

AN ANNOTATED CHECKLIST AND BIBLIOGRAPHY OF THE MOSQUITOES OF GREECE (DIPTERA: CULICIDAE)

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ABSTRACT. This is the first time since 1977 that a complete checklist of the mosquito species occurring in Greece has been assembled. Several nomenclatorial and taxonomic changes that have been made in the intervening 16 years are reflected in the checklist. Notes are added on several species to assist in understanding the changes and reasons for including certain species. A bibliography covers the literature related directly to the mosquitoes of Greece and information needed to understand what has taken place historically to affect the nomenclature and identification of Greek culicids.

INTRODUCTION

Early interest in the mosquitoes of Greece was related to military operations in Macedonia, where malaria was a public health problem (Cot and Hovasse 1917, Niclot 1917, Joyeux 1918, Waterston 1918a). Lists of both anophelines and culicines were published by Waterston (1918a, 1921-1922) and Joyeux (1918). The total number of species in six genera was 28. Cardamatis (1931a) was the earliest worker to record the known species from all of Greece. He tallied 19 species. The most complete list was by Pandazis (1932, 1935), noting 38 species in seven genera. Later, Peus (1954) reported results of his collections in Greece, naming 24 species. The latest tabulation was by Sakellariou and Lane (1977), who listed 38 species. However, there is a list given by both Peus (1967) and Dahl and White (1978) consisting of a table that divides Europe into 25 regions and indicates the species found in each region. The major part of Greece is located in Region 6, and a small part is in Region 7. In Region 6, they have registered 42 species, and we have confirmed all except *Ae. sticticus* (Meigen) to be in Greece. The most recent study of Greek

mosquitoes by Samanidou-Voyadjoglou and Darsie (1993) reported two new country records.

Many changes in nomenclature of the mosquito genera and species have occurred, and we are updating the checklist following the work of Knight and Stone (1977) and giving notes on some of the species. The following checklist contains seven genera, 15 subgenera, 53 species, and two subspecies. Those four preceded by an asterisk (*) were reported from Greece by Pandazis (1935) and Shannon (1935), but no voucher specimens have been found. We believe that the nine bearing a number sign (#) should occur in Greece based on known distribution in the literature. The remaining 41 species (74.5%) are represented by voucher specimens in the collections of the Athens School of Public Health, U.S. National Museum of Natural History, Smithsonian Institution, or the British Museum (Natural History).

CHECKLIST OF THE MOSQUITOES OCCURRING IN GREECE

Anopheles (*Anopheles*)

1. *algeriensis* Theobald
2. #*atroparvus* Van Thiel
3. *claviger* (Meigen)
4. *hyrcanus* (Pallas)
5. *maculipennis* Meigen
6. *marteri marteri* Senevet and Prunelle
marteri sogdianus Keshishian

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7. *melanoon subalpinus* Hackett and Lewis
 8. **messeae* Falleroni
 9. #*petragnani* Del Vecchio
 10. *plumbeus* Stephens
 11. *pseudopictus* Grassi
 12. *sacharovi* Favre
- Anopheles (Cellia)*
 13. **cinereus hispaniola* (Theobald)
 14. *superpictus* Grassi
- Aedes (Aedimorphus)*
 15. *vexans* (Meigen)
- Aedes (Finlaya)*
 16. *echinus* (Edwards)
 17. *geniculatus* (Olivier)
- Aedes (Ochlerotatus)*
 18. *annulipes* (Meigen)
 19. *berlandi* Seguy
 20. #*cantans* (Meigen)
 21. *caspicus* (Pallas)
 22. *detritus* (Haliday)
 23. *dorsalis* (Meigen)
 24. *lepidonotus* Edwards
 25. *mariae* (Sergent and Sergent)
 26. *pulcritarsis* (Rondani)
 27. **rusticus* (Rossi)
 28. *zammitii* (Theobald)
- Aedes (Rusticoidus)*
 29. #*refiki* Medschid
- Aedes (Stegomyia)*
 30. *aegypti* (Linnaeus)
 31. *cretinus* Edwards
- Coquillettidia (Coquillettidia)*
 32. #*buxtoni* Edwards
 33. *richiardii* (Ficalbi)
- Culex (Barraudius)*
 34. *modestus* Ficalbi
 35. *pusillus* Macquart
- Culex (Culex)*
 36. *laticinctus* Edwards
 37. *mimeticus* Noe
 38. *perexiguus* Theobald
 39. *pipiens* Linnaeus
 40. *theileri* Theobald
 41. #*torrentium* Martini

