, eyes bare; occiput entirely white haired behind postocular cilia; male with frons at vertex obviously much narrower than an eye, lacking proclinate fronto-orbital bristles and with 2-3, rarely 4, pairs of reclinate fronto-orbitals, female always with 2 pairs of each; parafacials bare; palpi slender, yellow. Mesonotum with 4 narrow black stripes; each humeral callus with 3 bristles in a nearly straight line, the innermost bristle much weaker than the others; 3 pairs of postsutural dorsocentral bristles; no apical scutellar bristles; infra-squamal setulae present; 3 sternopleural bristles. Legs black; foretibia with 1 median posterior bristle and no posterodorsal bristles; midtibia with 1 median anterodorsal bristle; male with long claws and pulvilli. Wing with apical cell usually open, rarely closed at margin, ending well before apex of wing; 3d vein ( $R_{4+5}$ ) with few bristles, usually 2 or 3 on node at base; posterior crossvein closer to bend of 4th vein than to anterior crossvein. Abdomen almost always heavily gray to yellowish-gray tomentose (pollinose), with tergum 1 + 2 dorsally subshining black, and usually narrow hindmarginal bands, narrow median stripe, and more or less changeable sublateral triangular areas on intermediate terga subshining black, tergum 5 usually with reddish-yellow hindmarginal band, occasionally all black; in males intermediate terga commonly reddish yellow on sides, and terga 1 + 2, 3, and 4 reddish yellow ventrally, in females postabdominal terga and genitalia reddish yellow except for narrow black margins of piercer; tergum 1 + 2 excavated to hindmargin; a pair of median marginal bristles present on terga 1 + 2, 3, and 4, and a pair of median discal bristles on 3 to 5, in males commonly 1 pair of discals strong and erect but often extra but usually weak discals on 3 and 4, in females 1 pair of discals often short and decumbent on 3 and 4; female with piercer and spined ventral keel, with short, stout, curved, closely set spines along ventral margin of tergum 4 and in some species of both 3 and 4, i.e., the keel. Size, 5-8.5 mm, commonly 6-7 mm.

The species can be divided into two groups on the basis of the appearance of the fifth tergum as seen in ventral aspect. The character is useful in both sexes, but it is most distinct in the males, and assignment of occasional unassociated females may be a bit uncertain. In the *armigera* group (figs. 3, 4), the fifth tergum ventrally has a few rows of well-spaced, more or less erect hairs and bristles, in about three irregular rows on each side, and the underlying tomentum is even and uniform. In the *rubentis* group (figs. 1, 2), the fifth tergum ventrally is beset on each side with more rows of more closely spaced, somewhat decumbent and posteriorly directed hairs, and few or no bristles,

and the underlying tomentum is usually interrupted by shining or thinly tomentose spots and bars, the area sometimes appearing mottled and sometimes shining with little tomentum visible. In species where this attribute is most distinct, it resembles the pilose areas sometimes called "sexual patches" in such genera as *Pseudomyiothyria* Townsend. Another feature that will help to confirm females of the *armigera* group is that both terga 3 and 4 have the characteristic short, curved, closely set spines on the keel, usually in two close rows, whereas in the *rubentis* group such spines are present only on the fourth tergum, the third having few and longer well-spaced spines.

Certain characters were found to be variable and unreliable. Ocellar bristles may be present or absent. There may be two or three pairs of reclinate fronto-orbital bristles in males. Facial bristles vary from few and weak in some species to rather strong and ascending high on each facial ridge, nearly to the end of the frontal row in other species. The apical cell of the wing is usually open, but it may be either widely or narrowly open, and occasionally (though rarely) closed at the margin of the wing. Finally, there may be one or two pairs of median discal bristles on the intermediate terga (terga 3 and 4).

All females of *Eucelatoria* have two pairs of reclinate fronto-orbital bristles, but differences in the number of these bristles in the males have proved unreliable. Specimens with two pairs of evenly spaced bristles seemed distinct from those with three pairs of more closely spaced ones; however, there are exceptions in both groups and the character could not be used in the keys. In general, species with sparse and erect hairs on tergum 5 have three pairs and those with dense and appressed hairs have two pairs. Among the sparsely haired species, in the males available to me, only 50 specimens have 2 pairs of the reclinate bristles and 317 have 3 pairs or more (253 with 3 pairs, 62 with 3 bristles on one side and 2 or 4 on the other, and 2 with 4 pairs). There are proportionately fewer males of *E. armigera* alone that have only 2 pairs (6 against 106 with 3 pairs or a total of 128 with 3 pairs or more). In contrast, in the species with a densely haired fifth tergum, 263 males have 2 pairs of reclinate bristles (including 6 with 1 bristle on one side, 2 on the other), 31 have 3 pairs (including 12 with 2 bristles on one side, 3 on the other), and 5 have 1 pair. In all specimens with three pairs, the hindmost pair is always shorter and more slender than the others, and one or both of the third bristles are sometimes weak and hairlike, though distinctly longer and blacker than surrounding hairs.

Similarly, the presence or absence of ocellar bristles seemed at first to have possibilities for recognition of species, but the character is only slightly more useful than the fronto-orbital bristles. The species with a densely haired fifth tergum virtually always have ocellar bristles, judging from the large sample before me (741 specimens examined, but only 3, all *E. teutonia*, lack ocellar bristles). Absence of ocellar bristles occurs commonly in species

with a sparsely haired fifth tergum, but ocellar bristles are sometimes found in these species and thus the character cannot be relied upon for such specimens. Of 666 specimens of these species, ocellars are absent in 480 (72.7 percent) but present in 186. It may be of interest to note that the proportion differs in northern and southern material, although species differences may also have affected this. In 229 specimens of *E. armigera* (southwestern U.S., Mexico, Hawaii), ocellars are absent in 127 (55.4 percent) and present in 102, whereas 269 specimens of all species from South America show ocellars absent in 239 (88.9 percent) and present in only 30. Of the South American sample, 165 specimens are from Peru and only scattered examples from all other countries.

Holotypes of all named species that have been placed in *Eucelatoria* have been studied, and they can be assigned to the two groups as follows:

Species with sparsely haired fifth tergum (*armigera* group):

*E. armigera* (Coquillett, May 1889). California.

Type-species.

*E. aurescens* Townsend, 1917. Brazil.

*E. australis* Townsend, 1911. Peru.

*E. botyvara* (Robineau-Desvoidy, 1830). Cuba.

**N. comb.**

*E. comosa* (Wulp, 1890). Mexico.

*E. cora* (Bigot, Jan. 9, 1889). Mexico.

*E. montana* Townsend, 1929. Peru.

*E. oppugnator* (Walton, 1914). Puerto Rico.

*E. pollens* (Wulp, 1890). Mexico.

Species with densely haired fifth tergum (*rubentis* group):

*E. bigeminata* (Curran, 1927). St. Croix, Virgin Islands. **N. comb.**

*E. eucelatorioides* (Blanchard, 1963). Argentina. **N. comb.**

*E. rubentis* (Coquillett, 1895). Florida.

*Chetolyga nigripalpis* Bigot, placed in *Eucelatoria* in the Neotropical Catalogue (Guimarães, 1971), is a *Eucelatoriopsis* (**n. comb.**, if this is regarded as a distinct genus).

The "*Eucelatoria physonotae* Thompson" listed by Guimarães (1977) is not a *Eucelatoria* s. str. It was described by Thompson in his new genus *Eucelatorioides*, which has a pair of apical scutellar bristles and differs from *Eucelatoria* in other respects as well.

The specific name *armigera* has been applied to at least four different species in the material before me, two in the *armigera* group (*armigera* and *oppugnator*) and two in the *rubentis* group (*bigeminata* and *bryani*, n. sp.), but most commonly to *armigera* and *bryani*. The distinctive reddish abdomen of *rubentis* has prevented misidentifications, so the major confusion in past records of "*armigera*" lies between true *armigera* and *bryani*. The character for division of the groups (couplet 1) will quickly separate the two species, and the difference in their ranges will serve to indicate probable identity for records of which material is not

available for rechecking. In America north of Mexico, where most attention has been given to species of *Eucelatoria* because of their importance as parasites of *Heliothis*, three species are common—*armigera*, *rubentis*, and *bryani*, and the three are easily distinguished. *E. cora* and *E. bigeminata* occur, but apparently in limited numbers. *E. armigera* and *cora* are far western, *rubentis* and *bigeminata* eastern, especially southeastern, and *bryani* west central.

