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LIST OF BLOOD-SUCKING MOSQUITOES (DIPTERA, CULICIDAE)
OF THE REPUBLIC OF KAZAKHSTAN

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Abstract

To date, there is no annotated checklist of blood-sucking mosquito species of the Republic of Kazakhstan. The present publication provides a list of blood-sucking mosquito species compiled on the basis of an analysis of publications containing data on the fauna of haematophagous mosquitoes inhabiting the territory of Kazakhstan. In compiling the list, data from monographic summaries on the systematics, biology and ecology of mosquitoes, from supplements and revisions to these summaries, and from individual articles on the mosquitoes of Kazakhstan were used. According to the compiled list, the fauna of blood-sucking mosquitoes of the Republic of Kazakhstan currently comprises 69 species. Of these, 10 species belong to the genus *Anopheles*, one species each to the genera *Uranotaenia* and *Coquillettidia*, the genus *Culiseta* is represented by 6 species, the genus *Aedes* includes 42 species, and the genus *Culex* is represented by 9 species. Outdated taxon names of various ranks and synonymous species names that have lost their validity are frequently encountered in the literature. Taxonomic remarks on certain species are provided at the end of the list.

Keywords: Kazakhstan, blood-sucking mosquitoes, *Culicidae*, *Anopheles*, *Culex*, *Aedes*, fauna, systematics.

ҚАЗАҚСТАН РЕСПУБЛИКАСЫНЫҢ ҚАНСОРҒЫШ МАСАЛАРЫНЫҢ
(DIPTERA, CULICIDAE) ТІЗІМІ

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Андатпа

Қазақстан Республикасының қан сорғыш маса түрлерінің аннотацияланған тізімі бүгінгі күнге дейін жасалмаған. Осы мақалада Қазақстан аумағында тіршілік ететін гематофаг масалардың фаунасы туралы деректер бар басылымдарды талдау негізінде жасалған қан сорғыш маса түрлерінің тізімі ұсынылған. Тізімді жасау барысында масалардың систематикасы, биологиясы және экологиясына арналған монографиялық еңбектердің, осы еңбектерге толықтырулар мен қайта қараулардың, сондай-ақ Қазақстан масаларына арналған жекелеген мақалалардың деректері пайдаланылды. Жасалған тізімге сәйкес, Қазақстан Республикасының қан сорғыш масалар фаунасы қазіргі уақытта 69 түрді қамтиды. Олардың ішінде 10 түр *Anopheles* туысына, *Uranotaenia* мен *Coquillettidia* туыстарының әрқайсысына бір түрден

жатады; *Culiseta* туысы 6 түрмен, *Aedes* туысы 42 түрмен, ал *Culex* туысы 9 түрмен ұсынылған. Әдебиеттерде әртүрлі дәрежедегі таксондардың ескірген атаулары мен заңды күшін жоғалтқан синонимдік түр атаулары жиі кездеседі. Тізімнің соңында жекелеген түрлерге таксономиялық ескертпелер берілген.

Кілт сөздер: Қазақстан, қан сорғыш масалар, *Culicidae*, *Anopheles*, *Culex*, *Aedes*, фауна, систематика.

СПИСОК КРОВОСОСУЩИХ КОМАРОВ (*DIPTERA*, *CULICIDAE*) РЕСПУБЛИКИ КАЗАХСТАН

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Аннотация

На сегодняшний день не существует аннотированного списка видов кровососущих комаров Республики Казахстан. В настоящей публикации приведён список видов кровососущих комаров, составленный по результатам анализа публикаций, содержащих сведения о фауне кровососущих комаров, обитающих на территории Казахстана. При составлении списка использованы данные из сводок по систематике, биологии и экологии комаров, дополнений и уточнений к этим сводкам, а также из отдельных статей по комарам Казахстана. Согласно составленному списку, фауна кровососущих комаров Республики Казахстан представлена 69 видами. Из них к роду *Anopheles* принадлежат 10 видов, по 1 виду в родах *Uranotaenia* и *Coquillettidia*, род *Culiseta* представлен 6 видами, в род *Aedes* входят 42 вида, род *Culex* - 9 видами. В литературных источниках нередко встречаются устаревшие названия таксонов различного уровня, а также синонимичные названия видов, утратившие валидность. В конце списка приводятся замечания по систематике отдельных видов.

Ключевые слова: Казахстан, кровососущие комары, *Culicidae*, *Anopheles*, *Culex*, *Aedes*, фауна, систематика.

