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# KEYS FOR THE IDENTIFICATION OF THE MOSQUITOES OF GREECE

RICHARD E DARSIE, JR.'AND ANNA SAMANIDOU-VOYADJOGLOU[2]

ABSTRACT Keys to the adult females and 4th instar larvae of the mosquitoes of Greece are presented. In all, 53 species in 7 genera are included. Also, *Aedes albopictus is* added because of the potential for its introduction into Greece.

## INTRODUCTION

A checklist of the mosquitoes of Greece was published by Samanidou-Voyadjoglou and Darsie (1993), reporting 53 species in 7 genera. We have prepared identification keys for these taxa that will also apply to the Eastern Mediterranean region and countries surrounding Greece. This work is a combination of the examination of voucher specimens (41 of 53 species) and compilation of taxonomic keys from the literature. Prior works that have been useful in formulating the keys were Edwards (1921), Aitken (1954), Senevet and Andarelli (1955, 1959), Hedeen (1958, 1959), Gutsevich et al. (1974), Harbach (1985, 1988), Cranston et al. (1987), Gillies and Coetzee (1987), and Glick (1992).

The most difficult group to treat in the keys was the *Anopheles maculipennis* Meigen complex. Our inclusion of the 5 species that occur in Greece in couplets 12 and 13 of the adult female key and couplets 9-13 of the larval key follow Aitken (1954), but their use is very tentative. The most reliable means of their identification is by egg morphology (White 1978). White did not recognize *Anopheles subalpinus* Hackett and Lewis as separate from *Anopheles melanoon* Hackett, and we are following his interpretation.

Separating adult females of *Aedes dorsalis* (Meigen) from *Aedes caspius* (Pallas) and *Aedes cantans* (Meigen) from *Aedes annulipes* (Meigen) is troublesome. In addition to the key characters, the scutal scales in *Ae. dorsalis* may vary from golden to reddish brown, wing veins R, and M are predominantly pale-scaled, and the pale abdominal tergal scales are white. In Ae. caspius, the median scutal scales are similar to Ae. dorsalis but extend more laterally, wing veins R, and M have a mixture of pale and dark scales, and pale abdominal tergal scales are mainly yellowish. Regarding the females of *Ae. cantans* and *Ae. annulipes*, Natvig (1948) noted that the scutal scales of *Ae. cantans* are dark brown, occasionally with patches of pale scales laterally, whereas in Ae. annulipes, scutal scales are golden brown with a more or less obvious broad median stripe of darker brown scales.

The key to 4th instar larvae of *Aedes* follows Hedeen (1959). Several species are difficult to separate. In addition to the characters given in the key, *Ae. dorsalis* can be distinguished from *Ae. caspius* by measuring the distance from the base of the siphon to the insertion of seta 1-S. This distance is 0.43-0.51 of the total length in *Ae. dorsalis* and 0.51-0.61 in *Ae. caspius* (Natvig 1948). The morphology of seta 4-X also separates Ae. cantans from Ae. annulipes. The former has 18-19 tufts and the latter at most 16 tufts (Gutsevich et a]. 1974).

*Culex univittatus* Theobald was reported from Greece by Pandazis (1935); however, Harbach (1988) stated that this taxon is actually *Culex perexiguus* Theobald in the Eastern Mediterranean region. In adult females of *Cx. perexiguus*, the anterior surface of the hindfemur is entirely dark-scaled, whereas in *Cx. univittatus*, it has a complete pale stripe. Larvae may be separated by the size of the siphonal setae, I-S_, in *Cx. perexigutts*, they are about as long as the diameter of the siphon at the point of attachment, whereas in *Cx. univittatus*, they are distinctly shorter.

*Aedes aegypti* (Linnaeus) is included in the keys. As explained by Sarnanidou-Voyadjoglou and Darsie (1993), *Ae. aegypti* has not been collected in Greece in recent years. However, it is included in the keys so that it can be identified in case of reintroduction. Like wise, *Aedes albopictus* (Skuse), not yet reported from Greece, is included in the keys. Mitchell (1995) pre sents ample evidence that this species is well estab lished in the neighboring countries, Albania and Italy. The potential for introduction into Greece is quite high. Descriptions of Aedes cretinus Edwards, closely related to *Ae. albopictus*, by Mattingly (1954) and Gutsevich et al. (1974) were helpful in placing Ae. albopictus in the keys.

A sibling species of *Anopheles claviger*, *Anoph eles superpictus*, has been reported from Greece (Knight and Stone 1977). It has been studied by Senevet and Andarelli (1955). The adult females are inseparable, but larvae can be recognized as indicated in the following keys.