## Key to the Species Groups of *Eucelatoria*

1. Fifth abdominal tergum ventrally with closely set, often more or less decumbent hairs (ca. 5 rows) arising in usually obviously interrupted tomentum that is different in appearance, especially evident in males, from the dense and even tomentum of dorsal surface (figs. 1, 2); ocellar bristles regularly present, though sometimes weak; females with short, stout, closely set, curved spines only on keel of tergum 4, keel of tergum 3 with 3 to 6, usually 4, longer spines posteriorly ----- *rubentis* group
- Fifth abdominal tergum ventrally with few rows (2 to 3) of well-spaced, often erect hairs and bristles that arise in dense even tomentum like that of dorsal surface (figs. 3, 4); ocellar bristles commonly absent, but occasionally present; females usually with short, stout, closely set, curved spines on keel of both terga 3 and 4, only a few neotropical species with 3 to 5 longer spines on tergum 3, as in *rubentis* group ----- *armigera* group<sup>1</sup>

<sup>1</sup>See discussion under *armigera*. Aside from a single male from Florida, possibly an undescribed species, and four females of uncertain position (two Florida, two Rio Grande Valley of Texas), possibly neotropical species, the only representatives of this group that I have seen in America north of Mexico are *E. armigera* in California, Arizona, northern Mexico, and Hawaii (introduced), and *E. cora*, if that is distinct.

## Key to Species of the *rubentis* Group

1. Males: Frons at vertex obviously much narrower than an eye, and lacking proclinate fronto-orbital bristles ----- 2
- Females: Frons at vertex equal to width of eye, or nearly so, and with 2 pairs of proclinate fronto-orbital bristles; abdomen with piercer and spined ventral keel ----- 10

### MALES

2. Abdomen typically predominantly bright reddish orange, with narrow median black stripe on intermediate terga, sometimes extending onto tergum 5 (rarely discal area of terga 4 and 5 blackish), and typically tergum 1 + 2 reddish orange except black median excavation and narrow dorsal band basally (southeastern U.S.) ----- *E. rubentis* (Coquillett)<sup>1</sup>
- Abdomen predominantly black in dorsal aspect, sometimes reddish orange on sides and venter, tergum 1 + 2 entirely or chiefly black, tergum 5 usually with reddish-orange band along hindmargin ----- 3
3. Cercus in profile narrowly prolonged at apex; surstylus digitate, the parallel-sided distal portion relatively long (fig. 12) (Peru) ----- *E. digitata*, n. sp.
- Cercus in profile not narrowly prolonged at apex; surstylus broadened at base, any parallel-sided distal portion not as long as in *digitata* ----- 4
4. Cerci in posterior aspect apically acute, sides strongly sloping from apex, each cercus in profile also strongly sloping from acute apex and appearing relatively broad for its length (figs. 11, 13). (If each cercus in posterior aspect is so narrowly blunt at apex that one is in doubt here, note the strong slope from acute apex in profile.) ----- 5
- Cerci in posterior aspect narrowly to broadly blunt at apices, though inner corners may be acute, each cercus in profile not sloping from apex, or not as strongly sloping as in preceding, and appearing relatively long and narrow (fig. 10) except in *E. teutonia* ----- 6
5. Tergum 5 almost entirely black, with narrow reddish band along hindmargin; genitalia with surstylus only slightly broadened basally (fig. 13) (Brazil) -----
- *E. guimaraesi*, n. sp.
- Tergum 5 entirely or chiefly reddish yellow, with more or less distinct pattern of alternating shining and dull areas; surstylus relatively strongly broadened basally (fig. 11); mesonotal stripes usually fused as 2 bigeminate marks (West Indies, Fla., Tex.) ----- *E. bigeminata* (Curran)
6. Cerci in posterior aspect short and broad, broadly rounded apically and sides in large part parallel (fig. 14); postgonite with conspicuous bulge anteriorly near base; tergum 5 black to distal margin (Brazil, Argentina) ----- *E. teutonia*, n. sp.
- Cerci in posterior aspect usually longer and narrower, if broad each is narrowed apically and the sides are not parallel (fig. 10); postgonite with slight or no bulge near base, not as conspicuous as in *teutonia*, tergum 5 sometimes black, but commonly with reddish-yellow band along hindmargin ----- 7
7. Tergum 5 entirely black, at least dorsally (Brazil, Peru; material inadequate for further study) ----- *E. sp.* or spp.
- Tergum 5 with narrow or broad, reddish-yellow band along posterior margin ----- 8

<sup>1</sup>Some incompletely colored or obviously feral specimens of some neotropical species may appear to key here

8. Intermediate terga predominantly shining black, the black areas far more extensive than the gray tomentose areas, hindmarginal bands broad, sublateral areas large and median stripe broad (fig. 7); tergum 5 with broad, reddish-yellow band, sometimes half length of tergum (Dominica) ..... *E. dominica*, n. sp.  
Intermediate terga predominantly gray or yellowish gray, with comparatively narrow, black hindmarginal bands and median stripe, and, if present, sublateral triangles (fig. 8) ..... 9
- 9.<sup>2</sup> Abdomen yellowish-gray tomentose; intermediate terga each with narrow to indistinct median black stripe, narrow black band along hindmargin, and usually no sublateral black triangles (fig. 8); tergum 5 with broad reddish-yellow band along hindmargin, two-fifths to one-third length of tergum (southwestern U.S., Mexico to Nicaragua) ..... *E. bryani*, n. sp.  
Abdomen gray tomentose; intermediate terga with distinct black median stripe, wider black bands along their hindmargins, and distinct to strong sublateral black triangles; tergum 5 with comparatively narrow reddish band along hindmargin, one-fifth to one-fourth length of tergum (Venezuela, Colombia) ..... *E. heliothis*, n. sp.
14. Tergum 5 predominantly reddish yellow, only narrowly blackish toward base, unevenly tomentose with alternating tomentose and shining areas; mesonotal stripes usually merged posteriorly to form 2 bigeminate marks; parafacial narrow below, only half the breadth of 3d antennal segment (Fla., Tex., West Indies) ..... *E. bigeminata* (Curran)  
Tergum 5 predominantly black dorsally, with reddish-yellow, parallel-sided, usually narrow band along hindmargin, if more broadly reddish the basal area evenly tomentose continuous with sides; mesonotal stripes almost always distinctly separated; parafacial usually wider in proportion to 3d antennal segment ..... 15
15. Piercer relatively narrow toward base, not appearing appreciably widened (cf. fig. 6) ..... 16  
Piercer obviously widened toward base (cf. fig. 5) ..... 17
16. Peruvian species ..... *E. digitata*, n. sp.<sup>3</sup>  
Brazilian species ..... *E. guimaraesi*, n. sp.<sup>3</sup>
- 17.<sup>4</sup> Tergum 5 predominantly black in ground color, especially dorsally, the dark reddish band along hindmargin bordered anteriorly by a narrow shining black area; abdomen gray tomentose, the intermediate terga each with shining black band along hindmargin and with conspicuous black sublateral areas ..... *E. heliothis*, n. sp.  
Tergum 5 predominantly reddish yellow in ground color, black dorsally toward base, the rather broad reddish-yellow apical band adjoining the yellowish-gray tomentose basal area without an intervening black area; abdomen yellowish-gray tomentose, intermediate terga with duller and narrower black hindmarginal bands and less conspicuous sublateral areas ..... *E. bryani*, n. sp.

#### FEMALES

10. Abdomen predominantly reddish yellow, varying from only a narrow black median stripe to some median black areas on dorsum of intermediate terga and base of 5, typically tergum 1 + 2 reddish orange except black median excavation and narrow dorsal band basally (southeastern U.S.) ..... *E. rubentis* (Coquillett)  
Abdomen predominantly black in dorsal aspect, usually with reddish-yellow band along posterior margin of tergum 5, occasionally with some yellow on extreme sides of intermediate terga ..... 11
11. Abdomen entirely black, or at most tergum 5 narrowly dark reddish posteroventrally ..... 12  
Tergum 5 with narrow to broad, reddish or reddish-yellow band along hindmargin ..... 13
12. Large species (6 mm) with strong erect bristles on terga 3-5 (Brazil, Argentina) ..... *E. teutonia*, n. sp.  
Smaller species (4-5 mm) with weak decumbent median discal bristles, or none, on intermediate terga 3 and 4 (Peru, Brazil) ..... *E. sp.* or spp.
13. Intermediate terga with extensive black pattern, including strong median stripe and broadly quadrate sublateral areas (cf. fig. 7 of male) (Dominica) (female unknown, but I presume that the heavily black pattern of the male will be reflected in the female) .....  
..... *E. dominica*, n. sp.  
Intermediate terga predominantly gray to yellowish-gray tomentose, not so extensively marked with black, the hindmarginal bands narrow and sublateral black triangles weak to moderately distinct ..... 14

<sup>2</sup>See note on *E. eucelatoroides* (Blanchard).

<sup>3</sup>Few females available, and I can find no reliable differences. The provenance may or may not prove to be a helpful clue.

