ADDITIONS TO THE DISTRIBUTION OF NORTH AMERICAN NEMESTRINIDAE; WITH NOTES ON VENATIONAL VARIATION

(Diptera)

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The large collections of Nemestrinidae accumulated in recent years by the Department of Entomology and Parasitology, University of California, at Berkeley and Davis, are the main source of the records listed below. I wish to thank Dr. Paul D. Hurd, Jr., and Mr. A. T. McClay for the opportunity to examine this material, most of which was collected on Mexican Expeditions sponsored by the Associates in Tropical Biogeography, University of California, by Paul D. Hurd, Jr. (P.D.H.), E. E. Gilbert (E.E.G.), and C. D. MacNeil (C.D.M.). A few records from other sources are included.

1. NEORHYNCHOCEPHALUS SACKENII (Williston)

CALIFORNIA: Fandango Pass, Modoc County, July 6, 1950 (H. E. Cott).

IDAHO: Lewiston, Nez Perce County, June 25, 1952 (E. I. Schlinger).

GEORGIA: Leesburg, Lee County, August 13, 1932 (L. K. Gloyd). This is the first record from the state and the most eastward known locality for the species.

MEXICO: Ahuacatlán, State of NAYARIT, July 18–22, 1951 (P.H.D.). This is the first Mexican record of the species.

Attention should be called to the valuable contributions to the bionomics of *N. sackenii* by G. T. York and H. W. Prescott (1952, *Jl. Econ. Entom.*, 45, pp. 5–10) and by G. T. York (1955, *Op. cit.*, 48, p. 328), in Montana, where the species was previously unknown.

2. NEORHYNCHOCEPHALUS VOLATICUS (Williston)

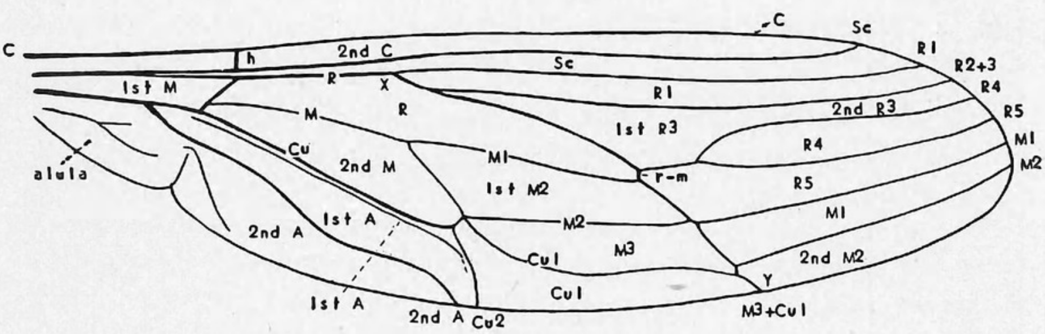
TEXAS: Palmetto State Park, Gonzales County, May 2, 1953 (B. J. Adelson).

MEXICO, NUEVO LEON: 4 miles east of El Cercado, June 6, 1951 (P.D.H.). —TAMAULIPAS: Altomira Farm ,M. E. Hoag—Ac. N. S. Phila.)—JALISCJ: 8 km. west of Tequila, July 18, 1951 (P.D.H.).—VERA CRUZ: Cuitlahuac, June 22, 1951 (P.D.H.); Vera Cruz, June 20, 1951 (P.D.H.).—PUEBLA: 16 miles southeast of Aeatlán, 4800 ft., July 10, 1952 (E.E.G. and C.D.M.).—OAXACA: Oaxaca, July 8, 1952 (E.E.G. and C.D.M.); 47 miles southeast of Oaxaca, 3000 ft., July 14, 1952 (E.E.G. and C.D.M.); 58 miles southeast of Oaxaca, 3600 ft., July 14, 1952 (E.E.G. and C.D.M.); Juchitán, 18 miles west of Oaxaca, July 20, 1952 (E.E.G. and C.D.M.).—GUERRERO: Acapulco, June 21, 1935 (A. E. Pritchard).—CHIAPAS: 72 miles southwest of Tuxtla Gutiérrez, 2500 ft., July 27, 1952 (E.E.G. and C.D.M.).