- Culex (Maillotia)*
 42. *hortensis* Ficalbi
- Culex (Neoculex)*
 43. #*impudicus* Ficalbi
 44. #*martinii* Medschid
 45. *territans* Walker
- Culiseta (Allotheobaldia)*
 46. *longiareolata* (Macquart)
- Culiseta (Culicella)*
 47. *fumipennis* (Stephens)
 48. *morsitans* Theobald
- Culiseta (Culiseta)*
 49. *annulata* (Schrank)
 50. **subochrea* (Edwards)
 51. #*glaphyroptera* (Schiner)
- Orthopodomyia*
 52. *pulcripalpis* (Rondani)
- Uranotaenia (Pseudoficalbia)*
 53. *unguiculata* Edwards

NOTES ON SOME GREEK MOSQUITOES

Anopheles (Anopheles) maculipennis

Anopheles maculipennis is a complex of closely related species whose members are distinguished mainly by the morphology of the eggs (De Buck et al. 1934; Hackett 1934, 1935a, 1937; Bates and Hackett 1938; Bates 1940; Bates et al. 1949). Which species of the complex occur in Greece is difficult to ascertain. For example, Pandazis (1935), Shannon (1935), and Hackett and Missiroli (1935) reported *An. messeae* in Greece. However, Bates (1940) stated that it did not occur there. An examination of the eggs of the Maculipennis Complex in Kavala, Macedonia, was made by Hackett and Lewis (1935), and they concluded that three types were present, i.e., "3 batches of *messeae*, 232 *typicus*, 16 of uncertain type, and 24 *subalpinus*." Shannon and Hadjinicolaou (1941) studied the eggs of the Maculipennis Complex in Macedonia and recorded *An. maculipennis* s.s. [as *An. typicus*], *An. sacharovi*, and *An. melanoon subalpinus* [as *An. subalpinus*]. More recently,

White (1978) indicated that *An. maculipennis s.s.*, *An. sacharovi*, and *An. melanoon subalpinus* are the taxa that occur in Greece. From the above review, there is little doubt that at least three of the Maculipennis Complex are found in Greece, i.e., *An. maculipennis s.s.*, *An. sacharovi*, and *An. melanoon subalpinus*. But what about other members of the complex? Based on the evidence given by Shannon (1935), Hackett and Lewis (1935), and Hackett and Missiroli (1935), we believe that *An. messeae* probably does occur in Greece. Regarding *An. labranchiae*, *An. m. melanoon*, and *An. atroparvus*, distributional information given by White (1978) excludes Greece. However, Dahl and White (1978) showed that *An. atroparvus* should be present in their Region 6, which includes Greece. We therefore omitted the former two but are keeping the latter taxon provisionally. Further collections are needed in which eggs of the Maculipennis Complex are studied.

Anopheles marteri

Keshishian (1938) described *An. sogdianus* as a distinct species, but Bates et al. (1949) established it as a subspecies of *An. marteri*, and they included characters for the separation of the two subspecies in an identification key.

Anopheles cinereus hispaniola

Senevet and Rioux (1960) and Peus (1967) suggested that *An. hispaniola* (Theobald) may be a subspecies of *An. cinereus*, and Dahl and White (1978) placed *An. hispaniola* in synonymy under *An. cinereus* without explanation. However, Ribeiro et al. (1980) have relegated *An. hispaniola* to a subspecies of *An. cinereus*, and we have followed their opinion.

Anopheles superpictus

According to Knight and Stone (1977), there are seven recognized synonyms of this species, of which *An. cardamatisi* Newstead and Carter, *An. macedoniensis* Cot and Hovasse, and *An. hellenicus* Peus have type lo-

calities in Greece. They still list *An. atheniensis* Cardamatis as a good species; however, Pandazis (1935) placed this species in synonymy with *An. superpictus*. Dahl and White (1978) erroneously repeated the synonymy (see Gaffigan and Ward 1985). We have found that the location in Athens where the type series was collected is now urbanized with streets and buildings. The Ilyssos River, from whose stream pools it was collected, is now confined to a system of underground pipes.