<sup>4</sup>See footnote 2.

## The armigera Group

Inadequate material from the Neotropical Region precludes full consideration of this group. In America north of Mexico, in which territory identifications are most commonly requested because of the increasing attention to parasites in general and parasites of *Heliothis* in particular, there is only one common species, *E. armigera*, in the Southwest (Calif., Ariz., northern Mexico, also introduced into Hawaii). Occasional specimens from Arizona might be referable to *E. comosa*, described from Mexico, but they appear to be pale variants of *armigera*. *E. comosa* may be a synonym of *armigera*, but I leave that question for study when adequate Mexican material is available. A small series of unusually small, dark specimens from Yuma, Ariz., reared from an undoubtedly aberrant host, the Egyptian alfalfa weevil (*Hypera brunneipennis* (Boheman)), seems to be close to *E. cora*, but the specimens may also be dark *armigera* and the status of *cora* is also left for future study. Eight other specimens deserve special notice. Three males and a female from Hidalgo County, Tex., represent a definitely different species from any of the preceding, and it seems likely to be a neotropical taxon that has ranged into the Rio Grande Valley. A female from Sonora, Tex., cannot now be distinguished from *armigera*, but it is far from the known range of that species. Two dark females from Hidalgo County, Tex., are apparently still different. A single male from the Everglades National Park, Dade County, Fla., is superficially similar to *E. rubentis*, but it shows the sparsely haired fifth tergum of the *armigera* group and the parafacials are extremely narrow. This may be another neotropical species, probably undescribed.

One may note that *E. cora* is the oldest name in the genus, and if found to represent the same species as *armigera*, it would be the senior synonym of the latter.

### *Eucelatoria armigera* (Coquillett)

*Tachina armigera* Coquillett, 1889 (May), Insect Life 1: 332 (Calif.).

*Frontina armigera* (Coq.) Coquillett, 1897, U.S. Dept. Agr., Div.

Ent., Tech. Ser. 7: 106. (In key, "From the type specimen.")

*Eucelatoria armigera* (Coq.) Townsend, 1909, Ent. Soc. Amer. Ann. 2: 249. (Type-species of new genus, by monotypy.)

*Lydella armigera* (Coq.) Curran, 1927, Canad. Ent. 59: 12.

*Eucelatoria armigera* (Coq.) Townsend, 1940, Manual of Myiology, Pt. X: 48. ("Ht female—Origin, Los Angeles, California; location, Washington.")

*Anetia armigera* (Coq.) Bibby, 1942, Jour. Econ. Ent. 35: 943.

Species with 5th abdominal tergum sparsely haired in ventral aspect and with reddish-yellow band on hindmargin; female with short, stout, curved, closely set spines along ventral margins of 3d and 4th terga, those on 3d but little longer than those on 4th.

Black in ground color, heavily gray tomentose; antenna black, 3d segment narrowly reddish at base; parafacial gray in male, yellowish in female; abdominal terga heavily gray or slightly yellowish-gray tomentose, the subshining black areas usually narrow and the reddish-yellow band along hindmargin of 5th tergum narrow.

Ocellar bristles, in available material, absent only slightly more often (53 percent) than present; facial ridges usually strongly bristled about half way, occasionally less, occasionally extending dorsad to level of lower end of frontal row.

Male.—Usually with 3 pairs of reclinate fronto-orbital bristles, the foremost pair longer and stronger than the others; male genitalia as figured (fig. 9), the cerci apically blunt, each approximately parallel sided in side view; each surstylus broadened at base, narrowing to apex.

Female.—With intermediate terga each with 2-3 rows of short, stout, curved, closely set spines on ventral margin, those on 3d tergum barely longer than those on 4th; piercer of moderate width at base, 2.1-2.5 times as long as wide (fig. 5).

Lectotype, female, Los Angeles County, Calif., with male in coitu, the pair labeled Type No. 3608 in the U.S. National Museum of Natural History.

This lectotype requires some explanation. The museum's characteristic red label, "Type No. 3608 U.S.N.M.," is on a pair pinned in coitu, "Los Angeles Co.," "Tachina armigera Coquillett" (small label in Coquillett's hand lettering), a printed label "Collection Coquillett," and a typical Coquillett determination label "Frontina armigera Coq." Coquillett described both sexes in the key in his 1897 revision and stated "from the type specimen," but since the label is on a pair in coitu and his publication did not specify the sex of the type, one cannot say that a lectotype was fixed there. Townsend (1940) said that the holotype was a female, and he probably had in mind the female of the pair labeled "Type" because he had worked at the museum for a few years and studied the collection. However, he did not label the specimen, and there are other females of the original series in the collection. To avoid prolonging uncertainty, I have designated the female of that "Type" pair in coitu as the lectotype.

The museum's type catalog shows that the species was entered by Coquillett himself on May 22, 1899, with seven specimens from Los Angeles, and "Type" was noted in the column for remarks. He was obviously recording the types from his revision of Tachinidae (1897) in a series of numbers reserved for him from 3518 through 3645, all in his handwriting and in the order the species appear in the revision. The collection now contains, in addition to the pair in coitu, a male and two females labeled "Paratype No. 3608," which are now paralectotypes. The location of the other specimens of the original series is unknown to me.

The museum collection also contains a pair in coitu, labeled "72° Par. on Heliothis armigera" and "Tachina armigera Coquillett," both apparently in the handwriting of Pergande. An old Division of Entomology card file shows the following note by Pergande: "722. Feb. 9, 1889. Rec'd from D. W. Coquillett, Los Angeles, Calif. 4 flies of a tachinid, with the inquiry if they are *Tachina anonyma*, but a comparison with the species proves them to be different.

They were bred from *Heliothis armigera*; marked them 72°." In the original description of *Tachina armigera*, Coquillett thanked C. V. Riley for correcting the description and for advising him on the generic position of the species. It is possible that the four specimens, including this pair still in the collection, were included in the numbers cited in the original description, but it is also possible that Coquillett described the species from the specimens still before him. At any rate, each specimen of the type series that came from the Coquillett collection, which was donated to the museum through the U.S. Department of Agriculture in 1894, is individually marked "armigera" in Coquillett's hand lettering, and this would of course have been added after the species was named, which was subsequent to the time the four specimens were sent to Washington.

***Eucelatoria bigeminata* (Curran), n. comb.**

- Lydeia bigeminata* Curran, 1927, Amer. Mus. Novitates 260: 10 (St. Croix, Virgin Is.).  
*L. bigeminata* Curran—Curran, 1928, Insects of Porto Rico and the Virgin Islands: Diptera or Two-Winged Flies, p. 110, in N.Y. Acad. Sci., Scientific Survey of Porto Rico and the Virgin Islands, vol. XI, pt. I (holotype noted).  
*L. bigeminata* Curran—Arnaud, 1963, Amer. Mus. Nat. Hist. Bul. 125: 120 (holotype listed).  
*Eucelatoria* sp. near *armigera* (Coq.) Harding, 1976, Environmental Ent. 5: 674 (Texas).

Parafacials narrow; mesonotal stripes usually bigeminate; 5th tergum dorsally with alternating shining and tomentose areas; male genitalia with cerci distally acute.

Parafrontals and sometimes parafacials yellowish gray; parafacial narrow, obviously much less than width of 3d antennal segment; facial ridges bristled only on lower fourth to third, commonly 3–5 bristles above each vibrissa. Mesonotum with 2 stripes on each side converging and usually merging posteriorly to form a bigeminate mark, occasionally the stripes narrowly separated. Abdomen predominantly gray to yellowish-gray tomentose; terga 1–4 entirely black in ground color, not reddish yellow on sides of 3 and 4 and ventrally, as in *E. bryani* and some other species; intermediate terga 3 and 4 dorsally darker than in *bryani*, with strong black median stripe, black and shining hindmarginal bands, and blackish and distinct sublateral areas, the last larger in the females than in males; 5th tergum dorsally black at base, especially in male, broadly reddish distally, usually about half of tergum (more in females), and entirely reddish on sides and below, with characteristic pattern on dorsum of alternating shining and heavily tomentose areas, more pronounced in male.

Male.—Two to three pairs of reclinate fronto-orbital bristles (in 32 examples, 18 have 2 pairs, 9 have 3 pairs, and 5 are mixed, 2 bristles on one side and 3 on the other). Abdomen: Ventral aspect of 5th tergum highly shining, sparsely tomentose. Male genitalia (fig. 11): Each cercus distally acute, in both posterior and lateral aspects, in latter strongly sloped from apex; surstylus broadened at base, distal portion narrowed; postgonite parallel sided on basal portion, without bulge at base.

