Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 6, No. 4, p. 368-373, 2015
http://www.innspub.net

INNSPUB
RESEARCH PAPER
OPEN ACCESS

Taxonomic study of mosquitoes (Culicidae: Diptera) of district Narowal, Punjab-Pakistan

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Article published on April 30, 2015

Key words: Diptera, Culicidae, Taxonomy, Key, District Narowal, Mosquitoes, Fauna.

Abstract

The purpose of study was to explore the mosquito fauna of District Narowal of Punjab-Pakistan and to construct identification keys. The selected localities were visited once a week from December 2012 to December 2013. Results showed that the collected specimens belong to 11 species in 4 genera of 2 subfamilies. The species are: Anophelinae: *Anopheles nigerrimus*Giles, 1900, *Anopheles culicifacies*Giles, 1901, *Anopheles stephensi*Liston, 1901,*Anopheles jamesii*Theobald, 1901, and *Anopheles maculates*Theobald, 1901. Culicine species include genus *Culex* with*Culexepidesmus*Theobald, 1910, *Culexfatigans*Wiedemann, 1828,*Culextheileri*Theobald, 1903 and*Culexvishnui*Theobald, 1901; genus *Armigeres*showed *Armigeres (Armigeres) obturbans*Walk, 1860, *Aedes*showed only one species *Aedes (Aedes) albopictus*Skuse, 1894. Descriptions, distribution and illustrated keys for the identification of all the mosquito species found in district Narowal are presented.

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Introduction

Mosquitoes (Culicidae: Diptera) are important arthropods responsible for the transmission of many pathogenic microbes. Infected mosquitoes carry these organisms from person to person without exhibiting any signs. Viral diseases spread through mosquitoes like dengue fever,Chikungunyaandyellow fever are transmitted by *Aedesaegypti*. Parasitic disease like malaria, caused by various species of Plasmodium, spread through mosquitoes of genus *Anopheles*.Lymphatic filariasis (the main cause of elephantiasis) spread by a vast varieties of mosquito species (W.H.O, 2011).

Male mosquitoes of genus *Anopheles* vibrate their wings 450 to 600 times/second (Hypertextbook.com 2000). A single female mosquito hold three times more blood than its weight. From 1934 to 1971 three species of genus*Culex* and one species of genus *Anopheles* were recorded and added in mosquito fauna of Pakistan (Khan, 1971). Theobald described one species of mosquito belong to subgenus *(Adimorphus) Aedesgouldi* from Pak-Afghan border. Three subfamlies of family Culicidae, fifteen genera of subfamily Culicinae and eleven subgenera of genus *Aedes*mosquitoes were identified from Afro-tropical Region (Huang, 2001).

World health organizationreported that three hundred million cases occur throughout the world in one year due to mosquitoes born diseases (Kalluri*et al.,* 2007). Diseases transmitted by mosquitoes in Pakistan include malaria and dengue fever (Paul *et al.,* 1998). A total of 34 species of genus *Anopheles* were reported throughout Pakistan out of which *An. culicifacies* was reported as an important malaria causing species in rural and town areas (Covell, 1931; Hick and Majid, 1937; Reisan and Borehan, 1982 Mahmood*et al.*, 1984; Pervez and Shah, 1989). *An. stephensi* was reported as primary vector of malaria in the urban areas of Pakistan (Rehman and Mutalib, 1967). Keeping in view the importance of mosquitoes as vectors of diseases, the present study was conducted with the objectives to explore the mosquito fauna of District Narowal and to construct the key for the identification of mosquito species of District Narowal.

Material and methods

Sampling Sites

Collection of mosquitoes was conducted at different localities and sub-localities of district Narowal. The localities included Noorkot, Manzoorpurplaat, Shakargarh, Gumtalah, Khan pur, AnayatPur, Daira Baba Nanak, Matay Kay Tharpaal, QilaKalarwala, Narowal, Bari Minhasaan, Rupochak, Zafarwal, Dhabi Wala, Sarraj, PindiBohri, Shahazada, Dhamthal, Talwandibindraan, Sathiyala, Essa, BadoChadaKalan and Khairallahpursayeddan.