The mosquito adults and larvae in the collection of the National School of Public Health, Athens, those taken during field trips to the Peloponnesus and Mid dle Greece, and Greek mosquitoes in the collection of the Walter Reed Biosystematic Unit, Smithsonian Institution, were used to test the keys. Complete sci entific names are not used in the following keys. The reader is referred to the checklist and taxonomic notes on some species in Samanidou-Voyadjoglou and Dar sie (1993). Morphological nomenclature follows Har bach and Knight (1980).

Florida Medical Entomology Laboratory, 200 9th Street SE, Vero Beach, FL 32962.

[1] Department of Parasitology, Entomology and Tropical Diseases, National School of Public Health, 196 Alexandras Avenue, 115 21 Athens, Greece.

## KEYS TO THE ADULT FEMALES

### KEY TO THE GENERA[3]

1. Palpi about as long as proboscis; scutellum evenly rounded ..... *Anopheles*
- Palpi 0.5 or less length of proboscis; scutellum trilobed ..... 2

2(l). Cell $R_2$ of wing less than 0.5 length of its stem, vein $R_{2+3}$; anal wing vein ending a little before fork of veins $Cu_1$ and $Cu_2$ ..... *Uranotaenia unguiculata*

- Cell $R_2$ of wing more than 0.5 length of its stem, $R_{2+3}$; anal wing vein ending well beyond fork of veins $Cu_1$ and $Cu_2$ ..... 3

3(2). Prespiracular setae present; row of setae present on subcostal wing vein basoventrally ..... *Culiseta*
- Prespiracular setae absent; subcostal vein without row of setae basoventrally ..... 4

4(3). Foretarsomere 4 as long as wide; palpi 0.5 length of proboscis; Scutum with delicate white lines ..... *Orthopodomyia pulcripalpis*

- Foretarsomere 4 distinctly longer than wide; palpi about 0.3 or less length of proboscis; Scutum with other scale pattern ..... 5

5(4). Postspiracular setae present; abdomen pointed apically ..... *Aedes*
- Postspiracular setae absent; abdomen rounded and blunt apically ..... 6

6(5). Legs with pulvilli present and claws small; hindtarsomere I as long as or longer than hindtibia (except *Cx. modestus)* …*Culex*

- Legs with pulvilli absent and claws large; hindtarsomere I distinctly shorter than hindtibia …….... *Coquillettidia*

### KEY TO THE SPECIES OF GENUS *AEDES*[4]

Note: female and larval stages of *Ochlerotatus*. *duplex* unknown

1 Tarsomeres entirely dark-scaled ..... 2
- Some tarsomeres with pale scales ..... 7

2(l). Abdomen with prominent silvery-white lateral patches, cerci short, scarcely visible ..... 3
- Abdomen with lateral patches yellowish or white, not silvery-white; cerci long, plainly visible ..... 4

3(2). Scutellum with narrow yellowish-white scales ..... *geniculatus*
- Scutellum with broad white scales ..... *echinus*

4(2). Proepimeron with broad straight black scales dorsally; Scutum with 1 or 2 broad dark-scaled longitudinal stripes ..... 5

- Proepimeron usually with narrow curved or straight yellow or brown scales dorsally; Scutum usually without dark-scaled longitudinal stripe ..... 6

5(4). Pale-scaled bands on abdominal terga not sharply defined, not widening in middle ..... *refiki*

- Pale-scaled bands on abdominal terga clearly defined, widening medially to form longitudinal stripe ..... *rusticus*

6(4). Pale scales on abdominal terga not forming transverse bands, almost completely covered with pale scales, sometimes dark scales making indistinct spots ..... *lepidonotus*

- Abdominal terga usually with distinct transverse pale-scaled bands, with numerous pale scales mixed with dark scales posteriorly ..... *detritus*

7(l). Tarsomeres with both basal and apical pale-scaled rings ..... 8
- Tarsomeres with basal rings at least on some segments ..... 12

8(7). Abdominal terga with basal pale bands only ..... 9
- Abdominal terga with pale-scaled median stripe, sometimes entirely pale-scaled ..... 11

9(8). Tarsomere 5 of all legs entirely pale-scaled; femora, tibiae, and wings very slightly speckled, if at all ..... *berlandi*

- Only hindtarsomere 5 entirely pale-scaled; femora, tibiae, and wings densely speckled with dark and pale scales ..... 10

10(9). Scutum uniformly brown ..... *mariae*
- Scutum with 2 longitudinal stripes of white scales ..... *zammittii*

11(8). Scutum golden-scaled with narrow dorsocentral stripes of white scales; bases of vein C mostly dark scaled, vein R with dark and white scales ..... *caspius*

- Scutum with narrow to broad median golden-scaled stripe and white to creamy scales laterally; bases of veins C and R white-scaled, occasionally with few dark scales ..... *dorsalis*

12(7). Hindtarsomeres with narrow basal rings; abdominal terga with pale bands indented medially ..... *vexans*
- Hindtarsomeres with broad basal rings; abdominal terga with pale bands not indented ..... 13

13(12). Pale scales of thorax and abdomen silvery-white ..... 14

[1] Adapted from Aitken (1954).
[4] Adapted from Edwards (1921), Aitken (1954), Cranston et al. (1987), and Gutsevich et al. (1974).

