

REVIEW ARTICLE

Control techniques for *Culicoides* biting midges and their application in the U.K. and northwestern Palaeartic

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Abstract. The recent emergence of bluetongue virus (Reoviridae: *Orbivirus*) (BTV) in northern Europe, for the first time in recorded history, has led to an urgent need for methods to control the disease caused by this virus and the midges that spread it. This paper reviews various methods of vector control that have been employed elsewhere and assesses their likely efficacy for controlling vectors of BTV in northern Europe. Methods of controlling *Culicoides* spp. (Diptera: Ceratopogonidae) have included: (a) application of insecticides and pathogens to habitats where larvae develop; (b) environmental interventions to remove larval breeding sites; (c) controlling adult midges by treating either resting sites, such as animal housing, or host animals with insecticides; (d) housing livestock in screened buildings, and (e) using repellents or host kairomones to lure and kill adult midges. The major vectors of BTV in northern Europe are species from the *Culicoides obsoletus* (Meigen) and *Culicoides pulicaris* (L.) groups, for which there are scant data on breeding habits, resting behaviour and host-oriented responses. Consequently, there is little information on which to base a rational strategy for controlling midges or for predicting the likely impact of interventions. However, data extrapolated from the results of vector control operations conducted elsewhere, combined with some assessment of how acceptable or not different methods may be within northern Europe, indicate that the treatment of livestock and animal housing with pyrethroids, the use of midge-proofed stabling for viraemic or high-value animals and the promotion of good farm practice to at least partially eliminate local breeding sites are the best options currently available. Research to assess and improve the efficacy of these methods is required and, in the longer term, efforts should be made to develop better bait systems for monitoring and, possibly, controlling midges. All these studies will need better methods of analysing the ecology and behaviour of midges in the field than are currently in use. The paucity of control options and basic knowledge serve to warn us that we must be better prepared for the possible emergence of other midge-borne diseases, particularly African horse sickness.

Key words. *Culicoides*, African horse sickness, bluetongue virus, cattle, Ceratopogonidae, horses, sheep, sweet itch, Europe, U.K.

Introduction

Culicoides spp. transmit a range of pathogens affecting livestock, the most important being two orbiviruses: bluetongue virus (BTV) and African horse sickness virus (AHSV), which

affect ruminants and equids, respectively (Mellor *et al.*, 2000). Until recently, the probability of the diseases caused by these viruses occurring in northern Europe had been considered by many to be low, primarily because the major vector of previous orbivirus outbreaks in Europe, *Culicoides imicola* Kieffer, is

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