Introduction

Large-scale faunistic surveys of blood-sucking mosquitoes in Central Asia and Kazakhstan have not been conducted for a considerable period. The most recent comprehensive synthesis of data on the species composition of blood-sucking mosquitoes across the entire territory of the country was published in a monograph by Dubitsky in 1970, in which the presence of 38 species of the genus *Aedes* was recorded [1]. The systematic catalogue of *Culicidae* lists only five species of the genus *Aedes* for Kazakhstan: *Ae. gutzevichi*, *Ae. stramineus*, *Ae. pulcritarsis*, *Ae. montchadskyi* and *Ae. kasachstanicus* [2]. Such significant discrepancies in the data underscore the need for faunistic research in the Republic of Kazakhstan.

In recent years, the fauna of blood-sucking mosquitoes in certain regions of Kazakhstan has been studied by a number of researchers; however, the information obtained remains very limited. Climate change, the country's economic growth, the expansion of global communications, and the intensification of tourism and trade all facilitate the introduction and spread of invasive mosquito species. This is confirmed, in particular, by the recent discovery on the territory of the country of *Ae. koreicus* – one of the invasive species that has spread widely across the world in recent years [3].

The electronic systematic catalogue of *Culicidae* [2] serves as the primary reference resource for all specialists studying haematophagous mosquitoes of the family *Culicidae*, and supplementing the information it contains is therefore an important task. Overall, published data on the fauna of blood-sucking mosquitoes of Kazakhstan remain extremely scarce, which necessitates further research in this area.

A separate problem is posed by nomenclatural instability within the family *Culicidae*. Outdated taxon names of various ranks are frequently encountered in twentieth-century literature sources and in many contemporary publications. Synonymous species names that have lost their validity also persist in the literature.

The World Catalogue of Mosquitoes, published in 1977 by K.L. Knight and A.A. Stone [8], together with its three supplements, summarised the nomenclatural organisation of the entire family *Culicidae* and listed all sources [9-12] in which the relevant names were established. However, in a series of papers published between 2004 and 2009, J.F. Reinert, R.E. Harbach and I.J. Kitching introduced numerous changes to the nomenclature of the tribe *Aedini* [13-16]. During this period, no single universally accepted classification of the tribe existed: some researchers adopted the revised classification while others adhered to the traditional nomenclature, leading to inconsistencies across publications.

In 2015, an article [17] was published in *PLoS ONE* in which the authors proposed a return to a linear classification, supplemented – taking into account the results of the work by J.F. Reinert, R.E. Harbach and I.J. Kitching – with combinations of generic, subgeneric and species names for the tribe *Aedini*, informal group names for the subgenera established by those authors after 1999 [16], and a list of abbreviations for currently valid generic-rank taxa of the family *Culicidae* [17]. The classification adopted in that publication and subsequent updates are reflected in the online taxonomic catalogue at www.mosquitocatalog.org [2].

The subfamily *Culicinae* comprises 218 extant generic taxa (including the nominotypical subgenera of 21 genera), of which 38 are currently recognised at the rank of genus and 180 are classified as subgenera. Many of the 38 genera are clearly polyphyletic taxa [18], whereas molecular data support the monophyly of *Culicinae* and at least nine tribes [19, 20, 21]. In October 2024, R.E. Harbach published a monograph in which a number of significant nomenclatural changes were presented [18]. The author notes that a natural classification of this subfamily cannot be achieved until all groups have been thoroughly investigated using both morphological and molecular data [18].

Although the changes proposed in that monograph have been reflected in the GBIF community catalogue [22], the present authors are of the opinion that until a sufficient number of detailed investigations of type representatives of all subgenera and genera of the subfamily have been completed, it is advisable to adhere to a classification that is understood and accepted by the entire research community. Accordingly, the classification of mosquitoes and the validity of names in this article follow the systematic catalogue of mosquitoes of the family *Culicidae* [2].

Materials and methods

The present work was carried out as a systematic review of published data on the fauna of blood-sucking mosquitoes of the Republic of Kazakhstan. To compile the annotated species checklist, the method of analysis of published faunistic, systematic and ecological sources, including regional faunistic summaries, was employed.

The source base comprised: (1) monographic summaries on the systematics, biology and ecology of mosquitoes of Kazakhstan and adjacent territories [1, 4, 5]; (2) supplements and revisions to these summaries [6, 7]; (3) individual articles containing data on the mosquito fauna

of various regions of the country, including published dissertation abstracts [26]; (4) the electronic systematic catalogue of *Culicidae* [2] as the primary taxonomic reference; and (5) publications on invasive mosquito species in the territory of Kazakhstan [3].