- Pale scales on thorax and abdomen yellowish or white, not silvery ..... 16
14(13). Scutum with lyre-shaped marking of white scales; clypeus with scales ..... *aegypti*
- Scutum with white longitudinal median stripe; clypeus bare ..... 15

15(14). Scutum with submedian narrow lines of pale scales extending from just posterior to scutal angle to

scutellum, with lateral line of pale scales from anterior promotory to wing root ..... *cretinus*
- Scutum with neither submedian nor lateral lines of pale scales ..... *albopictus*

16(13). Wings entirely dark-scaled; scutum with medioanterior patch of golden scales; hindtarsomere 5 entirely pale-scaled ..... *pulcritarsis*

- Wings with dark and pale scales; scutum with brown or reddish-brown scales medioanteriorly; hindtar somere 5 dark-scaled apically ..... 16

17(16). Pale scales on thorax, Scutum, wings, femora, and tibiae yellowish; pale-scaled ring on hindtarsomere *2* about 0.5 length of segment ..... *annulipes*

-Pale scales on thorax, scutum, wings, femora, and tibiae white; pale-scaled ring on hindtarsomere *2* about 0.3 length of segment..... *cantans*

## KEY TO THE SPECIES OF GENUS *ANOPHELES*[5]

1. Wings without spots of dark or usually pale scales ..... 2
- Wings with spots of pale or dark scales ..... 6

2(l). Frontal tuft entirely dark; scutum unicolorous reddish brown, with dark setae ..... *algeriensis*
- Frontal tuft with pale setae; scuturn with pale median stripe and dark laterally, setae pale medially ..... 3

3(2). Wings with apical pale spot; foretarsomere 1 distinctly longer than foretarsomeres 2-5 combined ..... 4
- Wings entirely dark-scaled; foretarsomere 1 shorter than or equal to foretarsomeres 2-5 combined ..... 5

4(3). Scutum with broad median whitish stripe on the anterior 0.5, with lateral dark stripes ..... *marteri marteri*

- Scutum grayish yellow with narrow longitudinal median dark stripe, similar stripes laterally ..... *marteri sogdianus*

5(3). P alpomere*5* less than 0.*5* length of palpomere 4*;* head and anterior margin of Scutum with patches of creamy or yellowish-white scales ..... *claviger (petragnani* see Introduction*)*

Palpomere *5* at least as long as palpomere 4*;* head and anterior margin of scutum with patches of white scales ..... *plumbeus*

6(l). Wings with spots of pale scales on costa ..... 7
- Wings entirely dark-scaled or with apical pale spot in some species (*maculipennis* complex) ..... 11

7(6). Costal wing vein with *2* pale spots in apical 0.5*;* proboscis and palpi shaggy; bases of forefemora enlarged ..... 8
- Costal wing vein with *5* pale spots; proboscis and palpi not shaggy; forefemora not enlarged ..... 9

8(7). Hindtarsomere 4 entirely pale-scaled*;* wing scales on veins M, Cu, and A white ..... *pseudopictus*
- Hindtarsomere 4 dark-scaled, with only apical pale band; scales on veins M, Cu, and A yellow . . h*yrcanus*

9(7). Palpomere 5 usually entirely dark-scaled ..... *cinereus hispaniola*
- Palpomere 5 usually pale-scaled, at least at apex ..... 10

10(9). Basal 0.25 of costal wing vein entirely dark-scaled ..... *sergentii*
- Basal 0.25 of costal wing vein with pale-scaled spot (presector pale spot) ..... *superpictus*

11(6). Scutum unicolorous; wing with dark-scaled spots less distinct ..... *sacharovi*
- Scutum with pale median stripe; wings with apical pale spot frequently present; dark-scaled wing spots distinct *(maculipennis* complex) ..... 12

12(11). Wings with plume scales on radial vein slender, gradually tapering toward tip ..... *atroparvus labranchiae*
- Wings with plume scales on radial vein broad ..... 13

13(12). Wings with plume scales of radial vein tapering acutely toward tip ..... *melanoon*

- Wings with plume scales on radial vein wider than in melanoon and tapering less acutely toward tip ..... maculipennis and messeae

## KEY TO THE SPECIES OF GENUS *COQUILLETTIDIA*[6]

1. Proboscis entirely dark-scaled; wing uniformly dark-scaled ..... *buxtoni*
- Proboscis largely pale-scaled; wing with pale and dark scales ..... *richiardii*

[5]Adapted from Aitken (1954), Senevet and Andarelli (1955), and Gillies and Coetzee (1987).
[6]Adapted from Aitken (1954).

