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POPULATION SURVEY OF MOSQUITO SPECIES IN PROXIMITY TO AN INTERNATIONAL AIRPORT AND OTHER URBAN SITES IN THE UK

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Abstract Twelve sites were sampled for the juvenile stages of mosquito populations and these yielded significant larval and pupal populations. The sites sampled, some close to Manchester Airport, and a number of other urban sites where there had been reported incidences of biting of humans. All sites had the potential to act as breeding zones for mosquitoes. In the study, it was identified that there is a potential conflict at the airport between maintaining a sufficient number of ponds for the indigenous wildlife and not increasing the sites that could be colonised by mosquitoes.
Key Words Mosquitoes, United Kingdom, West Nile Virus, mosquito breeding sites

INTRODUCTION

In recent decades, there has been a significant increase in the number of people using air travel and consequently the number of flights. It is estimated that by the year 2010, almost 950 million people will travel by air annually (Altekruse et al., 1997). The great increase in air travel and the associated shorter journey times elevate the chances of survival of any insects, which may be transported within the aircraft (Gushulak, 1995).

Arthropod-borne infectious diseases that are spread by insect vectors infect many millions of people throughout the World annually. The number of mosquito-borne viruses is constantly being re-classified as emerging" or "re-emerging" in their traditional areas ranges or in completely new geographic locations (Gratz, 1999). West Nile Virus (WNV) is a form of viral encephalitis, which disrupts the function of the CNS and subsequently causes inflammation of the brain tissue in human sufferers. WNV is transmitted generally by mosquitoes in temperate zones between late spring and early autumn and in warmer climates all year around. These times of the year, in general, correspond to mosquito activity. It is therefore a newly emerging arthropod-borne diseases which although not indigenous has been characterized by a number of recorded outbreaks in many European countries relatively recently (Murgue et al., 2002). The recent spread of the disease throughout most of the States in the US is well documented. This continuing geographical expansion of West Nile Virus into areas where little or no previous record of the infection is known raises the question of whether sites in the UK could offer a suitable environment for mosquitoes carrying the virus to survive and breed.

There is a wide range of arthropod species in which WNV has been identified with a recent total (Higgs et al., 2004) of around 75 species of mosquitoes. As these authors emphasize, presence of the virus within the insect species does not necessarily mean that the insect is acting as a vector of the disease. Higgs and colleagues were particularly interested in addressing the question as to which species of mosquito in the UK may be important should WNV be introduced to the UK.

There are 32 species of mosquitoes within the UK. Not all of these feed on humans and birds, which is a pre-requisite for the species to act as a vector of WNV. However, there are 11 species, which do feed on birds and humans (Snow et al., 1998). Whilst there is no evidence that WNV is present in the UK, the Government remains vigilant about the potential threats posed. The Department of Health has issued a WNV contingency plan to protect the public's health and emphasizes the importance of assessing the risks posed by collecting data on, for example the location of breeding sites, the degree of risk biting mosquitoes pose to people in the area, the population density of biting mosquitoes in the area and the extent of local WNV presence in birds, horses, other animals and people. The main hurdle to assessing the risk in a meaningful way is the paucity of information available on most of these factors, and indeed the means by which data would be amassed and if necessary operationalised into effective and efficient treatment regimes.

MATERIALS AND METHODS

Two criteria were used to select sampling sites. Firstly, ponds near dwellings where residents had contacted the City Council about biting insects causing nuisance were sampled to establish the species causing such nuisance. Secondly, ponds in the vicinity of Manchester Airport, where there could be a potential risk from exotic species being imported from WNV endemic areas and establishing in local ponds.

Twelve sites were sampled. These sites could all act as breeding zones for mosquitoes and they were surveyed to confirm the current species of mosquitoes present at the sites.

Sites were surveyed to collect mosquito larvae using fine mesh scoops and the water decanted into plastic containers from where any larval or pupal samples were removed. The removed specimens were placed in 70% alcohol and identified in the laboratory using the Cranston et al. (1987) key. No attempt was made to quantify the density of larvae present at each site.

RESULTS

The mosquitoes found at each site are listed in Table 1. The twelve sites surveyed all contained mosquitoes in some stage of development. Three different species were collected during sampling and all three are known to bite both humans and birds and could therefore act as a vector species for WNV. However, closer examination of the three species suggests a lesser risk than may be expected. Although *Anopheles atroparvus* was, at the turn of the 20th century commonly found resting in domestic premises in the UK and feeding on the occupants, modern and improved housing has made it less likely to feed on humans. It is more commonly found feeding on domestic animals. Feeding on human blood, although rare, does still occur. *Culiseta annulata* feeds on both human and bird blood. It is known to inflict a painful bite in humans. The most common species collected was *Culex pipiens*. This would appear to be an important vector for WNV, and it is an important vector in the US. Whilst it is known to bite humans and birds in the US, this is not the case in the UK, and the presence of this species should not pose a public health threat. However, the taxonomy of the *Culex pipiens* group is complex and the species *Culex pipiens molestus* does bite humans in the UK. It is impossible to separate *Culex pipiens pipiens* from *Culex pipiens molestus* on morphological criteria alone, features of the behaviour have to be taken into consideration.