Female.—Abdomen usually darker than in male, the sublateral black areas larger; 5th tergum commonly more extensively reddish yellow than in male; keel and its spines on 3 and 4 as described for *E. bryani*; piercer not strongly broadened at base (cf. fig. 6).

The holotype, kindly loaned for study by P. Wygodzinsky from the American Museum of Natural History, is in good condition except it lacks the postabdomen (noted by Arnaud, 1963). Luckily, enough of tergum 5 remains to show that it is a species of the *rubentis* group, with numerous appressed hairs ventrally, and as expected for species of this group, ocellar bristles present. I am indebted to D. M. Wood of Agriculture Canada for alerting me to the fact that this was probably a species of *Eucelatoria*.



The Texas series recorded here has abdominal coloring more like that of *E. bryani*, the intermediate terga having narrow black hindmargins, weak median stripe, and little or no sublateral blackish areas. However, the fifth tergum and the male genitalia are characteristic of *bigeminata* and the series has been so recorded.

Hosts.—The possible preference for looper larvae was noted in the introduction. I have seen no examples reared from *Heliothis*, unless a lone female from Colombia is *bigeminata*.

Material examined (U.S. National Museum of Natural History except as noted):

VIRGIN ISLANDS: Holotype, St. Croix (Amer. Mus. Nat. Hist.); 12 males, St. Croix, Mar. 9, 1968, "bloom of *Mangifera indica*," and 1 female, Dec. 29, 1967, "rotting squid" (both W. H. Pierce) (Fla. Dept. Agr.).

PUERTO RICO: 2 males, 4 females, Ponce, Nov. 13-22, 1968 (S. Medina Gaud); 1 female, Mayagüez, Apr. 13, 1933 (A. G. Harley), San Juan No. 3954.

CUBA: 2 males, 2 females, Havana (C. F. Baker); 1 male, 2 females, Santiago de Vegas, June 4, 1930, and 1 female, Jan. 29, 1919, "parasites of *Autographa brassicae*," i.e., *Trichoplusia ni*.

TRINIDAD: 4 males, 2 females, Curepe, Apr. 1972, "ex *Plusia brassicae*," i.e., *Trichoplusia ni*.

FLORIDA: 4 males, 2 females, Miami, Oct. 22-Dec. 1 (C. H. T. Townsend, 1 by Mrs. Townsend); 1 female, Plantation Key, Nov. 27, 1955 (H. V. Weems, Jr.), at light; 2 males, Monroe Co., Boca Chica Key, Oct. 9, 1971, and Stock Island, Oct. 2, 1971 (W. H. Pierce) (Fla. Dept. Agr.).

TEXAS: 5 males, 2 females, Hidalgo Co., May 8, 29, 30, and Oct. 9, 1969 (J. A. Harding), "looper larvae" on tomatoes, cotton, pigweed (Texas A & M Station, Weslaco); 1 male, Kingsville, Nov. 10, 1975 (J. E. Gillaspay).

MEXICO: 1 male, Rio Bravo, Tamaulipas, Feb. 7, 1970, ex cabbage looper on *Brassica*.

One female seems to belong here, but it is far from the known range of *bigeminata* and one cannot be too positive on the basis of a lone female: Palmira, Colombia, Feb. 25, 1975, ex *Heliothis virescens* on *Stylosanthes*.

#### *Eucelatoria bryani*, n. sp.

*Eucelatoria armigera* (Coq.) of authors, in part.

Fifth abdominal tergum with broad, reddish-yellow band along hindmargin; mesonotal stripes well separated; male genitalia as figured, the cerci apically blunt.

Parafrontals and sometimes parafacials yellowish; parafacial relatively broad, only weakly narrowed below, at narrowest as wide or slightly wider than 3d antennal segment; facial ridges usually well bristled about half way above vibrissae. Mesonotal stripes narrow, well separated, and not merging posteriorly. Abdomen predominantly yellowish-gray tomentose; intermediate terga with more or less distinct, narrow black median stripe that sometimes continues onto proximal part of 5th tergum; terga 3 and 4

with narrow, subshining black, hindmarginal bands and occasionally with weak, changeable black, sublateral triangular areas, usually none at all to the unaided eye, sides of the terga often obscurely reddish yellow in males; 5th tergum in both sexes with broad reddish-yellow band along hindmargin, and entirely reddish in ventral aspect.

Male.—Two pairs of reclinate fronto-orbital bristles, rarely only 1 pair (5 out of 143 males). Abdomen: Ventral aspect of 5th tergum (fig. 2) more or less shining, sometimes only sparsely tomentose, sometimes with more tomentum but interrupted by shining areas about bases of hairs. Male genitalia (fig. 10): Each cercus narrowly blunt at apex in posterior view, its sides parallel in side view; surstylus only slightly broadened at base, tapering to narrow apical portion; postgonite in profile parallel sided at base, lacking a bulge.

Female.—Fifth abdominal tergum usually more heavily and more evenly tomentose than in male; keel of abdomen with spines on ventral margins of both terga 3 and 4, those on 4 on each side in 2-3 rows of short, stout, curved, closely set spines on entire ventral margin of tergum, those on 3 on each side in a single row of 4-6 stout spines on distal third to half of ventral margin, the spines obviously longer (ca. 2 times) than spines on 4th tergum, and somewhat spaced; piercer broadened at base (cf. fig. 5).

Holotype male, allotype, and 9 paratypes, all male, Lynn Co., Tex., Nov. 8-11, 1949 (D. G. Bottrell), ex *Heliothis zea*. Type No. 76548 in the U.S. National Museum of Natural History.

Other paratypes (U.S. National Museum of Natural History except as noted):

ARIZONA: 5 males, 1 female, Tucson, Aug. 1968 (C. G. Jackson), ex *Heliothis* spp.; 7 males, 11 females, Tucson and Wilcox, Nov. 8, 1968, ex *Heliothis* spp.; 1 female, Mesa, Nov. 5, 1964 (Ayoade), ex *Spodoptera frugiperda*.

KANSAS: 1 male, 2 females, Kiowa Co., Sept. 18, 1975 (G. Salisbury), ex *H. zea*.

MISSISSIPPI: 20 males, 17 females, Washington Co., Nov. 10-17, 1971 (S. Pair), ex *H. zea*.

MISSOURI: 1 male, Willow Springs, Sept. 27, 1972, ex *H. zea*.

OKLAHOMA: 8 males, 5 females, Jackson, Marshall, and Tillman Cos., July, Aug., Oct., ex *H. zea*; 1 male, 1 female, Marshall Co., Sept. 30, 1973 (R. Wall), ex *Anticarsia gemmatilis*; 6 males, 5 females, Grady and Payne Cos., Aug. and Sept. 1966, ex *H. zea*, and 4 males, Jackson Co., Sept. 1965, ex *Heliothis* sp. (R. H. Adams or D. G. Bottrell) (Canad. Natl. Collect.).

TEXAS: 9 males, 10 females, Dawson, Dickens, Floyd, Hale, Kent, Lubbock, Martin, Motley, and Stonewall Cos., Sept.-Nov. 1969 (D. G. Bottrell), ex *H. zea* or *H. sp.*; 1 female, Alamo, Apr. 27, 1946 (F. A. Cowan) (Calif. Acad. Sci.); 3 males, 1 female, Brownsville, Mar. 15, 1965 (H. M. Graham), ex *H. zea*; 1 male, 2 females, Brownsville, June, July, 1970 (H. M. Graham), ex *H. virescens*; 4 males, 4 females, Burleson Co., July-Aug. 1975 (J. D. Lopez), ex *H.*

zea; 1 male, 2 females, College Station, Dec. 1927, ex *H. zea* (Calif. Acad. Sci.); 1 male, 1 female, Eastland Co., Aug. 9, 1972, ex *Heliothis* sp.; 1 female, Kingsville, Kleberg Co., July 25, 1976 (J. E. Gillaspay), at light; 7 males, 4 females, Presidio, Nov. 8, 1968, ex *Heliothis* spp.; 5 males, 3 females, Wilbarger Co., Aug.-Oct. 1975 (S. Oakes), ex *H. zea* and *H. virescens*; 3 males, 3 females, Burleson Co., 12-7-1338 (H. Menusan), ex bollworm (Tex. A & M); 2 males, 1 female, College Station (Tex. A & M); 1 male, 1 female, Stephenville, Aug. 13, 14, 1972, ex *Heliothis* sp. (Tex. A & M); 3 males, 5 females, Dickens, Kent, and Stonewall Cos., ex *H. zea* and *H. virescens* (Tex. A & M); 2 males, 3 females, College Station, Oct. 1 and Nov. 3 (female), 1921 (H. J. Reinhard); male, female, Brazos Co., Sept. 15, 1930, ex cotton bollworm (R. K. Fletcher); female, Plainview, Nov. 9, 1930 (S. E. Jones); female, 23 miles w. Ft. Davis, June 1, 1959 (J. F. McAlpine); male, 2 females, Big Bend National Park, May 5 and 9, 1959 (Santa Elena Canyon, 2,100 ft) and May 25, 1959 (female, Dagger Flats, 3,500 ft) (J. F. McAlpine); female, Presidio, Sept. 30, 1935 (last 13 specimens, Canad. Natl. Collect.).