Data Collection

The aerial net and mouth aspirators were used for collecting the mosquitoes. The collected mosquitoes were shifted in wide mouth killing jar. After killing, the mosquitoes were transferred in to the relaxing jar. Entomological pins were used for pinning the specimens. Triangular tags with glue were used for mounting the mosquitoes. The legs of mosquitoes were held away from their body. Insect wooden boxes were used for preserving the mosquitoes.

Identification of Specimens

Identification of these mosquitoes was done following Barraud (1934) The Fauna of British India including Ceylon and Burma. Zoya Ahmed, (2013) Taxonomic study of mosquitoes in Rawalpindi and Islamabad region. Qasim*et al.*, (2014) Taxonomic study of mosquitoes of Murree hills. Mosquitoes were examined under a binocular zoom microscope (Nikon SMZ 745T) with magnification up to 300X. Photograph of important taxonomic characters were taken by using a (5.01 MP) digital camera with state of the art system. Description of all the species was provided. Keys to the genera and species were constructed. All the voucher specimens were deposited in the Systematic Entomology Lab. of the department of Entomology the University of Agriculture Peshawar.

Results and discussion

In the result of present survey in the different localities of District Narowal Five hundred and seventy specimens of mosquitoes were collected from different habitats. These specimens fall into the 11 species in 4 genera and 2 subfamilies.

Taxonomic account of family Culicidae from District Narowal, Punjab

The distinguishing characters of the members of Culicidae are the long syringe like mouth parts or proboscis for sucking purpose. Wings clothed with scales and venations clearly visible.

Key to the Subfamilies of family Culicidae of District Narowal, Punjab

1. Palpi of male and female of same length; wings speckled having pale and black spots, some time spots not distinctly visible, dark brown costal margin.....Anophelinae

-. Female palpi shorter than those of male; wings not speckled and distinctly clear, proboscis normally straight but a bit curved, scutellumtrilobed.....Culicinae

SUBFAMILY ANOPHELINAE

Genus *Anopheles*Meigen, 1818

Spotted wings are the main character. Palpi as long as proboscis; apical segments of palpi spatula shaped in male.

Subgenus *Cellia*

Group *Anopheles*

Series *Anopheles*

Key to the Species of Anopheles

1- Palpi have clear spots or bands.....2

-: Palpi devoid of spots or bands, rarely slight bands present.....4

2- Second last segment of palpi white at apex and dark at base.....*jamesii*

-: Second last segment of Palpi not as above.....3

3- Two wide creamy white bands present on last two segments of palpi.....*stephensi*

-: Three wide creamy white bands present in female on apical segments of palpi.....*maculatus*

4- Abdomen dark with dark hairs and without scales.....*culicifacies*

-: Abdomen with narrow scales present on the posterior border of tergite VIII and tuft of dark scales on the ventral side of segment VII.....*nigerrimus*

***Anopheles jamesii* Theobald, 1901**

Material Examined: Narowal,Pindi Kalan; 4♂ 7♀, 10.vii.2013, Bara Bai; 4♂ 5♀, 13.iii,2013. Saidpur: 12♂ 14♀, 18.vi.2013, Shoaib. ECUAP.

Remarks: Total 46 specimens were collected from the sampled localities. The collection was made during March-Sep. The temperature of localities was 21-39°C. These localities were situated 5 km before Indo-Pak international border

***Anopheles stephensi* Liston, 1901**

Material Examined: Shakargarh: Narowal, Khan pur; 12♂ 10♀, 1.V.2013. AnayatPur: 12♀, 1.ii.2013, Shoaib. ECUAP.

Remarks: Total numbers of collected specimens were 34. This species was found in the rural areas near the Indo-Pak International border attached with occupied Kashmir especially where the temperature is low as compared to the other areas of district Narowal. This specie was particularly present in the month of February to May when temperature was 28-39˚C.

***Anopheles maculates* Theobald, 1901**

Examined Material: Shakargarh: Narowal, Bari Minhasaan: 15♂, 11.vii.2013. Rupo 8chak: 10♀, 12.ix.2013, Shoaib. ECUAP.

