

## Scientific Note

## New record and updated checklists of the mosquitoes of Afghanistan and Iraq

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This report includes a new distribution record and updated checklists of the mosquitoes known to occur in both Afghanistan and Iraq, based on our field collections from various localities during 2003-2005 and on accessioned specimens deposited in the U. S. National Museum of Natural History (USNMNH), Smithsonian Institution, Washington, D.C.

**a. AFGHANISTAN.** The mosquitoes of Afghanistan (33° 00' N, 65° 00' E) have been documented by several workers (e.g., Buck et al. 1972, Ward 1972, Arsenëva and Nerenov 1978, Danilov 1978, 1985a, 1985b, Harbach 1988, Glick 1992). Danilov (1985a, 1985b) recorded 38 species in five genera (i.e., *Aedes*, *Anopheles*, *Coquillittidia*, *Culiseta*, and *Uranotaenia*), while Ward (1972) listed only 28 species in four genera. Glick (1992) noted 21 species of *Anopheles* (subgenera *Anopheles* and *Cellia*), and Harbach (1988) observed seven species of *Culex* (subgenus *Culex*) from the country. To better understand the mosquito fauna of Afghanistan, adult collections were conducted from various localities from May to September 2005. Adults were collected with a modified miniature Centers for Disease Control light trap, baited with light only and hung from a tree branch or from a wall of the building about 1.8 m above the ground. Most adult specimens were killed in trap jars with insecticidal strip (2,2 dichlorovinyl dimethyl phosphate, 10%) and mounted on points on pins. In addition, mosquito specimens deposited in the USNMNH were examined and identified, and their collection data were recorded. Coordinates for localities or collection sites of museum specimens were recorded using gazetteers of the U.S. Board on Geographic Names (1971), Global Gazetteer (2007), and Biogeomancer (2008). Specimens were identified to species using keys and descriptions from pertinent literature (e.g., Gutsevich et al. 1971, Harbach 1988, and Glick 1992).

In Afghanistan, we collected 108 adults from various localities in five provinces (Kandahar, Kabul, Nangarhar, Khowst, and Parwan). In addition, we also examined 367 adults, one larva and eight male genitalia, of the USNMNH collections (recorded from 1942-1970) from four provinces (Bamiyan, Helmand, Heart, and Kunduz). Overall, from both collections, we identified 15 species in five genera (*Aedes*, *Anopheles*, *Culex*, *Culiseta* and *Uranotaenia*), and

two unidentified species (*Culex* (*Cux.*) sp. and *Anopheles* (*Cel.*) sp.) (Table 1). We report *Cx.* (*Cux.*) *tritaeniorhynchus* Giles from Afghanistan for the first time. With the addition of this species, there are now 43 species in five genera known in this country (Table 3).

*Anopheles habibi* Mulligan and Puri has been listed by various authors (i.e., Arsenëva and Nerenov 1978, Buck et al. 1972, Danilov 1978, 1985a, 1985b) as occurring in Afghanistan, but Glick (1992) treated this species as a junior synonym of *An. claviger* (Meigen). Although Buck et al. (1972), Ward (1972), Danilov (1985a, 1985b) reported *Cx. univittatus* Theobald from Afghanistan, it actually refers to *Cx. perexiguus* Theobald according to Harbach (1988). Danilov (1978) stated that *Ae. versicolor* (Barraud) "may be expected in the mountain regions of Afghanistan, Middle Asia, Iran and Turkey." Presently, there is no confirmed specimen of this species from Afghanistan, and any report about the existence of this species from that country may be erroneous; hence, it is not included in our updated checklist (Table 3).

**b. IRAQ.** To determine the mosquito fauna of Iraq (33° 00' N, 44° 00' E), adult collections were conducted from various localities from May 2003 to August 2004. Adults were collected with a modified miniature Centers for Disease Control light trap as described above, and they were mounted on points on pins, with proper labels. Furthermore, mosquito specimens deposited in the USNMNH were examined and identified, and their collection data were recorded. Coordinates for localities or collection sites of museum specimens were recorded using gazetteers of the U.S. Board on Geographic Names (1957), Global Gazetteer (2007) and Biogeomancer (2008). Specimens were identified to species using keys and descriptions from pertinent literature (e.g., Gutsevich et al. 1971, Harbach 1988, Glick 1992).

