

Checklist and Keys to the Culicinae of Iran  
(Diptera: Culicidae)

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**ABSTRACT.** A comprehensive study of the culicinae of Iran, started in 1980, has revealed 31 species in 4 genera. The status of previously reported species is reassessed and the presently recognized Iranian culicinae are listed. Keys for the recognition of adult females and 4th instar larvae of the reported species are given.

INTRODUCTION

The Culicinae mosquito fauna of Iran is relatively poorly known, despite earlier studies by Gutsevich (1943), Dow (1953) and Lotfi (1970, 1973). In an effort to better understand the fauna, a comprehensive study of the Culicinae of Iran has been made by the School of Public Health, Teheran University, since 1980. In this program, more than 60,000 larval mosquitoes and several thousand adults, from many parts of Iran, have been studied. Several hundred specimens deposited in the insect collections of the School of Public Health in the previous 15 years have been re-examined. In addition, the collections of the British Museum (Natural History) have been studied. This collection included some Iranian specimens and type material of many species distributed in Iran.

Some species reported in earlier studies of the Iranian fauna (Dow 1953; Lotfi 1970, 1973; Gutsevich 1943) have not been included. *Culex vishnui* Theobald, reported by Lotfi (1973), has been reidentified as *Cx. pseudovishnui* Colless (Zaim & Cranston 1984). Lotfi's (1970) records of *Cx. vagans* Wiedemann and *Cx. torrentium* Martini were based on doubtful larval identifications and only *Cx. torrentium* has been rediscovered (Harbach, 1985). Of other previously recorded species, *Aedes (Stegomyia) aegypti* (Linnaeus), *Cx. (Neoculex) impudicus* Ficalbi and *Cowilleltidia richiardii* (Ficalbi) have not been found, but *antennatus* (Becker) has been rediscovered by Harbach (1985).

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A *Coquillettidia* species from Marivan, Kurdistan (Western Iran), collected in August, 1971, has been found in the collections of the School of Public Health, Teheran. This single specimen possibly represents a third member of the genus in South-West Asia, clearly related to *Cq. buxtoni* (Edwards), but differing in the presence of pale scales on the wing and proboscis and in the pattern of scaling on the legs. Definite identification of this species cannot be made based on the one available female specimen and will have to await further specimens from the region. As a result, the genus is keyed out, but no species included.

Thus, investigations have revealed the presence in Iran of 33 species of Culicinae. The total does not include our treatment of *molestus* Forskål as a physiological and behavioral form of *Culex pipiens* Linnaeus, following the paper of Harbach, Harrison and Gad (1984). The species recognized are given below in the form of a list of Iranian Culicinae, in which species with an \* are new records for Iran.

*Aedes* (*Aedimorphus*) *vexans* (Meigen)

\**Ae.* (*Aed.*) *vittatus* (Bigot)

\**Ae.* (*Finlaya*) *echinus* (Edwards)

*Ae.* (*Fin.*) *geniculatus* (Oliver)

*Ae.* (*Ochlerotatus*) *caballus* (Theobald)

*Ae.* (*Och.*) *caspius* (Pallas)

\**Ae.* (*Och.*) *detritus* (Haliday)

\**Ae.* (*Och.*) *flavescens* (Mueller)

*Ae.* (*Och.*) *leucomelas* (Meigen)

\**Ae.* (*Och.*) *pulcritarsis* (Rondani)

*Culex* (*Barraudius*) *modestus* Ficalbi

*Cx.* (*Bar.*) *pusillus* Macquart

*Cx.* (*Culex*) *antennatus* (Becker)

*Cx.* (*Cx.*) *bitaeniorhynchus* Giles

*Cx.* (*Cx.*) *laticinctus* Edwards

*Cx.* (*Cx.*) *mimeticus* Noe

*Cx.* (*Cx.*) *pipiens* Linnaeus (inc. *molestus* Forskål)