3. HIRMONEURA (HIRMOPHLOEBA) TEXANA Cockerell
MEXICO, GUERRERO: Mexcala, June 29, 1951 (P.D.H.).

Venational variation in Nemestrinidae

The wing venation of the Nemestrinidae is one of the most specialized in the Diptera and it is difficult to reconcile it properly with that of the remainder of the order. None of the several attempts at homologizing all the cells and veins with those of other families are, in my opinion, completely satisfactory. As a definite terminology is nevertheless needed for descriptive purposes, I adopt here the terms and notations shown in Fig. 1 (for *Hirmoneura bradleyi*), and previously used by Bequaert and Carpenter in discussing the Miocene fossil species (1936, *Jour. Paleontology*, 10:396). It is only claimed for this system that it is no less rational than that of any of the proposed alternatives.



EXPLANATION OF FIGURES

Fig. 1, *Hirmoneura bradleyi* J. Bequaert. Comstock notations of veins and cell, as used in this article. For complete explanation, see Bequaert and Carpenter, 1936, *Jour. Paleontology*, 10(5):396.

In appraising and homologizing the venation of the Nemestrinidae one should be aware that many of the minor and even major details are subject to considerable intra-specific variation. In most species the available material is too limited for an understanding of the scope of these variations. It would be most instructive if they could be studied in extensive series obtained at localities where certain species occur in abundance, usually for definite and often very short yearly periods. The material used for the present study unfortunately is not of this type, as it consists of specimens collected at random at different times over a wide area.

A knowledge of intra-specific venational variation is essential for the proper recognition of the species and supra-specific categories. It is of even greater importance for the study of fossil insects, in which the wing is often the only part available or sufficiently preserved for detailed analysis. Before attempting to appraise the significance of venational characters, the paleontologist should become acquainted with the types and frequency of variation in the most closely related recent forms.

Both the species discussed below show a decided tendency toward the formation of supernumerary cross-veins at seemingly haphazard points in the apical field of the wing. Such extra cross-veins are a normal feature in some other members of the family. The tendency eventually culminates in the relatively few species of *Nemestrinus* and *Moegistorhynchus*, where the apical third to half of the wing is more or less reticulated. Without entering into any further discussion of the subject, I may state that this reticulation, which is exceptional in the family, is in my opinion a secondary specialization, not a primitive characteristic, as has been sometimes claimed. It has no particular bearing on the original venation of the immediate ancestors of the order Diptera. Paleontology offers no real clue as to what the venation of the ancestral Diptera may have been. All known fossil Diptera, including the known fossil Nemestrinidae, lack all trace of reticulation in the wing. This is also true, moreover, in those Recent families of Diptera which from the body morphology and anatomy of larva and adult are generally regarded as the most primitive living forms of the order.

Venational Variation in *N. volaticus*

Although hardly two specimens of this species are alike in every detail of venation, Fig. 2*A* of a ♂ from St. Augustine, Florida, may be regarded as fairly normal. In the apical third of the wing, the 1st and 2nd submarginal cells (1st R_3 and 2nd R_3) are separated by a cross-vein connecting the 2nd longitudinal vein (R_{2+3}) with the upper branch (R_4) of the 3rd longitudinal; the 2nd and 3rd submarginal cells (2nd R_3 and R_4), as well as the 1st and 2nd posterior cells (R_5 and M_1), open broadly in the apical margin of the wing at the costa; the 3rd submarginal cell (R_4) is connected by a broad base with the 1st submarginal (1st R_3).

The most instructive series studied consists of 3 ♀♀ and 4 ♂♂ collected the same day at Vera Cruz. Only two of these have a normal venation. The apical fields of four of the others are shown in Figs. 2*B-E*. In three flies the 2nd submarginal cell (2nd R_3)

is closed and stalked far from the margin, but the other cells open broadly on the costa (Fig. 2*C*); in addition, in one of these, the cross-vein dividing the 1st and 2nd submarginal cells is lacking (Fig. 2*B*). In two flies the 2nd submarginal is open on the costa, while the 2nd posterior cell (M_1) is closed and stalked before the margin in one (Fig. 2*D*) and almost closed in the other (Fig. 2*E*). All five flies show the same aberrations in both wings with only minor differences. It should be stressed that all seven Vera Cruz flies are cospecific and true *N. volaticus* in every other structural and color character. The aberration shown in Fig. 2*D* is of particular interest in that a closed and stalked 2nd posterior cell is a normal feature of the related *Neorhynchocephalus sackenii* (Fig. 3*A*).