The acceptance or rejection of species and subgenus names was based on the electronic catalogue at www.mosquitocatalog.org [2] in the edition of T.V. Gaffigan et al. (2015). For species whose systematic position had been revised in accordance with more recent works [17, 18], a critical analysis of the justification for such changes was carried out. Since a complete morphological and molecular investigation of all subgenera and genera of the subfamily *Culicinae* has not yet been completed, the classification system presented in the catalogue [2] - as the most widely used in contemporary scientific literature - was adopted as the basis for the classification employed in this article.

The synonymy and nomenclatural status of taxa were verified using the catalogues [2, 8-12], the GBIF resource [22, 23, 27] and specialised publications [13-17, 24, 25, 28]. All species whose occurrence in Kazakhstan has been reliably confirmed or reasonably inferred from published data are included in the list. Species whose presence requires further confirmation are marked with a corresponding footnote.

Results

Annotated checklist of blood-sucking mosquitoes of the Republic of Kazakhstan (Figure 1).

Family CULICIDAE

Subfamily ANOPHELINAE

Genus *Anopheles* Meigen, 1818

Subgenus *Anopheles* Meigen, 1818

An. (Ano.) algeriensis Theobald, 1903

An. (Ano.) atroparvus Van Theil, 1927

An. (Ano.) claviger Meigen, 1804

An. (Ano.) hyrcanus Pallas, 1771

An. (Ano.) sacharovi Favre, 1903

An. (Ano.) maculipennis Meigen, 1818

An. (Ano.) messeae Falleroni, 1926

An. (Ano.) daciae Linton, Nicolescu, Harbach, 2004

Subgenus *Cellia* Theobald, 1902

An. (Cel.) superpictus Grassi, 1899

An. (Cel.) pulcherrimus Theobald, 1902

Subfamily CULICINAE

Tribe *Uranotaeniini*

Genus *Uranotaenia* Lynch Arribalzaga, 1891

Subgenus *Pseudoicalbia* Theobald, 1912

Ur. (Pc.) unguiculata Edwards, 1913

Tribe *Culisetini*

Genus *Culiseta* Felt, 1904

Subgenus *Allotheobaldia* Broelemann, 1919

Cs. (All.) longiareolata Macquart, 1838

Subgenus *Culicella* Felt, 1904

Cs. (Cue.) morsitans Theobald, 1901

Cs. (Cue.) ochroptera Peus, 1935

Subgenus *Culiseta* Felt, 1904

Cs. (Cus.) alaskaensis Ludlow, 1906

Cs. (Cus.) annulata Schrank, 1776

Cs. (Cus.) bergrothi Edwards, 1921

Tribe *Mansoniini*

Genus *Coquillettidia* Dyar, 1905

Subgenus *Coquillettidia* Dyar, 1905

Co. (Coq.) richiardii Ficalbi, 1889

Tribe *Aedini*

Genus *Aedes* Meigen, 1818

Subgenus *Acartomyia* Theobald, 1903

Ae. (Acy.) mariae Sergent, 1903

Subgenus *Aedes* Meigen, 1818

