Recent introductions of aedine species (Diptera: Culicidae: Aedini) into new geographic areas

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Abstract

Information on introductions to new geographic areas of species in the aedine generic-level taxa Aedimorphus, Finlaya, Georgecraigius, Halaedes, Howardina, Hulecoeteomyia, Rampamyia, Stegomyia, Tanakaius and Verrallina is provided.

Key words: Aedimorphus, Finlaya, Georgecraigius atropalpus, Halaedes australis, Howardina bahamensis, Hulecoeteomyia japonica japonica, Rampamyia notoscripta, Stegomyia aegypti, Stegomyia albopicta, Tanakaius togoi, Verrallina

Introduction

As indicated in the series of papers on the phylogeny and classification of mosquitoes in tribe Aedini (Reinert et al., 2004, 2006, 2008), some aedine species have been introduced into new geographical areas in recent times. Species of Aedini found outside of their natural ranges are listed below with their literature citations.

Introductions of Aedine Species to New Areas

Stegomyia aegypti (Linnaeus) represents the oldest species of Aedini with recorded information on introductions to new geographic areas. Christophers (1960) in his book on this species reported “It has been suggested that the original home of A. aegypti was the New World. Dyar (1928), however, notes that there are no nearly related species in the American continent, but many such in the Old World, especially in Africa, and he considered that it was probably the African continent from which the species originated”. Christophers also noted that “The species is almost the only, if not the only, mosquito that, with human agency, is spread around the whole globe. But in spite of this wide zonal diffusion its distribution is very strictly limited by latitude and as far as present records go it very rarely occurs beyond latitudes of 45° N. and 35° S.” Dyar (1928) stated “In the early days of navigation, with long voyages and water conserved in open wooden receptacles, the species readily bred on board ship, and was carried wherever the vessel went”. Dyar also suggested that the species was brought to America in the
early days, perhaps by Columbus himself. Mattingly (1957) tended to favor the southern Palaearctic Region over Africa south of the Sahara as the possible sites of origin of *St. aegypti*. Belkin (1962), however, reported that this species is undoubtedly a native of the Ethiopian Region (currently known as the Afrotropical Region) where the majority of the other members of the group are found. He also indicated that “The dispersal of *aegypti* may very well have been started by the Portuguese in their circuitous route to the Indies, which included stops in West Africa and eastern Brazil before rounding the Cape of Good Hope. Belkin et al. (1970) stated “The ubiquitous and universally known *aegypti* is an African species now widely distributed throughout the world within the 20° C isotherms, usually in close association with human settlements”. Powell et al. (1980) reported on a multivariate discriminant analysis that was based on sequences of *St. aegypti* from 34 populations collected in Africa, Asia, the Caribbean, North America and South America. Their results indicated that these populations were sufficiently genetically differentiated to allow a strong inference of the geographical origin of a population. Tabachnick (1991) provided insights on introductions, reintroductions and multiple introductions of *St. aegypti* into various areas of the world based primarily on the genetic composition of the various populations. It is noted that evaluation of the sources and times of population introductions to the New World has been complicated by the attempts during the 1960s to eradicate previous *St. aegypti* populations from much of this geographical area. During recent decades, the range and prevalence of *St. aegypti* have been reduced in a number of areas such that the species is now apparently absent around much of the Mediterranean basin and has become scarce or localized in the southern United States of America (USA) (see O’Meara et al., 1993) partly due to competitive displacement by the more recently invasive *St. albopicta*.