Remarks: This species is especially present in areas with low temperature conditions as compared to other areas of the District Narowal. The collection of this species was made during the months of July–Sep when the temperature was 25-39˚C. The collected specimens were 25.

***Anopheles culicifacies* Giles, 1901**

Material Examined: Narowal, Daira Baba Nanak: 13♂ 15♀, 2.vii.2013. AnayatPur: 4♂ 16♀, 12.viii.2013, Shoaib. ECUAP.

Remarks: The specimens were collected during the months of July-Aug when the temperature was between 28-39˚C.A total of 48 specimens were collected.In district Narowal a large number of animal and poultry sheds are present especially in the upper mentioned localities.

***Anopheles nigerrimus*Giles, 1900**

Material Examined: Collections of these species were made from villages of district Narowal.BadochadaKalan: 12♂ 5♀, 12.vii.2013, Rupochak: 17♂ 19♀, 2.ix.2013, Gumtalah: 14♂ 13♀, Khan pur: 11♂ 12♀, 13.vii.2013, Shoaib. ECUAP.

Remarks: Total 103 specimens were collected from above mentioned localities in months of July-Sep when temperature was 23-35˚C. During monsoon this species was found in excavation hollows near the villages and towns. This mosquito was also found from the burrows-pit, buffalo wallows, brick pits, drains, pools from leaks and waste water.

SUBFAMILY CULICINAE

Fifteen genera belong to this subfamily Culicinae. These mosquitoes have trilobedScutellum and this the major character in subfamily *culicinae*, wings margins without v-shape knick and clypeus have more length than width.

KEY TO GENERA OF SUBFAMILY CULICINAE

1- Claws with pulvili.....*Culex*

:- Claws without pulvili, Pleurae lack Postspiracular bristles.....2

2- Claws usually toothed, snout compressed laterally and bend downward at tip, smooth scales on vertex and scutellum.....*Armigeres*

:- Claws usually toothed, snout slender and erect, body covered with several scales..... *Aedes*

Genus *Culex*Linnaeus, 1758

Many species belong to this genus act as vector of imperative diseases like West Nile virus, encephalitis, Filariasis and Japanese encephalitis.

Subgenus *Culex* Linnaeus, 1758

Male have palpi longer than female, apical segments of palpi are furnished with hairs and seems to be rising upward. Proboscis clearly marked with a pale ring in the center.

Key to species of subgenus *Culex*

1- Proboscis and tarsi with dark and pale spots, tibiae and femora yellowish with slightly scattered brown scales (rarely the entire legs are yellowish in color)..... *epidesmus*

: - Proboscis and tarsi not spotted, tibiae and femora not as above.....2

2- Meso-femur pale when examined from behind or beneath..... *fatigans*

: - Mesofemur without pale stripe.....4

3- Ventral 1/3rd part of meta-femur provided with drab stripe..... *theileri*

:- Outer side of meta-femur furnished with pale scales from base to knee joint, dorsal side marked with dark scales from base to knee joint..... *vishnui*

***Culex (Culex) epidesmus* Theobald, 1910**

Material Examined: Narowal.Matay Kay Tharpaal: 4♂ 4♀, 3.viii.2013, QilaKalarwala: 7♂ 8♀, 3.ix.2013, Shoaib. ECUAP.

Remarks: This species was collected during the months of Aug-Sep when the temperature 20- 29˚C.A total of 23 specimens were collected. This species was found in the specific above mentioned localities and some surrounding areas but not throughout all sampled localities.

***Culex (Culex) fatigans*Wiedemann, 1828**

Material Examined: Narowal. Dhamthal: 7♂ 7♀, 14.ii.2013 Talwandibindraan: 6♂ 7♀, 4.iv.2013, BadochadaKalan: 10♂ 3♀, 4.iii.2013,

Khairallahpursayeddan: 5♂ 3♀, 15.ix.2013, Shoaib. ECUAP.

