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Culex (Culex) tritaeniorhynchus Giles, a newly discovered potential vector of arboviruses in Greece

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Abstract

Culex (Culex) tritaeniorhynchus is recorded from Greece for the first time - the second reported occurrence of this species in political Europe. Collections made in an area of coastal marsh during the summer of 2003 yielded six adult mosquitoes, four reared from larvae collected at three sites and two captured in a light trap. Whether the species is well established in the area is uncertain, but its presence in Greece is a major concern because it is a known vector of arboviruses in areas across southern Asia.

Introduction

In recent decades, entomologists have documented the introduction of a number of mosquito species into regions and countries of the world where they were not previously known to occur. The countries recently infested by these pests are now faced with the potential introduction and local transmission of pathogens known to be vectored by these mosquitoes. Three exotic species, apparently spread by commerce, now occur in Europe: *Aedes albopictus* (Skuse) in Italy (Sabatini *et al*., 1990, Dalla Pozza & Majori, 1992), Albania (Adhami & Reiter, 1998), France (Schaffner *et al*., 2001), Belgium (Schaffner *et al*., 2003) and Serbia & Montenegro (Petrić, pers. comm.), *Ochlerotatus atropalpus* (Coquillett) in Italy (Romi *et al*., 1997) and *Oc. japonicus* (Theobald) in France (Schaffner *et al*., 2003).

While the risk of importation and establishment of exotic vectors and diseases continues to grow, the need to achieve a better understanding of native species and their distributions in relation to climatic, environmental and demographic changes must not be ignored. In this paper, we document the presence of *Culex tritaeniorhynchus* Giles, a potential vector of arboviruses, in an area of Greece where environmental modification is planned to convert a coastal marsh into a national park and protected wetland. The presence of this vector species and the potential for international travellers with arboviral diseases to visit the area increases the risk for autochthonous transmission.

Material and methods

Intensive surveys of the mosquito fauna in the area of Marathon, located some 50 km northeast of Athens, were initiated in May 2003. The study area (24^{o}04'E, 38^{o} 09'N) covers approximately 10 km^{2}along the coast in the Prefecture of Attica. The area includes a coastal marsh separated from the sea by a small wood of pine trees. Several drainage channels emanate from a natural spring and traverse the marsh. The marsh is flooded in early spring, but pools form as the level of the water subsides during the summer.

Mosquito collections were made at weekly intervals throughout the summer. Collections of immature stages were taken to Athens and reared individually in mass in the laboratory. When adults emerged, they were killed in chloroform vapour and mounted on pins. Adults were collected in light traps stationed at four sites around the marsh. Pinned adults and specimens collected in light traps were identified to species using the keys of Samanidou & Harbach (2001). The collections included six mosquitoes, four reared from immature stages (exuviae not retained) and two collected in a light trap, which could not be identified with the keys. These specimens were subsequently identified as *Culex tritaeniorhynchus* Giles using the keys of Harbach (1988) for the species of *Culex (Culex)* that occur in southwestern Asia and Egypt. The genitalia of a male were dissected to confirm this identification. A female (GR 281) and the male with its dissected genitalia mounted on a microscope slide (GR 273B) are retained as vouchers in The Natural History Museum (BNNH), London.

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Results

A single adult of *Cx. tritaeniorhynchus* emerged from each of two larval collections made in diffirent areas of the marsh (some 200 m apart) on 22 July. The water at both sites was shallow, not more than 15 cm deep, coloured with brown algae and contained a moderate amount of submerged and emergent vegetation. Both collections also contained larvae of *Anopheles (Anopheles) sacharovi* Favre and *Cx. (Barraudius) modestus* Ficalbi in high densities, and larvae of *Cx. (Cux.) theileri* Theobald and *Uranotaenia (Pseudoficalbia) unguiculata* Edwards in moderate densities.

A third adult of *Cx. tritaeniorhynchus* emerged form a collection made on 6 August approximately 500 m north of the sites that gave rise to the first two specimens. The water at this site was almost clear. It was also shallow, less than 15 cm deep, and contained green and brown algae and rather dense submerged and emergent vegetation. The other species mentioned above were also found at this site, but in this case larvae of *Cx. modestus* were extremely abundant.

