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Muhammad Sami-ur-Rehman
Department of Entomology,
PMAS-Arid Agriculture
University, Rawalpindi, Punjab,
Pakistan

Muhammad Farooq Nasir
Department of Entomology,
PMAS-Arid Agriculture
University, Rawalpindi, Punjab,
Pakistan

Muhammad Naeem
Department of Entomology,
PMAS-Arid Agriculture
University, Rawalpindi, Punjab,
Pakistan

Arif Mehmood
Department of Entomology,
PMAS-Arid Agriculture
University, Rawalpindi, Punjab,
Pakistan

Muhammad Mushtaq
Department of Zoology, PMAS-
Arid Agriculture University,
Rawalpindi, Punjab, Pakistan

Correspondence
Muhammad Sami-ur-Rehman
Department of Entomology,
PMAS-Arid Agriculture
University, Rawalpindi, Punjab,
Pakistan

Fauna of *Culex* (Culicidae; Diptera) mosquitoes in tehsil Pind Dadan Khan, Jhelum, Punjab, Pakistan

Muhammad Sami-ur-Rehman, Muhammad Farooq Nasir, Muhammad Naeem, Arif Mehmood and Muhammad Mushtaq

Abstract

A total of 11 mosquito species were identified including *Culex univittatus*, *Culex fuscitarsis*, *Culex gelidus*, *Culex hutchinsoni*, *Culex fuscocephala*, *Culex bailyi*, *Culex nigropunctatus*, *Culex bahri*, *Culex plantaginis*, *Culex flavicornis*, *Culex brevipalpis*. Three of these identified species were an addition to the fauna of mosquitoes of Pakistan which are *Culex bahri*, *Culex plantaginis*, *Culex flavicornis*. The specimens were collected from the localities of Jalalpur Sharif, Jinnah Park, Hindu Temple, Khewra, Dharyala Jalap, Haran Pur, Lilla and Railway Station. The objective of this study was to collect and identify the mosquito specimens from Tehsil, Pind Dadan Khan, Jhelum up to species level as well as description of the fauna of mosquitoes from the study area.

Keywords: Mosquito, Taxonomy, Culicidae, Diptera, Pind Dadan Khan

1. Introduction

Mosquitoes are the nematocerid flies which pertain to order Diptera and family Culicidae of the insect's taxonomic classification [10]. Mosquitoes display a worldwide distribution ranging from throughout the tropic as well as temperate regions [20]. They are well known to be the vectors of several pathogenic microbes spreading diseases in humans as well as animals. The most commonly known diseases caused by mosquitoes include malaria, lymphatic filariases, arboviral encephalitides, dengue, yellow fever, West Nile, Japanese, Eastern Equine [19, 20].

Up till now, the total number of identified species and subspecies of mosquitoes is known to be 3,601. The two subfamilies Anophelinae and Culicinae contain a number of 482 and 3,119 identified species respectively [21]. Studies on mosquito systematics have been carried out in several areas of Pakistan as well as Asia describing the fauna of mosquitoes of these areas. A total of 31 species were recorded from the valley of Peshawar which belonged to 6 genera including *Anopheles* (10), *Aedes* (8), *Culex* (9), *Culiseta* (2), *Armigeres* (1) and *Mansonia* (1) [1]. Five genera were identified in a study of different localities of Tandojam, Sindh [5]. First record of *Culex raptor* from Pakistan was reported from Murre Hills, Punjab, Pakistan by Qasim *et al.* in 2014 [17]. A total of fourteen species were identified by Hamidian *et al.* (2011) from the North Khorasan province, among which 77% of the *Culex* in the Middle Asia also occurred in Iran [6]. Hantosh *et al.* (2012) reported one *Culex* and four *Anopheles* species from different localities in Iraq [8]. Keeping in view the taxonomic studies on mosquitoes in several regions of the country as well as their economic importance, there was a need to explore the mosquito fauna of Tehsil, Pind Dadan Khan, Jhelum. For this purpose, collection and identification of the mosquito specimens up to species level was done and a description of the fauna of mosquitoes in tehsil Pind Dadan Khan, Jhelum was given in this study.

