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Biodiversity of Caelifera (Orthoptera) from Gorakh hill station, Dadu Sindh Pakistan

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Abstract
Present study was designed to explore the biodiversity of Caelifera of Gorakh Hill Station that is situated at at Kirthar Mountain, 94 km (58 miles) northwest of Dadu, at an altitude of 5,689 meters (1,734 meters). During the present expedition a total of 250 specimens were captured from Gorakh Hill Station at an altitude of 5,689 meters (1,734 meters) during the year 2016 in month of June. Biodiversity of Caelifera (Orthoptera) from this site comprises of four families, Acrididae, Tetrigidae, Dericorythidae and Pyrgomorphidae. A total of 39 species were identified. Beside this, family Acrididae was found most dominant with 19 species followed by Tetrigidae with 11 species while lowest population of Dericorythidae with 5 species and Pyrgomorphidae with 4 species were recorded.

Keywords: Gorakh hill, biodiversity, caelifera, orthoptera, species

1. Introduction
Gorakh is a small hill station in Sindh, Pakistan. It is located at Kirthar Mountain, 94 km (58 miles) northwest of Dadu, at an altitude of 5,689 meters (1,734 meters). Gorakh Hill Station is located in one of the highest plateaus in Sindh, on an area of 10,000 square meters [1, 2]. Due to the mild weather and beautiful scenery, it is very appealing to nature lovers. The habitat of Gorakh gives it a special climate, with winter temperatures below zero, summer temperatures below 20°C, and annual rainfall of about 120 mm. The Climatic conditions of this area make it more suitable for the biodiversity of insects particularly Caeliferans diversity [3, 4].
Caelifera is sub-order of Orthopteroid insects. These include grasshoppers and allies of grasshoppers (Acridoidea), and other superfamily classified with them: Tetrigoidea (ground-hoppers) and Tridactyloidea (pygmy mole crickets) [5-8].
Caelifera includes approximately 2,400 effective genera and approximately 11,000 known species. There may be many unlisted species, especially in tropical forests. Caelifera has major tropical spreads (like most orthopterans), and fewer species are known from the middle climatic zone. Caelifera is divided into two different types: the more basic Tridactylidea and the Acridoidea [9, 10].
Many species, especially locusts, are important agricultural pests, but not all species are locusts: a non-taxonomic term referring to species in which populations may change in shape and exhibit swarming behavior when congested [10]. Examples of agricultural locust pests that are not referred to as locusts include certain species in Pyrgomorphidae, in particular *Zonocerus variegatus* [11]. The caeliferan grasshoppers cause considerable damage to the agricultural crops and are found destructive pests worldwide.
Caeliferan collections are penetrating to riot, and they can be used as indicators of land management deprivation or habitat change [20]. The objective of this study was to explore the biodiversity of Caelifera of Gorakh Hill station.

2. Materials and Methods
Caeliferans were captured with the help of insect net from different sites of Gorakh Hill during the year 2016 in month of June (Fig. 5; Map 1). The samples were killed with help of killing jar containing potassium cyanide. The insects were preserved into insects cabinets. The Caeliferans were identified with help of taxonomic keys available in the literature [12, 20] and with help of "http://orthoptera.speciesfile.org".

