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Mosquito diversity from Kempty falls, near Mussoorie, Uttarakhand (India)

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Abstract
Mosquito diversity was studied from the outdoor as well as indoor areas adjoining Kempty falls, Mussoorie during post monsoon (September, 2017). The collected specimens were examined thoroughly to find out their taxonomic position. From the total 255 collected specimens, 20 species belonging to four genera i.e. *Aedes*, *Armigeres*, *Anopheles* and *Culex* were identified.

Keywords: diversity, mosquito and Kempty fall

Introduction
Biodiversity on earth is facing numerous crises and threats, most prominently by a large scale exploitation of natural resources and habitats to fulfil the demands of an exponentially growing human population (McKee *et al.* 2004) [8]. Habitat loss and environmental degradation in terrestrial ecosystems cover a wide range of alteration of natural and semi-natural ecosystems by human activities (Pereira *et al.*, 2010) [12]. Species extinction rates have reached at alarming stage and this situation is predicted to persist throughout the 21st century. Scientists are talking about the mass extinctions in this century and predicted the loss of nearly one million species. The different problems to conserve the biodiversity are reflected to a parallel crisis for alpha taxonomy (Mayo *et al.*, 2008) [9]. Biodiversity, encompassing diversity of genes, species, and ecosystems, is fundamental to biology, yet tools to monitor it are insufficient. Biodiversity can be estimated by using the species richness in a community or by this number together with the proportion of species (species evenness) or by other more indirect estimators among which is morphological variation (Gaston & Spicer, 2004) [6]. Taxonomy is the discipline of biology aimed to allocate all living organisms to formal classificatory units (the *taxa*) referred to a hierarchy of categories (e.g., species, genera, families, etc.) and to name all these units according to an international nomenclatural system of Latin *nomina*, which constitutes a language common to all biologists (Dubois, 2000) [5].
Mosquitoes belong to family Culicidae and order Diptera is one of the most important group of insects. Mosquitoes are responsible for several human diseases as they act as potential vectors. Due to environment degradation and new agro ecosystems, these insects have flourished and their population increased to maximum extent in the recent years. The flare up of diseases like malaria, Filariasis, Chikungunya, Japanese Encephalitis (JE), Dengue, Dengue Haemorrhagic Fever (DHF) in different parts of India during the last decade is the crystal clear evidence in this regard. Therefore, there is need to evaluate mosquito diversity from different unexplored habitats, which will be helpful to fight against the diseases occurred due mosquitoes. During present investigation, an attempt has been made to explore the mosquito diversity from Kempty fall, near Mussoorie, Uttrakhand (India).

Materials and Methods
The mosquitoes specimens were collected from Kempty falls with the aid of sucking-tubes, aspirators torch and test tubes. The collection of adult mosquito species was done in the month of September, 2017. By using spray of pyrethrum solution in a closed room on white cotton bed-sheets, the indoor collections of resting mosquitoes were made. In spite of this, human bait collection methods were also employed in outdoor collections by torch light and test tube. Only adult mosquitoes were collected and preserved for identification purposes. A total of 255 mosquito specimens were procured during this preliminary survey and identified with reference to Christophers (1933) [2], Barraud (1934) [1], Sirivanakarn (1976) [14], Huang (1979) [7] and Nagpal *et al.* (2005) [11].

Table 1: List of identified species with number of collected specimens.

S. No.	Organism	Male	Female	Total
1.	*Anopheles peditaeniatus* Leicester	-	11	11
2.	*Anopheles subpictus* Grassi	04	08	12
3.	*Anopheles vagus* Donitz	03	05	08
4.	*Armigeres subalbatus* (Coquillett)	15	37	52
5.	*Armigeres kuchingensis* Edwards	07	13	20
6.	*Armigeres kesseli* Ramalingam	04	13	17
7.	*Armigeres durhami* (Edwards)	-	02	02
8.	*Culex bitaeniorhynchus* Giles	05	12	17