In Iraq, we collected 1,847 adult mosquitoes from various localities in two governates (Salah ad Din and At-Tā'mim). In addition, we also examined 33 adults of the USNMNH collections (recorded from 1918-1987) from three governates (Al-Basrah, Baghdad, and Al-Anbar). Overall, from both collections, we identified ten species in four genera (*Aedes*, *Anopheles*, *Culex* and *Culiseta*), and

Table 1. Summary of collection localities of mosquitoes (based on observed specimens) in Afghanistan.

Species	Province	Locality	Grid Coordinates		Collection Date	Number/ Stage	Collector	Remarks	Repository
			Latitude	Longitude					
<i>Aedes (Ochlerotatus) caspius</i> (Pallas)	Kunduz	Anguratloajhr**	36.82N	68.69E	1970	2F***	R.A. Ward	-	AC
	Parwan	Charikar	35.02N	69.17E	29-30 May 2004	1F	R.G. Lowen	LT	FC
<i>Anopheles (Anopheles) hyrcanus</i> (Pallas)	Kunduz	Anguratloajhr**	36.73N	68.73E	4-5, 14-15, 18-19, 24-25 Jun 2004	5F, 1M	R.G. Lowen	LT	FC
					9-10, 12-15, 21-24, 30-31 Jul 2004	13F	R.G. Lowen	LT	FC
	Kunduz	Anguratloajhr**	36.82N	68.69E	2-3, 30-31 Aug 2004	2F	R.G. Lowen	LT	FC
					1-2 Sep 2004	1F	R.G. Lowen	LT	FC
<i>An. (Ano) pseudopictus</i> Grassi	Kunduz	Anguratloajhr**	36.82N	68.69E	24 Jul 1970	3F	V.M. De Swarte	LT	FC
	Kunduz	Bulla Quechi	36.71N	68.96E	17 Nov 1968, 24-25 Jul 1970	3F	R.A. Ward, Dr. Nuskin	OC	AC
<i>Ani (Celia) pulcherrimus</i> Theobald	Nangarhar	Jalalabad	34.43N	70.45E	8-20 Nov 1968	139F, 43M	D.P. Wojcik	LT, MT, RA (400ME)	AC
					22-23 Jul 2004	1F	V.M. De Swarte	LT	FC
	Kunduz	Anguratloajhr**	36.82N	68.69E	24-25 Jul 1970	19F, 9M	R.A. Ward, M. Grawar	RM	AC
					19 Nov 1968	2F, 6M	M. Wojcik	LU (400ME)	AC
<i>An. (Gz.) splendidus</i> Koidzumi	Ghazni	Sabzab	34.08N	68.03E	3 Nov 1942	1L	S.J. Carpenter	-	AC
	Nangarhar	Jalalabad	34.43N	70.45E	23-24 Jul 2004	1F	V.M. De Swarte	LT	FC
<i>An. (Gz.) stephensi</i> Liston	Parwan	Charikar	35.02N	69.17E	14-15 Jul; 1-2 Sep 2004	6F, 1M	R.G. Lowen	LT	FC
	Khowsht	Khost	33.34N	69.92E	26-27 Jul 2004	1F	R.G. Lowen	LT	FC
<i>An. (Gz.) sp.</i>	Nangarhar	Jalalabad	34.43N	70.45E	23-24 Jul 2004	1F	V.M. De Swarte	LT	FC
	Kunduz	Bulla Quechi	36.71N	68.96E	15 Sep 1968	21F, 14M, 5G	-	RA	AC
<i>Culex (Burradius) pusillus</i> Macquart	Kunduz	Bulla Quechi	36.71N	68.96E	15 Sep 1968	7F, 6M	D.P. Wojcik	RA (600ME)	AC
<i>Cx. (Culex) peregrinus</i> Theobald	Helmand	Karuarigin**	30.99N	63.99E	6 Oct 1968	1F	D.P. Wojcik	RA (680ME)	AC