DISCUSSION

The mosquitoes collected in this study do not represent all the mosquitoes which are present in the area. But it can be seen from the table that there are present mosquitoes which could act as vectors of blood borne diseases in humans. The survey has shown that all the sites sampled during this study, no matter how temporary, are able to maintain active populations of mosquitoes. Two of the species that have been identified, *Culiseta annulata* and *Anopheles atroparvus* are capable of feeding on blood from humans and birds and therefore could act as vectors of WNV should it be introduced to the UK.

The North West of England has been recognised by the Chief Medical Officer of Great Britain as a site, which is likely to facilitate the establishment of the disease in this country. The Department of Health (DOH) in the UK has concerns about the treatment of mosquito breeding sites, should WNV become established and would require Local Authorities to be involved in the treatment of potential breeding sites. The DOH recently established an increased surveillance for WNV for general practitioners and clinicians working in hospitals.

An interesting feature that was encountered during this work was that at the airport there could be a significant potential conflict between ecological and public health concerns. Ecological groups brought considerable pressure to bear on the airport authorities, when the second runway at Manchester was built, because of concerns about the breeding sites of the great crested newt *(Triturus cristatus)*. Since the Second World War, great crested newt populations have drastically declined throughout much of Europe and the species is threatened in several countries. It is believed that Greater Manchester has a high concentration of great crested newt ponds that could be significant in national terms. The great crested newt is listed in Annexes II and IV of the EC Habitats Directive and Appendix II of the Bern Convention. It is protected under Schedule 2 of the Conservation (Natural habitats) Regulations 1994 and Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). This means that the law protects great crested newts against trade, transportation, possession, capture, injury, killing or disturbance. In addition, their habitat also receives legal protection from disturbance. Manchester Airport agreed to establish two ponds for every one pond that had been destroyed during the construction of the second runway following concerns about the impact of the runway on the breeding populations of the great crested newt. Whilst this may have been important ecologically, it also opens up many potential breeding sites for biting insects with a dependency upon water for their life cycles like mosquitoes.

Table 1. The mosquitoes found in sample sites in urban areas of Manchester and in sites surrounding the airport.

SAMPLE SITES	DESCRIPTION	SPECIES IDENTIFIED
Gib Wood	Wooded area close to residential properties	*Culex pipiens* Many larvae *Culiseta annulata* Many larvae
Heaton Park	Public park	*Culex pipiens* Many larvae *Culiseta annulata* and pupae
Swinton Golf Course pond 1	Municipal golf course	*Culex pipiens* Many larvae
Swinton Golf Course pond 2	Municipal golf course	*Culex pipiens* Adult male Pupal cases
Airport – tank surround	Tank adjacent to airport	*Culex pipiens* Many larvae
Crewe Road site	Public fishing pond	*Anopheles atroparvus* Larvae
Airport pond site	Pond near to airport	*Anopheles atroparvus* Larvae
Tyres in copse near Airport	Illegal tyre dump	*Culex pipiens* Many larvae *Culiseta annulata* Many larvae
Tyres near Manchester Airport	Illegal tyre dump	*Culex pipiens* Many larvae
Tyres near Manchester Airport	Illegal tyre dump	*Culex pipiens* Many larvae
Tyres near Manchester Airport	Illegal tyre dump	*Culex pipiens* Many larvae *Culiseta annulata* Many larvae
Nan Nook Woods	Wooded area close to residential properties	*Culex pipiens* Many larvae *Culiseta annulata* Many larvae

Elimination or reduction of habitats, which provide suitable breeding sites for mosquitoes is the most efficient method available for limiting mosquito populations. This regime also helps to minimise the use of potentially harmful pesticides. At Manchester airport the difficulty arises in attempting to satisfy two concerns: maintaining a sufficient number of ponds for the indigenous wildlife and not increasing the sites, which could be colonised by mosquitoes.

It is clear from this study that sites which yielded the most densed populations of mosquitoes, were the tyre dumps near to the airport. Concerns in main land Europe have been raised about *Aedes albopictus* the Asian tiger mosquito being introduced into areas where it had previously not been established via consignments of tyres. Whilst this species has not been recorded in the UK, it could become established and it may well come into the country in some of the many imported tyres. In 2001, over 5.75 million tyres were imported into the UK from various overseas sources (Medlock, 2004). Trying to monitor tyre numbers such as this for mosquito populations is an enormous task.

There are arguments that even if WNV is present in the UK it is unlikely to cause significant problems to human and animal health particularly because the bird population in the UK seems to be unaffected by the virus. Many have looked at the startling way in which WNV has spread throughout the US and parallels are

being sought to evaluate whether a similar spread could occur in the UK. Within the US a large number of vertebrate species have been affected by the virus, with the bird population being dramatically affected leading to rapid spread of the virus. In all the outbreaks reported within Europe the bird population is not affected in the same way (Higgs et al., 2003) and indeed it appears that the bird population has acquired a certain protection from the virus.

The likelihood of WNV becoming established cannot be completely discounted particularly because of significant climatic changes, which have been predicted likely to occur. The introduction or re-introduction of mosquito species and the possible arrival of susceptible bird species completely change the picture. In the UK there is a lack of coordinated information on the location of mosquitoes and their breeding sites. This has been noted by the Chartered Institute of Environmental Health in the UK, which has now established a web site to record mosquito findings. Local authorities, private pest control companies and local entomological clubs are being encouraged to record where species are found.

The major difficulty in attempting to estimate the risk of WNV is the huge uncertainty and lack of understanding of relevant mosquito and bird ecology. At sites of ecological importance this may prove to be even more complex and developing contingency plans to deal with public health threats need to be carefully planned and managed.

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