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

John F. Reinert

Center for Medical, Agricultural and Veterinary Entomology (CMAVE), United States Department of Agriculture, Agricultural Research Service, 1600/1700 S.W. 23rd Drive, Gainesville, FL 32608-1067, USA, Email: John.Reinert@ars.usda.gov.

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^{o} N. and 35^{o} 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^{o} 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 & Wuithiranyagool, 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

Adhami, J. & Murati, N. (1987) Prani e mushkonjës *Aedes albopictus* në Shqipëri. *Revista Mjekësore* **1**, 13−16.

Adhami, J. & Reiter, P. (1998) Introduction and establishment of *Aedes* (*Stegomyia*) *albopictus* Skuse (Diptera: Culicidae) in Albania. *Journal of the American Mosquito Control Association* **14**, 340−343.

Aranda, C., Eritja, R. & Roiz, D. (2006) First record and establishment of the mosquito *Aedes albopictus* in Spain. *Medical and Veterinary Entomology* **20**, 150−152.

Belkin, J.N. (1962) *The mosquitoes of the South Pacific* (Diptera, Culicidae) [*sic*]. Volumes I and II. University of California Press, Berkeley and Los Angeles, CA.

Belkin, J.N., Heinemann, S.J. & Page, W.A. (1970) Mosquito studies (Diptera, Culicidae) XXI. The Culicidae of Jamaica. *Contributions of the American Entomological Institute (Ann Arbor)* **6**(1), 1−458.

Belton, P. (1980) The first record of *Aedes togoi* (Theo.) in the United States−aboriginal or ferry passenger ? *Mosquito News* **40**, 624−626.

Belton, P. & Belton, O.C. (1990) *Aedes togoi* comes abroad. *Journal of the American Mosquito Control Association* **6**, 328−329.

Broche, R.G. & Borja, E.M. (1999) *Aedes albopictus* in Cuba. *Journal of the American Mosquito Control Association* **15**, 569−570.

Christophers, S.R. (1960) *Aëdes aegypti* [*sic*] *(L.) the yellow fever mosquito, its life history, bionomics and structure*. The University Press, Camridge, UK.

Carnevale, P. & Pages, F. (2007) First record of *Aedes albopictus* in Gabon. *Journal of the American Mosquito Control Association* **23**, 471−472.

Casas-Martínez, M. & Torres-Estrada, J.L. (2003) First evidence of *Aedes albopictus* (Skuse) in sountern Chiapas, Mexico. *Emerging Infectious Diseases Journal* **9**(5), 2 pp.

Chadee, D.D., Fat, F.H. & Persad, R.C. (2003) First record of *Aedes albopictus* from Trinidad, West Indies. *Journal of the American Mosquito Control Association* **19**, 438−439.

Cornel, A.J. & Hunt, R.H. (1991) *Aedes albopictus* in Africa? First records of live specimens in imported tires in Cape Town. *Journal of the American Mosquito Control Association* **7**, 107−108.

Dolla Pozza, G. & Majori, G. (1992) First record of *Aedes albopictus* establishment in Italy. *Journal of the American Mosquito Control Association* **8**, 318−320.

Dyar, H.G. (1928) The mosquitoes of the Americas. Carnegie Institution of Washington, USA.

Enserink, M. (2008) A mosquito goes global. *Science* **320**(5878), 864−866.

Fonseca, D.M., Campbell, S., Crans, W.J., Mogi, M., Miyagi, I., Toma, T., Bullians, M., Andreadis, T.G., Berry, R.L., Pagac, B., Sardelis, M.R. & Wilkerson, R.C. (2001) *Aedes* (*Finlaya*) *japonicus* (Diptera: Culicidae), a newly recognized mosquito in the United States: Analyses of genetic variation in the United States and putative

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

Fontenille, D. & Rodhain, F. (1989) Biology and distribution of *Aedes albopictus* and *Aedes aegypti* in Madagascar. *Journal of the American Mosquito Control Association* **5**, 219−225.

Forattini, O.P. (1986) Identificacão de *Aedes* (*Stegomyia*) *albopictus* no Brasil. *Revista Saude Publica São Paulo* **20**, 244−245.

Haddad, N., Harbach, R.E., Chamat, S. & Bouharoun-Tayoun, H. (2007) Presence of *Aedes albopictus* in Lebanon and Syria. *Journal of the American Mosquito Control Association* **23**, 226−228.