## KEY TO SUBGENERA OF GENUS *CULEX*[7]

I . Abdominal terga with apical bands or lateral patches or entirely dark-scaled ..... 2
- Abdominal terga with basal pale-scaled bands or lateral patches ..... 3
2(l). Prealar scales and usually postspiracular scales present ..... *Maillotia (Cx. hortensis)*
- Prealar and postspiracular scales absent ..... *Neoculex*

3(l). Proboscis shorter than forefemur; hindtarsomere I short, not more than 0.85 length of hindtibia . , B*arraudius*
- Proboscis longer than forefemur; hindtarsomere I usually long, not less than 0.86 length of hindtibia *Culex*

## KEY TO THE SPECIES OF SUBGENUS *BARRAUDIUS*[8]

1. Abdominal terga usually with longitudinal stripe of pale scales laterally, sometimes forming more or less

well-developed triangular patches at basal margin of segments ..... *modestus*
- Abdominal terga with pale-scaled spots basolaterally ..... *pusillus*

## KEY TO THE SPECIES OF SUBGENUS *CULEX*[9]

1. Hindtarsomeres with broad pale bands; wings with prominent pale-scaled spots ..... *mimeticus*

- Hindtarsomeres and wings dark-scaled; if pale scales present *(theileri)*, hindtarsomeres 3-5 all dark and pale scales on wings not in spots ..... 2

2(1). Postspiracular and prealar scales present ..... 3
- Postspiracular scales absent; prealar scales present or absent ..... 4

3(2). All tibiae with anterior pale stripes; prealar and upper and lower meskatepisternal scale patches confluent; basal pale bands of abdominal terga produced posteriorly in middle ..... *theileri*

-Fore- and hindtibiae normally without pale stripes; prealar and upper and lower meskatepisternal scale patches separate; basal pale bands of abdominal terga not produced posteriorly in middle ..... *perexiguus*

4(2). Prealar scales present ..... 5
- Prealar scales absent ..... 6

5(4). Wing with short line of pale scales at base of costa; scales of forecoxa entirely pale; frequently 2-4 lower mesepimeral setae ..... (in part) *laticinctus*

Wing entirely dark-scaled; forecoxa with some dark scales; usually only one lower mesepimeral seta ..... ..... (in part) *torrentium*

6(4). Two to 4 lower mesepimeral setae present; scales of forecoxa all pale; wing with short line of pale scales at base of costa; proboscis all dark or faintly pale beneath ..... (in part) *laticinctus*

- Only one lower mesepimeral seta present; forecoxa with some dark scales; wing entirely dark-scaled; proboscis usually distinctly pale beneath in middle ..... 7

7(6). Cell $_{R2}$ more than 4.0 length of vein $_{R213;}$ integument and scales between supraalar and posterior dorso central setae usually noticeably darker than surrounding integument and scales, like an ovoid spot .... *pipiens*

- Cell $_{R2}$ less than 4.0 length of vein $_{R213;}$ integument and scales between supraalar and posterior dorso central setae not appreciably darker than surrounding integument and scales ..... (in part) *torrentium*

## KEY TO THE SPECIES OF SUBGENUS *NEOCULEX*[10]

1. Apical pale bands on abdominal terga narrow but not inmerrupted ..... *territans*
- Apical pale bands interrupted on at least some abdominal terga ..... 2

2(1). Almost all abdominal terga with apical pale bands interrupted or represented by 1-2 scales ..... *martinh*
- At least some abdominal terga with apical narrow pale bands ..... *impudicus*

## KEY TO THE SPECIES OF GENUS *CULISETA*[11]

1. Femora and tibiae spotted or striped with pale scales; scutum with pale-scaled stripes sometimes faint .... 2
- Femora and tibiae not spotted nor striped; scuturn without pale stripes ..... 3

2(l). Costal vein with many pale scales; Scutum with lyre-shaped white-scaled marking ..... *longiareolata*
- Costal vein entirely dark-scaled; scuturn with narrow lines of golden scales ..... *glaphyroptera*

3(l). Wings without spots; tarsomeres with narrow, inconspicuous basal pale rings ..... 4

[7]Adapted from Harbach (1988).
[8]Adapted from Gutsevich et al. (1974).
[9]Adapted from Harbach (1988).
[10]Adapted from Senevet and Andarelli (1959).
[11]Adapted from Aitken (1954).