Of 15 specimens caught the same day near Tequila, Jalisco, 12 are nearly normal, except that the 3rd submarginal cell (R_4) is sometimes stalked at the base. In one ♂ the 2nd submarginal cell (2nd R_3) is closed and stalked before the margin in both wings; in two other ♂♂ the tip of the upper branch of the 3rd longitudinal vein (R_4) is obliterated, the vein stopping in the membrane a short distance from the costa, and in one of these, this upper branch is also partly obliterated near mid-length.

A ♂ from Juchitán, Oaxaca, has the 2nd submarginal cell (2nd R_3) closed just at the costa in the left wing and broadly open in the right.

A ♀ from 58 miles southeast of Oaxaca has the 1st posterior cell (R_4) closed and stalked before the costa in the right wing (Fig. 2*H*) and narrowly open at apex in the left wing. Otherwise this specimen agrees with two ♀♀ and one ♂ with normal venation, taken with it.

A ♀ from Cuitlahuac, Vera Cruz, has the 3rd posterior cell (2nd M_2) divided by a nearly vertical supernumerary cross-vein at about the basal third in both wings.

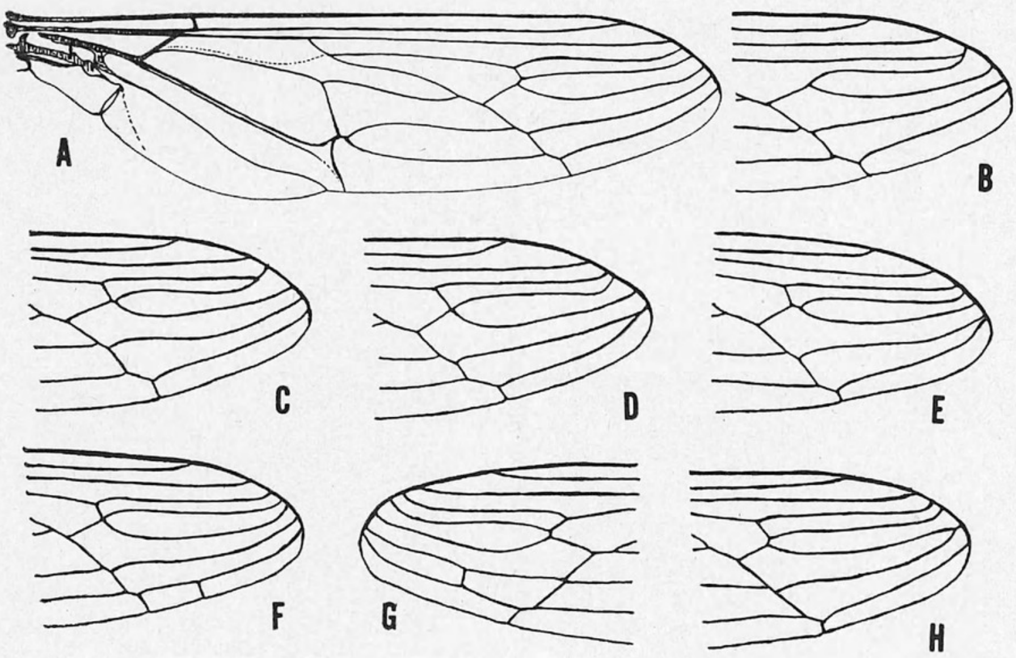
A ♀ from Chichen-Itzá, Yucatán, has a supernumerary cross-vein dividing the 2nd posterior cell (M_1) at about mid-length in the left wing (Fig. 2*G*); the right wing is normal.

A ♂ from Raymondville, Texas, lacks the cross-vein dividing the 1st and 2nd submarginal cells (2nd R_3 and R_4) in the left wing; the right wing is normal.

A ♀ from Hidalgo County, Texas, has the 2nd submarginal cell closed exactly at the costa in the left wing; the right wing is normal.

In a ♂ from Archer, Alachua County, Florida, the 2nd submarginal cell is stalked before the margin in the left wing; the right wing is normal.

Of 19 specimens from Monticello, Florida, 17 are normal. In one ♂ the 2nd submarginal cell is stalked before the margin in the right wing, normally open in the left. In another ♂ the 3rd posterior cell (2nd M_2) is divided by a nearly vertical supernumerary cross-vein at about the basal third in the right wing (Fig. 2*F*); the left wing is normal.