A forth specimen of *Cx. tritaeniorhynchus* emerged from a collection made on 12 August only few meters from the site where the third specimen was found. The water at this site was rather turbid. Algae were absent but a moderate amount of subinerged and emergent vegetation was present. The collection also contained larvae of *An. sacharovi, Cx. modestus, Cx. (Cux.) pipiens* Linnaeus and *Ur. unguiculata*.

Two mosquitoes with entirely dark wings, ringed proboscis and ringed tarsi were captured in a light trap set up on the night of 29 July. The specimens were in poor condition but they were probably *Culex tritaeniorhynchus* since no other *Culex* species in Greece has this combination of characters. *Culex (Cux.) mimeticus* Noe has a ringed proboscis and ringed tarsi, but it is easily distinguished from *Cx. tritaeniorhynchus* by the presence of pale spots on the wings.

Discussion

It is unknown whether *Cx. tritaeniorhynchus* only occurs near Marathon or is more widely distributed in Greece and has gone unnoticed until now. The mosquito fauna is either poorly or completely unknown in many areas of the country. Anopheline mosquitoes were studied intensively in Greece until malaria was eradicated in the 1960s, but a paucity of data dating back to the 1930s is available for culicines. Before 2003, mosquito surveys were last conducted near Marathon in 1996 (by AS). *Culex tritaeniorhynchus* was not found at that time, but the marsh had little water and was largely dry by mid-July. No collections were made in the area before 1996 or between 1996 and 2003. A single record of *Cx. tritaeniorhynchus* in Albania (Danielová & Adhami, 1960; Adhami, 1987) suggests that the species is probably more widely distributed in Greece and has an historical presence in the region. It seems likely that southeastern Europe lies at the periphery of the species' range and the species has been present but undetected in Greece until now.

Culex tritaeniorhynchus is a common species across southern Asia, the Middle East and the Afrotropical Region. It typically breeds in marshes but larvae are also commonly found in rice fields, flood waters, swamps, ponds, ditches, stream margins, grassy pools, seepage and animal footprints. Females generally feed on birds, pigs and other domestic animals but are also attracted to humans both indoors and outdoors. *Culex tritaeniorhynchus* is a vector or potential vector of pathogens that cause human disease. It is the primary vector of Japanese encephalitis in areas of southern Asia. It has been found infected with dengue, Rift Valley fever, Sindbis, Getah and Tembusu viruses, and microfilariae of both *Brugia malayi* and *Wuchereria bancrofti*, in many areas of eastern and southeastern Asia. The presence of *Cx. tritaeniorhynchus* in an area close to the international airport and capital city of Greece is clearly a threat to human health.

The following modifications to specific couplets in the keys of Samanidou & Harbach (2001) and Darsie & Samanidou-Voyadjoglou (1997) are provided to aid the identification of *Cx. tritaeniorhynchus* in Greece.

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Adult females of genus *Culex* (from Samanidou & Harbach, 2001)

7(5). Hindtarsomeres with pale rings; lower mesepimeral seta(e) absent..... 7
Hindtarsomeres without pale rings; lower mesepimeral seta(e) present …….…….…….…….……..... 8

7'(7). Wing with pattern of pale spots; midtibia with anterior pale stripe……..…….……*mimeticus*
Wing and anterior surface of midtibia entirely dark-scaled ..... *tritaeniorhynchus*

Fourth-instar larvae of subgenus *Culex* (from Darsie & Samanidou-Voyadjoglou, 1997)

5(1). Comb scales evenly fringed at sides and apex; pecten spines comb-like, with ventral denticles of similar size arising along entire length….....*tritaeniorhynchus*
Comb scales with sharp apical spine and lateral fringes proximally; pecten spines with long pointed apex and short denticles at base
.....5

5'(5). Seta l3-Twith 6-10 branches; seta 7-I distinctly shorter than 6-I, 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 13-T with 1-3 branches; 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*

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