- Wings with scales clustered to form spots; tarsomeres with broad conspicuous basal pale rings ..... 5

4(3). Proboscis with pale-scaled ring; abdominal sterna with V-shaped pattern of dark scales ..... *futnipennis*
- Proboscis entirely dark-scaled; abdominal sterna mostly pale-scaled ..... *morsitans*

5(3). Wing vein Cu entirely dark-scaled; abdominal terga with pale scales only on basal bands ..... *annulata*

- Wing vein Cu with some pale scales; abdominal terga with yellow scales scattered among dark scales
…….. *subochrea*

## KEYS TO THE 4TH INSTAR LARVAE

### KEY TO THE GENERA[12]

1. Siphon absent; seta I on some abdominal segments palmate ..... *Anopheles*
- Siphon present; seta I on abdominal segments not palmate ..... 2

2(l). Siphon attenuated apically, with saw, adapted for piercing plant tissue ..... *Coquillettidia*
- Apex of siphon blunt, without saw, not adapted for piercing plant tissue ..... 3

3(2). Siphon without pecten ..... *Orthopodomyia pulcripalpis*

- Siphon with pecten ..... 4

4(3). Abdominal segment VIII with comb scales attached to comb plate; setae 5,6-C thick spines
…….. *Uranotaenia unguiculata*

- Abdominal segment VIII without comb plate; setae 5,6-C hair-like ..... **5**

5(4). Siphon with ventral pair of setae near base…….. *Culiseta*
- Siphon without ventral pair of setae near base ..... 6

6(5). Siphon with one pair of setae ..... (in part) *Aedes*
- Siphon with 3 or more pairs of setae ..... 7

7(6). Saddle complete, encircling abdominal segment X ..... *Culex*
- Saddle incomplete, not encircling abdominal segment X ..... (in part) *Aedes*

### KEY TO THE SPECIES OF GENUS *AEDES /OCHLEROTATUS*[13]

Note: female and larval stages of *Ochlerotatus*. *duplex* unknown

1. Seta I-A single; antenna not spiculate ..... 2
- Seta I-A with 2 or more branches; antenna spiculate ..... 6

**2(l).** Siphonal acus absent; setae 4,6-C placed far forward on head ..... 3
- Siphon with acus; setae 4,6-C more posterior on head ..... 5

3(2). Comb scales with large median and stout submedian spines; setal support plate of setae 9-12-T with prominent spine ……. *aegypti*
Comb scales with large median spine and weak lateral spicules; setal support plate of setae 9-12-T with very small spine ……..4

4(3). Setae of 4-X all single ..... *albopictus*
- Some setae of 4-X branched ..... *cretinus*

5(2). Pecten extending distal to middle of siphon; setae 6-III-VI long, stout ..... *echinus*
- Pecten not extending beyond middle of siphon; setae 6-III-VI shorter and slender ..... *geniculatus*

6(l). Seta 1-A 2-3-branched; shaft of antenna usually smooth or with few scattered spicules ..... 7
- Seta 1-A with more than 3 branches; shaft of antenna usually more or less uniformly spiculate ..... 8

7(6). Comb scales in single row; siphon index less than 5.0 ..... *pulcritarsis*
- Comb scales in triangular patch; siphon index 5.0 or more ..... *berlandi*
..... *sticticus*
Comb Scales in two irregular rows..... *cataphylla*

8(6). One or more distal pecten spines widely spaced ..... 9
- Pecten spines evenly spaced ..... 13

9(8). Siphon with several setae dorsally ..... 10
- Siphon with only one seta ..... 12

10(9). Subventral seta of siphon inserted within pecten ..... *rusticus*
- Subventral seta inserted beyond pecten ..... 11

11(10). Siphon with 3 pairs of setae on dorsal surface; basalmost siphon seta shorter than width of siphon at point of attachment ……. *refiki*
- Siphon with 2 pairs of setae on dorsal surface; basalmost siphon seta longer than width of siphon at point of attachment ..... *lepidonotus*

12(9) Comb scales 18-28 on VIOI arranged in triangular patch..... (in part) *caspius*
Comb scales 9-12 arranged jin single or double row ..... 12a

12a Seta 5,6-C with 1-2 branches ..... *punctor*
Seta 5,6-C with 5 or more branches..... *vexans*
Seta C-5,63-4 branches..... *intrudens*

13(8). Comb scales with median spine much larger than submedian spicules ..... 14

[12]Adapted from Aitken (1954)
[13]Partially adapted from Hedeen (1959).