<i>Cx. (Culex) pipiens</i> Linnaeus	Helmand	Garwarigin**	30.99N	63.99E	6 Oct 1968	1F	D.P. Wojcik	LT	AC
	Kunduz	Anguratloajhr**	36.82N	68.69E	21 Jul 1970	1F	R.A. Ward	LT	AC
<i>Cx. (Culex) theileri</i> Theobald	Kunduz	Bulla Quechi	36.71N	68.96E	13-18 Nov 1968	26F, 9M	D.P. Wojcik	-	AC
	Kabul	Kabul	34.52N	69.18E	10-16 Jul 2004	15F	A.J. Bowen, V.M. De Swarte	LT	FC
	Kandahar	Kandahar	31.61N	65.71E	19-20 Aug 2004	9F	R.G. Lowen	LT	FC
	Parwan	Charikar	35.02N	69.17E	14-15, 21-24 Jul 2004	4F	R.G. Lowen	LT	FC
	Helmand	Garwarigin**	30.99N	63.99E	6 Oct, 29 Nov 1968	2F	D.P. Wojcik	LT, RA (680ME)	AC
	Kunduz	Bulla Quechi	36.71N	68.96E	16 Nov 1968	1F	D.P. Wojcik	RA (400ME)	AC
	Parwan	Charikar	35.02N	69.17E	14-17 Jun 2004	2F	R.G. Lowen, J. Zium	LT	FC
	Bamiyan	Sayedabat	34.80	67.83	21-27 Aug 1968	14E, 10M	D.P. Wojcik	RA (2400ME)	AC
	Khowsht	Khost	33.34	69.92	26-27 Jul 2004	1F	R.G. Lowen	LT	FC
	Parwan	Charikar	35.02	69.17	24-25 May; 14-15 Jun, 11-12 Aug 2004	3F	R.G. Lowen	LT	FC
	Kabul	Kabul	34.52	69.18	10-18 Jul 2004	15F	A.J. Bowen, V.M. De Swarte	LT	FC
	Nangarhar	Jalalabad	34.43	70.45	22-23 Jul 2004	7F	V.M. De Swarte	LT	FC
<i>Cx. (Culex) tritaeniorhynchus</i> Giles*	Parwan	Charikar	35.02	69.17	12-17 Jul 2004	13F	R.G. Lowen	LT	FC
	Khowsht	Khost	33.34	69.92	26-27 Jul 2004	2F	R.G. Lowen	LT	FC
<i>Cx. (Culex) vagans</i> Wiedemann	Herat	Kharuk	34.5	62.58	19 Oct 1968	1F	D.P. Wojcik	RA (1360ME)	AC
	Bamiyan	Sayedabat Village	34.80	67.83	27 Oct 1968	1F	D.P. Wojcik	RA (2400ME)	AC
<i>Cx. (Culex) sp.</i>	Herat	Kharuk	34.5	62.58	15-22 Oct 1968	21E, 9M	D.P. Wojcik	RA (1360ME)	AC
	Kabul	Kabul	34.57	69.21	31 May-1 Jun; 10-11 Jul 2004	2F	R.G. Lowen	LT	FC
Uranotaenia ( <i>Uranotaenia</i> ) unguiculata Edwards	Parwan	Charikar	35.02	69.17	31 May-1 Jun 2004	1F	R.G. Lowen	LT	FC
	Kunduz	Bulla Quechi	36.71	68.96	9-17 Nov 1968	3F, 5M, 3G	D.P. Wojcik	RA (400ME)	AC

\*New record.

\*\*Provincial coordinates; exact locality grid coordinates of locality from museum specimen label unknown.

\*\*\*AC (accessioned museum collection at the U.S. National Museum of Natural History, Smithsonian Institution, Washington, D. C.), F (female), FC (field collected, deposited in the NMNH), G (male genitalia), L (whole larva), LT (CDC light trap collections), LU (unknown type of light trap), ME (meter elevation), MT (malaise trap), M (male), OC (resting on outdoor cave), RA (reared), RM (resting on mudwall), RS (resting on stream banks).