Ae. (Aed.) cinereus Meigen, 1818

Ae. (Aed.) rossicus Dolbeshkin, Gorickaja et Mitrofanova, 1930

Ae. (Aed.) cinereus esoensis Yamada

Subgenus *Aedimorphus* Theobald, 1903

Ae. (Adm.) vexans Meigen, 1830

Ae. (Adm.) vexans nipponii Theobald, 1907

Subgenus *Dahlia* Reinert, Harbach & Kitching, 2006

Ae. (Dah.) geniculatus Olivier, 1791

Subgenus *Hulecoeteomyia* Theobald, 1903

Ae. (Hul.) koreicus Edwards, 2017

Subgenus *Ochlerotatus* Lynch Arribalzaga, 1891

Ae. (Och.) behningi Martini, 1926

Ae. (Och.) cantans Meigen, 1818

Ae. (Och.) caspius Pallas, 1771

Ae. (Och.) cataphylla Dyar, 1916

Ae. (Och.) communis De Geer, 1776

Ae. (Och.) cyprius Ludlow, 1920

Ae. (Och.) detritus Haliday, 1833

Ae. (Och.) diantaeus Howard, Dyar et Knab, 1913

Ae. (Och.) dorsalis Meigen, 1830

Ae. (Och.) excrucians Walker, 1856

Ae. (Och.) euedes Howard, Dyar et Knab, 1913

Ae. (Och.) flavescens Muller, 1764

Ae. (Och.) hexodontus Dyar, 1916

Ae. (Och.) hungaricus Mihalyi, 1955

Ae. (Och.) impiger Walker, 1848

Ae. (Och.) intrudens Dyar, 1906

- Ae. (Och.) kasachstanicus* Gutsevich, 1962
Ae. (Och.) leucomelas Meigen, 1804
Ae. (Och.) montchadskyi Dubitsky, 1968
Ae. (Och.) nigrinus Eckstein, 1918
Ae. (Och.) nigripes Zetterstedt, 1838
Ae. (Och.) pionips Dyar, 1919
Ae. (Och.) pulchritarsis Rondani, 1872 [= *Ae. (Och.) pulchritarsis* Rondani, 1872]
Ae. (Och.) pullatus Coquillett, 1904
Ae. (Och.) punctator Kirby, 1837
Ae. (Och.) rempeli Vockeroth, 1954
Ae. (Och.) riparius Dyar et Knab, 1907
Ae. (Och.) simanini Gutsevich, 1966
Ae. (Och.) sticticus Meigen, 1838
Ae. (Och.) stramineus Dubitsky, 1970
Subgenus *Rusticoidus* Shevchenko et Prudkina, 1973
Ae. (Rus.) lepidonotus Edwards, 1920
Ae. (Rus.) rusticus Rossi, 1790
Ae. (Rus.) subdiversus Martini, 1926
Subgenus *Stegomyia* Theobald, 1901
Ae. (Stg.) galloisi Yamada, 1921 *
* Presence of the species requires confirmation.

Tribe *Culicini***Genus *Culex* Linnaeus, 1758****Subgenus *Barraudius* Edwards, 1921**

Cx. (Bar.) modestus Ficalbi, 1890

Cx. (Bar.) pusillus Macquart, 1850

Subgenus *Culex* Linnaeus, 1758

Cx. (Cux.) theileri Theobald, 1903

Cx. (Cux.) torrentium Martini, 1925

Cx. (Cux.) vagans Wiedemann, 1828

Cx. (Cux.) pipiens Linnaeus, 1758

Cx. (Cux.) pipiens molestus Forskal, 1775

Subgenus *Maillotia* Theobald, 1907

Cx. (Mai.) hortensis Ficalbi, 1889

Subgenus *Neoculex* Dyar, 1905

Cx. (Nex.) territans Walker, 1856

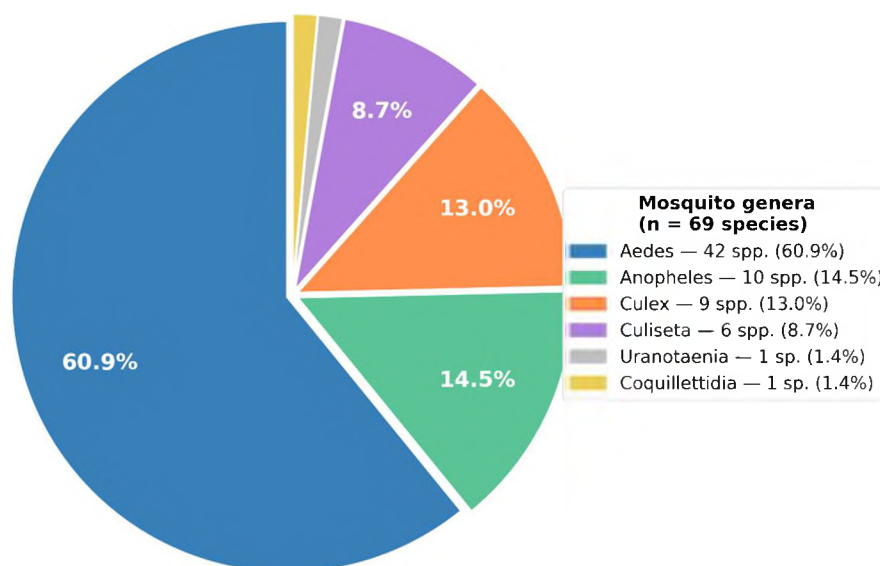


Figure 1. Species composition of blood-sucking mosquitoes of the Republic of Kazakhstan by genus (n = 69 species, Diptera, Culicidae)