MEXICO: 2 males, Allende, Nov. 24; 1 female, Aguascalientes, Dec. 1, 1909 (F. C. Bishopp); 2 males, Tapachula, Chiapas, Sept. 1974 (R. Bodegas); 1 male, 4 females, Etla, Oaxaca, Sept., 1923 (E. G. Smyth); 1 male, Tehuacán Puebla, Sept. 10, 1959 (R. H. and E. M. Painter); 3 females, El Bonito, 7 mi s. Ciudad Valles, San Luis Potosí, Dec. 19, 21, 1970 (P. H. and M. Arnaud) (Arnaud collect.); 1 male, Culiacán, Sinaloa, Mar. 2, 1961, ex *H. zea*; 20 males, 18 females, Valle del Yaqui, Sonora, Sept. 1958, Mar. and Nov. 1959 (J. A. Sifuentes), ex *H. zea*; 2 males, 4 females, San Andres Tuxtla, Veracruz, Apr. 8, 1970 (P. D. Lindgren), ex *H. virescens*; 2 males, 2 females, Guadalajara, Mich., Aug. 27, 1947 (F. A. Cowan, M. R. Wheeler) (Tex. A & M and Canad. Natl. Collect.); female, 18 miles s. San Luis Potosí, S.L.P., Sept. 1, 1958 (H. F. Howden), and male, San Pedro, Coah., Oct. 23, 1970, ex *H. zea* (Canad. Natl. Collect.).

EL SALVADOR: 1 female, Zapotitan, 1972 (J. E. Mancia C.), ex *H. zea*.

NICARAGUA: 1 male, 1 female, Rivas, Apr. 8, 1970 (H. E. Ostmark), ex *Prodenia* (i.e., *Spodoptera*) larvae on peanut leaves.

I have also seen a number of specimens not included here as paratypes because of poor condition, but which may be listed as additional distribution or host records.

ARIZONA: Nogales, ex *Heliothis*.

TEXAS: Brownsville, June-July 1968, ex *H. virescens*, and June 26, 1969 (1 female), ex *Spodoptera frugiperda*; Hidalgo Co. (ex *Heliothis*), Clarendon, Rio Hondo (ex *H. virescens*), and Uvalde; El Paso (ex *H. zea* in truck from Tacoma, Mexico).

MEXICO: Tampico, ex *H. virescens*.

NICARAGUA: Leon, ex *Heliothis*.

Chaetotactic aberrations of number, position, and development occur and usually do not merit special mention, but one unusual one was noted. In a male, Stonewall

County, Tex., ex *H. zea*, there was a fully developed pair of strong and erect median discal bristles in the middle of the excavation of tergum 1 + 2, i.e., on tergum 2.

The ranges of *E. bryani* and *E. heliothis* overlap in Central America, the former being recorded from Nicaragua and El Salvador, the latter from Honduras. The two species are very similar, and the male genitalia are indistinguishable. The darker pattern of the abdomen appears to merit separation of the two, but possibly *heliothis* should be considered a subspecies of *bryani*. The host difference, with *bryani* chiefly reared from *H. zea* and *heliothis* chiefly from *H. virescens*, may have some significance, but it may also be simply a difference in the concentration of studies on those hosts.

*E. bryani* was introduced into India based on material from Mississippi, and it was cultured on *Heliothis armigera* at Bangalore at the Indian Station of the Commonwealth Institute of Biological Control. It has also been introduced into Trinidad from Arizona material.

The species is named in honor of D. E. Bryan in recognition of his leadership on studies of *Eucelatoria* species in the Cotton Insects Biological Control Investigations, U.S. Department of Agriculture, Tucson, Ariz., and for his years of friendly interest and patience that finally resulted in this revision.

#### *Eucelatoria digitata*, n. sp.

Unique in the genus in the male genitalia, with characteristic cercus and surstylus (fig. 12); female with piercer narrower toward base than in most species.

Black in ground color, heavily gray tomentose; occasionally parafrontals yellowish tinted, and rarely the parafacials also; parafacial usually only moderately narrowed; facial ridges bristled on only lower fourth to third, commonly 3-5 bristles above a vibrissa. Mesonotum with the 2 stripes on each side converging, usually narrowly separated posteriorly. Abdomen black, predominantly gray tomentose, occasionally in males the intermediate terga reddish yellow on sides; intermediate terga with narrow black median stripe and narrowly black and shining hindmargins and small sublateral triangles, the latter more distinct in females; 5th tergum predominantly black with narrow, reddish-yellow, hindmarginal band.

Male.—Commonly with 2 pairs of reclinate fronto-orbital bristles (11 with 2 pairs, 3 with 3 pairs, and 3 mixed, 2 bristles on one side and 3 on the other). Abdomen: 5th tergum in ventral aspect highly shining, thinly tomentose. Male genitalia (fig. 12): Cerci in posterior aspect acute, well separated, in lateral aspect each narrowly prolonged at apex and strongly sloped back from base of prolongation; surstylus digitate, the parallel-sided distal portion relatively long, fingerlike; basal portion of postgonite with slight bulge at base.

Female.—Abdomen, keel, and spines as described for *E. bryani*; piercer relatively narrow toward base, as in figure 6, not appreciably widened.

Holotype male, allotype, and 1 paratype (male), San Diego, Peru, Apr. 7, 1912 (C. H. T. Townsend), on flowers of *Flaveria*. Type No. 76549 in the U.S. National Museum of Natural History.

Other paratypes:

PERU: In the same museum, and all collected by C. H. T. Townsend unless otherwise stated: 1 male, Piura, Aug. 20, 1945 (P. A. Berry), "ex cotton buds"; 2 males, 2 females, Piura, Apr. 7-11 (1 male), June 19 (1 male), Apr. 17, 1912, and Aug. 1; 1 male, San Rafael, Casma, Apr. 4, 1912; 1 female, Casahuiri, 4,500 ft, May 22; 1 male, La Arena, July 19, 1944 (P. A. Berry); 4 males, Cascomba, May 11; 2 males, 1 female, San Cristobal Hill, Lima, 1,000 ft, Sept. 28, 1912; 3 males, Lima, "12-6" (Dec. 6?); 1 female, Lima, Jan. 8-10; 1 male, 1 female, Lima, July 15, 1967 (K. Raven), ex *Pseudoplusia includens*; 1 female, Bartoloma, Lima, Mar. 15, 1920 (collector?).

CHILE: 3 males, 5 females, Valle de Azapa, Arica, Tarapaca, emerged as follows: 2 males, 1 female, Jan. 17 (1 female), 23, 28, 1969, ex lepidopterous larvae on *Acelza* (Ricardo Mendoza M.); 2 females, Apr. 23, 1976, ex lepidopterous larvae on *Chenopodiaceae* (Hector Vargas C.); 1 male, 2 females, Apr. 29 (1 male, 1 female) and May 17, 1976, ex larva of *Hymenia recurvalis* (F.) on *Chenopodiaceae* (Hector Vargas C.) (Collins. Estación Experimental Agronómica, Maipú, Chile, and Centro de Investigación y Capacitación Agrícola, Universidad del Norte, Arica, Chile).

Males of this species are easily recognized by the unique genitalia, but females are much less distinct. The species was included under *E. australis* Townsend in the collection, but that is a species of the *armigera* group and easily recognized as such in both sexes by the sparsely haired fifth tergum. The allotype male of *australis* is actually *digitata*, as are others from Piura, Peru, the type locality of *australis*.

The specific name is a Latin participle meaning "having fingers," from the form of the surstylus.

***Eucelatoria dominica*, n. sp.**

Intermediate terga with large black markings, contrasting with very broad reddish-yellow band on hindmargin of 5th tergum.

Parafrontals gray to yellowish-gray tomentose; para-facials gray, only moderately narrow below; facial ridges with strong bristles ascending to about midway of ridge. Mesonotal stripes only moderately narrow, narrowly separated. Abdomen (fig. 7) black in ground color, intermediate terga with strong black median stripe, and broadly shining black posteriorly, on nearly half of each tergum, and on sublateral areas; 5th tergum black on basal two-fifths to half, broadly reddish yellow distally and on sides and venter, the reddish-yellow band broadest in holotype.

Male.—Two pairs of reclinate fronto-orbital bristles in the 4 available examples. Abdomen: Ventral aspect of 5th

tergum highly shining, thinly tomentose. Male genitalia as described and figured for *E. bryani* (cf. fig. 10).