*Cx.* (*Cx.*) *pseudovishnui* Colless

*Cx.* (*Cx.*) *quinfasciatus* Say

*Cx.* (*Cx.*) *sinaiticus* Kirkpatrick

*Cx.* (*Cx.*) *sitiens* Wiedemann

- Cx. (Cx.) thieleri* Theobald  
*Cx. (Cx.) torrentium* Martini  
*Cx. (Cx.) tritaeniorhynchus* Giles  
*Cx. (Cx.) perexiguus* Theobald  
*Cx. (Maillotia) arbieeni* Salem  
*Cx. (Mai.) deserticola* Kirkpatrick  
*Cx. (Mai.) hortensis* Ficalbi  
*Cx. (Neoculex) territans* Walker  
*Culiseta (Allotheobaldia) longiareolata* (Macquart)  
*Cs. (Culiseta) alaskaensis* (Ludlow)  
*Cs. (Csa.) annulata* (Schrank)  
*Uranotaenia (Uranotaenia) unguiculata unguiculata* Edwards

#### ZOOGEOGRAPHY

Iran is an arid land of 1.6 million km<sup>2</sup>, extending north to the USSR and the Caspian Sea, to Afghanistan and Pakistan in the east, to the Persian Gulf and Sea of Oman in the south and bordered by Turkey and Iraq in the west. Mountains spread in a gigantic V-shape over the nation. Between these ranges lies a high plateau where flowing waters from the mountains disappear into desert sand. The mountain ranges divide the country into three separate climatic and biotic regions: the Caspian Sea littoral; the central plateau and the Persian Gulf littoral with the Khuzistan plain.

The Caspian sea littoral comprises the northern slopes of the Alborz mountains and the Caspian plain, a narrow strip of land, forest covered, with mediterranean climate. The average temperature ranges between 10° and 35° C, and the average relative humidity between 70% and 100%. Water sources are abundant, keeping the region green throughout the year.

The central plateau, situated between the Alborz and Zagros ranges of mountains, is very mountainous in the northwest where the ranges originate and is a somewhat lower desert in the east. The climate is dry, with average temperatures between 0° and 40° C, with hot, dry summers and cold, snow-bound winters. The few rivers originate on the southern slopes of the Alborz mountains, and these, together with the 'qanats' (underground water sources) and springs, provide potable and irrigation water.

The Persian Gulf littoral and Khuzistan plain, to the south of the foothills of the Zagros mountains, has a tropical climate. The average temperature ranges between 12° and 50° C. The average relative humidities range between 40% and 80%, the highest values being along the coastal plain. The coastal plains become broader as the Zagros mountains lose height towards Pakistan.

The spatial distribution of mosquitoes within Iran is treated elsewhere (Zaim *et al.* 1984; 1985 a,b), but it is instructive to look at the geographical affinities of the total culicinae fauna of Iran listed in this paper. It is clear that the great majority of species are found elsewhere in the Palaearctic region. Excluding the cosmopolitan *Cx. pipiens* and *Cx. quinquefasciatus*, we can recognize the widely distributed Palaearctic (including some Nearctic) to Oriental species, some of which occur in the Afrotropical region: these include *Ae. vexans*, *Ae. flavescens*, *Cx. territans* and *Cs. longiareolata*. Other species have a more restricted distribution outside Iran, with a frequent pattern of a Mediterranean, Middle East and western Oriental distribution: these species are *Ae. vittatus*, *Ae. echinus*, *Cx. laticinctus*, *Cx. mimeticus*, *Cx. sinaiticus*, *Cx. arbieeni*, *Cx. hortensis*, *Cx. deserticola* and *Ur. unguiculata*. Within this group, the extent of the western distribution in the Mediterranean countries varies, and it may be possible to recognize a more restricted 'eremic' group of *Cx. sinaiticus*, *Cx. arbieeni* and *Cx. deserticola*.

Some Iranian Culicinae occur in the Afrotropical region, but several of these species have a wider distribution in the southern Palaearctic and western Oriental region, for example *Cx. bitaeniorhynchus*, *Cx. sitiens*, *Cx. thieleri* and *Cx. tritaeniorhynchus*. *Cx. perexiguus* appears to have an unusual Afrotropical to Oriental 'eremic' distribution, extending through the Sahel region eastward to the Indian subcontinent. Only two Iranian species can be considered to be principally Afrotropical, with restricted distribution in the Middle East, namely *Ae. caballus* and *Cx. antennatus*. Similarly, although many species are also found in the Oriental region, only one species appears to be essentially restricted to this region: *Cx. pseudovishnui*, which has its westernmost occurrence in Iran.

