



Research Article

An Annotated Check List of Butterfly Fauna in Potohar Plateau, Punjab, Pakistan

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WI and MFM designed the study, WI collected the data, wrote the paper and analyzed the data. MFM provided guidance and helped in data analysis.

Keywords

Butterfly fauna, Check list, Family, Locales, Pakistan, Explore



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Abstract | Butterflies are stunning and attractive insects that are also important pollinators and members of a well-studied taxonomic group, order Lepidoptera of class Insecta. In order to explore the diversity of the butterfly fauna, a field survey was conducted every two weeks from June 2017 to September 2019 in selected locales of the Potohar Plateau, Punjab, Pakistan. An annotated checklist of the butterfly fauna was prepared using a total of 1117 specimens of butterflies from 32 species across 22 genera, 11 subfamilies, and four families from this study. With 14 (43.75%) species, the Nymphalidae family was dominated that was followed by the Pieridae family, which had 13 (40.62%) species, the Lycaenidae family, which had three (9.37%) species, and the Papilionidae family, which had two (6.25%) species. With regard to occurrence status, species of butterfly fauna found to be 17(53.12%) as common, four (12.5%) are fairly common, three (9.38%) are uncommon and eight (25%) are rare ones species in the study area. The commonly found 17 species of butterfly fauna are as follow; *Papilio demoleus*, *Pieris canidia*, *Pieris brassicae*, *Pontia daplidice*, *Belenois aurota*, *Colotis etridae*, *Colias fieldii*, *Catopsilia crocalae*, *Catopsilia pomona*, *Catopsilia pyranthae*, *Eurema hecabe*, *Euchrysops cnejus*, *Danaus chrysippus*, *Ypthima asterope*, *Ariadne merione*, *Junonia orithya* and *Junonia almana*; four Fairly Common (F.C.) species are; *Colias eratae*, *Catopsilia florella*, *Tarucus theophrastus* and *Ypthima nareda*; three Un-Common (U.C.) species are; *Papilio polytes*, *Melanitis leda* and *Junonia hierta* and eight Rare (R) species are; *Colotis calais*, *Zizeeria maha*, *Tirumala limniace*, *Hipparchia parisatis*, *Polyura agraria*, *Neptis sappho*, *Vanessa cardui* and *Phalanta phalantha*. Furthermore, the biodiversity of butterfly fauna found in the present study at Potohar Plateau, Punjab, Pakistan could be protected by the government and wild life conservation agencies for sustainable management of these resources.

Novelty Statement | This study shows that butterfly species (Potohar Plateau, Punjab, Pakistan) are threatened due to increased predator population and habitat destruction due to human intervention and excessive use of insecticides and pesticides and should be preserved and protected by biodiversity and wild life conservation schemes.

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Introduction

In total 157338 species of lepidopterous insects (butterflies, moth and skippers) have been reported in the

Catalogue of Life (Zhang, 2011; Stork, 2018). In the world, around 18000 species of butterflies are estimated (Irungbam, 2018; Varshney and Smetacek, 2015), 1318 butterfly species are reported in India (Irungbam, 2018; Varshney and Smetacek, 2015), whereas, in Pakistan 436 species of butterflies have been reported (Tshikolovets and Pages, 2016). Members of the order Lepidoptera (espe-

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cially butterflies) are most suitable for comparative quantitative study of insect fauna due to their response to climate and vegetation, species richness, abundance, advanced taxonomy and ease of sampling (Perveen and Haroon, 2016; Aslam, 2013; Perveen and Ahmad, 2012; Zhang and Wei, 2009).