Remarks: A total of 48 specimens were collected from selected localities. This species was found in the areas with dense vegetation so that's why this species was also found from the hilly areas of India and Pakistan but those hilly areas where the temperature is not less than 5°C throughout the maximum breeding season e.g. in Pakistan: KalarKahaar and Muzzafarabad and in India: Khassi hills.

***Culex(Culex) theileri* Theobald, 1903**

Material Examined: Narowal.Din Pur: 4♂ 2♀, 16.xii.2013. Jamwaal: 3♂ 4♀, 7.ix.2013. Maryaal: 1♂ 3♀, 6.ix.2013. Antowali: 2♂ 5♀, 17.viii.2013. Bagwanpur: 4♂ 6♀, 7.viii.2013. Maingri: 2♂ 4♀, 18.ii.2013. Mirpur: 1♂ 1♀, 5.iii.2013. Khanpur: 7♂ 4♀, 3.iv.2013. Dhamthal: 3♂ 5♀, 4.iv.2013. PindiBohdi: 2♂ 6♀,7.ii.2013.Maingrah: 5♂ 5♀, 5.ix.2013. Dudhuchak: 3♂ 2♀, 15.x.2013, Shoaib. ECUAP.

Remarks: A total of 84 specimens were collected from upper mentioned sites.The temperature during the time of collection was 19-27°C. This species is commonly animal biting and not responsible for transmission of human diseases (http://www.wrbu.org).

***Culex (Culex) vishnui*Theobald, 1901**

Material Examined: Narowal. MadahPuli: 2♂ 3♀ 7.vi.2013, Titer Pur: 4♂ 5♀, 7.iii.2013. Dhalowali: 4♂ 4♀, 19.iv.2013. Bhattachowk: 1♂ 2♀, 15.iv.2013, Shoaib. ECUAP.

Remarks: Total collected specimens were 25. This species was found in the areas near to the roads and some town areas. This species was collected during the months March-June when temperature of selected localities was 25-35˚C. The above mentioned areas found along the roads. Both sides of the road have tall trees of *Accasianilotica, Populusindica*and dense grass.

Genus *Armigeres* Theobald, 1901

Medium size Mosquitoes, very similar to *Aedesspp* in general seem.

***Armigeres (Armigeres) obturbans*Walk, 1860**

Material Studied: Narowal. Dhudochak: 15♂ 12♀, 26.iii.2013. Pindi Bohri: 6♂ 8♀, 28.iv.2013. Phalwari: 8♂ 12♀, 19.v.2013. Jasar: 4♂ 7♀, 17.vii, 2013. Manzoorpur plot: 11♂ 15♀, 23.v.2013, Shoaib. ECUAP.

Remarks: Total 30 specimens were collected. This species was collected during the months of March-July when the temperature was 29-40˚C. In these months temperature is increases by and by.

***Aedes (Stegomyia) albopictus* Skuse, 1894**

Material Examined: Narowal. DhabliWala: 1♂ 4♀, 15.iii.2013. Sarraj: 2♂ 3♀, 16.ix.2013. Shahazada: 3♂ 3♀, 20.v.2013, Shoaib.ECUAP.

Remarks: According to Skuse (1894) this species is very distinct because the whole body is speckled with black and white markings. Total 16 specimens were collected from the sampled localities of the district. This species was collected during the months of July-September. This species is new to district Narowal-Pakistan.

Conclusion and recommendations

The study on the taxonomy of mosquitoes of district Narowal showed that 11 species of mosquitoes in 4 genera and 2 subfamilies occur in the area. These species are:Anophelinae:*Anopheles nigerrimus, Anopheles culicifacies, Anopheles stephensi, Anopheles jamesii,* and *Anopheles maculates.* Culicinae: *Culex*: *Culexepidesmus, Culexfatigans, Culextheileri, Culexvishnui. Armigeres: Armigeres (Armigeres) obturbans.* Genus *Aedes* comprise only one species *Aedes (Stegomyia) albopictus*.It is recommended that further sampling be done in the area for discovery of more species. It is also recommended that month wise sampling be done in District Narowal. To determine the appearance and

abundance of mosquitoes in each month for advance management.

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