EXPLANATION OF FIGURES

Fig. 2, *Neorhynchocephalus volaticus* (Williston): *A*, St. Augustine, Fla., normal venation; *B–H*, wing tips with abnormal venation; *B–E*, Vera Cruz, V.C.; *F*, Monticello, Fla.; *G*. Chitzen Itzá, Yuc.; *H*, southest of Oaxaca, Oax.

The 141 specimens of *N. volaticus* examined for this study came from the entire range of the species, which is known to extend from Kansas, Missouri and Florida in the north to Guatemala in the south. Of these, 17, or approximately 12 per cent, are conspicuously abnormal in the apical field of the wing, either in one or in both wings. This is rather a high percentage as compared with venational variations in most other Diptera under natural conditions.

The venation of the basal two-thirds of the wing appears to be less variable than the apical field, except for the base of the

4th posterior cell (M_3). In some flies (Fig. 2*A*) this cell is stalked at the base, the stalk, variable in length, being inserted close to the lower apical corner of the 2nd basal cell (2nd M). In others, the upper and lower margins of the cell (M_2 and Cu_1) end together at this corner opposite the 5th longitudinal vein (Cu), so that five veins meet at one point. In one ♀ from Willard, Missouri, the lower margin (Cu_1) of the 4th posterior cell starts below the apical corner of the 2nd basal cell, the 4th posterior cell being contiguous over a short stretch with the anal cell (1st A).

Venational Variation in *N. sackenii*

The variation in this species was discussed at some length, but not illustrated, in two earlier papers (J. Bequaert, 1930, *Psyche*, 37:293–294; and 1934, *Jour. New York Ent. Soc.*, 42:170–171). Normally (Fig. 3*A*) the 2nd posterior cell (M_1) is closed and stalked before the costa; but the stalk is sometimes very short (Fig. 3*B*), or the cell may be closed just at the margin or even narrowly open there. The other cells of the apical field usually open broadly on the costa. The base of the 3rd submarginal cell (R_4) often forms a short cross-vein at the tip of the 1st submarginal cell (1st R_3).

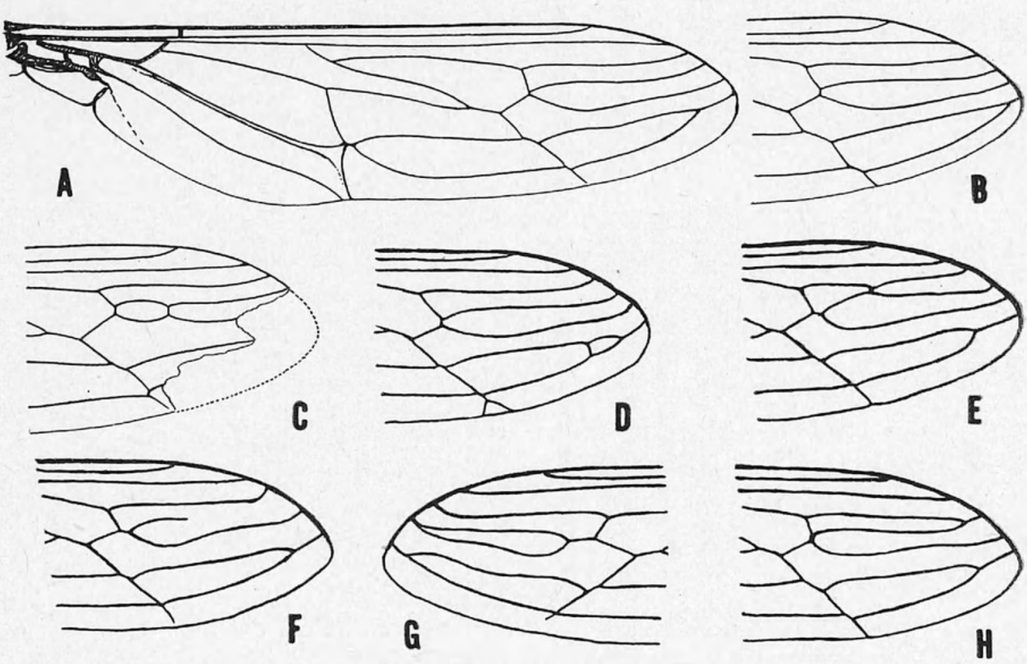
In a ♀ from Salt Lake City, Utah, the 3rd submarginal cell (R_4) is divided by a supernumerary cross-vein, near the basal third of the cell, in the right wing (Fig. 3*C*); the left wing is normal.