Aedes aegypti

This species has been recorded in Greece by Waterston (1918a), Joyeux (1918), and Ekblom (1929, as *Stegomyia fasciata* Fabricius), Cardamatis (1931a, as *Culex elegans* Ficalbi), and Pandazis (1932, as *Aedes argenteus* Poiret). There is no doubt that it was present in much of Greece. During the years when malaria eradication was still in progress (Livadas 1958), *Ae. aegypti* populations were decimated. Through the decade of the 1960s, routine sampling for *Ae. aegypti* was conducted by personnel of the Ministry of Health. Results of this effort are not available, but no specimens were being encountered at the time of its cessation (Athens School of Public Health, unpublished data). We collected none while sampling in several districts in 1992.

Aedes berlandi

A specimen was recently discovered in collections made in Macedonia in 1934 by R.C. Shannon (Samanidou-Voyadjoglou and Darsie 1993). Its synonym is *Ae. longitubus* Cambournac, and that name was employed for this species in the older literature (e.g., Clavero 1946, Aitken 1954).

Aedes communis

Cardamatis (1931a) reported this species from Athens, although Pandazis (1935) did not find it. Nevertheless, it has been reported from Yugoslavia and Syria (Natvig 1948), Bulgaria (Bozhkov 1966), and Turkey (Parish 1959). From this distribution, one would

expect it to occur in Greece. Knowing that it is a northern, Holarctic species (Knight and Stone 1977), despite the evidence, we hesitate to list it from Greece until voucher specimens are obtained.

***Aedes pulcritarsis* and
*Orthopodomyia pulchripalpis***

The spelling of the specific name of these two species has been corrected from the long-standing usage of *Ae. pulchritarsis* and *Or. pulchripalpis* by Snow (1986). It conforms to the original spelling by Rondani, the author of these two species.

Culex pipiens

There is little doubt that the only species of the Pipiens Complex that occurs in Greece is *Cx. pipiens* (Mattingly et al. 1951). Indeed, our study of the genitalia of 22 males from various locations resulted in a mean DV/D ratio (Barr 1957) of -0.104 , confirming its identification. Cardamatis (1931a) erroneously recorded *Cx. quinquefasciatus* Say (as *Cx. fatigans* Wiedemann) from Greece.

Culiseta subochrea

Edwards (1921a) described this species as a variety of *Cs. annulata*. In the same year, he (1921b) raised it to specific rank with the statement, "this differs so conspicuously and sharply in coloration that it must be regarded as a distinct species." This was followed for many years until Maslov (1964) reduced it to a subspecies of *Cs. annulata*. Finally, Ribeiro et al. (1977) again recognized its specific status, and we are agreeing with them.

***Toxorhynchites* sp.**

A larva apparently misidentified as a species of *Toxorhynchites* (= *Megarhinus*) was collected from a tree hole in the Axios Valley near Polykastro (Karasouli), Macedonia, by Waterston (1918a). The larva was deposited in the British Museum (Natural History) and subsequently studied by Edwards (1921b). He

was unable to identify the larva, so it remains a mystery because Knight and Stone (1977), Knight (1978), and Ward (1984, 1992) do not include any species of the genus from Europe. We have not included it in our checklist because it is unlikely that a species of this genus occurs in Europe.

**Species without voucher and
literature confirmation**

The following references give the distribution of those species in the checklist without voucher specimens: *An. petragrani* (Knight and Stone 1977), *Ae. cantans* (Gutsevich et al. 1974, Knight and Stone 1977), *Ae. refiki* (Gutsevich et al. 1974, Knight and Stone 1977), *Cq. buxtoni* (Coluzzi and Conti 1962, Knight and Stone 1977), *Cx. torrentium* (Harbach 1988), *Cx. impudicus* (Senevet and Andarelli 1959, Knight and Stone 1977), *Cx. martinii* (Senevet and Andarelli 1959, Knight and Stone 1977), *Cs. glaphyroptera* (Maslov 1986). *Anopheles atroparvus* has been discussed above.

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