9.	*Culex vishnui* Theobald	09	15	24
10.	*Culex pseudovishnui* Colless	04	11	15
11.	*Culex tritaeniorhynchus* Giles	-	07	07
12.	*Culex fuscocephala* Theobald	-	03	03
13.	*Culex mimulus* Edwards	-	02	02
14.	*Culex quinquefasciatus* Say	03	17	20
15.	*Culex gelidus* Theobald	02	05	07
16.	*Culex whitmorei* Giles	-	03	03
17.	*Aedes aegypti* (Linnaeus)	08	04	12
18.	*Aedes albolateralis* (Theobald)	-	02	02
19.	*Aedes albopictus* (Skuse)	07	12	19
20.	*Aedes thomsoni* (Theobald)	-	02	02
Total		71	184	255

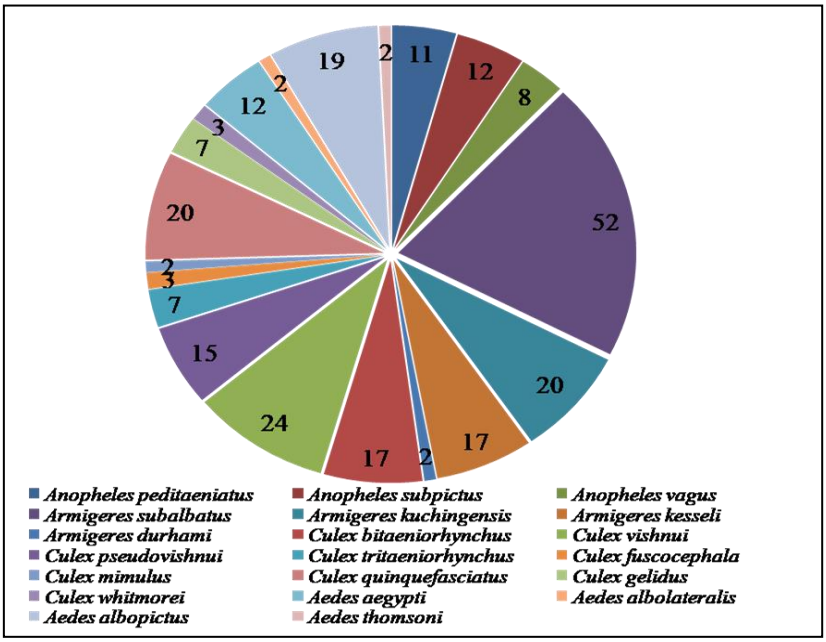

Fig 1: Number of collected specimens of each mosquito species.

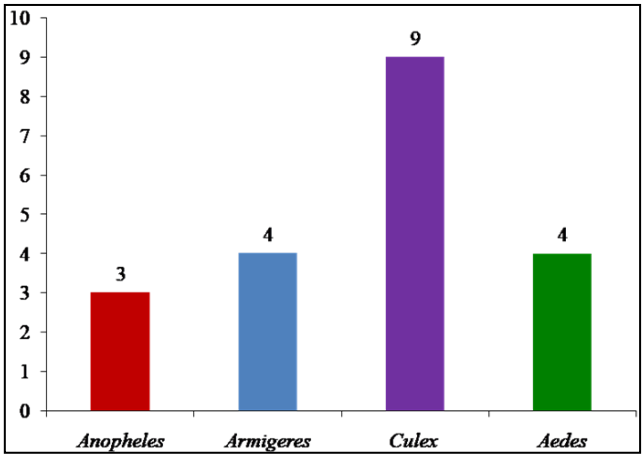

Fig 2: Number of species belonging to different mosquito genera.

Results and Discussions

During present investigation, from total of 255 specimens, 71 male and 184 female, of blood sucking insects of 20 species belonging to 4 genera were identified (Table 1). The species *Armigeres subalbatus* (Coquillett) was found to most abundant followed by species *Culex vishnui* Theobald (Fig. 1). Genus *Culex* found to most diverse with 9 species followed by *Armigeres* and *Aedes* with 4 species each (Fig. 2).

Rani and Singh (2011) [13], Devi and Jauhri (2004 & 2013) [4, 3] and Mondal *et al*. (2014) [10] worked on the mosquito fauna of Dehradun and its surrounding areas, results of present study are congruent with these earlier reports. The present study has yielded fruitful results and will go in a long way as a good model study to conduct such studies on remaining taxa of this economically important group of insects. Taxonomic revision of various insect groups is need of the hour. It becomes very crystal clear from the above discussion that intensive and extensive collections cum survey tours are required to complete taxonomic studies.

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