3. Results and Discussion

During the present study a total of 250 specimens were captured from Gorakh Hill Station at an altitude of 5,689 meters (1,734 meters) during the year 2016 in month of June. Biodiversity of Caelifera (Orthoptera) from this site comprises on four families, Acrididae, Tetrigidae, Dericorythidae and Pyrgomorphidae with subfamilies i-e: Acridinae (2 species: *Phlaeoba tenebrosa* (Walker, 1871), *Truxalis eximia eximia* Eichwald, 1830), Catantopinae (2 species: *Diabolocatantops innotabilis* Walker, 1870, *Diabolocatantops sp.*), Cyrtacanthacridinae (3 species: *Anacridium aegyptium* (Linnaeus, 1764), *Anacridium rubrispinium* Bey-Bienko, 1948, *Cyrtacanthacris tatarica* (Linnaeus, 1758), Calliptaminae (2 species: *Acorypha glaucopsis* (Walker, 1870), *Calliptamus barbarus barbarus* (Costa, 1836)), Eyprepocnemidinae (4 species: *Heteracris littoralis* (Rambur, 1838, *Heteracris adspersa* (Redtenbacher, 1889), *Eyprepocnemis rosea*, Uvarov, 1942, *Eyprepocnemis alacris alacris* (Serville, 1838)) and Oedipodinae (6 species: *Acrotylus humbertians* (Saussure), *Acrotylus longipes longipes* (Charpentier, 1845), *Aiolopus thalassinus tamulus* (Fabricius, 1798), *Locusta migratoria* (Linnaeus, 1758), *Hilethera aelopoides* (Uvarov,1922), *Sphingonotus savignyi*, Saussure, 1884) of family Acrididae, Amorphinae (3 species: *Bolivaritettix nilgricus* (Hebard, 1930),*Bolivaritettix sp. Cingalotettix sp.*), Tetriginae (8 species: *Copotettix annandalei*, Hancock, 1915, *Coptotettix fossulatus* Bolívar, 1887,*Eucriotettix maculatus* (Kirby, 1914), *Ergatettix dorsifera* (Waker,1871), *Hedotettix gracilis* (Haan, 1843), *Paratettix cingalensis* (Walker, 1871), *Tetrix mundus* (Walker, 1871), *Thoradonota sp.*) of Family Tetrigidae, Dericorythinae (3 species: *Dericorys albidula* Serville, 1838, *Dericorys tibialis* (Pallas, 1773), *Dericorys* sp.) Conophyminae (2 species: *Conophyma indicum* Mistshenko, 1950, *Conophyma sp.*) of Family Dericorythidae, Pyrgomorphinae (4 species: *Chrotogonus tracypterus trachypterus* (Blanchard, 1836), *Tenuitarsus orientalis* Kevan, 1959, *Pyrgomorpha conica teretecornis* (Brullé, 1840), *Pyrgomorpha cognatus miniata* Uvarov. 1943) of Family Pyrgomorphidae were sorted out. The family Acrididae was found most dominant with 19 species followed by Tetrigidae with 11 species while lowest population of Dericorythidae with 5 species and Pyrgomorphidae with 4 species were recorded (Fig. 2, 3, 4).

Kirby [12] provided taxonomic contribution to the grasshoppers (Acrididae) in Fauna of British India. Randell [13] separated the Caeliferan female species on the basis of their genital components. Yin *et al.* [14] gave synonymic catalogue of grasshoppers and their allies of the world particularly Caeliferan biodiversity. Vickery [15] classified the Orthopteroid insects (Caelifera) and Katydids (Ensifera). Günther [16] gave a catalogue of Caelifera. Schirmel *et al.* [17] stated importance of habitat of Orthopteroids. Beside this, their study was to assess differences in abundance of Orthoptera (Caelifera and Ensifera) in different habitats. They also noticed that the distribution patterns vary amongst species that may be due to specificity of habitat predilections of the species. Tan [18] captured 33 known species from 30 genera representing 5 families of Caelifera from Bukit Timah and Central Catchment Nature Reserves. Beside this, he sorted out Caelifera into the superfamily Acridomorpha (23 species with 4 families) is represented with far more species compared to Tetrigoidea (10 species of 1 family). In addition to this he stated that highest diversity of family Acrididae with (15 species), followed by Tetrigidae (10 species). In contrast, the family Trigonopterygidae was with single species. Jabbari *et al.* [19] reported the Caeliferan biodiversity of northern Iran and sorted out the 19 species pertaining to 17 genera, 9 subfamilies and 3 families. Ali and Panhwar [20] provided a checklist of 73 species belonging to 11 sub-families and 38 genera of othopterean fauna from Hazara region Pakistan. Beside this, they pointed out that subfamily Acridinae was abundant amongst other subfamilies of Caeliferan biodiversity. The present study agrees with their statement. Heller *et al.*, [23] provided check list of Orthopteroid insects of Europe. Beside this they enlisted 974 species of Orthopteroids. Of which 593 were belonging to Ensifera and 381 to Caelifera. Andersen *et al.*, [24] reported the biodiversity of grasshopper from Australian tropical savannas. Theuerkauf and Rouys [25] studied the Orthopteroid insects from Central Europe and provided the role of habitat patch size and linear corridors. In addition to this they concluded that most Orthoptera, Dermaptera, and Blattodea species survived in Central Europe if human land use was replaced by intensive grazing and browsing by wild herbivores. The present study agree with their statement. The present information would definitely provide a firm basis for the future researchers engaged with Caeliferan biodiversity of Pakistan.