The remaining species of Iranian Culicinae are Palaearctic, with no clear restriction to the southern or southwest margin of the region. These are *Ae. geniculatus*, *Ae. caspius*, *Ae. detritus*, *Cx. modestus*, *Cx. pusillus*, *Cx. torrentium*, *Cs. subochrea* and *Cs. alaskaensis*.

In conclusion, most Iranian Culicinae are principally Palaearctic in their distribution, but many species are found also in the Afrotropical and Oriental regions. However, very few of these species are otherwise restricted to these zoogeographic regions. A mediterranean and possibly eremic component of the fauna can be recognized.

#### KEYS

Keys have been prepared for the recognition of adult females and final (4th) stage larvae. Adult mosquitoes should be collected dry and pinned or lightly glued to points in such a way that the setation and scale patterns of the lateral and dorsal thorax and abdominal segments are clearly visible. Worn specimens will not be identifiable with certainty, neither will specimens with lateral thoracic characters obscured. Larvae should be collected into 70% alcohol or lactophenol and transferred to microscope slides, dissected such that the terminal segments of the abdomen can be seen in lateral view.

Species asterisked are included on the basis of non-Iranian specimens.

KEYS TO THE ADULT FEMALE MOSQUITOES OF IRAN  
KEY TO GENERA

1. Palps as long as proboscis; scutellum uniformly rounded posteriorly  
 . . . . . *Anopheles* (not treated)
- Palps several times shorter than proboscis; scutellum trilobed  
 posteriorly . . . . . 2
- 2(1). Wing vein 1A reaching margin close to level of mediocubital crossvein  
 . . . . . *Uranotaenia*
- Wing vein 1A reaching margin well beyond level of mediocubital  
 crossvein . . . . . 3
- 3(2). Spiracular setae present . . . . . *Culiseta*
- Spiracular setae absent . . . . . 4
- 4(3) Postspiracular setae present; claws with inner denticles; cerci more  
 or less protruding . . . . . *Aedes*
- Postspiracular setae absent; claws simple; cerci not protruding . 5
- 5(4). Pulvilli present . . . . . *Culex*
- Pulvilli present . . . . . *Coquillettidia*

KEY TO SPECIES OF GENUS *Aedes*

1. Tarsi with light rings . . . . . 2
- Tarsi without light rings . . . . . 7
- 2(1). Each light tarsal ring extends over two tarsomeres. . . . . 3
- Each light tarsal ring present only on base of tarsomeres . . . . 4
- 3(2). Wing with only dark scales . . . . . *pulcritarsis*
- Wing with light and dark scales . . . . . *caspius*

- 4(2). Proboscis distinctly longer than forefemur; scutellum with yellow or white, narrow, curved scales . . . . . 5
- Proboscis shorter than forefemur; scutellum with silvery-white, broad, straight scales . . . . . 6
- 5(4). Pale tarsal rings very narrow, no more than 1/4 tarsomere length.  
 . . . . . *vexans*
- Pale tarsal rings broader, more than 1/3 tarsomere length . . . . .  
 . . . . . *flavescens*
- 6(4). Scutum with 3 pairs of small, round, white-scaled spots . . *vittatus*
- Scutum without such pale spots . . . . . *caballus*
- 7(1). Cerci short, little protruding; scales on pale areas of abdomen shining, silvery . . . . . 8
- Cerci longer, clearly protruding; scales on pale areas of abdomen dull, without silvery sheen . . . . . 9
- 8(7). Scutellum with narrow, yellowish scales . . . . . *geniculatus*
- Scutellum with broad white scales . . . . . *echinus*
- 9(7). Dark parts of abdominal terga with numerous scattered pale scales  
 . . . . . *detritus*
- Dark parts of abdominal terga without pale scales . . . *leucomelas*

KEY TO SPECIES OF GENUS *Culex*

1. Hind tarsomere 1 distinctly shorter than hind tibia; small species  
 . . . . . 2
- Hind tarsomere 1 subequal to, or distinctly longer than hind tibia;  
 moderate to large species . . . . . 3
- 2(1). Abdomen with lateral light scales more or less developed as spots  
 . . . . . *pusillus*
- Abdomen with light scales aggregated into more or less distinct  
 stripe, sometimes forming triangular spots on anterior margin  
 of tergum . . . . . *modestus*
- 3(1). Proboscis with ring of pale scales . . . . . 4
- Proboscis without pale ring . . . . . 5