Table 2. Summary of collection localities of mosquitoes (based on observed specimens) in Iraq.

Species	Governorate	Locality	Grid Coordinates		Collection Date	Number/ Stage	Collector	Remarks	Repository
			Latitude	Longitude					
<i>Aedes (Ochlerotatus) caspius</i> (Pallas)	Salah ad Din	Balad	34.02N	44.15E	2-31 May 2003	851F*	M. Carder, O. Price	LT	FC
	Salah ad Din	Tikrit	34.60N	43.68E	14, 17, 22 Aug 2003	236F	M. Carder, O. Price	LT	FC
<i>Anopheles (Cellia) pulcherrimus</i> Theobald	Al-Basrah	Basrah	30.49N	47.82E	Oct 1918	2M, 1F	P.J. Barraud	RA	AC
<i>An. (Ccl.) stephensi</i> Liston	Al-Basrah	Basrah	30.49N	47.82E	Oct 1918	3M, 1F	P.J. Barraud	-	AC
	Al-Basrah	Basrah	30.49N	47.82E	21 Oct 1918	2F	P.J. Barraud	-	AC
<i>Culex (Barraditus) modestus</i> Ficalbi	Al-Basrah	Basrah	30.49N	47.82E	Oct 1918	1M	P.J. Barraud	-	AC
<i>Cx. (Culex) pipiens</i> Linnaeus	Salah ad Din	Balad	34.02N	44.15E	2-31 May 2003	247F	M. Carder, O. Price	LT	FC
	Salah ad Din	Tikrit	34.60N	43.68E	7, 27-29 May; 1-8 Jun 2003	141F	M. Carder, O. Price	LT	FC
<i>Cx. (Cux.) quinquefasciatus</i> Say	Baghdad	Baghdad City	33.34N	44.39E	17 Aug 1984	3M, 11F	Scientific Research Council	-	AC
	Al-Basrah	Basrah	30.49N	47.82E	Oct 1918	1M	P.J. Barraud	-	AC
	Baghdad	Baghdad	33.34N	44.39E	Mar 1987	4M, 6F	Z.H. Mohsen	RB	AC
	Baghdad	Baghdad	33.34N	44.39E	Mar 1987	3M, 9F	Z.H. Mohsen	RC	AC
<i>Cx. (Cux.) theileri</i> Theobald	Al-Basrah	Basrah	30.49N	47.82E	Jan 1919	1M	P.J. Barraud	-	AC
	Al-Anbar	Abu Ghraib	33.32N	44.20E	24 Oct 1955	1M, 1F	not specified	-	AC
<i>Cx. (Cux.) tritaeniorhynchus</i> Giles	Salah ad Din	Ad Dawr	34.46N	43.80E	14, 17 Aug 2004	1F	M. Carder, O. Price	LT	FC
	Salah ad Din	Tikrit	34.60N	43.68E	17, 22 Aug 2003	86F	M. Carder, O. Price	LT	FC
	Al-Ta'mim	Kirkuk	35.47N	44.39E	14, 17 Aug 2003	3F	M. Carder, O. Price	LT	FC
<i>Cx. (Cux.)</i> sp.	Salah ad Din	Ad Dawr	34.46N	43.80E	14, 17 Aug 2004	2F	M. Carder, O. Price	LT	FC
	Salah ad Din	Al Sahara	34.67N	43.54E	4, 6 Aug 2003	20F	M. Carder, O. Price	LT	FC
	Salah ad Din	Tikrit	34.60N	43.68E	14, 17, 22 Aug 2003	224F	M. Carder, O. Price	LT	FC
<i>Culiseta (Allotheobaldia) longiareolata</i> (Macquart)	Salah ad Din	Balad	34.02N	44.15E	2-31 May 2003	9F	M. Carder, O. Price	LT	FC
	Salah ad Din	Tikrit	34.60N	43.68E	7, 22, 27-29 May; 1-8 Jun 2003	30F	M. Carder, O. Price	LT	FC
<i>Cs. (Culiseta) subochrea</i> (Edwards)	Al-Basrah	Basrah	30.49N	47.82E	Mar 1919	1F	P.J. Barraud	-	AC

\*AC (accessioned museum collection at the U.S. National Museum of Natural History, Smithsonian Institution, Washington, D. C.), F (female), FC (field collected, deposited in the NMNH), LT (CDC light trap collections), M (male), RA (reared from larvae collected from soaked pit in desert), RB (reared from autogenous laid eggs), RC (reared from field-collected egg raft).