Hunt, R.H., Cornel, A.J. & Coetzee, M. (1990) *Aedes albopictus*: An unwelcome introduction to Cape Town. *South African Journal of Epidemiology and Infect*. **5**, 9−10.

Ibáñex-Bernal & Martínez-Campos, C. (1994) *Aedes albopictus* in Mexico. *Journal of the American Mosquito Control Association* **10**, 231−232.

Irish, S.R. & Pierce, C.S. (2008) Update on the distribution of *Ochlerotatus japonicus* in Oregon and Washington. *Journal of the American Mosquito Control Association* **24**, 110−111.

Kay, B.H., Ives, W.A., Whelan, P.I., Barker-Hudson, P., Fanning, I.D. & Marks, E.N. (1990) Is *Aedes albopictus* in Australia? *Medical Journal of Australia* **153**, 31−34.

Klobucar, A., Merdic, E., Benic, N., Baklaic, Z. & Krcmar, S. (2006) First record of *Aedes albopictus* in Croatia. *Journal of the American Mosquito Control Association* **22**, 147−148.

Laird, M., Calder, L., Thornton, R.C., Syme, R., Holder, P.W. & Magi, M. (1994) Japanese *Aedes albopictus* among four mosquito species reaching New Zealand in used tires. *Journal of the American Mosquito Control Association* **10**, 14−23.

Larish, L.B. & Savage, H.M. (2005) Introduction and establishment of *Aedes* (*Finlaya*) *japonicus japonicus* (Theobald) on the island of Hawaii: Implications for arbovirus transmission. *Journal of the American Mosquito Control Association* **21**, 318−321.

Laille, P.M., Fauran, P. & Rodhain, F. (1990) Note sur la presence d'*Aedes* (*Stegomyia*) *albopictus* dans les Iles Fidji. *Bulletin de la Societe de Pathologie Exotique* **83**, 394−398.

Lugo, E.C., Moreno, G., Zachariah, M.A., López, M.M., López, J.D., Delgado, M.A., Valle, S.I., Espinoza, P.M., Salgado, M.J., Pérez, R., Hammond, S.N. & Harris, E. (2005) Identification of *Aedes albopictus* in urban Nicaragua. *Journal of the American Mosquito Control Association* **21**, 325−327.

Madon, M.B., Mulla, M.S., Shaw, M.W., Kluh, S. & Hazelrigg, J.E. (2002) Introduction of *Aedes albopictus* (Skuse) in southern California and potential for its establishment. *Journal of Vector Ecology* **27**, 149−154.

Madon, M.B., Hazelrigg, J.E., Shaw, M.W., Kluh, S. & Mulla, M.S. (2003) Has *Aedes albopictus* established in California? *Journal of the American Mosquito Control Association* **19**, 297−300.

Mattingly, P.F. (1957) Genetical aspects of the *Aëdes aegypti* problem I.– Taxonomy and bionomics. *Annals of Tropical Medicine and Parasitology* **51**(4), 392–408.

Merdic, E., Zitko, T., Jelicic, Z. & Klobucar, A. (2009) Spreading of *Aedes albopictus* on Croation islands by boats and yachts. Paper 5.1, Conference Programme and Abstract Book, 5th European Mosquito Control Association Workshop, Turin, Italy.

Meredith, J. & Phillips, J.E. (1973) Ultrastructure of anal papillae from a seawater mosquito larva (*Aedes togoi* Theobald). *Canadian Journal of Zoology* **51**, 349–353.

Mitchell, C.J. (1995) Geographic spread of *Aedes albopictus* and potential for involvement in arbovirus cycles in the Mediterranean basin. *Journal of Vector Ecology* **20**, 44−58.

Ogata, K. & Samayoa, A.L. (1996) Discovery of *Aedes albopictus* in Guatemala. *Journal of the American Mosquito Control Association* **12**, 503−506.

O'Meara, G.F., Evans, L.F. Jr., Gettman, A.D. & Patterson, A.W. (1995) Exotic tank bromeliads harboring immature *Aedes albopictus* and *Aedes bahamensis* (Diptera: Culicidae) in Florida. *Journal of Vector Ecology* **20**, 216−224.