*Stegomyia albopicta* (Skuse), a species of probable Asian origin, has been introduced into many areas of the world by the used tire trade, as summarized by Mitchell (1995) and Reiter (1998). Ventrillon (1904) first reported this species in Madagascar but the wider current distribution in this country is provided by Fontenille & Rodhain (1989). Examples of introductions of this species during the recent past have been reported from the USA (e.g., Sprenger & Wuitiranyagool, 1986; O’Meara et al., 1993; Reiter, 1998; Madon et al., 2002, 2003), Brazil (Forattini, 1986), Albania (Adhami & Murati, 1987; Adhami & Reiter, 1998), Italy (Sabatini et al., 1990; Dalla Pozza & Majori, 1992), Fiji Islands (Laille et al., 1990; Mitchell, 1995), Australia (Kay et al., 1990; Ritchie et al., 2006), South Africa (Hunt et al., 1990; Cornell & Hunt, 1991), Nigeria (Savage et al., 1992), Dominican Republic (Pena, 1993), New Zealand (Laird et al., 1994), Mexico (Ibáñez-Bernal & Martínez-Campos, 1994; Casas-Martínez & Estrata, 2003), Papua New Guinea (Mitchell, 1995), Guatemala (Ogata & Samayoa, 1996), Argentina (Rossi et al., 1999), Cuba (Broche & Borja, 1999), France (Schaffner & Karch, 2000; Schaffner et al., 2001), Cameroon (Toto & Fontenille, 2001), Equatorial Guinea (Toto et al., 2003), Serbia and Montenegro (Schaffner, 2003), Trinidad, West Indies (Chadee et al., 2003),
Belgium (Schaffner et al., 2004), Nicaragua (Lugo et al., 2005), Croatia (Klobucar et al., 2006; Merdic et al., 2009), Spain (Aranda et al., 2006), the Netherlands (Scholte et al., 2007, 2008), Gabon (Coffinet et al., 2007), Lebanon and Syria (Haddad et al., 2007), Germany (Pluskota et al., 2008), and other countries as listed by Reiter (1998), i.e. Barbados, Bolivia, Cayman Islands, Columbia and El Salvador. These countries are only a partial listing of those recently inhabited by this species, which poses a risk to human health as a potential vector of pathogens. The article by Enserink (2008) “A mosquito goes global” records how rapidly this species has spread throughout new areas.

Introductions continue as exemplified by the discovery of Hulecoeteomyia japonica japonica (Theobald) in the eastern USA (Peyton et al., 1999), 21 states in the USA and Canada (Widdel et al., 2005), Washington, USA (Roppo et al., 2004, Sames & Pehling, 2005), Hawaii, USA (Larish & Savage, 2005), Oregon, USA (Irish & Pierce, 2008), France and Belgium (Schaffner et al., 2003) and Switzerland (Schaffner & Mathis, 2009). Fonseca et al. (2001) attempted to identify the putative source of populations in the eastern USA of Hl. japonica. Also, Tanakaius togoi (Theobald) was introduced into the Pacific southwest of Canada and northwest of the USA (Meredith & Phillips, 1973; Trimble & Wellington, 1979; Wood et al., 1979; Belton, 1980; Belton & Belton, 1990; Sames et al., 2004); Georgecraigius atropalpus (Coquillett) was introduced into Italy (Romi et al., 1997) and Howardina bahamensis (Berlin) was introduced into Florida, USA (Pafume et al., 1988; O’Meara et al., 1995).

Two aedine species that have been introduced into the Hawaiian Islands, St. aegypti (widespread by 1892) and St. albopicta (numerous in 1902), were noted by Usinger (1944). Ward (1984) provided a case history of mosquitoes, including species of Aedini, introduced onto the western Pacific island of Guam (Mariana Islands). Laird et al. (1994) discuss the importation of the following exotic species into New Zealand: Halaedes australis (Erichson), Hulecoeteomyia japonica, Rampamyia notoscripta (Skuse) and Stegomyia albopicta. Belkin (1962) provided interesting observations on the “Bionomics and Dispersal” of mosquitoes (p. 46) and “Mosquitoes and Human Migrations” (p. 65). In the latter section (pp. 65–66) he discussed the spread of aedine species in the southern Pacific islands of the following generic-level taxa: Aedimorphus Theobald, Finlaya Theobald, Rampamyia Reinert, Harbach & Kitching, Stegomyia Theobald and Verrallina Theobald.

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References


source populations. *Journal of Medical Entomology* 38, 135–146.


Mosquito Control Association 20, 201–203.