2. Materials and Methods

Tehsil Pind Dadan Khan is located at the southern side of the District Jhelum bearing an area of 875 square miles and lies between 32°27' and 32°50' North and 72°32' and 73°29' East. Tehsil Pind Dadan Khan is also known for its exceptional richness in some minerals including salt, gypsum, coal, fire clay and limestone [11]. For the purpose of the study of taxonomy of mosquitoes from tehsil Pind Dadan Khan, broad spectrum surveys of different localities of the area were conducted in order to obtain a diversified collection of the specimens. The localities from which sampling was done were Railway Station, Hindu Temple, Jalalpur

Sharif, Khewra, Dharyala Jalap, Haran Pur, Lilla and Jinnah Park.

The localities were surveyed with regular time intervals during the research tenure and the specimens were collected by the help of aspirators and aerial nets. The collected specimens were then identified up to species level by observing their morphological characters under the microscope using the taxonomic keys including “The Fauna of British India including Ceylon and Burma” [2] and Walter Reed Biosystematics Unit (WRBU). The identification of the specimens was carried out under the Binocular microscope (Swift) in order to distinguish their morphological characters by comparing them with the published literature. The specimens were identified on the basis of their morphological characters including eyes, legs, antennae, wings, abdomen, hairs, femur, tibia, palpi, proboscis, pulvilli, etc. The study on the systematics of mosquitoes was carried out in the Biosystematics Laboratory of Department of Entomology at Pir Mehr Ali Shah, Arid Agriculture University, Rawalpindi.

3. Results and Discussion

A total of 11 species under one subfamily, one genus and six subgenera were identified from the given localities, three of which were reported for the first time from Pakistan including *Cx. plantaginis*, *Cx. bahri*, and *Cx. flavicornis*.

3.1 Family Culicidae

Proboscis long, wing venation and scales present alongside wing veins are the major identification characteristics of family Culicidae.

3.2 Genus *Culex* Linnaeus, 1758

Presence of a well-developed palpi is the main distinguishing character of this genera. Spiracular as well as postspiracular bristles missing. The scales on mesonotum and scutellum usually narrow. Well-developed mesonotal bristles present.

3.3 Subgenus *Culex* Linnaeus (1758)

Mosquitoes ranging from moderate to small size. The dorsal surface of vertex mainly supported with vertical and narrow scales while flat scales are observed at each of the lateral sides of the head. Mesonotal and scutellar scales are narrow. Male palpi greater in length than proboscis with its apical segments bending upwards and supported with tufts of hairs. Female palpi are shorter in length than proboscis. No scales on antennal segments of males.

3.3.1 *Culex (Culex) univittatus* Theobald, 1901

Synonyms; *simplex* Theobald, *montforti* Ventrillon

Material Examined

Jalalpur Sharif; 1♂ 1♀, 10.V.2016. 2♀, 03.VI.2016. Haran Pur; 2♂ 2♀, 19.V.2016. 1♂, 08.VI.2016. Dharyala Jalap; 1♂ 1♀, 28.V.2016. 1♂ 2♀, 09.VI.2016. 1♂ 1♀ 15.VI.2016. Railway station; 1♂ 1♀, 23.XII.2016. 1♀, 29.I.2017. Lilla; 1♂ 2♀, 19.XI.2016. 1♂ 1♀, 27.I.2017.

Comments

This species was reported from Pakistan in 1971^[12]. Adults were mostly collected from the graveyards, scrape yards and animal sheds. Mid and hind tibiae provided with a pale stripe on anterior side. White scales observed behind prothoracic spiracle in the form of a patch.

3.3.2 *Culex (Culex) fuscitarsis* Barraud, 1924

Synonyms; *fuscocephala*

Material Examined

Haran pur; 1♂ 1♀, 28.V.2016. 1♂ 2♀, 11.VI.2016. 2♂ 1♀, 09.VII.2016. Jalalpur sharif; 2♂ 1♀, 02.VII.2016. 3♂ 1♀, 09.VII.2016. 1♂ 2♀, 11.VII.2016. Dharyala jalap; 1♂ 2♀, 03.VII.2016. 1♂ 3♀, 09.VII.2016. Jinnah Park; 1♂ 1♀, 28.V.2016. 2♂ 1♀, 29.V.2016. 1♂ 3♀, 03.VI.2016. 2♂ 1♀, 1♂ 1♀, 19.VI.2016. Lilla; 2♂ 1♀, 11.VIII.2016.