O'Meara, G.F., Gettman, A.D., Evans Jr., L.F. & Curtis, G.A. (1993) The spread of *Aedes albopictus* in Florida. *American Entomologist* **39**, 163−172.

Pafume, B.A., Campos, E.G., Francy, D.B., Peyton, E.L., Davis, A.N. & Nelms M. (1988) Discovery of *Aedes* (*Howardina*) *bahamensis* in the United States. *Journal of the American Mosquito Control Association* **4**, 380.

Pena, C. (1993) First report of *Aedes* (*Stegomyia*) *albopictus* (Skuse) from the Dominican Republic. *Society of Vector Ecology* **24**, 4−5.

Peyton, E.L., Campbell, S.R., Candeletti, T.M., Romanowski, M. & Crans, W.J. (1999) *Aedes* (*Finlaya*) *japonicus japonicus* (Theobald), a new introduction into the United States. *Journal of the American Mosquito Control Association* **15**, 238−241.

Pluskota, B., Storch, V., Braunbeck, T., Beck, M. & Becker, N. (2008) First record of *Stegomyia albopicta* (Skuse) (Diptera: Culicidae) in Germany. *Journal of the European Mosquito Control Association* **26**, 1−5.

Powell, J.R., Tabachnick, W.J. & Arnold, J. (1980) Genetics and the origin of a vector population: *Aedes aegypti*, a case study. *Science* **208**, 1385−1387.

Reinert, J.F., Harbach, R.E. & Kitching, I.J. (2004) Phylogeny and classification of Aedini (Diptera: Culicidae) based on morphological characters of all life stages. *Zoological Journal of the Linnean Society* **142**, 289−368.

Reinert, J.F., Harbach, R.E. & Kitching, I.J. (2006) Phylogeny and classification of *Finlaya* and allied taxa (Diptera: Culicidae: Aedini) based on morphological data from all life stages. *Zoological Journal of the Linnean Society* **148**, 1−101.

Reinert, J.F., Harbach, R.E. & Kitching, I.J. (2008) Phylogeny and classification of *Ochlerotatus* and allied taxa (Diptera: Culicidae: Aedini) based on morphological data from all life stages. *Zoological Journal of the Linnean Society* **153**, 29−114.

Reiter, P. (1998) *Aedes albopictus* and the world trade in used tires, 1988−1995: The shape of things to come? *Journal of the American*

Mosquito Control Association **14**, 83−94.

Ritchie, S.A., Moore, P., Carruthers, M., Williams, C., Montgomery, B., Foley, P., Ahboo, S., van den Hurk, A.F., Lindsay, M.D., Cooper, B., Beebe, N. & Russell, R.C. (2006) Discovery of a widespread infestation *of Aedes albopictus* in the Torres Strait, Australia. *Journal of the American Mosquito Control Association* **22**, 358−365.

Romi, R., Sabatinelli, G., Savelli, L.G., Raris, M., Zago, M. & Malatesta, R. (1997) Identification of a North American mosquito species, *Aedes atropalpus* (Diptera: Culicidae), in Italy. *Journal of the American Mosquito Control Association* **13**, 245−246.

Roppo, M.R., Lilia, J.L., Maloney, F.A. & Sames, W.J. (2004) First occurrence of *Ochlerotatus japonicus* in the state of Washington. *Journal of the American Mosquito Control Association* **20**, 83−84.

Rossi, G.C., Pascual, N.T. & Krsticevic, F.J. (1999) First record of *Aedes albopictus* (Skuse) from Argentina. *Journal of the American Mosquito Control Association* **15**, 422.

Sabatini, A., Raineri, V., Travato, G. & Coluzzi, M. (1990) *Aedes albopictus* in Italia e possiblile diffusione della specie nell'area mediterranea. *Parassitologia* **32**, 301−304.

Sames, W.J. & Pehling, D. (2005) Update on *Ochlerotatus japonicus* in the state of Washington. *Journal of the American Mosquito Control Association* **21**, 98−99.

Sames, W.J., Herman, W.E., Frorin, D.A. & Maloney, F.A. (2004) Distribution of *Ochlerotatus togoi* along the Pacific coast of Washington. *Journal of the American Mosquito Control Association* **20**, 105−109.

Savage, H.M., Ezike, V.I., Nwankwo, C.A.N., Spiegel, R. & Miller, B.R. (1992) First record of breeding populations of *Aedes albopictus* in continental Africa: Implications for arboviral transmission. *Journal of the American Mosquito Association* **8**, 101−103.