Female.—Unknown, but judging from other species the dark pattern of the male will presumably be even more extensive in the female.

Holotype male, Clarke Hall, Dominica, Mar. 1-10, 1965 (W. W. Wirth, light trap). Paratypes, 3 males, same locality, 2 of Feb. 4, 1964 (Dale F. Bray, at black light), and 1, Nov. 12-17, 1964 (P. J. Spangler). In the U.S. National Museum of Natural History, Type No. 76550. All specimens were collected during the Bredin-Archbold-Smithsonian Biological Survey of Dominica.

The predominantly black abdominal pattern of this species is distinctive, though the genitalia are not.

The specific name is a noun in apposition after the island of Dominica.

***Eucelatoria eucelatorioides* (Blanchard), n. comb.**

*Celatoriopsis eucelatorioides* Blanchard, 1963, Rev. Invest. Agr. 17: 228-230, fig. 33 (Argentina).

The new genus and new species were described from Argentina, from Cerro Azul, Misiones (holotype female), and Las Breñas, Chaco (male and female paratypes), the holotype reared from *Heliothis* sp. and the paratypes from *H. gelatopoeon* (Dyar) [correctly *gelatopoeus*]. From the description, I believed that the species belonged to *Eucelatoria*, but the description lacked the necessary details that permitted assignment to the *armigera* group or the *rubentis* group. However, Sixto Coscarón and Manuel J. Viana were able with some difficulty to locate the type series in that part of the Blanchard collection now in the Museo Argentino de Ciencias Naturales at Buenos Aires. Through their good offices, I was able to study the three specimens and to place the species in the *rubentis* group.

This species is obviously very closely related to *E. bryani* and *E. heliothis*, especially to the latter, but so few specimens are inadequate for detailed study. I have therefore not included *eucelatorioides* in the key pending more adequate material from Argentina. All three species have approximately the same male genitalia, but some apparently small differences in those of *eucelatorioides* may prove to be consistent. The lone available male of this species also has a dark abdomen close to that described for *heliothis*, with the fifth tergum predominantly black in ground color and the reddish hindmarginal band rather narrow, a strong median black stripe on terga 3 to 5, and distinct brownish sublateral areas. Females are likewise close to *heliothis*, and both species have a gray tomentose abdomen compared with the yellowish gray of *bryani*.

***Eucelatoria guimaraesi*, n. sp.**

Fifth tergum reddish yellow on hindmargin; cerci apically acute.

Parafrontals slightly yellowish-gray tomentose; para-facials gray, moderately narrowed below; facial ridges bristled on lower fourth to half. Mesonotum with the 2

stripes on each side convergent, each pair narrowly separated, or touching posteriorly. Abdomen black in ground color, heavily tomentose, sides of intermediate terga slightly yellowish in males; intermediate terga strongly marked with subshining black areas, the narrow median stripe, narrow hindmarginal bands, and distinct sublateral areas; 5th tergum chiefly black, with narrow reddish-yellow band on hindmargin, wider in female than in male.

Male.—Two pairs of reclinate fronto-orbital bristles (1 male with a weak additional bristle on 1 side). Abdomen: In ventral aspect, 5th tergum highly shining, thinly tomentose. Male genitalia (fig. 13): Cerci apically acute, narrowly separated, in lateral view each strongly sloping from acute apex and appearing broad in proportion to its length; surstylus slightly broadened at base, the narrowed distal portion relatively long; postgonite with slight bulge anteriorly at base.

Female.—Fifth tergum more broadly reddish yellow along hindmargin than in male; keel and its spines as described for *E. bryani*; piercer only slightly broadened basally.

Holotype male and allotype, Planaltina, 1,000 m, D.F., Brazil, Feb. 28, 1977 (V. O. Becker), ex *Spodoptera frugiperda*. Paratypes, all Brazil: 1 male, same locality and collector as holotype, July 8, 1976; 1 female, Mury, Nova Friburgo, Rio de Janeiro-Br., Apr. 1964 (Gred and J. H. Guimarães); 1 female, Faz. Unai-B., Minas Gerais, Feb. 17, 1978 (J. G. Smith), ex *Plusia* on soybeans. Holotype, allotype, and 1 paratype in the Museu de Zoologia da Universidade de São Paulo, 2 paratypes in the U.S. National Museum of Natural History.

This species is closest to *E. bigeminata*, especially in having the cerci acute, but it lacks the alternating shining and tomentose pattern on the fifth tergum.

*E. guimaraesi* is named in honor of my friend, Jose Henrique Guimarães of São Paulo, who has contributed greatly to the study of neotropical Tachinidae.

#### *Eucelatoria heliothis*, n. sp.

Near *E. bryani* but with abdomen gray tomentose, and more extensive black pattern as described herein, 5th tergum chiefly black, the reddish-yellow hindmarginal band narrow.

Parafrontals and parafacials usually gray, seldom yellowish tinted and then weakly so; parafacial only moderately narrowed; facial ridges bristled on lower third to half. Mesonotal stripes narrowly separated. Abdomen predominantly gray tomentose, blackish in ground color, but sides of intermediate terga of males often reddish yellow; intermediate terga with strong black markings of median stripe, hindmarginal bands, and sublateral areas, the last stronger in females than in males; 5th tergum chiefly black dorsally and on sides, and sometimes ventrally as well, with narrow, reddish-yellow, hindmarginal band.

Male.—Regularly 2 pairs of reclinate fronto-orbital bristles (34 males in sample). Fifth tergum ventrally more or

less shining, thinly tomentose, dorsally heavily and evenly tomentose on proximal two-thirds, followed by a narrow shining black area before the narrow, reddish-yellow hindmarginal band. Male genitalia (cf. fig. 10) approximately as in *E. bryani*, each cercus narrowly blunt at apex in posterior view, its sides approximately parallel in side view; surstylus slightly broadened at base, narrowed on distal portion; postgonite parallel sided on basal portion.

Female.—Abdomen dorsally darker than in male, the sublateral black areas more extensive; reddish-yellow hindmarginal band narrow and bordered anteriorly by a shining black area; keel and its spines and the piercer as described for *E. bryani*.

Holotype male, allotype, and 4 paratypes (2 males, 2 females), El Pao, Cojedes, Venezuela, Feb. 25, 1971, "ex larva *Heliothis virescens* en tabaco," received from Jorge B. Teran, Facultad de Agronomía, Universidad Central de Venezuela, Maracay, Aragua, Venezuela. Type No. 76551 in the U.S. National Museum of Natural History through the courtesy of Dr. Teran, to whom paratypes are returned.

#### Other paratypes:

VENEZUELA (all ex *H. virescens* on tobacco except as noted): 1 male, 2 females, Hda. El Médano, Cagua, Aragua, Apr. 21, 1971 (E. Felipe); 1 male, 1 female, Maracay, Aragua, May 22, 1965 (D. Villasmil); 1 male, El Limón, 450 m, Aragua, May 28, 1968 (O. Aponte), ex *Heliothis* sp. on tobacco; 1 male, El Limón, 450 m, Aragua, Aug. 22, 1968 (J. B. Teran), ex *Herpetogramma bipunctalis*; 3 males, 3 females, Bejuma, Carabobo, Feb. 23, 1970 (D. Villasmil); 1 female, Mariata, 460 m, Carabobo, Sept. 6, 1968 (J. B. Teran, R. Casares); 6 males, 8 females, Hda. El Pilar, Lezama, Guárico, Apr. 30, 1971 (D. Villasmil); 1 female, Sarare, Lara, July 26, 1949 (F. Aponte); 1 male, 1 female, Guache, Portuguesa, Jan. 4, 1950 (J. V. Araujo); 3 males, 1 female, Las Mazaguas, Portuguesa, Jan. 26, 1967 (Luis Vicaín). Paratypes in U.S. National Museum of Natural History and Universidad Central de Venezuela.

COLOMBIA (all from Department of Valle): 3 males, 1 female, Bolívar, Sept. 1975 (Octavio Marín), ex *Sacadodes pyralis*; 2 males, 2 females, Buga, Dec. 16, 1971 (R. Cardenas), ex *H. virescens*; 1 male, 2 females, Guadalupe, Palmira, July 1979 (Maritza Almarín), ex *Heliothis*; 2 males, Palmira, Feb. 10, 1973 (F. García), ex *H. virescens*; 1 male, Palmira, Feb. 25, 1975, ex *H. virescens* on *Stylosanthes*; 1 male, 3 females, Zarzal—La Unión, Aug. 1975 (Octavio Marín), ex *H. virescens*. Paratypes in the U.S. National Museum of Natural History and the Ministry of Agriculture, Colombia.