Comments

The specimen were mostly collected from animal sheds, scrape yards and graveyards. *Culex fuscitarsis* is also reported from Pakistan in 2014^[17]. It was usually observed in the months of May, June, July and August. Abdomen of *Culex fuscitarsis* appears to be basally banded with narrow pale bands.

3.3.3 *Culex (Culex) gelidus* Theobald, 1901

Synonyms; *cuneatus*, *bipunctata*

Material Examined

Jalalpur sharif; 2♂ 1♀, 03.VII.2016. 1♂ 2♀, 10.VII.2016. Haran pur; 1♂ 3♀, 09.VII.2016. 2♂ 1♀, 11.VII.2016. Lilla; 2♂ 1♀, 17.VII.2016. Dharyala Jalap; 1♂ 1♀, 20.III.2016. 2♂ 1♀, 16.IV.2016.

Comments

Wings of *Culex gelidus* were with usual broad scales and tibiae were observed to be unlined. The specimens were collected from stagnant water near residential areas, graveyards, scrape yards and animal sheds. This species was mostly found in the month of July.

3.3.4 *Culex (Culex) hutchinsoni* Barraud, 1924

Material Examined

Khewra; 1♂ 2♀, 21.V.2016. 1♂ 3♀, 29.V.2016. Jinnah Park; 2♂ 1♀, 29.V.2016. 1♂ 1♀, 16.VI.2016. 2♂ 2♀, 24.VII.2016. Railway station; 1♂ 2♀, 31.V.2016. 3♂ 1♀, 29.VI.2016. 2♂, 10.VII.2016. 3♂ 1♀, 24.VII.2016.

Comments

The specimens were correlated with the published literature^[2]. These specimens were collected from residential areas of Pind Dadan Khan. *Culex hutchinsoni* is a very small species dark brown in color with the terminal segment of male palpi having whitish spots at their bases.

3.3.5 *Culex (culex) fuscocephala* Theobald, 1907

Synonyms; *fuscitarsis*

Material Examined

Lilla; 2♂ 1♀, 10.VII.2016. 1♂ 1♀, 17.VII.2016. 1♂, 24.VII.2016. Khewra; 2♂ 2♀, 11.VII.2016. 1♂ 1♀, 23.VII.2016.

Comments

Culex fuscocephala was the least found species only found in the month of July. The abdomen of the adult mosquitoes appears to be unbanded and the pleurae contained a patch of scales in between two clean patches which were dark brown in color. The specimens were more often collected from the scrape yards, graveyards, and river side.

3.4 Subgenus *Culiciomyia* Theobald, 1907

Moderate sized mosquitoes. Narrow and vertical scales on vertex and nape while flat scales at each side of the head. Mesonotal and scutellar scales narrow. Scales on tarsi and wings dark. Usually one lower mesepimeral bristle.

3.4.1 *Culex (Culiciomyia) bailyi*, Barraud (1934)

Material Examined

Khewra; 1♂ 2♀, 20.V.2016. 1♂ 1♀, 30.V.2016. 1♂ 1♀, 25.VI.2016. 2♂ 3♀, 02.VII.2016. Hindu temple; 2♂ 1♀, 18.VI.2016. 1♂ 1♀, 16.VII.2016. 1♂ 1♀, 29.VII.2016. Haran pur; 1♂ 1♀, 19.VIII.2016. 1♂ 2♀, 16.X.2016.

Comments

There was no clear dark area at the pleurae while a stripe of dark color was observed across the pleurae, mainly on its upper part. The specimens were mostly collected from stagnant water around the residential area, graveyards and vegetable fields.