Table 3. Updated checklists of mosquito species from Afghanistan and Iraq.

Species	Afghanistan	Iraq
<i>Aedes (Aedemorphus) vexans</i> (Meigen)	D, X*	R
<i>Ae. (Ochlerotatus) caspius</i> (Pallas)	A3, B, D, W, X	A1, K, X
<i>Ae. (Och.) dorsalis</i> (Meigen)	-	I, K
<i>Ae. (Och. pulcritarsis)</i> (Rondani)	D	-
<i>Ae. (Stegomyia) aegypti</i> (Linnaeus)	-	-
<i>Anopheles (Anopheles) algeriensis</i> Theobald	A3, D, G, W, X	A2, G, P
<i>An. (Ano.) barianensis</i> James	D	-
<i>An. (Ano.) claviger</i> Meigen	A3, B, D, G, W, X	A2, G, P
<i>An. (Ano.) hyrcanus</i> (Pallas)	A3, B, D, G, W, X	A2, G, K, P
<i>An. (Ano.) lindesayi</i> Giles	A3, B, D, G, W, X	-
<i>An. (Ano.) maculipennis</i> Meigen	-	A2, G, K, P
<i>An. (Ano.) marteri</i> Senevet and Prunelle	-	A2, G, K, P
<i>An. (Ano.) martinius</i> Shingarev	D, G, X	-
<i>An. (Ano.) melanoon</i> Hackett	-	G
<i>An. (Ano.) peditaeniatus</i> (Leceister)	A3, B, D, G, W, X	-
<i>An. (Ano.) pseudopictus</i> Grassi	G, X	-
<i>An. (Ano.) sacharovi</i> Favre	A3, B, C, X	A2, G, K, P
<i>An. (Cellia) annularis</i> Van der Wulp	A3, B, D, G, W, X	-
<i>An. (Cel.) apoci</i> Marsh	-	A2, G, K
<i>An. (Cel.) culicifacies</i> Giles	A3, B, D, G, W, X	A2, G, K
<i>An. (Cel.) dthali</i> Patton	A3, D, G, X	A2, G, K, P
<i>An. (Cel.) fluviatilis</i> James	A3, B, D, G, W, X	A2, G, K, P
<i>An. (Cel.) jeyporiensis</i> James	A3, D	-
<i>An. (Cel.) moghulensis</i> Christophers	A3, B, D, G, W, X	-
<i>An. (Cel.) multicolor</i> Cambouliu	A3, B, D, G, W, X	A2, G, K, P
<i>An. (Cel.) pulcherrimus</i> Theobald	A3, B, D, G, W, X	A2, G, K, P, X
<i>An. (Cel.) sergentii</i> (Theobald)	-	A2, G, K, X
<i>An. (Cel.) splendidus</i> Koidzumi	A3, B, D, G, W, X	-
<i>An. (Cel.) stephensi</i> Liston	A3, B, D, G, W, X	A2, G, K, P, X
<i>An. (Cel.) subpictus</i> Grassi	A3, B, D, G, W, X	-
<i>An. (Cel.) superpictus</i> Grassi	A3, B, D, G, W, X	A2, G, K, P
<i>An. (Cel.) turkhudi</i> Liston	A3, B, D, G, W, X	A2, G
<i>An. (Cel.) vagus</i> (Donitz)	A3, D, W	-
<i>An. (Cel.) willmori</i> (James)	D, G, W	-
<i>Coquillittidia (Coquillittidia) richiardii</i> (Ficalbi)	D	-
<i>Culex (Barradius) modestus</i> Ficalbi	A3, D	A1, K, X
<i>Cx. (Bar.) pusillus</i> Macquart	A3, B, D, W, X	A1, I, K
<i>Cx. (Culex) mimeticus</i> Noe	H2	A1, I, H1, H2
<i>Cx. (Cux.) perexiguus</i> Theobald	H2, X	H1, H2
<i>Cx. (Cux.) pipiens</i> Linnaeus	A3, B, D, H2, W, X	A1, I, H1, H2, K, X
<i>Cx. (Cux.) pseudovishnui</i> Colless	-	H2
<i>Cx. (Cux.) quinquefasciatus</i> Say	D, H2	H2, I, K, X
<i>Cx. (Cux.) theileri</i> Theobald	A3, B, D, H2, W, X	A1, H1, H2, I, K, X
<i>Cx. (Cux.) tritaeniorhynchus</i> Giles	X**	A1, H1, H2, I, K, X
<i>Cx. (Cux.) vagans</i> Wiedemann	H2, X	-
<i>Cx. (Mailloitia) deserticola</i> Kirkpatrick	A, B, D, W, X	H1, I
<i>Cx. (Mai.) hortensis</i> Ficalbi	A3, D	A1, I
<i>Cx. (Mai.) quettensis</i> Mattingly	D, W	-
<i>Cx. (Neoculex) territans</i> Walker	-	A1
<i>Culiseta (Allotheobaldia) longiareolata</i> (Macquart)	A3, B, D, W, X	A1, I, K, X
<i>Cs. (Culicella) fumipennis</i> (Stephens)	-	U
<i>Cs. (Culiseta) annulata</i> (Schrank)	-	I, K
<i>Cs. (Cus.) subochrea</i> (Edwards)	D	A1, I, K
<i>Uranotaenia (Pseudoficalbia) unguiculata</i> Edwards	A3, B, D, W, X	A1, K
Total number of species	43	37