Discussion

Taxonomic remarks on selected species

The annotated list draws attention to the ambiguous systematic position of *Ae. pulcritarsis*. In a number of publications this species appears under the name *Ae. pulchritarsis*; however, the spelling *pulcritarsis* is currently the valid one [2]. The restoration of the validity of the original species name did not affect the generic assignment: from the genus *Culex*, to which the species was originally assigned, it was transferred to the genus *Aedes* [2, 23]. The subgeneric status of the species also remains somewhat equivocal: in the world mosquito catalogue, *Ae. pulcritarsis* (as *Ae. pulchritarsis*) was assigned to the subgenus *Ochlerotatus*. Danilov (1982) [24] justified its transfer to the subgenus *Finlaya*, with which Mamedniyazov (1992) [7] and Gornostayeva (2000) [25] agreed. However, in the current classification this species belongs to the subgenus *Ochlerotatus* [2], and it is in this placement that the species appears in the present list.

Changes also affected the subgeneric status of *Ae. geniculatus*: previously assigned to the subgenus *Finlaya*, it was transferred after 2015 to the subgenus *Dahlia*. The species *Ae. koreicus*, formerly belonging to the subgenus *Stegomyia*, was moved following the adopted revisions to the subgenus *Hulecoeteomyia*; *Ae. mariae* was transferred from the subgenus *Ochlerotatus* to the subgenus *Acartomyia*.

The dissertation of Prygunova I.G. records the occurrence of *Ae. maculatus* in northern Kazakhstan [26]. According to the current classification, *Ae. maculatus* is a synonym of *Ae. (Rus.) rusticus*; furthermore, this name was frequently applied to specimens of *Ae. cantans* [2, 27, 28]. The species *Ae. rusticus* has been included in the present list, although additional studies are required to confirm the presence of this species in the blood-sucking mosquito fauna of Kazakhstan.

It should also be noted that *Coquillettidia richiardii* is more commonly referred to as *Mansonia richiardii* in the literature on blood-sucking mosquitoes of Kazakhstan, and that *Aedes euedes* appears under the name *Ae. beklemishevi* in twentieth-century publications.

The systematic position of *Cx. pipiens molestus* remains ambiguous. In various publications and summaries it is treated as a subspecies of *Cx. pipiens*, whereas in the systematic catalogue of *Culicidae* it appears as a synonym of the latter. In the present list it is given as a separate entry rather than as a synonym.

Current state and prospects for faunal research

The results obtained reveal a substantial gap between faunistic data accumulated during the Soviet period and the current state of knowledge regarding the species composition of blood-sucking mosquitoes of Kazakhstan. Most of the available species-composition data were collected several decades ago. The presence of a number of the species included in the list was recorded in only one locality and has never subsequently been confirmed. Researchers of that era lacked access to modern diagnostic equipment and the possibilities offered by genetic and molecular methods.

It must be recognised that climate change and the expansion of transport connectivity are facilitating the spread of species and their establishment in areas where their presence had not previously been recorded. A telling example is the discovery of the invasive species *Ae. koreicus* in Kazakhstan [3], which demonstrates the reality of such processes.

Particular attention should be paid to the need for a revision of species composition using molecular-genetic methods [29]. The traditional morphological diagnostics on which the historical data are based do not always permit reliable discrimination of closely related species, which may lead to both overestimates and underestimates of species diversity.

The present list should therefore be regarded as preliminary, requiring verification and supplementation on the basis of modern field and laboratory research employing integrative taxonomic approaches.

Conclusion

On the basis of a systematic analysis of published data, an annotated checklist of blood-sucking mosquitoes (Diptera, Culicidae) of the Republic of Kazakhstan has been compiled, comprising 69 species. Of these, 10 species belong to the genus *Anopheles*, one species each to the genera *Uranotaenia* and *Coquillettidia*, 6 species to the genus *Culiseta*, 42 species to the genus *Aedes*, and 9 species to the genus *Culex*.

The majority of data on the species composition of blood-sucking mosquitoes of Kazakhstan were obtained during the Soviet period using methods that do not meet modern standards of molecular-genetic diagnostics. The presence of a number of the listed species has been recorded only sporadically and requires confirmation. Climate change and the expansion of transport connectivity are creating conditions for the colonisation by invasive species of territories in which they were not previously recorded.

A comprehensive revision of the species composition of blood-sucking mosquitoes in the territory of the Republic of Kazakhstan is therefore necessary, employing modern integrative taxonomic methods including molecular-genetic diagnostics. The present checklist provides the essential nomenclatural foundation for planning such research and can serve as a baseline for biodiversity monitoring of this insect group.

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