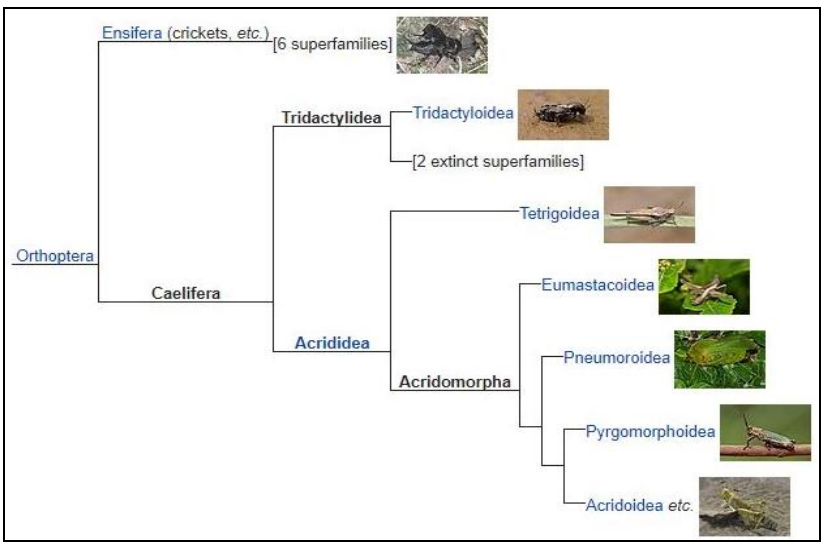


Fig 1: Showing the phylogeny of the Caelifera, in detail for grasshoppers, with 6 out of 8 extant superfamilies shown here as a cladogram. Like the Ensifera, Caelifera and all of its superfamilies appear to be monophyletic [21, 22]