Butterflies are very important for pollination in plants (Morris *et al.*, 1991). They are important for monitoring effects of environment whenever we are using chemicals like insecticides and pesticides to control insect pests (Morris *et al.*, 1991). They are also helpful in identification of key areas in conservation biology (Morris *et al.*, 1991). Butterflies fly due to their two pairs of wings. On their wings, beautiful scales are intricately overlapped. They warm up their bodies by basking in winter (Perveen and Haroon, 2016). They are very beneficially important for economic point of view. They serve as a pollination agent (Maheshwari, 2003; Iqbal *et al.*, 2016). Due to their important role as an assisting agent in the development of flowers, fruits, seeds, and food crops, they are extremely important for the survival of animal, insect, and human diversity on this planet, Earth (Maheshwari, 2003; Iqbal *et al.*, 2016). They also play a role of environmental indicator species due to their many environmental indicating distinguishing characters. They are affected by weather extremities due to their sensitivity to environmental changes. So, whenever, there are changes in structure and composition of vegetation then there will also be changes in abundance and distribution of butterfly species (Sawchik *et al.*, 2005; Iqbal *et al.*, 2016). They are simply more visible than the other insects that are equally adversely affected. That's why they are such good indicator species, easy to survey and follow. Moreover, It is a bitter reality that butterflies are most adversely affected than any other animal or insect species as they are declining in their abundance, distribution and species richness due to increasing trend of urbanization features like construction of housing societies, buildings, roads, mowed lawns and industrialization (Iqbal *et al.*, 2016; Clark *et al.*, 2007). However, every ecosystem on earth has butterflies, with the exception of the Arctic, Antarctica, and snow-covered mountains. They are an integral element of flowering plants and vegetation (Hasan, 1994).

In 2001, 320 species of butterflies were recorded in Pakistan (Roberts, 2001), but as of late, 436 species have been identified (Tshikolovets and Pages, 2016). Although, the butterfly fauna of various regions in Pakistan has been explored but the study area had not previously received much attention (Perveen and Ahmad, 2012; Haroon *et al.*, 2014; Mal *et al.*, 2014; Perveen and Haroon, 2015; Iqbal *et al.*, 2016; Noor *et al.*, 2018; Shah *et al.*, 2017). This is an effort to investigate the variety of butterfly fauna in some selected areas of the Potohar Plateau in Punjab, Pakistan.

Therefore, the primary goal of this research study was to gather, catalog, and identify the species of butterflies found on Pakistan's Potohar Plateau (Roberts, 2001; Perveen and Ahmad, 2012; Haroon *et al.*, 2014; Mal *et al.*, 2014; Perveen and Haroon, 2015; Iqbal *et al.*, 2016; Tshikolovets and Pages, 2016; Shah *et al.*, 2017; Noor *et al.*, 2018).

Materials and Methods

Study area

The Potohar Plateau in Pakistan is located between 32.5° N to 34.0°N and 72° E to 74°E (Chaudhary and Rasul, 2004; Shah *et al.*, 2017; Khanam *et al.*, 2017a; Khanam *et al.*, 2017b). It is situated at the junction point of Oriental and Palearctic biogeographical region (Shah *et al.*, 2017).

It is rain fed area. The elevation level of this region from the sea level is 350 to 575 m. It has semi-arid to humid climate. Average annual rain fall of this region is from 250 -500 mm. In summer, mean temperature is 45 C° but in winter season, it is below than freezing point. It is comprised of 22000 km² area, out of which 10000 km² area is used for agricultural purpose (Khanam *et al.*, 2017a; Khanam *et al.*, 2017b). There is deficiency in systematic study of crop productivity due to lack of water supply as this area is rain fed area (Shahid *et al.*, 1990). The human population of this region is about 2 million people; out of which 30% population is urban and 70% population is rural. In rural population, people manly dependent on agriculture for their living subsistence (Taj *et al.*, 2007).

It is administratively comprised of Pakistan's Islamabad Capital Territory (ICT) and Jhelum, Chakwal, Rawalpindi, and Attock districts of the Punjab province (Khanam *et al.*, 2017a; Khanam *et al.*, 2017b).

Sampling and Identification of Butterfly Species

The sampling was done from 53 locales of the agro-eco system of all districts; Jhelum, Chakwal, Rawalpindi and Attock of Potohar, Punjab, Pakistan during June 2017 to September 2019 on fortnightly basis (Figure 1 and Supplementary Table 1 and 2). We identified butterfly species by using the taxonomic keys, literature and taxonomic procedures (Roberts, 2001; Perveen and Ahmad, 2012; Tshikolovets and Pages, 2016; Perveen and Haroon, 2016).

