Giant whiteflies (Sternorrhyncha, Aleyrodidae): a discussion of their taxonomic and evolutionary significance, with the description of a new species of *Udamoselis* Enderlein from Ecuador

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Three adult male whitefly specimens from Ecuador are described as *Udamoselis estrellamarinae* sp. n. This genus and its subfamily are reappraised on adult characters, including wing venation, paronychium structure, and distribution of abdominal wax glands. In the absence of associated puparia nomenclatural caution is preferred, but the subfamilies Udamoselinae and Aleurodicinae are likely to be synonymous. Wing venation of other very large whiteflies is illustrated, and is discussed in comparison with fossil taxa. Speculation is made on the possible biology of such giant whitefly species.

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Introduction

In an account of the history of higher systematics in the Aleyrodidae, Russell (2000) stated that five whitefly subfamily names have been used for extant taxa. Of these, Uraleyrodinae Sampson & Drews (1941) was found to be synonymous with Aleyrodinae Westwood (1840), based on a study of adult characters by Russell (1986). Takahashi (1932) had erected the subfamily Siphonaleyrodinae solely for his new species *Siphonaleyrodes formosanus*, which is clearly a member of the psylloid family Triozidae, and which was placed as a junior synonym of *Trioza cinnamomi* (Boselli, 1930) by Mound & Halsey (1978), a view with which Russell (2000) concurred. The oldest-established subfamily, Aleyrodinae, is generally accepted and regarded as well defined by adult and nymphal [puparial] characters (Gill 1990). This leaves Udamoselinae Enderlein (1909) and Aleurodicinae Quaintance & Baker (1913) whose controversial relationship is the subject of this paper. The genus *Udamoselis*, the species *U. pigmentaria* and the subfamily Udamoselinae were all proposed by Enderlein (1909), based upon his study of a single adult male specimen. Enderlein’s specimen has subsequently never been traced, and is thought to have been lost during the upheavals of the Second World War. As well as being described from a single specimen, no satisfactory collecting locality is known and Enderlein simply gave this as ‘in all probability South America’, indicating that the specimen must have been given to him. Enderlein also included *Aleurodicus* Douglas (1892) in his new subfamily, without any discussion.

Quaintance & Baker (1913) discussed whitefly wing venation in detail, illustrating a range of actual and theoretical patterns (Fig. 33). They proposed an other new subfamily, Aleurodicinae, accommodating *Aleurodicus, Dialeurodicus* Cockerell (1902), their own new genus *Leonardius* and *Paraleyrodes* Quaintance (1909), whilst continuing to accept Enderlein’s subfamily Udamoselinae for *Udamoselis* alone. Their reason for supporting a separate subfamily for *Udamoselis* was the more complex wing venation described and illustrated by Enderlein (Fig. 7), but the insect’s enormous size (Table 1) may well have also been a factor in their decision. The

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relative complexity of the wing venation and great body size, in turn, have been regarded as possible evidence that *Udamoselis* might be a particularly primitive whitefly, and thus form a link between the other present-day taxa and species described from the fossil record (such as by Schlee 1970, Shcherbakov 2000, and Hamilton 1990).

*U. pigmentaria* was regarded as a *nomen dubium* by Mound & Halsey (1978: 250), on the basis of inadequate description of the adult, combined with the absence of knowledge of the puparial stage upon which most whitefly taxonomy is now based. Enderlein's description of the solitary male did indeed omit mention of some characters that are now thought likely to be important in the systematics of adults, and this supported the proposal that it be regarded as *nomen dubium*. Perhaps most importantly, Enderlein's description and illustration of the fore and hind wings (see Fig. 7, here) showed a venation that is considerably more complex than had been seen in any other known extant whiteflies: this raised a question as to whether all the firm lines in Enderlein's drawings were truly veins and, hence, whether his illustrations were accurate.

Leaving aside the uncertainty over wing venation, the absence of any detail of such characters as abdominal wax glands or tarsal paronychium, the loss of the antennal flagellum in his sole specimen, and the lack of optical resolution available to Enderlein [he stated that no empodial paronychium was visible with his ‘magnifying glass’], his description was nonetheless remarkably detailed if sometimes rather ambiguous. With the considerable importance of this taxon Quaintance & Baker (1913) provided a complete English translation of Enderlein’s description of *U. pigmentaria* and this translation has been extensively consulted in the course of the present study. In the absence of study material, Mound and Halsey’s (1978) decision to regard *U. pigmentaria* as *nomen dubium* was pragmatic, allowing the continuing use of Aleurodicinae as the name for the numerically smaller of only two extant whitefly subfamilies, accommodating about eight percent of described whiteflies.

Schlee (1970) stated that ‘The systematic position of *Udamoselis* within the Aleyrodina cannot be elaborated until a new find is made, because of the insufficient present knowledge based upon the single specimen, which has probably been destroyed. The assumed close kinship relation between *Udamoselis* and the Aleurodicidae [i.e. Aleurodicinae] is unproved’. In contrast, Shcherbakov (2000) said: ‘... despite an incomplete knowledge of the type genus, the name *Udamoselinae* should be used in the broad sense of Enderlein (1909) and Sampson (1943), i.e. including Aleurodicinae.’

Three new specimens recently collected in Ecuador correlate with Enderlein’s description sufficiently well to be regarded as belonging to *Udamoselis*, thus allowing this intriguing controversy to be reappraised. Many of the attributes described by Enderlein for *U. pigmentaria* are apparently accurate, although other parts of his description remain ambiguous through the absence of the original specimen, combined with Enderlein’s failure to provide any illustrations beyond the wings. Nevertheless the author now considers it quite likely that *U. pigmentaria* itself will prove to be identifiable, in the event of new material becoming available, and its identity should no longer be regarded as *nomen dubium*. However, the subfamilial position of *Udamoselis* remains somewhat uncertain, as will be discussed later in this paper.

Examination of the three males from Ecuador has revealed their wings (Figs 5, 6) to display the identical venation illustrated by Enderlein (Fig. 7), but has confirmed that not all veins are as distinct as implied by Enderlein’s simplified line drawings. Comparison of the Ecuadorean material with the description of *U. pigmentaria* leads to the conclusion that the two taxa are congeners but are distinct species. Despite the small sample size, and frustrating lack of females and (especially) of puparia, it is felt that naming the Ecuadorean species is valid because of the wider interest in higher systematics that these specimens are likely to generate. *Udamoselis estrellamarinae* is therefore here described, and is named for its discoverer (see below).

Materials, methods and terminology

Background

In 2005 the author visited Ecuador, in company with Dra Estrella Hernández-Suárez and Sr Elicio Tapia. The purpose was to search for whitefly colonies that might yield natural enemies of the pest species, *Lecanoides floccissimus* Martin, Hernández-Suárez & Carnero, 1997, in connection with achieving its natural control in the Canary Islands. Whilst sorting collected material for possible rearing of parasitoids, Hernández-Suárez noticed three very large, darkly-pigmented and relatively wax-free adult male whiteflies inside a bag containing a substantial colony of *Lecanoides mirabilis* (Cockerell, 1898) on *Annona* leaves. An extensive search of other bags of material from the same garden tree failed to reveal any additional specimens. The three specimens were brought back to the laboratory at the Natural History Museum, London, for further study.