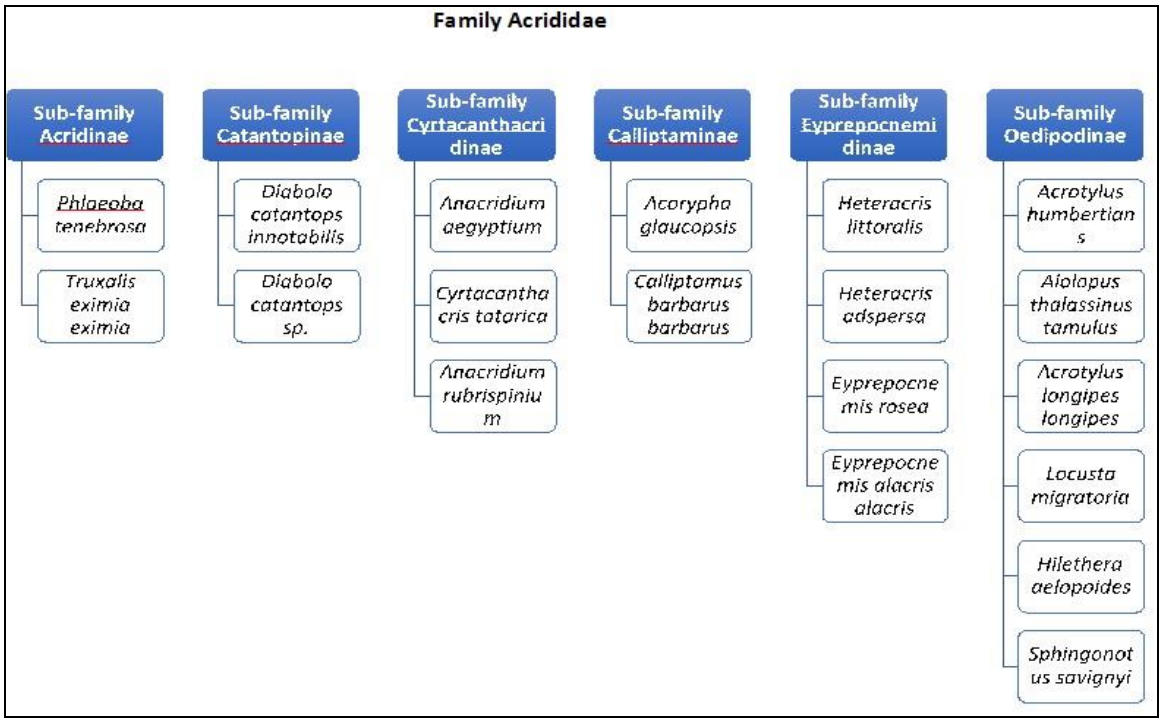


Fig 2: Showing the species of family Acrididae captured from Gorakh Hill Station

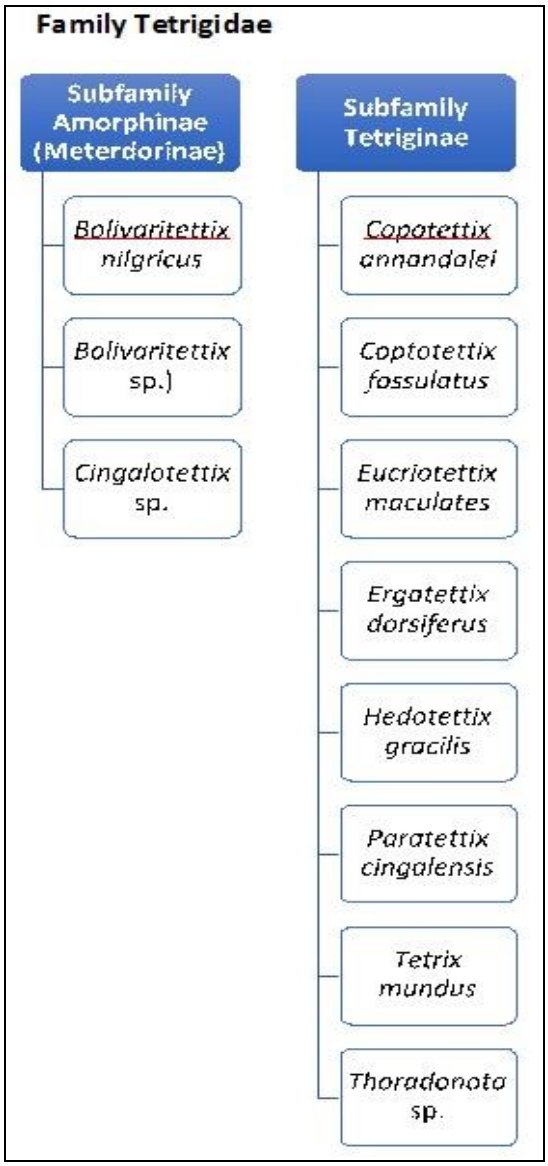


Fig 3: Showing the species of family Tetrigidae captured from Gorakh Hill Station