- Comb scales fringed with subequal spicules ..... 19

14(13). Siphon almost as wide apically as basally ..... 15
- Siphon distinctly tapering to apex ..... 16

15(14). Some pecten spines with 4 or more denticles on basal margin; antenna moderately spiculate …….... *zammittii*
- Pecten spines with fewer than 4 denticles on basal margin; antenna sparsely spiculate ..... *mariae*

16 Seta 4-X with 1 precratial tuft..... co*m*munis
Seta 4-X with 2 precratal setal tufts..... 17
Seta 4-X with 4 precratal seteal tufts, usually 20 or more comb scales..... 18
Seta 4-X with 4-5 precratial tufts, 10-20 comb scales..... *nigrinus*

17(16). Seta I-S near middle of siphon, with 3-5 branches; seta 3-VIII usually with fewer than 8 branches ..... (in part) *dorsalis*

- Seta I -S beyond middle of siphon, with 5 or more branches; seta 3-VIII usually with 8 or more branches ..... (in part) *caspius* ..... *pullatus*

18 a (16)
Comb scales usually 35 or more..... *annulipes* ..... *behningi*
Comb scales usually 25-35..... *excrucians*
Comb scales usually less than 25..... 18 (b)

18 (b) Siphon long, tapered, 9-S hook like..... *flavescens*
Siphon long, tapered, 9-S not hook like..... *riparius*

19(13). Comb scales numbering more than 45 ..... *detritus*
- Comb scales numbering 35 or fewer ..... 20

20(19). Seta 4-X with at most 2 precratal setal tufts ..... 21
- Seta 4-X with at least 3 precratal setal tufts ..... 22

21(20). Seta I-S near middle of siphon; seta 3-VIll usually with fewer than 8 branches ..... (in part) *dorsalis*
- Seta I-S beyond middle of siphon; seta 3-VIll usually with 8 or more branches ..... (in part) *caspius*

22(20). Comb scales usually numbering 35 or more ..... (in part) *annulipes*
- Comb scales usually numbering fewer than 35 ..... (in part) *cantans*

## KEY TO THE SPECIES OF GENUS *ANOPHELES*[14]

1. Setae 5-7-C very short, simple; seta 7-C short, with 2,3 branches; antenna smooth ..... *plumbeus*
- Setae 5-7-C long, with many branches; seta 7-C nearly as long as antenna, plumose; antenna spiculose ..... 2

2(l). Setae 2-C closer to each other than to setae 3-C; seta I-A conspicuous, branched ..... 3
- Setae 2-C closer to setae 3-C than to each other; seta I-A simple, small ..... 15

3(2). Seta 3-C simple, sparsely aciculate or with 2-4 branches ..... 4
- Seta 3-C dcndritic ..... 8

4(3). Head with 3 transverse pigmented bands; seta I -P with 4 or more branches; seta 0-1VV well developed, with 4 or 5 branches; anterior tergal plates large, 5.0-6.0 wider than long ..... algeriensis
- Head spotted, not banded; seta I-P single or double; seta 0-IV,V minute, simple, or absent; anterior tergal plates no more than 3.0 wider than long ..... 5

5(4). Seta I-P weakly developed, with 3,4 branches; setae 1-II-VII with leaflets only slightly serrated and without long filament ..... 6
- Seta I -P strong, plumose; setae 1-II-VII with shoulders of leaflets distinct, filament long, thin ..... 7

6(5). Total branches of the 4 setae 2-IV,V about 12 ..... *superpictus*
- Total branches of the 4 setae 2-lV,V less than 10 ..... *claviger*

7(5). Setae 2,3-P attached to common setal support plate; filament of palmate leaflet 0.5 total leaflet length ..... *m. marteri*
- Setae 2,3-P with separate setal support plates; filament of palmate leaflet 0.3 total leaflet length…….... *m. sogdianus*

8(3). Seta I-A in middle of antenna-, seta 2-C simple or with short branches apically ..... 9
- Seta I-A in basal 0.25 of antenna; seta 2-C with long apical branches (*maculipennis* complex) ..... 10

9(8). Seta 2-C simple ..... *pseudopictus*
- Seta 2-C with short branches apically ..... *hyrcanus*

10(8). Setae 2-IV,V (4 setae together) with mean number of branches 9.63, SD 1.85, range 4-13 ..... *labranchiae*
- Setae 2-lV,V together with mean number of branches greater than 9.63 ..... 11

11(10). Setae 2-1V,V together with mean number of branches 10.8, SD 1.62, range 7-16 ..... *atroparvus*
- Setae 2-IV,V together with mean number of branches greater than 10.8 ..... 12

12(11). Setae 2-1V,V together with mean number of branches 13.05, SD 1.35, range 10-17 ..... *maculipennis*
- Setae 2-1V,V together with mean number of branches greater than 13.05 ..... 13

13(12). Setae 2-1V,V together with mean number of branches 14.82, SD 2.40, range 11-21 ..... *messeae*
- Setae 2-1V,V together with mean number of branches greater than 14.8 ..... *superpictus* (in part)

14(13). Setae 2-IV,V together with mean number of branches 24.49, SD 3.30, range 16-32 ..... *subalpinus*
- Setae 2-1V,V together with mean number of branches 30.78, SD 4.29, range 19-38 ..... *sacharovi*

[14]Adapted from Aitken (1954), Senevet and Andarelli (1955, 1959), and Gillies and Coetzee (1987). SD = standard deviation.