3.4.2 *Culex (Culiciomyia) nigropunctatus* Edwards, 1926

Synonyms; *annulata*

Material Examined

Hindu temple; 1♂ 1♀, 23.VII.2016. 1♂ 2♀, 20.VIII.2016. Jinnah Park; 1♂ 1♀, 09.VII.2016. 1♂ 1♀, 21.VIII.2016. Lilla; 1♂, 10.IX.2016. 2♀, 18.IX.2016. Jalalpur sharif; 1♂ 1♀, 30.IX.2016. 1♂, 15.X.2016. Railway station; 1♂ 1♀, 26.II.2017.

Comments

Culex nigropunctatus appeared to be a small species and brownish in color. A definite blackish velvety spot on the upper part of the mesepimeron is usually a distinguished character displayed by this species.

3.4.3 *Culex (Culiciomyia) bahri* Edwards, 1914

Synonyms; *lemmonae*

Material Examined

Jinnah Park; 1♂ 1♀, 28.VI.2016. 2♂ 1♀, 31.VII.2016. 1♂ 1♀, 17.IX.2016. Haran pur; 1♂ 1♀, 15.VII.2016. 1♂ 2♀, 11.IX.2016. 1♂ 1♀, 22.X.2016. 1♂ 1♀, 31.X.2016. Dharyala jalap; 1♂ 1♀, 06.XI.2016. 1♂ 1♀, 27.XI.2016. 2♂ 2♀, 11.XII.2016.

Comments

The specimens were analyzed and correlated to the published description given in 1934 [2]. Plume series of scales in the wings was narrower and the last two segments of the ♂ palpi were observed to be longer than the proboscis. This species was reported for the first time from Pakistan in this study.

3.5 Subgenus *Lophoceratomyia* Theobald, 1905

Brownish mosquitoes which are medium to small in their size. Small flat scales present on vertex of head towards the margins of eyes. Proboscis and palpi lack pale rings and are dark brownish in colour. One or two lower mesepimeral bristles. Tarsi dark entirely. Dark scales on wings which are dispersed and few in number.

3.5.1 *Culex (Lophoceratomyia) plantaginis* Barraud, 1924

Material Examined

Hindu temple; 1♂ 2♀, 16.VII.2016. 2♂ 1♀, 27.VIII.2016.

Jinnah Park; 1♂ 1♀, 20.VIII.2016. 1♂ 2♀, 09.X.2016. 1♂ 1♀, 16.X.2016. 1♂, 12.XI.2016. 2♀, 04.XII.2016. Jalalpur sharif; 1♂ 1♀, 13.V.2016. 1♂ 1♀, 18.VI.2016. 2♂ 3♀, 15.VII.2016. Haran pur; 1♂ 2♀, 21.VIII.2016. 1♂ 1♀, 11.IX.2016. Khewra; 1♂ 1♀, 01.X.2016. 2♂ 1♀, 22.X.2016. Dharyala jalap; 1♂ 1♀, 20.VIII.2016. 1♂ 1♀, 30.X.2016. Lilla; 2♂ 1♀, 30.X.2016. 1♂ 1♀, 27.XI.2016. Railway station; 1♂ 2♀, 23.VIII.2016. 1♂ 1♀, 20.XI.2016.

Comments

It was the most observed species in the localities of the study area. Wing scales were sparse specifically on vein 6. The scales on the mesonotum were light brown and the basal segment of antennae was with a dull and somewhat rounded appearance. The specimen were accumulated from different habitats including graveyards, scrape yards, vegetable fields and standing water. *Culex plantaginis* has been firstly reported from Pakistan in this study.

3.5.2 *Culex (Lophoceratomyia) flavicornis* Barraud, 1924

Material Examined

Railway station; 2♂ 1♀, 31.VII.2016. 1♂ 3♀, 18.IX.2016. Khewra; 1♂ 1♀, 06.IX.2016. 1♂ 1♀, 16.X.2016. Lilla; 3♂ 2♀, 13.XI.2016. Jinnah Park; 1♂ 2♀, 20.XI.2016. Haran pur; 1♂ 1♀, 20.V.2016. 2♂ 1♀, 17.VII.2016. 1♂ 1♀, 16.XII.2016.