- 4(3). Wing, especially costa, with spots of white scales . . . . . *mimeticus*  
 Wing without such spots, occasionally with scattered white scales  
 . . . . . 5
- 5(4). Wing with brown and white scales . . . . . *bitaeniorhynchus*  
 Wing with uniform brown scales . . . . . 6
- 6(5). Anterior surface of fore and mid femora speckled with light and  
 dark scales . . . . . *sitiens*  
 Anterior surface of fore and mid femora unspeckled . . . . . 7
- 7(6). Erect scales on mid-vertex pale, creamy or yellowish-white, contrasting  
 sharply with black erect scales on lateral and postero-lateral vertex  
 . . . . . *pseudovishnui*  
 Erect scales of vertex uniformly brown . . . . . *tritaeniorhynchus*
- 8(3). At least forefemur with light longitudinal stripe on dark background,  
 usually present on fore- and mid-femora and tibiae . . . . . 9  
 Fore- and mid-femora and tibiae dark, without light stripe . . . 10
- 9(8). Light transverse stripe on tergites usually produced medio-posteriorly  
 into triangular shape; postspiracular area with distinct scale patches  
 . . . . . *theileri*  
 Light transverse stripe on tergites of more or less even width,  
 not produced posteriorly; postspiracular area without scales *vagens*\*
- 10(8). Light transverse stripes on posterior margin of terga . . . . . 11  
 Light transverse stripes or pale lateral spots on anterior margin of  
 terga . . . . . 15
- 11(10). Light areas clearly reduced, medially narrowed or interrupted . . 12  
 Light stripes broad, either of even width or medially extended  
 posteriorly . . . . . 13
- 12(11). Light stripes narrow but not interrupted . . . . . *territans*  
 Light stripes interrupted at least on some terga . . . . . *impudicus*\*
- 13(11). Sterna entirely light colored . . . . . *deserticola*  
 Sterna dark with large, triangular, light areas at the apex of most  
 sterna . . . . . 14

- 14(13). Light stripes with projections on most terga . . . . . *hortensis*  
 Light stripes of more or less even width, with, at most, weak projections on a few terga . . . . . *arbieeni*
- 15(10). Light transverse stripe on terga reduced to lateral spots . . . . . *antennatus\**  
 Light transverse stripes on terga continuous on most segments . . . . . 16
- 16(15). Postspiracular and prealar scales present . . . . . 17  
 Postspiracular and prealar scales absent . . . . . 13
- 17(16). Hind tibia with anterior pale stripe . . . . . *perexiguus*  
 Hind tibia mostly dark, without distinct pale stripe . . *sinaiticus*
- 18(16). At least 2 lower mesepimeral setae . . . . . *laticinctus*  
 Only 1 lower mesepimeral seta . . . . . *pipiens*  
*quinquefasciatus*  
*torrentium\**

KEY TO SPECIES OF GENUS *Culiseta*

- 1. Mesonotum with distinct lyre-shaped pattern of white scales . . . . . *longiareolata*  
 Mesonotum without lyre-shaped arrangement of white scales . . . . . 2
- 2(1). Hind tarsomere 1 with white ring in middle; hind femur with subapical light ring . . . . . *subochrea*  
 Hind tarsomere and femur without light rings . . . . . *alaskaensis*

KEY TO SPECIES OF GENUS *Utanotaenia*

Only *Uranotaenia (Uranotaenia) unguiculata unguiculata* Edwards is known from Iran. The species may be recognized by the short wing vein 1A, which is curved to meet the margin just below the mediocubital crossvein.



