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Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea

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Abstract

Light trap surveys of adult *Culicoides* Latreille in the Republic of Korea (ROK) resulted in the capture of three previously unreported species, *C. nasuensis* Kitaoka, *C. pallidulus* Yu and *C. jacobsoni* Macfie. These new records are supported by supplementary morphological descriptions and DNA barcodes (mitochondrial cytochrome oxidase I or COI). An updated checklist of species reported from the ROK is provided.

Key words: DNA barcodes, *Culicoides pallidulus*, *Culicoides nasuensis*, *Culicoides jacobsoni*, Korea

Introduction

Biting midges of the genus *Culicoides* Latreille are important pests of humans and livestock and many species act as vectors of important medical and veterinary pathogens (Mellor *et al.* 2000). Kim *et al.* (2012) provided a brief summary of the history of research into the *Culicoides* fauna of the Republic of Korea (ROK) noting the presence of several species of medical and veterinary importance. There are currently 28 species of *Culicoides* reported from the ROK (Cho & Chong 1974; Wada 1990) and the presence of additional species has been reported by Cho & Chong (1974), Kang & Yu (1991) and Lee (1993), suggesting that the fauna has not yet been fully documented. Additionally, recent uses of DNA barcoding (Hebert *et al.* 2003), by Pagés *et al.* (2009), Ander *et al.* (2012) and Bellis *et al.* (2013) have clarified the status of several species of *Culicoides* elsewhere and if applied more fully to Korean material, will likely reveal more records and perhaps new species.

Surveys of adult biting midges from the southern part of the ROK resulted in the discovery of three species previously not known from the ROK. This paper reports the presence of *C. nasuensis* Kitaoka, *C. pallidulus* Yu and *C. jacobsoni* Macfie from the ROK and provides supplementary morphological and molecular data for these species and an updated checklist of the *Culicoides* fauna of the ROK.

Methods and Material

Culicoides and other biting flies were collected using black light traps set near nine cowsheds, as described by Kim *et al.* (2012), and New Jersey light traps set at 10 US army installations and one military training site from May to October, 2010–2011 as part of the 65th Medical Brigade (Eighth US Army, ROK) arthropod-borne disease surveillance program. Black light and New Jersey light traps were placed 1.5 m above the ground and operated for