Results and Discussion

Following is a systematic check list of the butterfly species found in the Potohar Plateau, Pakistan;

Systematic Classification of Collected Butterflies

Phylum: Arthropoda

Class: Insecta

Order: Lepidoptera

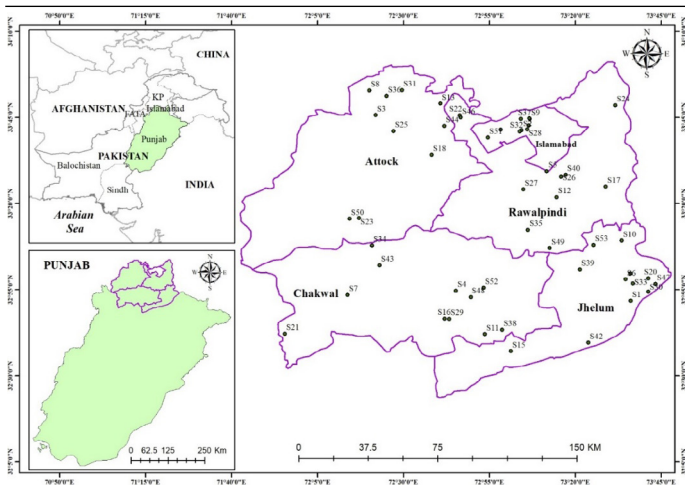


Figure 1: Study sites in the Potohar Plateau, Punjab, Pakistan (For coordinates along altitude of sites, see appendix Table 1).

Family: Papilionidae

Subfamily: Papilioninae

Common Mormon, *Papilio polytes*, Linnaeus, 1758

Lime butterfly, *Papilio demoleus*, Linnaeus, 1758

Family: Pieridae

Subfamily: Pierinae (Whites)

Alpine or Kashmir large white, *Pieris canidia*, De Niceville, 1883

Large cabbage white, *Pieris brassicae*, Linnaeus, 1758

Bath white, *Pontia daplidice*, Linnaeus, 1758

Pioneer, *Belenois aurota*, Moore, 1881

Little orange tip, *Colotis etridae*, Boisduval, 1836

Small salmon arab, *Colotis Calais*, Cramer, 1775

Subfamily: Coliadinae

Pale clouded yellow, *Colias eratae*, Butler, 1880

Fiery clouded yellow, *Colias fieldii*, Menetries, 1855

Common emigrant, *Catopsilia crocalae*, Cramer 1775

Lemon emigrant, *Catopsilia pomona*, Fabricius, 1775

Common Vagrant, *Catopsilia florella*, Fabricius, 1775

African or Mottled emigrant, *Catopsilia pyranthae*, Linnaeus, 1758

Common grass yellow, *Eurema hecabe*, Linnaeus, 1758

Family: Lycaenidae

Subfamily: Polyommatainae

Blue Pierrot, *Tarucus Theophrastus*, Fabricius, 1793

Pale grass blue, *Zizeera maha*, Kollar, 1844

Gram blue, *Euchryops cnejus*, Fabricius, 1798

Family: Nymphalidae

Subfamily: Danainae

Plain tiger, *Danaus chryssipus*, Linnaeus, 1758

Blue Pansy, *Tirumala limniace*, Cramer, 1775

Subfamily: Satyrinae

Large three ring, *Ypthima nareda*, Kollar, 1844

Common three ring, *Ypthima aestrope*, Klug, 1829

Common evening brown, *Melanitis leda*, Linnaeus, 1758

White edge rock brown, *Hipparchia parisatis*, Kollar, 1849

Subfamily: Charaxinae

Nawab butterflies, *Polyura agrarian*, Swinhoe, 1887

Subfamily: Biblidinae

Common Castor, *Ariadne merione*, Moore, 1884

Subfamily: Limenitidinae

Common glider, *Neptis sappho*, Pallas, 1771

Subfamily: Nymphalinae

Painted lady, *Vanessa cardui*, Linnaeus, 1758

Blue Pansy, *Junonia orithya*, Linnaeus, 1758

Yellow Pansy, *Junonia hierta*, Fabricius, 1798

Peacock Pansy, *Junonia almanac*, Linnaeus, 1758

Subfamily: Heliconinae

Common leopard, *Phalanta phalantha*, Drury, 1770

Table 1: Overview of the identified species of butterflies in Potohar Plateau, Pakistan during July, 2017 to September, 2019.