## KEY TO THE FOURTH INSTAR LARVAE OF MOSQUITOES OF IRAN

## KEY TO GENERA

1. Siphon present . . . . . (Culicinae) . . . . . 2  
 Siphon absent . . . . . (Anophelinae, not treated)
- 2(1). Siphon pointed, without pecten and with complex apical "saw"  
 apparatus . . . . . *Coquillettidia*  
 Siphon subcylindrical, with pecten, unmodified apically . . . . . 3
- 3(2). Siphonal setae present at base of siphon . . . . . *Culiseta*  
 Siphonal setae medial, never basal . . . . . 4
- 4(3). Several pairs of siphonal setae present . . . . . *Culex*  
 One pair of siphonal setae present . . . . . 5
- 5(4). Abdominal segment VIII with sclerotised plate . . . . . *Uranotaenia*  
 Abdominal segment VIII without sclerotised plate . . . . . *Aedes*

## KEY TO SPECIES GENUS

1. Acus at base of siphon well developed . . . . . 2  
 Acus absent from base of siphon . . . . . *vittatus*
- 2(1). Antenna smooth, without spinules; anal papillae well developed  
 . . . . . 3  
 Antenna spinulose; if spinules weak, then anal papillae short  
 and spherical . . . . . 5
- 3(2). Antennal seta 1A a simple hair; pecten spines long, pointed and  
 equally spaced . . . . . 4  
 Antennal seta 1A with 2-4 short branches; pecten spines short,  
 somewhat blunt and broad based . . . . . *pulcritarsis*
- 4(3). Pecten extending no more than 0.4 siphon length; body setation  
 well developed, with only few thinner branches amongst stellate  
 setae . . . . . *geniculatus*  
 Pecten at least 0.5 siphon length; body setation strongly developed,  
 with numerous thicker branches amongst stellate setae . . . . . *echinus*

- 5(2). Four to seven precratal setae (arising anterior to grid);  
siphonal seta (1-S) longer than siphonal width . . . . . *flavescens*
- At most 3 precratal setae (*Ae. vexans*, which may have 4 precratals,  
has siphonal seta (1-S) shorter than siphon width) . . . . . 6
- 6(5). Anal papillae usually shorter than saddle . . . . . 7
- Anal papillae longer than saddle . . . . . 9
- 7(6). Comb scales lacking main spine . . . . . *detritus*
- At least some comb scales with long main spine . . . . . 8
- 8(7). Cratal setae of ventral brush with extended fused bases, at least  
1.5 to 2 times length of transverse grid bar at base of median  
cratal seta . . . . . *leucomelas*
- Cratal setae of ventral brush branched from near base, fused stem  
no more than subequal to length of transverse grid bar at base of  
median cratal seta . . . . . *caspius*
- 9(6). Distal pecten spines more widely separated than proximal spines  
. . . . . *vexans*
- Distal pecten spines no more widely separated than proximal  
spines . . . . . *caballus*

KEY TO SPECIES OF GENUS *Culex*

1. Siphon index (ratio of siphon length to siphon width) about 3;  
siphonal setae arranged in irregular (zig-zag) row on posterior  
surface of siphon . . . . . *pusillus*
- Siphon index at least 4; siphonal setae often arranged more regularly,  
usually on postero-lateral surface of siphon . . . . . 2
- 2(1). Comb with 4-8 large scales, each with distinct main spine . . . . . 3
- Comb with at least 20 scales, without distinct main spine . . . . . 4
- 3(2). Pecten with 7-9 spines grouped at base of siphon; mentum with  
numerous small subequal teeth . . . . . *bitaeniorhynchus*
- Pecten with 8-14 spines extending over basal 0.25 of siphon; mentum  
with fewer teeth, larger in center of mentum . . . . . *pseudovishnui*

- 4(2). Siphon with numerous strong setae on subdorsal part of distal  
0.66 . . . . . *arbieeni*  
Siphon without such setae . . . . . 5
- 5(4). Siphonal setae mostly situated in irregular row on posterior  
surface or in adjacent pairs close together on midline . . . . . 6  
Siphonal setae in pairs on postero-lateral surface, occasionally  
on lateral surface . . . . . 12
- 6(5). Main tracheal trunk narrow, less than half siphon width . . . . . 7  
Main tracheal trunk broad, more than half siphon width . . . . . 9
- 7(6). Comb composed of spines . . . . . *mimeticus*  
Comb composed of scales . . . . . 8
- 8(7). Prothoracic seta 3 bifid, prothoracic seta 8 always simple;  
siphonal setae often less than 0.3 siphon length . . . . *hortensis*  
Prothoracic seta 3 simple, prothoracic seta 8 usually with  
2-3 branches; siphonal setae often more than 0.3 siphon  
length . . . . . *deserticola*
- 9(6). Comb composed of spines . . . . . *thieleri*  
Comb composed of scales . . . . . 10
- 10(9). Anal papillae small and globular . . . . . *sitiens*  
Anal papillae usually longer and elongate, never globular . . . . 11
- 11(10). All siphonal setae on posterior surface . . . . . *modestus*  
Two pairs of siphonal setae on apical 0.25 of siphon, another  
pair further from apex on lateral surface and another on postero-  
lateral margin . . . . . *laticinctus*
- 12(5). Siphon widest in middle, tapering more strongly apically than  
basally; width of siphon at apex more than 0.5 width at base  
. . . . . *quinquefasciatus*  
Siphon widest at base, tapering towards apex . . . . . 13
- 13(12). Main tracheal trunk narrow, less than half siphon width  
. . . . . 14  
Main tracheal trunk broad, more than half siphon width  
. . . . . 16

