



## RESEARCH PAPER

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## Seasonal variation in some spider (Araneae) families from Dir Lower, Pakistan

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**Key words:** Aranea, Taxonomy, Season, Distribution, Dir lower

<http://dx.doi.org/10.12692/ijb/16.3.665-669>

Article published on March 30, 2020

### Abstract

Spiders are diverse group of 120 families belonging to class arachnids. They also have diverse habitats. Some are found throughout the years while some are seasonal. Collection was done from April 2018 to December 2019. Spiders were then preserved in 70%-80 ethanol. For smaller specimens eppendorf tubes were used while for larger specimens other vials (big jars) were used. A total of 155 spiders of the specified families were collected belonging to about 7 families, 8 genera and 8 species. An increase was observed in diversity of spiders from April to September and then gradual decreases were observed except for the month of August. *Olios stimulator* was reported for the 1<sup>st</sup> time from Pakistan, previously reported from India. This study will provide a base for further study as spiders of the area is unexplored very well.

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## Introduction

Spiders belong to class arachnid with 120 families, 4153 genera and 48393 species (World Spider Catalog, 2020). There is a great diversity and abundance of spiders in different agro ecosystems. Each species has a different spatial abundance in different agricultural fields and also have variable seasonal dynamics which play an important role in controlling insect pests (Mukhtar *et al.*, 2012). Spiders are found in various colors and sizes. They are found mostly in terrestrial ecosystem as a predator. The size of the giant bird eating spider, *Theraphosid* (Thorell), is 75mm. Its leg length is up to 255mm. Their metamorphosis takes place through ecdysis (molting). Replacement of old skin with new one helps in increasing their size (Kazim *et al.*, 2014). Spiders consist of hateful and harmful animals (Davey, 1994). They play a great role in protecting crops from the various pests (Perveen and Jamal, 2012) as a biological pest control agent (Platnick, 1995). They are found in various habitats like ground, under stones, underground tunnel systems, and near waters, but most likely they are in moist places. Some spiders live on the seaside where they sink into the sea twice a day. Many species including the water spiders, *Argyroneta aquatic* live in fresh waters (Kazim *et al.*, 2014).

Seasonality play an important role in distribution of spiders and their diversity along time. In tropics very minute changes has been recorded all along the year but still great variation in diversity of species has been observed in dry and rainy seasons. Mostly seasonal variations are recorded among arthropod species. These variations are recorded in changes of abundance of species and richness of species in various seasons. Spiders are a diverse group and shows both types ie some have no seasonal patterns and found throughout the years while some shows these variations. Previous studies of (Lubin, 1978; Pinkus- Rendon *et al.*, 2006a,b; Mineo *et al.*, 2010; Marin *et al.*, 2016) have shown heterogeneous response about the community structure, abundance and composition of species. But still this topic has received little attention (Campuzano *et al.*, 2019). These variations are considered as important factors

for diversity. These environmental changes also affect spider habitat selection. Wet season has been observed with great diversity and variation among species while dry condition with lowest abundance of spiders (Mineo *et al.*, 2010). Spider's distribution and abundance play an important role in controlling pest. In Pakistan pesticides are mainly used to control pests which are harmful for both environment and biodiversity. Spiders can be used as a biological control for pests to minimize the harmful effect of pests (Khan *et al.*, 2017).

The current study shows seasonal variations recorded among different families of spider at District Dir Lower, Khyber Pakhtunkhwa, Pakistan. This was a part of exploration of spider's diversity at selected area. Aims of the study were to find variations among species, habitat selection and seasonal variations among species of spiders in District Dir Lower. It is also aimed to increase the knowledge on ecology of spiders. By knowing the ecology of spiders one can use it as a biological control agent.

## Materials and methods

### Study area

The present study was conducted from April 2018 to November 2019 in District Dir lower. Dir is a small former princely state situated in North of Khyber Pakhtunkhwa, 34° North latitude and 71° East latitude. Swat valley is situated on the East of Dir lower, Chitral valley at North, Bajaur and Afghanistan at west and Malakand district on its South (Wikipedia and Fig. 1). Temperature remain very cool in the month of December, January and February while hottest in May, June, July and August (reaches to above 40°C). Most of the rain fall occurs from January to September; most humid month was February (Table 1).