S.No.	Name of species
1	<i>Papilio polytes</i> , Linnaeus, 1758
2	<i>Papilio demoleus</i> , Linnaeus, 1758
3	<i>Pieris canidia</i> , De Niceville, 1883
4	<i>Pieris brassicae</i> , Linnaeus, 1758
5	<i>Pontia daplidice</i> , Linnaeus, 1758
6	<i>Belenois aurota</i> , Moore, 1881
7	<i>Colotis etridae</i> , Boisduval, 1836
8	<i>Colotis calais</i> , Cramer, 1775
9	<i>Colias eratae</i> , Butler, 1880
10	<i>Colias fieldii</i> , Menetries, 1855
11	<i>Catopsilia crocalae</i> , Cramer, 1775
12	<i>Catopsilia pomona</i> , Fabricius, 1775
13	<i>Catopsilia florella</i> , Fabricius, 1775
14	<i>Catopsilia pyranthae</i> , Linnaeus, 1758
15	<i>Eurema hecabe</i> , Linnaeus, 1758
16	<i>Tarucus theophrastus</i> , Fabricius, 1793
17	<i>Zizeera maha</i> , Kollar, 1844
18	<i>Euchryops cnejus</i> , Fabricius, 1798
19	<i>Danaus chryssipus</i> , Linnaeus, 1758
20	<i>Tirumala limniace</i> , Cramer, 1775
21	<i>Ypthima nareda</i> , Kollar, 1844
22	<i>Ypthima aestrope</i> , Klug, 1829
23	<i>Melanitis leda</i> , Linnaeus, 1758
24	<i>Hipparchia parisatis</i> , Kollar, 1849
25	<i>Polyura agraria</i> , Swinhoe, 1887
26	<i>Ariadne merione</i> , Moore, 1884
27	<i>Neptis sappho</i> , Pallas, 1771
28	<i>Vanessa cardui</i> , Linnaeus, 1758
29	<i>Junonia orithya</i> , Linnaeus, 1758
30	<i>Junonia hierta</i> , Fabricius, 1798
31	<i>Junonia almana</i> , Linnaeus, 1758
32	<i>Phalanta phalantha</i> , Drury, 1770

Table 2: Composition and status of butterfly species in Potohar Plateau, Pakistan during July, 2017 to September, 2019.

S.#	Family	No. of species	Occurrence			
			Common (C)	Fairly common (FC)	Uncommon (UC)	Rare (R)
1	Papilionidae	2	1	0	1	0
2	Pieridae	13	10	2	0	1
3	Lycaenidae	3	1	1	0	1
4	Nymphalidae	14	5	1	2	6
	$\Sigma=4$	$\Sigma=32$	$\Sigma=17$	$\Sigma=4$	$\Sigma=3$	$\Sigma=8$
	%	100%	53.12%	12.50%	9.38%	25%

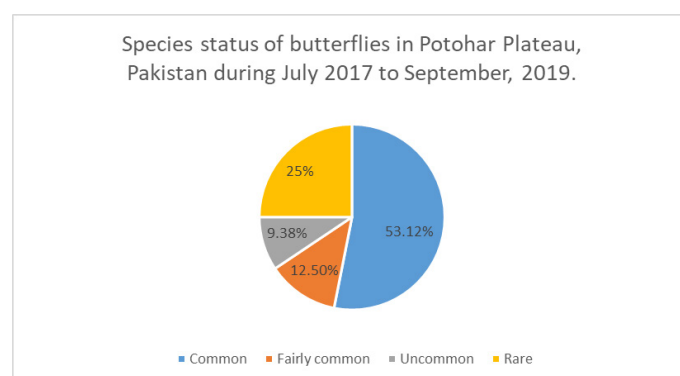
At 53 locales in the Potohar Plateau, Pakistan, a total of 1117 individuals of 32 butterfly species from 22 genera, 11 subfamilies, and four families were recorded during the study period from July 2017 to September 2019 (Table 1 and 2).

In terms of number and percentage of species composition, most abundant family was family Nymphalidae with 14 (43.75%) butterfly species followed by family Pieridae with 13 (40.62%) butterfly species, family Lycaenidae with three (9.37%) butterfly species and family Papilionidae with two (6.25%) butterfly species (Table 2 and 3).