HONDURAS: 2 males, 1 female, Aguan Valley, Culucó, Mar. 19 and May 21 (1 male), 1979 (Gary V. Manley), ex *H. zea* (U.S. National Museum of Natural History).

In addition to these paratypes, a few specimens in poor condition have been examined. Two localities added are Acarigua, Portuguesa, and Puerto Nuevo, Tachira, both in Venezuela, the first from a specimen reared from *H. virescens* on tobacco.

This species is very close to *E. bryani* and keys out close to it in both sexes, but the consistently darker abdomen and narrower hindmarginal band on the fifth tergum in so much material have persuaded me to recognize it as new. The overlapping ranges of the two have been noted under *E. bryani*.

The specific name *heliothis* is a noun in apposition from the generic name of its apparently major host.

Six specimens from Peru and Brazil are tentatively recorded as *E. heliothis*, but they are far from the range of the adequate Venezuela and Colombia material and I have not included them in the type series: 2 males, Tarapoto, San Martín Dept., Peru, 1972 (Manuel Soto); 1 male, 1 female, Lima, Peru, Jan. 1958 (J. Wille); 1 male, 1 female, Nova Granada, São Paulo, Brazil, Feb. 28, 1938 (E. J. Hambleton) (U.S. Natl. Mus. Nat. Hist.). It may be significant that the six were reared from *H. virescens*, the common host for *E. heliothis*.

#### *Eucelatoria rubentis* (Coquillett)

*Achaetoneura rubentis* Coquillett, in Johnson, 1895, Phila. Acad. Nat. Sci. Proc. 1895: 310 (holotype, Jacksonville, Fla., in U.S. National Museum).

*Frontina rubentis* (Coq.) Coquillett, 1897, U.S. Dept. Agr., Div. Ent., Tech. Ser. 7: 104 (Tifton, Ga., and Lake Worth, Fla.).

*Lydella rubentis* (Coq.) Webber, 1930, U.S. Natl. Mus. Proc. 78 (art. 10): 36.

*Eucelatoria rubentis* (Coq.) (as *rubentis*, error) Wilson, 1932, Fla. Ent. 16: 39.

Abdomen, especially in males, predominantly reddish yellow, with linear black median stripe.

Parafrontals and parafacials typically bright gray tomentose, latter only slightly narrowed below; facial ridges bristled on approximately lower half. Mesonotal stripes well separated, not merging posteriorly. Abdomen predominantly reddish yellow in ground color, in males typically only the excavation on tergum 1 + 2, linear stripe on 3 and 4, and basal band on 5 black, sometimes the intermediate terga partially black on disk, especially in females; tergum 5 always broadly reddish yellow distally.

Male.—Usually 2 pairs of reclinate fronto-orbital bristles (36 with 2 pairs, 3 with 3, and 2 mixed, 2 on one side, 3 on the other). Abdomen: Ventral aspect of 5th tergum shining to dull, thinly tomentose to moderately so. Male genitalia: As described and figured for *E. bryani* (cf. fig. 10).

Female.—Keel and spines as described for *E. bryani*; piercer only moderately broadened at base (fig. 6).

Distribution: Arkansas to Delaware (and probably New Jersey, old record not verified), south to Texas and north-eastern Mexico (Tamaulipas) and Florida. I have seen one specimen from the Bahamas (Great Abaco Island) but none from the West Indies or southward. Two specimens were taken at Miami, Fla., in quarantine inspections of airplanes, one a plane from Borinquen, Puerto Rico, and one from Curaçao via Guantánamo, Cuba, but it is possible that these were actually flies from the Miami area.

Aldrich, in his card catalog at the U.S. National Museum of Natural History, considered that *rubentis* was a synonym of *E. comosa* (van der Wulp), described from Mexico, and he so marked it in the National Collection. No doubt this was the basis of the record of *comosa* from cutworms in Florida published by Ingram et al. (1939), repeated by Patton (1958). However, the holotype male of *comosa* in the British Museum (Nat. Hist.) showed that although it is also a species with predominantly reddish-yellow abdomen, it is a member of the *armigera* group, i.e., species with sparse hairs ventrally on the fifth tergum.

Although *rubentis* had been placed in *Eucelatoria* for many years in the National Collection, first by Townsend, apparently the first publication to mention the combination was that of Wilson (1932) based on an identification by Aldrich.

*E. rubentis* has been reared from both *Heliothis zea* and *H. virescens*, but not often. Available records indicate that it parasitizes several hosts, chiefly Noctuidae, including a number of important pests:

#### Noctuidae

*Anicla infecta* (Ochsenheimer)

*Anticarsia gemmatilis* Hübner, velvetbean caterpillar

*Heliothis virescens* (Fabricius), tobacco budworm

*H. zea* (Boddie), bollworm, corn earworm, tomato fruitworm

*Leucania latiuscula* (Herrich-Schäffer)

*Litoprosopus futilis* (Grote and Robinson)

*Mocis latipes* (Guenée)

*Plathypena scabra* (Fabricius), green cloverworm

*Pseudaletia unipuncta* (Haworth), armyworm

*Pseudoplusia includens* (Walker), soybean looper

*Spodoptera exigua* (Hübner), beet armyworm

*S. frugiperda* (J. E. Smith), fall armyworm

*Trichoplusia ni* (Hübner), cabbage looper

#### Pyrallidae

*Hymenia perspectalis* (Hübner), spotted beet webworm

*H. (or Spoladea) recurvalis* (Fabricius), Hawaiian beetle webworm

#### Diprionidae

A pine sawfly

#### *Eucelatoria teutonia*, n. sp.

Large, dark species with somewhat infuscated wings and entirely black 5th abdominal tergum; cerci unusually short and blunt (fig. 14), and postgonites each with basal bulge.

Parafrontals and parafacials yellowish, the latter somewhat narrowed below; facial ridges bristled on approximately lower half. Mesonotum yellowish-gray tomentose, the usual 4 stripes strong. Abdomen predominantly black in ground color, but in male intermediate terga laterally and terga 1-4 ventrally broadly reddish yellow; 5th tergum en-