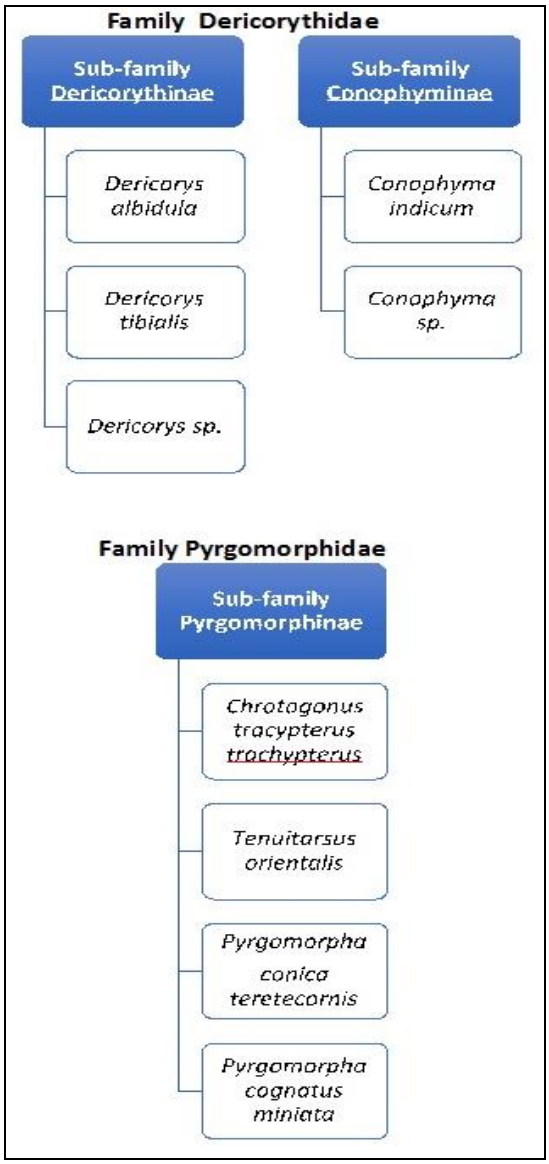
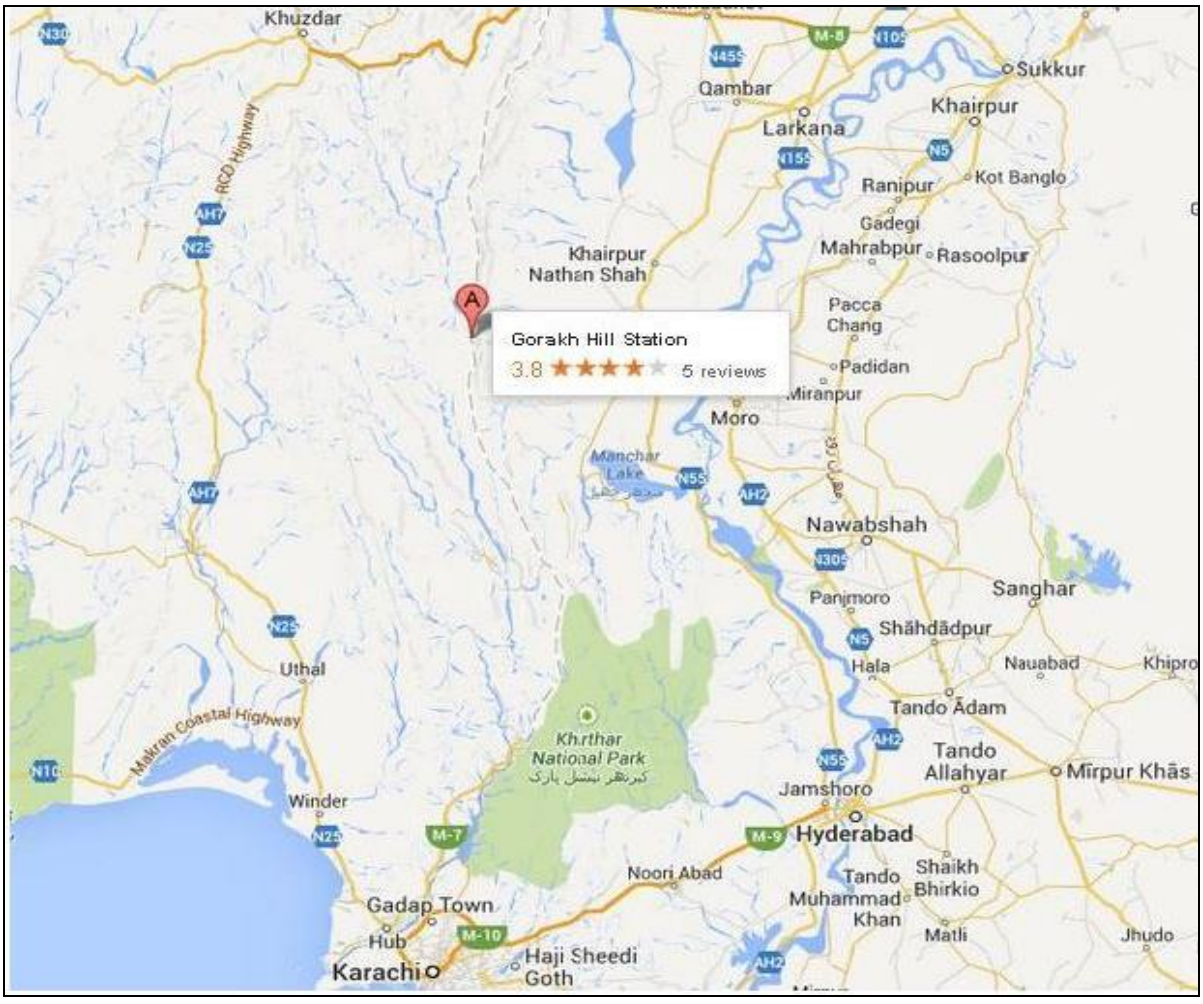


Fig 4: Showing the species of family Dericorythidae & Pyrgomorphinae captured from Gorakh Hill Station

A B C

E F G

Fig 5: Showing the different sites of Gorakh Hill Station



Map 1: Showing google map of Gorakh Hill Station (http://www.pakimag.com)

4. Conclusion

The present study concludes that Gorakh Hill Station is diverse region and it provides an ideal situation for the breeding of insects diversity particularly Caelifera (Orthoptera). More surveys should be undertaken to explore the biodiversity of other group of insects.

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