\*References: A1 (Abul-hab 1968), A2 (Abul-hab and Al-Kassal 1986), A3 (Arseneva and Nerenov 1978), B (Buck et al. 1972), D (Danilov 1985a, b), G (Glick 1992), H1 (Harbach 1985), H2 (Harbach 1988), I (Ibrahim et al. 1983), K (Khalaf 1962), P (Pringle 1954), R (Reinert 1973), U (WRBU 2001), W (Ward 1972), X (this survey).

an unidentified species of *Culex* (*Cux.*) (Table 2). With our above collections and our recent review of literature, there are now 37 species known in this country (Table 3).

Two species of *Culex*, i.e., *Cx. univittatus* (Abul-hab 1968) and *Cx. vishnui* Theobald (Khalaf 1962, Abul-hab 1968) were reported from Iraq, but Harbach (1988) determined them as *Cx. perexiguus*. Abul-hab (1968) and Ibrahim et al. (1983) also noted the occurrence of *Cx. decens* Theobald from Iraq, but Harbach (1988) corrected them as *Cx. pseudovishnui* Colless. Abul-hab (1968) erroneously reported *Cx. apicalis* Adams from Iraq, but it was subsequently determined to be *Cx. territans* Walker (see Gutsevich et al. 1971; *Cx. apicalis* is known only from North America). Glick (1992) recorded *An. subalpinus* Hackett and Lewis from Iraq; however, Linton et al. (2002) synonymized *An. subalpinus* with *An. melanoon* Hackett. Glick (1992) reported *An. marteri sogdianus* Keshishian while Pringle (1954) noted *An. sogdianus*. Ribeiro et al. (1985), however, synonymized the subspecies *sogdianus* with *marteri*. Other species described from Iraq include *An. lukisii* Christophers (synonymized with *An. algeriensis* Theobald) and *An. mesopotamiae* Christophers and Chand (synonymized with *An. hyrcanus* (Pallas) (WRBU 2001).

A total of 54 species are currently known in both countries. There are six more mosquito species occurring from Afghanistan (43) than Iraq (37). Although 27 species are common to both countries, 16 species in four genera (*Aedes*, *Anopheles*, *Coquillettia*, and *Culex*) are present in Afghanistan, but they are absent in Iraq. These two countries exhibit differences in climatic conditions, terrains, elevations, and other environmental features, which may have affected the diversity of mosquito species fauna.

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