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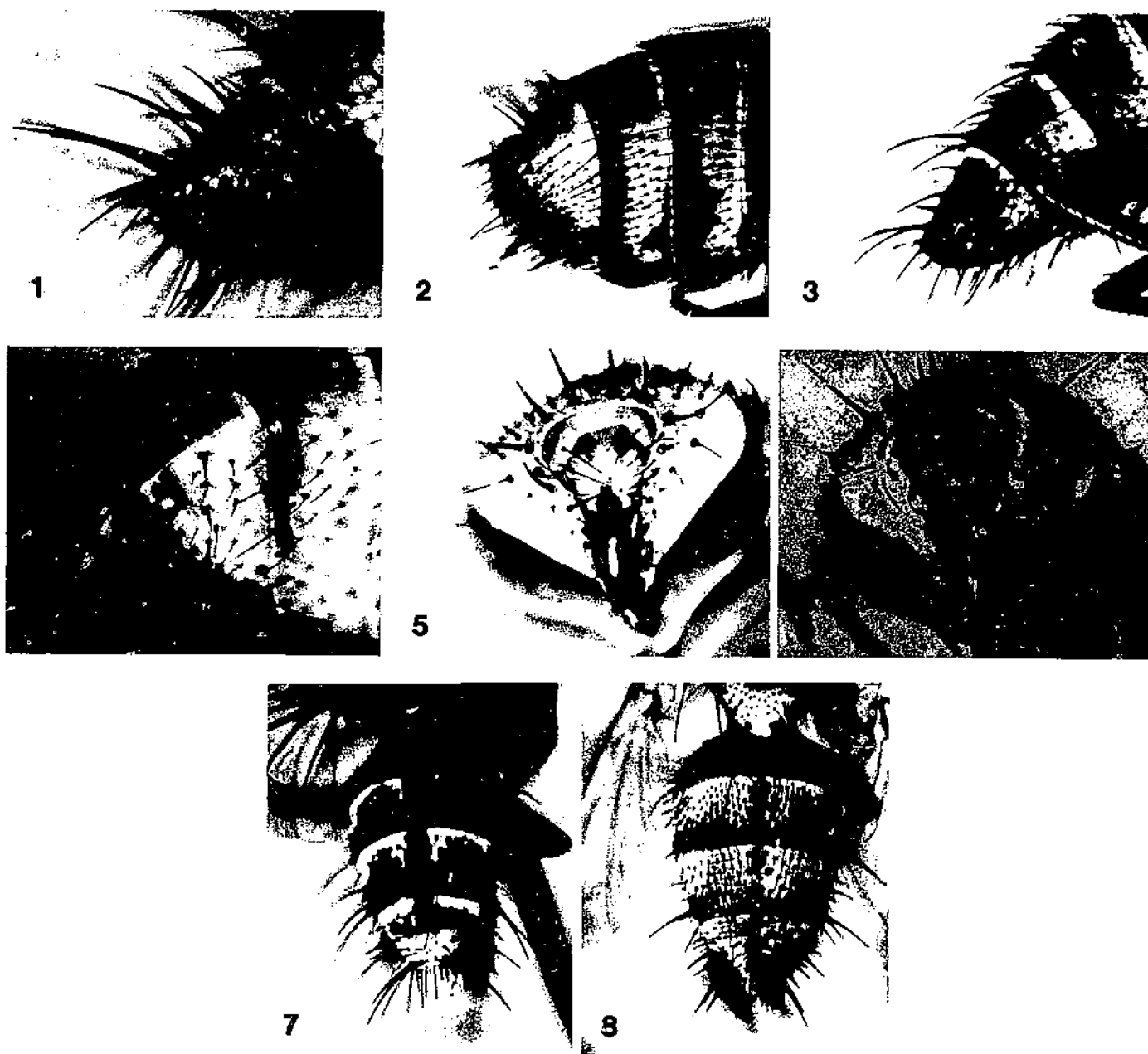
- tiely black in both sexes; intermediate terga with linear median stripe subshining black, and middle third and posterior band on each of these terga black, heavily brownish-gray tomentose; intermediate terga with strong and erect median discal bristles in both sexes. Wing more or less heavily browned except anal area and hindmargin up to end of costa.
- Male.—Usually 3 pairs of reclinate fronto-orbital bristles (only 1 of the 47 available males has 2 pairs). Abdomen: 5th tergum in ventral aspect only subshining, not as thinly tomentose as usual. Male genitalia (fig. 14): Cerci unusually short and broad, broadly blunt apically, in side view rounded apically and parallel sided; surstylus only slightly broadened at base, thence tapering; postgonite with distinct posterior bulge on proximal portion.
- Female.—Keel and its spines as described for *E. bryani*; piercer moderately broadened at base.
- Holotype male, allotype, and 46 paratypes (males), Nova Teutonia, Santa Catarina, Brazil, various dates Dec. 1960 to Feb. 1967 (F. Plaumann). Holotype and paratypes in the Canadian National Collection; allotype and 1 paratype in the Museu de Zoologia da Universidade de São Paulo; paratypes, including 1 male, Ignacio, Misiones, Argentina, May 27, 1961 (N. L. H. Krauss), in the U.S. National Museum of Natural History. The holotype and 28 paratypes were collected in February 1965 and the allotype in February 1967.
- The cerci and postgonites are especially distinctive and will distinguish this species from all others in the genus. The males show varying numbers of black hairs at the apex of the scutellum, continuous with those on the dorsum, but these are fine and should not be mistaken for apical scutellar bristles.
- The specific name is a noun in apposition after the name of the type locality.
- The female is unusual in *Eucelatoria* in having the abdominal bristles, both marginal and discal pairs, strong and erect as in *Heliodexodes*. Three of the 47 available males lack ocellar bristles, an unusual occurrence in the *rubentis* group.
- Eucelatoria* sp. or spp.**
- A pair of *Eucelatoria* spp. from Cañete, Peru, reared from *H. virescens*, and three females from Brazil have the tergum entirely black and thus appear distinct. However, there is nothing distinctive about the male genitalia, and I leave the question of their status until adequate material is available.
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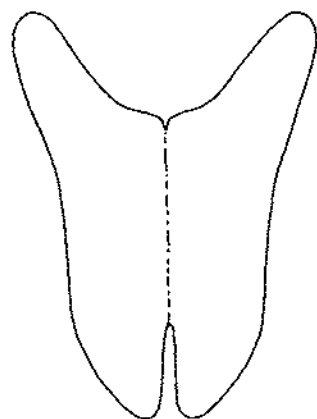
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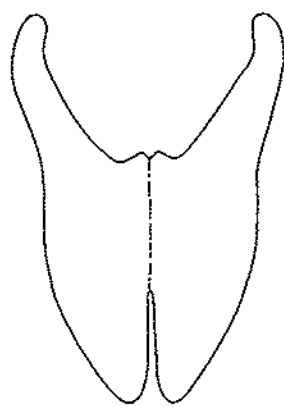
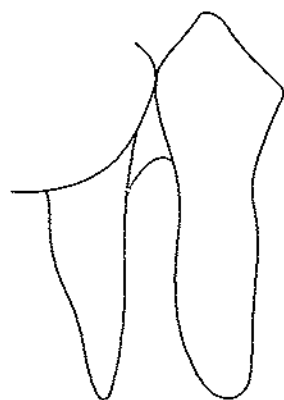


Figures 1-8.—*Eucelatoria* species: Abdomen, ventral aspect, of *bryani*: 1, Male; 2, female; and *armigera*: 3, Male; 4, female. Piercing sternotheca: 5, *armigera*; 6, *rubentis*. Abdomen, dorsal aspect: 7, *dominica*; 8, *bryani*.

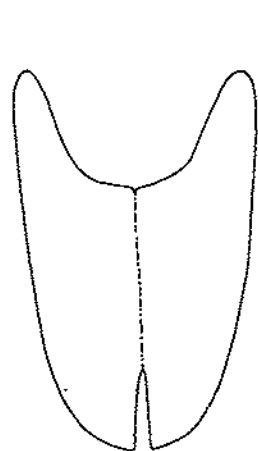
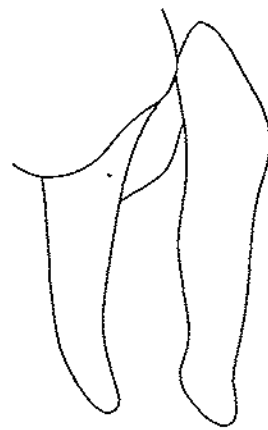




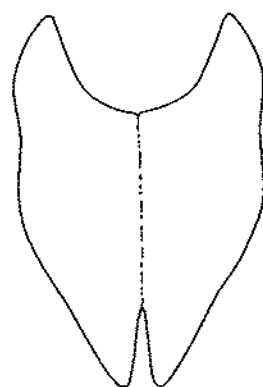
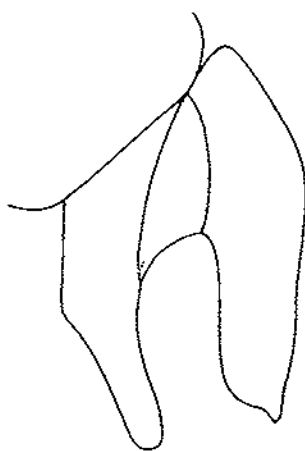
9 armigera



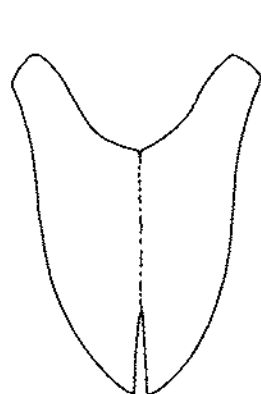
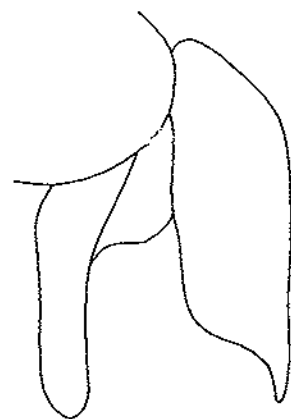
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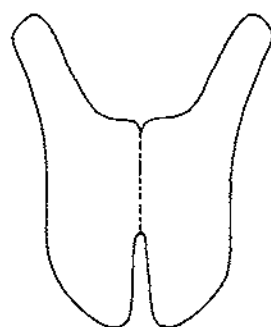
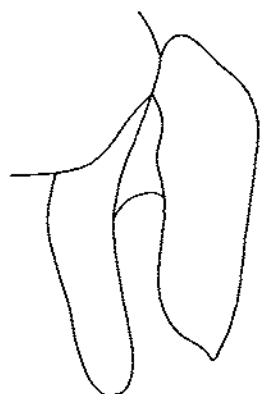
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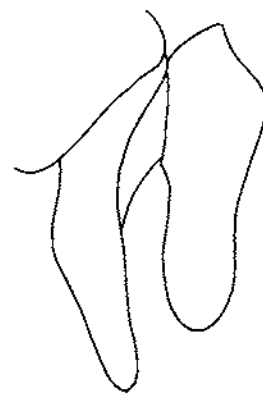
12 digitata



13 guimaraesi



14 teutonia



Figures 9-14.—*Eucelatoria* species: Male genitalia, outlines of: Left, posterior aspect of fused cerci; right, lateral aspect of left surstylus and cercus.

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**END**