### Collection and Preservation

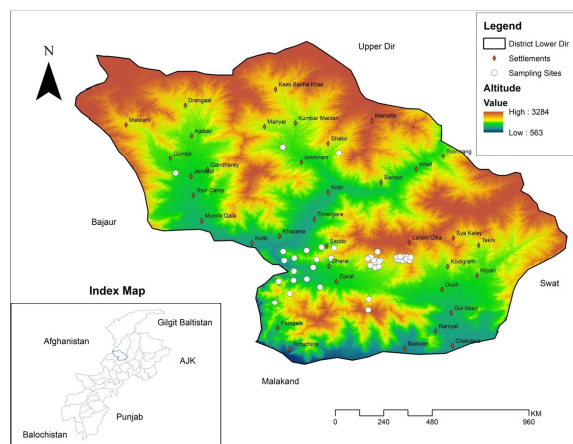
Spiders were collected from different localities of Dir Lower, Pakistan during different visits throughout the study. Collection was done while using different methods like cryptic searching, aerial hand picking, ground hand collection and vegetation beating. Spiders were collected in different jars (for large spiders) and effindorp tubes (for small spiders).

70%- 80% ethanol were added for preservations. The vials were labeled with a specific number and their information like latitude, longitude and altitude with date of sampling were recorded.

**Table 1.** Month wise two years (2018-19) mean Temperature and Humidity of District Dir Lower.

Month	Mean Temperature °C		Relative Humidity (%)
	Maximum	Minimum	
January	18.3	5.3	60%
February	18.6	6.6	63%
March	22.3	11	61%
April	26	17	52%
May	32.5	21.5	52%
June	40.2	25.1	38%
July	38.5	27	47%
August	36.3	26.3	62%
September	34.6	23.3	57%
October	29.3	15	49%
November	26.6	9.6	40%
December	20.3	6.5	61%

**Source:** Meteorological department Dir Lower.



**Fig. 1.** Map of the study area and collection sites.

### Identification

Identification was done by using stereo microscope to study different organs of the spiders in laboratory at the Department of Zoology Islamia College University Peshawar, Punjab University Lahore and Agriculture University Peshawar. The collected specimens were identified with help of available keys i.e (Proszynski, 2017), (Metzner online library for salticidae), (World Spider Catalog, 2020) and (Sethi and Tikader, 1988).

### Results

A total of 155 specimens belonging to 7 families i.e. Salticidae, Araneidae, Sparassidae, Scytodidae, Eresidae, Thomasidae and Pholcidae and 8 genera (*Plexippus*,

*Hasarius*, *Araneus*, *Olios*, *Scytodes*, *Stegodyphus*, *Thomisius* and *Crossopriza*) were collected during different months of the year. In month of April 09 specimens were collected belonging to 02 families, 07 specimens from Family Salticidae which were all belonging to *Plexippus paykulli* that have cosmopolitan occurrence, also common in present study. Present specimens were caught on walls and on stones in hills. Four specimens of *Olios stimulator* on walls at night and 2 specimens of *Stegodyphus sarasinorum* (immature) in their extensive large web were also caught in month of May. An increase in the number of specimens of each family collected was observed in each month, with increase in temperature. As temperature exceeded some point a decrease were also observed in the month of August. Jumping Spiders during the month of August were found in shade and under stones, Araneidae in their web at night and Pholcidae under rocks to bare high temperature. Large number of the specimens (59) were collected in the month of July because most of the spiders collected reach to maturity level in this month and they were motile in search of mate, food and shade. As the temperature falls the spider number of each family also decreases because temperature has direct effect on spiders so they hides in various habitats and difficult to collect them. No specimens of the identified species were collected in the months of January, February and March, and less number of specimens each 05 specimens were collected in the month of November and December and this decrease is due to decrease in temperature.

