

Culicidae

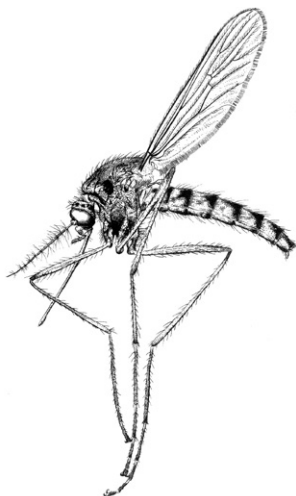
Francis Schaffner (1998 Checklist: Hans Briegel)

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Diagnosis: Culicidae («true» mosquitoes) adults are small to medium (3.0-12.0 mm) slender delicate nematocerous flies with slight sexual dimorphism in morphology. Eyes reniform, with facets of equal size, similar in both sexes; ocelli absent. Biting mouthparts (proboscis) much longer than head, extending far beyond clypeus. Antenna long with very small scape, enlarged globose pedicel, and 13 long slender flagellomeres; each flagellomere with a whorl of hairs that are usually much longer and more abundant in male than in female. Palpi, 4-5 segmented, short (Culicinae) or long (Anophelinae) and with short hairs in females, but always long and with long hairs in males (both subfamilies) for Palaearctic species. Legs slender and long, tarsi clearly five-segmented. Scales present on wing veins, head and legs and usually on thorax and abdomen, forming different colour patterns that allow species identification.

Biology: The immature stages of Culicidae are aquatic. Larvae and pupae are active swimmers in quiet waters (except those of *Coquillettidia* spp. which are fixed on immersed plant roots), and breathe at the water surface. Larvae feed on particles of detritus, algae, bacteria, etc.; pupae do not feed anymore. They develop in many habitats, mainly in any shallow stagnant waters, either temporary (e.g. *Aedes* spp.) or (semi-) permanent (e.g. *Anopheles* and *Culex* spp.). Some species utilise small containers only, either natural (phytotelms) or artificial (human-made), in particular the common house mosquito (*Culex pipiens*) and the *Aedes* invasive species (e.g. *Aedes albopictus*). Adults feed on plants to get a sugar meal, but females also take a blood meal from various hosts, in order to obtain proteins for the development of their eggs. Feeding preferences and behaviour varies from one species to another, but many of them bite mammals, including humans. Some species are univoltine (e.g. snow-melt species) while others have successive generations from spring to fall (e.g. container-inhabiting species). They overwinter either as eggs in the ground (e.g. snow-melt and floodwater species) or on the water container inner surfaces (e.g. *Aedes* container-inhabiting species), or as larvae in water habitats (a few *Aedes*, *Anopheles*, *Culiseta* spp.) or as adult females in shelters (some *Anopheles*, *Culex*, and *Culiseta* spp.). The Culicidae can occur locally in huge numbers, in particular after natural flooding (e.g. alluvial plains in spring) or in case of accumulation of human-made containers. Due to their feeding habits, mosquitoes can generate disturbing nuisance, and some species can transmit disease pathogens to animal and human (e.g. malaria parasites, dirofilaria worms, chikungunya, dengue and West Nile viruses).

Nomenclature and classification: Classification used herein is consistent with the Systematic catalogue of Culicidae which is recognised as a reference, maintained by the Walter Reed Biosystematics Unit (<http://www.mosquitocatalog.org>), and recently published in the form of a book (Wilkerson et al. 2021).



Aedes vexans,
female (CMPD A, p.94).

Number of species: CH: 41 (1998 Checklist: 35),
AT: 38, BE: 31, DE: 53, ES: 60, FR: 61, IT: 62, LI: 9, Europe: 101, World: ~3500.
(World: Harbach 2007, European countries: Robert et al. 2019.)

Level of faunistic knowledge in Switzerland: Very good, but occurrences of 6 recorded species need to be confirmed, and 1-2 additional species can be expected.

General references: Becker et al. (2010) [key female, male and larvae, species descriptions, biology, medical importance, control, Europe, vector species of other biogeographical regions], Gunay et al. (2018) [computer-aided key female, male and larvae, Europe, Near East, North Africa], Harbach (2007) [phylogeny], Kampen & Schaffner (2008) [biology, pest and vector role, control], Medlock et al. (2015) [invasive species Europe], Minař (1990) [species list Europe], Medlock et al. (2012) [sampling methods], Robert et al. (2019) [distribution Western-Palaeartic region], Schaffner & Mathieu (2020) [mosquito identification methods], Schaffner et al. (2001) [computer-aided key female, male and larvae, biology, vector role, distribution, Europe], Schaffner et al. (2012) [monitoring invasive species, biology, risk], Schaffner et al. (2014) [monitoring native species, biology, risk], Wilkerson et al. (2021) [systematics, synonymy, biology, vector role, distribution, illustrations, world].

References to the Swiss fauna: Briegel (1973), Briegel (1998), Briegel et al. (2002), Flacio et al. (2004), Flacio et al. (2014), Fouque et al. (1991), Merz et al. (2006), Raboud (1980), Schaffner & Mathis (2011), Schaffner & Mathis (2013), Schaffner et al. (2009), Suter et al. (2015), Wagner et al. (2018).