Comments

The antennal segment 6 contains a tuft of bright yellowish hairs whereas head is supported with the appearance of both narrow and flat scales. This species was mostly observed in the months of May, July, September, November and December. This species was reported in this study for the first time from Pakistan.

3.6 Subgenus *Neoculex* Dyar, 1905

Mosquitoes of small size with blackish tarsi. Numerous and strong mesonotal bristles. Narrow scales on the vertex of head as well as on scutellum.

3.6.1 *Culex (Neoculex) brevipalpis* Giles, 1902

Synonyms; *fidelis*, *longipes*, *macropus*, *uniformis*

The collection of these specimen was done from areas with heavy vegetation and stagnant water, scrape yards, rain water ponds and residential areas.

Material Examined

Jalalpur sharif; 2♂ 1♀, 17.VI.2016. 1♂ 3♀, 10.VII.2016. 2♂ 2♀, 24.VII.2016. Dharyala jalap; 1♂ 2♀, 31.VII.2016. 1♂ 1♀, 25.IX.2016. 1♂ 2♀, 20.XI.2016. Khewra; 1♂ 1♀, 10.IX.2016. 2♂ 1♀, 19.XI.2016. 1♂ 1♀, 03.XII.2016. Lilla; 1♂ 1♀, 09.X.2016. 1♂ 1♀, 13.XI.2016. 1♂ 3♀, 11.XII.2016.

Comments

These specimens were mainly characterized by the absence of lower mesepimeral bristle in them. This species was recorded in the months of June, July and from September to December.

4. Discussion

The presence of adult mosquitoes was recorded throughout the study period but the presence of species varied according to their favorable environmental conditions in different months. However, the maximum number of mosquito species

were recorded in the month of July due to high humidity during the monsoon season. The higher percentage of humidity played a vital role in the development of mosquitoes. The second highest figure of mosquito species recorded was in the month of June which was 11 while, the third highest figure was obtained in the month of October (10) which was due to great fluctuations in temperature in between day and night. Results showed that *Cx. plantaginis* was the most observed species during the study which was recorded in the months of May, June, July, August and October, November, December followed by *Cx. bahri* which was observed in the months of June, July, September, October, November and December, *Cx. brevipalpis* in similar months as of *Cx. bahri*, *Cx. univittatus* in the months of May, June, August, September and October, *Cx. bailyi* in May, June, July, August and October, *Cx. nigropunctatus* in July, August, September, October and February, *Cx. flavicornis* in May, July, September, November and December, *Cx. fuscitarsis* in May, June, July and August, *Cx. hutchinsoni* in May, June and July, and *Cx. gelidus* in March and July respectively. Whereas, *Cx. fuscocephala* was the least observed species which was recorded in the month of July. Furthermore, *Cx. plantaginis* was observed in almost all of the collection localities except Jalalpur Sharif. Following *Cx. plantaginis* was *Cx. fuscitarsis*, *Cx. nigropunctatus*, *Cx. flavicornis*, *Cx. univittatus*, *Cx. brevipalpis*, *Cx. gelidus*, *Cx. hutchinsoni*, *Cx. bailyi* and *Cx. bahri* which were recorded from 5, 5, 5, 4, 4, 3, 3, 3, 3 localities respectively. While *Cx. fuscocephala* was only observed from the localities of Khewra and Lilla.

5. Conclusions

A total of 11 species under one subfamily, one genus and six subgenera were identified from the given localities. The species which were recorded from the surveyed localities included; *Culex univittatus*, *Culex fuscitarsis*, *Culex gelidus*, *Culex hutchinsoni*, *Culex fuscocephala*, *Culex bailyi*, *Culex nigropunctatus*, *Culex bahri*, *Culex plantaginis*, *Culex flavicornis*, *Culex brevipalpis*. Three of these identified species were an addition to the fauna of mosquitoes of Pakistan. Maximum number of species were recorded from Haran Pur and Jalalpur Sharif (which were 10 in number from both localities) while a minimum of 7 species were recorded from Hindu temple (which was the lowest number of species in the surveyed area).

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