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 Cordulellettiidae richardii (Ficalbi) have not been found, but antennatus (Becker) has been rediscovered by Harbach (1985).

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A Coquillettidia species from Marivan, Kurdestan (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. duxtoni (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 p. 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. (Finl.) echinus (Edwards)
Ae. (Finl.) geniculatus (Olive)
Ae. (Ochlerotatus) caballus (Theobald)
Ae. (Och.) caspius (Pallas)
* Ae. (Och.) detritus (Haliday)
* Ae. (Och.) flavescens (Mueller)
Ae. (Och.) leucocelas (Meigen)
* Ae. (Och.) pulcritarsis (Rondani)
Culex (Barraudius) modestus Ficalbi
Cq. (Bar.) pusillus Macquart
Cq. (Culex) antennatus (Becker)
Cq. (Cq.) bitaeniorynchus Giles
Cq. (Cq.) laticinatus Edwards
Cq. (Cq.) mimeticus Noe
Cq. (Cq.) p. Linnaeus (inc. molestus Forskål)
Cq. (Cq.) pseudovishnui Colless
Cq. (Cq.) quinquefasciatus Say
Cq. (Cq.) sinaiticus Kirkpatrick
Cq. (Cq.) sitiens Wiedemann
**Zoogeography**

Iran is an arid land of 1.6 million km², 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 'ganats' (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. laticinatus, Cx. mimetius, Cx. sinaicus, Cx. arbeiini, 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. sinaicus, Cx. arbeiini 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. bitaeniorynchus, Cx. sitiens, Cx. thieleri and Cx. tritaeniorynchus. 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. oaballus and Cx. antennis. 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. genticulatus, Ae. caspius, Ae. detritus, Cx. modestus, Cx. puellus, 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. Nymph 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 .................................. palaritarsis
   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(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 .vagans*

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 ............ territorans
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 .............. laticinatus
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 Aedes

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 ........ pularitarsis

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 ....... flavescent

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 ...................... leucometas

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 ........
     .................. tritaeniornynchus

     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 .................. perextiguus

KEY TO SPECIES OF GENUS Culiset

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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LITERATURE CITED