15(2). Setae 5-7-C not plumose, with 4 or more branches from near base; setae 6-IV,V plumose ..... *cinereus hispaniola*
- Setae 5-7-C long, plumose; setae 6-lVV with 2-4 branches from near base ..... *superpictus*

## KEY TO THE SPECIES OF GENUS *COQUILLETTIDIA*[15]

1. Seta 1-VIll with 2-4 branches; seta 2-S stout, single (one seta) ..... *richiardii*
- Seta 1-VIll with 5-7 branches; seta 2-S weaker, double (2 setae) ..... *buxtoni*

## KEY TO THE SUBGENERA OF GENUS *CULEX*[16]

1. Ventral brush with one or more precratal setae ..... 2
- Ventral brush with all setae attached to grid ..... 3

2(l). Siphon with 2 or more anterolateral setae; seta 3-P more than 0.5 length of seta 1-P .....
..... *Maillotia (Cx. hortensis)*
Siphon without anterolateral setae; seta 3-P less than 0.5 length of seta 1-P ..... *Neoculex*

3(l). Siphon with all setae in single zigzag posterior row ..... *Barraudius*
- Siphon with 2 ventrolateral rows, 1-3 setae dorsally out of line ..... *Culex*

## KEY TO THE SPECIES OF SUBGENUS *BARRAUDIUS*[17]

1. Siphon short, index less than 3.0, the 2 apical setae 1-S at least as long as width of siphon at point of attachment ..... *pusillus*

- Siphon long, index at least 4.0, the 2 apical setae 1-S shorter than width of siphon at point of attachment ....
..... *modestus*

## KEY TO THE SPECIES OF SUBGENUS *CULEX*[18]

1. All comb scales evenly fringed at sides and apex ..... 2
- At least some comb scales spinelike, with pointed apex and fringe at sides ..... 5

2(l). Siphon with 6-8 pairs of setae, with one pair arising laterally and 5-7 pairs relatively close to posterior midline, with 1-2 pairs located within pecten ..... *laticinctus*

- Siphon with 3-6 pairs of setae, with 1-3 pairs arising laterally and 2-4 pairs ventrolaterally; sometimes with one pair arising within pecten ..... 3

3(2). Seta 1-S no longer than diameter of siphon at point of attachment, usually in 5 pairs; seta 6-VI normally single; seta 5-C double or triple (occasionally with 4 branches) ..... *perexiguus*

- Seta 1-S longer than diameter of siphon at point of attachment, usually in 4 pairs; seta 6-VI normally double; seta 5-C with 4-8 branches ..... 4

4(3). Seta 1-T more than half length of seta 2-T-, seta 1-X and setae 3-1, VII normally double, often triple ..... *torrentium*

- Seta 1 -T less than half the length of seta 2-T; seta 1-X and setae 3-1,VIIusually single, never triple . . p*ipiens*

5(l). Seta 7-I distinctly shorter than 6-1, usually double; seta 14-C with 2 or more branches, rarely single; seta I-C slender, usually not thicker than branches of setae 5,6-C ..... *theileri*

- Seta 7-I about as long as 6-I, usually single; seta 14-C single; seta I-C stout, usually much thicker than branches of setae 5,6-C ..... *mimeticus*

## KEY TO THE SPECIES OF SUBGENUS *NEOCULEX*[19]

1. Thorax spiculate ..... *impudicus*
- Thorax smooth ..... 2

2(l). Siphon widening at apex; seta 3-P with 2 or more branches ..... *territans*
- Siphon only slightly wider at apex, if at all; seta 3-P single ..... *martinii*

[15]Adapted from Gutsevich et al. (1974).
[16]Adapted from Harbach (1985).
[17]Adapted from Gutsevich et al. (1974).
[18]Adapted from Harbach (1988).
[19]Adapted from Senevet and Andarelli (1959).

