

***Anopheles (Anopheles) melanoon* Hackett 1934**

**Biology:** Larvae of *An. melanoon* are typically found in sunlit stagnant water bodies with a large surface area and some vegetation (Jetten and Takken 1994). They may occur in marshes, edges of rivers and lakes, ponds, and ground pools. In Sardinia, larvae can be found in fresh-water ground pools, streams and water collections with a sunny exposure in the springtime and shadier situations during the summer months (Aitken 1954a). Elsewhere, the species is reported to breed in rice fields (Hackett and Missiroli 1935). Hibernation takes place in the adult female stage with complete diapause. The winter quarters are not well known, but may be the same as in other members of the complex, e.g. *An. maculipennis* s.s., *An. messeae* and *An. subalpinus*. *An. melanoon* females reveal a zoophilic preference, they mainly feed on cattle and have only occasionally been recorded as feeding on humans, both indoors and outdoors. Cattle stables are reported as daytime resting shelters (Ribeiro et al. 1980), but others described the species as semi-exophilic (Artemiev 1980). The adults are eurygamous. *An. melanoon* is a rare species with a limited distribution range. So far, it has never been found in the same numbers as other members of the complex.

**Distribution:** *An. melanoon* seems to be confined to southwestern and southern Europe. It has been found in Portugal and Spain (one record each), Corsica, Sardinia, and Italy. More eastern records probably refer to *An. subalpinus*.

***Anopheles (Anopheles) messeae* Falleroni 1926**

**Biology:** The larvae are typically found in cool, fresh, stagnant water bodies with an abundant growth of submerged vegetation. They occur at the edges of rivers and lakes, in swamps, flood plains, ponds and ditches. In central Europe, the larvae are restricted to inland areas and fresh water habitats and avoid breeding sites with a high content of organic matter. *An. messeae* prefers larger water bodies which are available mainly in lowlands with poorly regulated ground water level (Mohrig 1969). It is the predominant species of the *Anopheles Maculipennis* Complex in inundation areas and flood plains of larger rivers, e.g. the Danube, Sava, Rhone or Rhine rivers. It is

rare or almost completely absent along the coastlines and in mountainous regions. Hibernation takes place in the adult female stage, the diapause is complete. The winter months are usually passed in abandoned buildings. The females are essentially zoophilic species feeding almost exclusively on domestic animals; thus contact with humans is largely suppressed in an agricultural area with livestock (Jetten and Takken 1994). Blood meals are taken from humans only when the density of *An. messeae* is very high and there is a shortage of livestock, but they may also attack humans in houses (Barber and Rice 1935; Dahl 1977). Artemiev (1980) described the species as endophilic as it was found resting during the daytime in stables, barns, and cellars as well as in human buildings. The adults are eurygamous.

**Distribution:** *An. messeae* is the most widespread member of the complex. Its range stretches in the northern Palaearctic region from the Atlantic coast in the west, through Scandinavia, across northern and central Europe and Asia as far as into China. The species is virtually absent in southern Europe, it cannot be found on the Iberian peninsula, southern Italy, and in the eastern Mediterranean region. *An. messeae* is regarded as being comparatively more susceptible to high temperature and low humidity than *An. atroparvus* and this behaviour might limit the southern distribution of the species.

***Anopheles (Anopheles) sacharovi* Favre 1903**

Adults of this species are most readily distinguished from the other members of the complex by the lighter colouration of the mesonotum and some wing characters. The pale median stripe on the scutum, characteristic of the other members of the complex is absent. The lateral parts of the scutum are yellowish brown, more or less the same as in the middle part. The scales of the wing fringe are uniformly dark, without a pale patch at the wing apex (Fig. 6.9a). The dark spots on the wings, particularly in males, are less conspicuous than in the other members of the complex and barely distinguishable in old worn out specimens. The eggs of *An. sacharovi* are unique in the lack of the air floats (Fig. 9.4a), but in the south of its distribution range, where development continues throughout the year, eggs deposited in winter may have rudimentary floats. Usually the larvae of *An. sacharovi* are smaller than



the larvae of the other members of the complex, and the outer clypeal setae are relatively longer.