- 14(13). Comb composed of spines . . . . . *sinaiticus*  
 Comb composed of scales . . . . . 15
- 15(14). Siphonal setae not longer than twice siphon width at point of attachment; distal pecten spines with 1-2 lateral denticles . . . . . *territans*  
 Siphonal setae longer than twice siphon width at point of attachment; distal pecten spines with 3 long lateral denticles . . . *impudicus\**
- 16(13). All siphonal setae subequal in length . . . . . 17  
 At least basal 2 pairs of siphonal setae distinctly longer than apical setae . . . . . *pipiens  
 torrentium\*  
 vagans*
- 17(16). Siphonal setae as long, or slightly longer than siphon width at point of attachment; pecten spines with multiple lateral denticles . . . . . *tritaeniorhynchus*  
 Siphonal setae shorter than siphon width at point of attachment . . . . . 18
- 18(17). Inner frontal seta (5-C) usually with 2 branches; distal pecten spines usually with 2 lateral denticles . . . . . *antennatus\**  
 Inner frontal seta usually with 3 branches; distal pecten spines with 3 or more lateral denticles . . . . . *perexiguus*

KEY TO SPECIES OF GENUS

1. Pecten spines large, widely separated on entire siphon . . . . . *longiareolata*  
 Pecten spines fine, reduced to long hairs distally on siphon . . . . . 2
- 2(1). Comb scales narrow, elongate, with parallel lateral margins . . . . . *alaskaensis*  
 Comb scales distinctly broader at base, narrowing medially . . . . . *subochrea*

KEY TO SPECIES OF GENUS *Uranotaenia*

Only *Uranotaenia (Uranotaenia) unguiculata unguiculata* Edwards is known from Iran. The species may be recognized by the possession of a single pair of siphonal setae on the median part of the siphon and by the presence of a lateral sclerotized plate on abdominal segment VIII.

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## ERRATUM

The following corrections should be made for "Checklist and Keys to the Culicinae of Iran" by M. Zaim and P. S. Cranston which appeared in Vol. 18 (3&4): 233-245:

- Page 233 - Abstract, line 2, should be 33 species.
- Page 233 - Third paragraph, *Cowillettidia* should be *Coquillettidia*.
- Page 235 - *Cx.* (Cx) *thieleri* should be *Cx.* (Cx) *theileri*.
- Page 235 - *Cs.* (Csa) *annulata* (Schrank) should be replaced by *Cs.* (Csa) *subochrea* (Edwards).
- Page 237 - couplet 5(4) Pulvilli present... *Coquillettidia* should read Pulvilli absent... *Coquillettidia*.
- Page 240 - KEY TO SPECIES GENUS *Utanotaenia* should be replaced by KEY TO SPECIES OF GENUS *Uranotaenia*.
- Page 240 - Asterisk should be removed on *antennatus* (couplet 15) and on *torrentium* (couplet 18).
- Page 241 - KEY TO SPECIES GENUS should be replaced by KEY TO SPECIES OF GENUS *Aedes*.
- Page 243 - Couplet 9(6) *thieleri* should be *theileri*.
- Page 244 - Asterisk should be removed on *torrentium* (couplet 16) and on *antennatus* (couplet 18). Asterisk should be placed on *vagans* (couplet 16).
- Page 244 - KEY TO SPECIES OF GENUS should be replaced by KEY TO SPECIES OF GENUS *Culiseta*.