Checklist

Aedes Meigen, 1818

(*Aedes* s.str.)

- *cinereus* Meigen, 1818 !

- *geminus* Peus, 1970 !

(*Aedimorphus* Theobald, 1903)

- *vexans* (Meigen, 1830) !

(*Dahlia* Reinert, Harbach & Kitching, 2007)

- *geniculatus* (Olivier, 1791) !

(*Hulecoeteomyia* Theobald, 1904)

- *japonicus* (Theobald, 1901) !

- *koreicus* (Edwards, 1917) L

(*Ochlerotatus* Lynch Arribalzaga, 1891)

- *annulipes* (Meigen, 1830) !

- *cantans* (Meigen, 1818) !

- *caspicus* (Pallas, 1771) ! N1

- *cataphylla* Dyar, 1916 !

- *communis* (De Geer, 1776) !

- *excrucians* (Walker, 1856) ? N2

- *flavescens* (Müller, 1764) L

- *intrudens* Dyar, 1919 ? N3

- *pullatus* (Coquillett, 1904) !

- *punctor* (Kirby, 1837) !

- *riparius* Dyar & Knab, 1907 ? N4

- *sticticus* (Meigen, 1838) !

(*Rusticoides* Shevchenko & Prudkina, 1973)

- *refiki* Medschid, 1928 L

- *rusticus* (Rossi, 1790) !

(*Stegomyia* Theobald, 1901)

- *albopictus* (Skuse, 1894) !

Anopheles Meigen, 1818

(*Anopheles* s.str.)

- *claviger* (Meigen, 1804) !

- *maculipennis* s.l. Meigen, 1818 ! N5

- *messeae* Falleroni, 1926 !

- *plumbeus* Stephens, 1828 !

Coquillettidia Dyar, 1905

(*Coquillettidia* s.str.)

- *buxtoni* (Edwards, 1923) !

- *richiardii* (Ficalbi, 1889) !

Culex Linnaeus, 1758

(*Barraudius* Edwards, 1921)

- *modestus* Ficalbi, 1889 !

(*Culex* s.str.)

- *pipiens* s.l. Linnaeus, 1758 ! N6

- *theileri* Theobald, 1903 ? N7

- *torrentium* Martini, 1925 !

(*Maillotia* Theobald, 1907)

- *hortensis* Ficalbi, 1890 !

(*Neoculex* Dyar, 1905)

- *martinii* Medschid, 1930 !

- *territans* Walker, 1856 !

Culiseta Felt, 1904

(*Allotheobaldia* Brolemann, 1919)

- *longiareolata* (Macquart, 1838) !

(*Culicella* Felt, 1904)

- *fumipennis* (Stephens, 1825) L

- *morsitans* (Theobald, 1901) !

(*Culiseta* s.str.)

- *alaskaensis* (Ludlow, 1906) L

- *annulata* (Schränk, 1776) !

- *glaphyroptera* (Schiner, 1864) ? N4

Orthopodomyia Theobald, 1904

- *pulcrpalpis* (Rondani, 1872) ? N7

Excluded species

Aedes dorsalis (Meigen, 1830)

Notes

- N1 *Aedes caspius*: some specimens were reported under the name *Aedes dorsalis*, most probably because of a misidentification due to inverted figures in the identification key used (Cranston et al. 1987, cited by the author in the 1998 Checklist [Briegel 1998]); thus *Ae. dorsalis* is removed from the species list.
- N2 *Aedes excrucians* s.l. is a species complex, of which two members could occur in Switzerland: *Ae. excrucians* s.str. and *Ae. surcoufi*; to date, the precise identity of the Swiss population is not clear (Schaffner & Mathis 2011).
- N3 *Aedes intrudens*: reported at three occasions in the literature (Briegel 1973, Fouque et al. 1991, Flacio et al. 2004), but specimens need to be checked for confirmation. Since the Swiss records are located outside the species' known distribution range, its presence has to be confirmed.
- N4 *Culiseta glaphyroptera* and *Aedes riparius*: only a few specimens reported at one occasion in the literature (Briegel 1973) and no specimens available; since these records are located at the margin of their known distribution range, their presence needs to be confirmed.
- N5 *Anopheles maculipennis* s.l. (*An. maculipennis* s.str. and *An. messeae*) is a species complex of which the members can be accurately identified only by molecular methods. Thus, historical records of *An. atroparvus* and *An. melanoon* are removed from the checklist (including an erroneously PCR-identified record of *An. atroparvus* in Schaffner & Mathis (2011)).
- N6 *Culex pipiens* s.l.: this species complex comprises two biotypes, namely *pipiens* and *molestus*. Whereas the first is considered ornithophilic and has a winter diapause, the second is considered mostly anthropophilic, autogenous (first egg batch laid without blood meal) and breeds throughout the year in underground sheltered sites (pits and flooded cellars). However this picture becomes unclear during summer, when both populations meet and hybridise, with offspring showing mixed characteristics. Both forms occur in Switzerland.
- N7 *Culex theileri* and *Orthopodomyia pulcrpalpis*: only a few specimens reported at one occasion in the literature (Fouque et al. 1991) and no specimens available; since these records are located at the margin of their known distribution range, their presence needs to be confirmed.

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