Schaffner, F. (2003) Mosquitoes in used tyres in Europe: Species list and larval key. *European Mosquito Bulletin* **16**, 7−12.

Schaffner, F. & Karch, S. (2000) Première observation d'*Aedes albopictus* (Skuse, 1894) en France métropolitaine. *Comptes Rendus de l'Academie des Sciences Paris, Sciences de la vie/Life Sciences* **323**, 373−375.

Schaffner, F. & Mathis, A. (2009) Emergence of *Aedes japonicus* in central Europe. Paper 5.2, Conference Programme and Abstract Book, 5th European Mosquito Control Association Workshop, Turin, Italy.

Schaffner, F., Boulétreau, B., Guillet, B., Guilloteau, J. & Karch, S. (2001) *Aedes albopictus* (Skuse, 1894) established in metropolitan France. *Journal of the European Mosquito Control Association* **9**, 1−2.

Schaffner, F., Chouin, S. & Guilloteau, J. (2003) First record of *Ochlerotatus* (*Finlaya*) *japonicus japonicus* (Theobald, 1901) in metropolitan France. *Journal of the American Mosquito Control Association* **19**, 1−5.

Schaffner, F., van Bortel, W. & Coosemans, M. (2004) First record of *Aedes* (*Stegomyia*) *albopictus* in Belgium. *Journal of the American*

Mosquito Control Association **20**, 201−203.

Scholte, E-J., Jacobs, F., Linton, Y-M., Dijkstra, E., Fransen, J. & Takken, W. (2007) First record of *Aedes (Stegomyia) albopictus* in the Netherlands. *Journal of the European Mosquito Control Association* **22**, 5−9.

Scholte, E-J., Dijkstra, E., Blok, H., de Vries, A., Takken, W., Hofhuis, A., Koopmans, M., de Boer, A. & Reusken, C.B.E.M. (2008) Accidental importation of the mosquito *Aedes albopictus* into the Netherlands: A survey of mosquito distribution and the presence of dengue virus. *Medical and Veterinary Entomology* **22**, 352−358.

Sprenger, D. & Wuithiranyagool, T. (1986) The discovery and distribution of *Aedes albopictus* in Harris County, Texas. *Journal of the American Mosquito Control Association* **2**, 217−219.

Tabachnick, W.J. (1991) Evolutionary genetics and arthropod-borne disease: The yellow fever mosquito. *American Entomologist* **37**(1), 14-24.

Toto, J-C., Abaga, S., Carnevale, P. & Simard, F. (2003) First report of the Oriental mosquito *Aedes albopictus* on the west African island of Bilko, Equatorial Guinea. *Medical and Veterinary Entomology* **17**, 343−346.

Toto, J-C. & Fontenille, D. (2001) *Aedes* (*Stegomyia*) *albopictus* (Skuse), as potential new dengue vector in southern Cameroon. *Emerging Infectious Diseases* **7**, 1066−1067.

Trimble, R.M. & Wellington, W.G. (1979) Colonization of North American *Aedes togoi*. *Mosquito News* **39**, 18−20.

Usinger, R.L. (1944) Entomological phases of the recent dengue epidemic in Honolulu. *Public Health Reports, United States Public Health Service* **59**(13), 423−430.

Ventrillon, E. (1904) Description de culicids de Madagascar. *Bulletin Museum Naturelle Histoire Paris* **12**, 143−145.

Widdel, A.K., McCuistaon, L.J., Crans, W.J., Kramer, L.D. & Fonseca, D.M. (2005) Finding needles in the haystack: Single copy microsatellite loci for *Aedes japonicus* (Diptera: Culicidae). *American Journal of Tropical Medicine and Hygiene* **73**, 744−748.

Ward, R.A. (1984) Mosquito fauna of Guam: Case history of an introduced fauna. Chapter 8, pp. 143−162. *In*: Laird, M. (ed.). *Commerce and the spread of pests and disease vectors*. Praeger Scientific, New York.

Wood, D.M., Dang, P.T. & Ellis, R.A. (1979) *The insects and arachnids of Canada Part 6. The mosquitoes of Canada Diptera: Culicidae*. Canadian Government Publishing Centre, Supply and Services Canada, Hull, Quebec, Canada.