## KEY TO THE SPECIES OF GENUS *CULISETA*[20]

1. Distal pecten spines long and hairlike ..... 2
- Distal pecten spines not long, hairlike ..... 4
2(l). Seta 6-C with more than 4 subequal branches ..... *glaphyroptera*
- Seta 6-C with fewer than 4 branches, one or more branches longer and stronger than others ..... 3
3 (2) Distance between seta 4-C =or > that between seta 5-C ..... 3 b
Distance between seta 4-C less that between seta 5-C ..... *subochrea*
3(b) Siphon index < 3.0 ..... *alaskaensis*
Siphon indes > 3.0 ..... *annulata*
4(l). Siphon index less than 2.5; pecten spines extending to near apex ..... *longiareolata*

- Siphon index 5.0 or greater; pecten spines reaching to near apex ..... 5
5(4). Pecten with 2-5 large, widely spaced spines in basal 0.6; seta 2-S multibranched ..... *fumipennis*
- Pecten with 5-7 more closely set spines in basal 0.2; seta 2-S short, single ..... *morsitans*


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### REFERENCES CITED


Aitken, I H. G. 1954. The Culicidae of Sardinia and Corsica (Diptera). Bull. Entomol. Res. 45:437-494.

Cranston, P. S., C. D. Ramsdale, K. R. Snow and G. B. White. 1987. Keys to the adults, male hypopygia, fourth-instar larvae and pupae of the British mosquitoes. Freshwater Biol. Assoc., Sci. Pub. 48.

Edwards. E W. 1921. A revision of the mosquitoes of the Palearctic Region. Bull. Entomol. Res. 12:263-351.

Gillies, M. T. and M. Coetzee. 1987. A supplement to the Anophelinae of Africa south of the Sahara (Afrotropical Region). Publ. S. Afr. Inst. Med. Res. No. 55.

Glick, J. 1. 1992. Illustrated key to the female *Anopheles* of southwestern Asia and Egypt (Diptera: Culicidae). Mosq. Syst. 24:125-153.

Gutsevich, A., S. Monchadskii and A. A. Shtakel'berg. 1974. Fauna of the U.S.S.R. Diptera Mosquitoes Family Culicidae. Leningrad, Akad. Nauk. USSR Zool. N. Ser. 100, 384:1-408.

Harbach, R. E. 1985. Pictorial keys to the genera of mos quitoes, subgenera of *Culex (Culex)* occurring in south western Asia and Egypt, with notes on the subgeneric placement of *Culex deserticola* (Diptera: Culicidae). Mosq. Syst. 17:83-107.

Harbach, R. E. 1988. The mosquitoes of the subgenus *Culex* in southwestern Asia and Egypt (Diptera: Culic idae). Contrib. Am. Entomol. Inst. (Gainesville) 24:1 240.

Harbach, R. E. and K. L. Knight. 1980. Taxonomists' glossary of mosquito anatomy. Plexus Publishing, Inc., Marlton, NJ.

Hedeen, R. A. 1958. A review of the mosquito larvae of France 1. Genera *Culiseta*, *Mansonia*, *Orthopodomyia* and *Uranotaenia.* Mosq. News 18:308-321.

Hedeen, R. A. 1959. A review of the mosquito larvae of France 11. The genus *Aedes.* Mosq. News 19:179-183.

Knight, K. L. and A. Stone. 1977. A catalog of the mos quitoes of the world (Diptera: Culicidae). Entomologi cal Society of America, College Park, Maryland.

Mattingly, R E 1954. Notes on the subgenus *Stegomyia*

Ann. Trop. Med. Parasitol. 48:259-270.

Mitchell, C. J. 1995. Geographic spread of *Aedes albo pictus* and potential for involvement in arbovirus cycles in the Mediterranean Basin. J. Vector Ecol. 20:44-58.

Natvig, L. R. 1948. Contributions to the knowledge of the Danish and Fermoscandian mosquitoes. Nors. En tomol. Tidsskr. Suppl. 1.

Pandazis, G. 1935. La fauna des Culicides de Grece. Acta Inst. Mus. Zool., Univ. Athens 1:1-27 [VI Int. Congr. Entomol. 2:911-935. 1940].

Samanidou-Voyadjoglou, A. and R. E Darsie, Jr. 1993. An annotated checklist and bibliography of the mos quitoes of Greece (Diptera: Culicidae). Mosq. Syst. 25: 177-183.

Senevet, P. and L. Andarelli. 1955. Les Anopheles de I'Afrique du Nord et du Bassin Mediterraneen. Editions P. Lechevalier, Paris.

Senevet, P. and L. Andarelli. 1959. Les moustiques de I'Afrique du Nord et du Bassin Mediterraneen. Les gen res *Culex*, *Uranotaenia*, *Theobaldia*, *Orthopodomyia* et *Mansonia.* Encycl. Entomol. XXXVII.

White, G. B. 1978. Systematic reappraisal of the *Anoph elesmaculipennis* complex. Mosq. Syst. 10:13-44.


[20] Adapted from Hedeen (1958).