Most abundant species in diversity (67 in number) was *Stegodyphes sarasinorum*, then was *Plexippus paykulli* both of which were collected from all the localities. Less dominant species was *Hasarius adonsoni* which were 2 in numbers and both were caught in hot months i.e. May and September. This specimen was very rare in present study and only 2 specimens were caught both on walls. *Araneus mitificus* were collected in orb web both at night and day time in vegetation, as these spiders form web for which vegetations are must. *Olios stimulator* (15 specimens) was collected on the walls and on plants in summer (May, June, July, September) but under

stones in winter, mature in both seasons with immature one also been observed in spring season. *Scytodes thoracica* (07 specimes) was mostly collected in summer at night time in crevices and under stones no specimen was recorded in winter season, this is because these species are observed nocturnal and their behavior was to hide. They come out at night in summer for search of food as the number of insect's increases in summer. *Thomisus pugilis* (06 specimens) of both male and female were collected from flower of hibiscus plant at afternoon in summer. They stay there to catch prey whenever an insect come for nectar. They are rarely found in winter season (only one specimen in present study) as they hide to cope with cold. *Crossopriza lyoni* (04 specimens) were collected in summer and were found both in houses and rocks (Table 2).

**Table 2.** Number of Specimens of different families collected from April to December.

Family	Species	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Salticidae	<i>Plexippus paykulli</i> (M+F)	07	05	09	04	02	12	05	02	02	48
	<i>Hasarius adonsoni</i> (M)	00	01	00	00	00	01	00	00	00	02
Araneidae	<i>Araneus mitificus</i> (M+F)	02	00	00	00	01	01	00	00	02	06
Sparassidae	<i>Olios stimulator</i>	00	04	04	04	00	01	01	01	00	15
Scytodidae	<i>Scytodes thoracica</i>	00	00	02	02	00	02	00	01	00	07
Eresidae	<i>Stegodyphus sarasinorum</i>	00	02	06	44	03	08	03	01	00	67
Thomisidae	<i>Thomisus pugilis</i>	00	00	00	03	00	02	00	00	01	06
Pholcidae	<i>Crossopriza lyoni</i>	00	00	00	02	02	00	00	00	00	04
Total		09	12	21	59	08	27	09	05	05	155

## Discussion

Spiders live everywhere there are large numbers of insects and habitats to support them. As habitats increases the diversity of spiders also increases. Small changes in habitat can affect spider's diversity as they are extremely sensitive creature. Temperature and humidity are two important factors which limit spiders to their habitats within the range of their physiological tolerances (Ade and Dixit, 2016). Spider changes their color with surrounding to hide from predators as well as to catch prey (They and Casas, 2009). Most of the crab spiders change their colors with surrounding and with change in temperature, these changes are mostly irreversible while some re-

establish within an hour. This color change is for survival and for thermoregulation. As spider rapidly change with observing any small change in environment (Graf and Nentwig, 2001). *Scytodes* are also called as spitting spiders as they have an extra silk gland in their chelicerae. These spiders are found in crevices and under stones (Zamani, 2014). Spider can feed on all type of insects (Mukhtar *et al.*, 2012). Low number of specimens was also recorded in a previous study of Mukhtar *et al.* (2012). They also recorded an increase in number of spiders with increase in temperature. The decrease in specimens was reasoned as harsh environmental conditions (temperature, dormancy and scarcity of food) that decline their activities. In another study Malik *et al.* (2012) also found less number of specimens from December to January.

In present study the changes in humidity and temperature directly affected the habitat and diversity of spiders in the given area. A color change was also observed in crab spiders with seasonal changes. They were observed in different color around the year. *Olios stimulator*, *Plexippus paykulli* and *Hasarius adonsoni* were observed to change their habitat with change in temperature. These spiders restrict their habitats to cope with temperature or they become dormant in winter. They come out in summer for food as the number of insect's increases in summer and for mating and thus great number (59) were recorded in the month of July. While less record was observed in November and December.

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