In the right wing of a ♂ from Fort Huachuca, Arizona, the closed 2nd posterior cell is divided at the tip by a short cross-vein; while the terminal section of the "diagonal vein" is forked, producing a small, triangular cell at the lower margin of the wing (Fig. 3*D*); the left wing is normal.

In both wings of a ♀ from Spanaway, Washington, the 2nd submarginal cell (2nd R_3) is divided near the basal third by a short extra cross-vein connecting the 2nd longitudinal vein (R_{2+3}) with the upper branch of the 3rd longitudinal (R_4); in addition the 3rd submarginal cell (R_4) is briefly stalked at the base, instead of contiguous with the 1st submarginal cell (Fig. 3*E*).

Both wings are abnormal in a ♀ from Logan, Utah. In the right wing (Fig. 3*F*), the upper branch of the 3rd longitudinal vein (R_4) is mostly obliterated, being developed only over less than the basal half; the 3rd submarginal cell (R_4) is briefly stalked at the base. In the left wing (Fig. 3*G*), the 3rd submarginal cell (R_4) has a long basal stalk, but is narrowed into a point over the apical half, the two branches of the 3rd longitudinal vein (R_4 and R_5) being almost fused before the costa. In both wings the terminal section of the "diagonal vein" is shortened, ending far from the hind margin of the wing.

In a ♂ from Cheyenne County, Kansas, the right wing has the tip of the 2nd submarginal cell (2nd R_3) closed and connected with the costa by means of a stalk as long as that of the 2nd posterior cell (M_1); in the left wing, the 2nd submarginal cell (2nd R_3) is much narrowed apically and barely opens on the costa.



EXPLANATION OF FIGURES

Fig. 3, *Neorhynchocephalus sackenii* (Williston): *A*, Goose Lake, Calif., normal venation; *B–H*, wing tips with abnormal venation; *B*, Huachuca Mountains, Ariz.; *C*, Salt Lake City, Utah; *D*, Fort Huachuca, Ariz.; *E*. Spanaway, Wash.; *F–G*, Logan, Utah, right and left wing; *H*, Quincy, Calif.

A series of 39 flies (34 ♂♂ and 5 ♀♀) taken at Quincy, California, from June 25 to July 6, 1949, are the largest single population sample I have seen thus far of any American nemestrinid. The venation may be called normal in 35 of these flies, although the stalk of the 2nd posterior cell (M_1) varies from long (as in Fig. 3*A*) to short (as in Fig. 3*B*). It is abnormal in the four remaining flies, or 10.2 per cent of the total. In one ♂ the 2nd posterior cell (M_1) of the right wing is not stalked, but opens narrowly on the costa, the venation being otherwise normal; the tip of the left wing is missing. The other three flies have a stalked 2nd posterior cell. In a second ♂ the 2nd submarginal cell (2nd R_3) is closed before the costa, with which it is connected by means of a moderately long stalk, in the right wing (Fig. 3*H*); in the left wing, the 2nd submarginal cell is closed just at the costa, and, in addition, the 3rd submarginal cell (R_4) is divided by an extra cross-vein at about mid-length of the cell. In the third ♂ the apical area of the left wing is mostly missing; in the right wing, the 3rd submarginal cell (R_4) is divided by an extra cross-vein slightly before mid-length of the cell, and the cell is sessile at the base. In one ♀ the right wing is normal; in the left wing the 3rd submarginal cell (R_4) is divided by an extra cross-vein placed as in the preceding ♂, and the cell is also sessile at the base.

A total of 82 specimens of *N. sackenii*, from British Columbia, Washington, Oregon, California, Utah, Colorado, Arizona, Kansas, Missouri, Arkansas, Georgia, and Nayarit (Mexico), were examined for the present study. Of these, eight, or 9.7 per cent, have a decidedly abnormal venation, a slightly lower percentage than for the larger sample of *N. volaticus*. The sample is too small in either case, however, to conclude that the venation is actually less or more variable in each of these two species.

A NORTHERN EXTENSION OF RANGE FOR ENDEODES BASALIS LECONTE

(Coleoptera: Malachiidae)

On August 15, 1956, I collected nine specimens of this species from beneath dried seaweed on the sandy beach at Seaside, Monterey County, California. Previously, this species has been recorded only from south of the Big Sur region, which is thought to be a barrier for many seashore forms. This new record now shows that the ranges of *E. basalis* and *E. collaris* overlap. They are, however, not closely related, and inhabit different ecological niches.—IAN MOORE, *San Diego Natural History Museum.*