**Biology:** Larvae can be generally found in open, sun exposed shallow water bodies with abundant surface vegetation, both in fresh and saline waters. They are more tolerant to salinity than other members of the complex (e.g. *An. maculipennis s.s.*), and usually occur in coastal swamps and marshes, lagoons and nearby streams, irrigation drains, and roadside ditches, rice fields, grassy ponds, pools, or seepages. In rice fields, the larvae are often found together with those of *Cx. modestus*. The larvae are not very mobile and rarely leave the water surface, but if they do, they return after a short time (Gutsevich and Dubitzky 1987). *An. sacharovi* is the most thermophilic species of the *Anopheles Maculipennis* Complex, and water temperatures of the breeding sites up to 39°C during daytime are not uncommon. Hibernation takes place in the adult female stage, and the individuals preferably seek stables and other animal shelters for overwintering. When the temperatures are suitable, they may take blood meals occasionally during winter. Hibernation starts earlier and lasts longer than in other members of the complex (Martini 1931). In spring, adults are not very abundant, the maximum population is usually reached between July and August. The females predominantly feed on humans but also on cattle when available. Even during the daytime they may be persistent biters in sheltered situations (Postiglione et al. 1973). In some places they become numerous and attack humans in large numbers (Gutsevich and Dubitzky 1987). *An. sacharovi* is usually an endophilic species; adults are frequently found in stables and human dwellings during the day, and leave their daytime shelters during the hours of darkness. Occasionally they can also be found resting outdoors: recorded outdoor shelters include hollows and cavities under bridges and earth banks, hollow trees or rock cavities (Postiglione et al. 1973). Saliternik (1957) caught marked mosquitoes at a distance of 3.5 km from the release point. The flight range of *An. sacharovi* may exceed this distance, if the blood source is far from the breeding places.

**Distribution:** In southern Europe, *An. sacharovi* is mainly a coastal species and distributed in the eastern Mediterranean sub-region. It can be found in Corsica, Sardinia, Sicily, in coastal areas of Italy, Greece, former Yugoslavia and Albania, south of the Balkan peninsula and in the western and southern coastal plains of Turkey. The range extends eastwards from the Near

East through middle Asia, Iran, and Afghanistan to China. In its continental distribution range, *An. sacharovi* is a characteristic species for areas with a dry and hot climate.

#### ***Anopheles (Anopheles) subalpinus* Hackett and Lewis 1935**

**Biology:** Larvae can be found in various types of sunlit, stagnant water bodies where aquatic vegetation is present. They occur in swamps, edges of lakes, flooded rice fields, or ponds and avoid shady places and small water collections. Regular breeding sites can be found up to an altitude of about 1200 m (Postiglione et al. 1973). Hibernation of adult females is complete, and caves and abandoned buildings are chosen as winter quarters (Senevet and Andarelli 1956). *An. subalpinus* is regarded as being a strongly zoophilic species, which rarely feeds on humans. Females are endophilic and can be found during the day in large numbers in stables and barns, and very rarely in human dwellings or buildings; the adults are eurygamous.

**Distribution:** *An. subalpinus* is a southern European mosquito with a range from the Iberian Peninsula, through the northern Mediterranean countries to the lowlands around the Caspian Sea.

**Note on systematics:** According to genetic studies and widespread surveys, *An. subalpinus* was formerly regarded as a subspecies of *An. melanoon*. It should merely represent an alternative egg phenotype of *An. melanoon*. The two forms of eggs apparently are intergrading conspecific varieties that occur in pure populations in limited geographical areas (Bates 1940; White 1978). Based on material from Portugal, *An. melanoon* and *An. subalpinus* were treated as two distinct species on account of the differences of their eggs and the apparent area of sympatry of both forms in southwestern Europe (Ribeiro et al. 1980; Ramos et al. 1982). Furthermore, evidence was provided of reproductive isolation between sympatric populations of the two species (Cianchi et al. 1987). Subsequently, regarding *An. subalpinus* as a distinct species of the *Anopheles Maculipennis* Complex was accepted by others (Ward 1992).

**Medical importance of the species of the *Anopheles Maculipennis* Complex:** The anthropophilic species of the complex, such as *An. atroparvus* in coastal Europe, *An. labranchiae* around the west-