The observed butterfly fauna was divided into four groups based on their relative numbers as, Common >9-10, Fairly Common includes 6-8, Un-Common, 3-5 and Rare includes 0-2 (Elanchezhyan *et al.*, 2017; Bogtapa, 2015). So, occurrence status of butterfly fauna in Potohar Plateau, Pakistan was calculated in study area. Out of 32 species recorded, 17(53.13%) species are Common; four (12.50%) species are Fairly Common; three (9.38%) species of family Nymphalidae are Un-Common and eight (25%) species of family Nymphalidae are Rare (Table 2 and 3).

Out of 17 common species, 13 common species are found in family Pieridae, two common species in family Papilionidae and also two common species are found in family Lycaenidae. In study area, 17 common species are; *Papilio demoleus*, *Pieris canidia*, *Pieris brassicae*, *Pontia daplidice*, *Belenois aurota*, *Colotis etridae*, *Colias fieldii*, *Catopsilia crocalae*, *Catopsilia pomona*, *Catopsilia pyranthae*, *Eurema hecabe*, *Euchrysops cnejus*, *Danaus chrysippus*, *Ypthima asterope*, *Ariadne merione*, *Junonia orithya* and *Junonia almana*. Out of four fairly common (FC), three fairly common species are found in family Nymphalidae and one fairly common species is found in family Lycaenidae. Four fairly common species (F.C.) are; *Colias eratae*, *Catopsilia florella*, *Tarucus theophrastus* and *Ypthima nareda*. Three uncommon species (U.C.) of family Nymphalidae are; *Papilio polytes*, *Melanitis leda* and *Junonia hierta*. While eight rare (R) species of family Nymphalidae are; *Colotis calais*,

Zizeeria maha, *Tirumala limniace*, *Hipparchia parisatis*, *Polyura agraria*, *Neptis sappho*, *Vanessa cardui* and *Phalanta phalantha* (Table 2 and 3; Figure 2).

**Figure 2: Species status of butterflies during July, 2017 to September, 2019 in Potohar Plateau, Pakistan.**

Adult butterflies exhibit significant aesthetic and commercial value (Perveen and Ahmad, 2012). Numerous researchers investigated the butterfly flora in specific Pakistani regions and prepared check lists as well (Perveen and Ahmad, 2012; Haroon *et al.*, 2014; Mal *et al.*, 2014; Perveen and Haroon, 2015; Iqbal *et al.*, 2016; Noor *et al.*, 2018; Shah *et al.*, 2017).

In Kohat, Khyber Pakhtunkhwa, Pakistan, an entomological study was carried out from September to December 2008, and a checklist of the local butterfly fauna was created. The researchers discovered 21 species that belonged to three families. *Pieris brassicae*, *Pieris ajaka*, *Pieris rapae*, *Pieris napi*, *Catopsilia pomona*, *Colias etrida*, *Colias croceus*, *Eumera hecabe*, *Ixias pyrene*, *Belenois aurota*, *Colotis protractus* and *Gonepteryx rhamni* were among the 12 identified species of the family Pieridae. Nine identified species of the family Nymphalidae included *Ariadne merione*, *Argynnis hyperbius*, *Cynthia cardui*, *Junonia almanac*, *Junonia orithya*, *Hipparchia parisatis*, *Phalanta phalantha*, *Danaus chryssipus* and *Danaus genutia* (Perveen and Ahmad, 2012).

In union council Koaz Bahram Dheri, Khyber Pakhtunkhwa Pakistan, a checklist of the butterfly fauna was published from July to October 2012. They gathered 232

Table 3: Check list of butterfly fauna at Potohar Plateau, Pakistan during July 2017 to September, 2019 (Where, n= Number of individuals; Status, C= Common, FC= Fairly common, UC= Uncommon & R= Rare).

Family	Subfamily	Taxonomic Names	Common Names	n	Status
Papilionidae (6.25%)	Papilioninae	<i>Papilio polytes</i> , Linnaeus, 1758	Common Mormon	3	UC
		<i>Papilio demoleus</i> , Linnaeus, 1758	Lime butterfly	15	C
Pieridae (40.63%)	Pierinae	<i>Pieris canidia</i> , De Niceville, 1883	Alpine large white	124	C
		<i>Pieris brassicae</i> , Linnaeus, 1758	Large cabbage white	77	C
		<i>Pontia daphidice</i> , Linnaeus, 1758	Bath white	13	C
		<i>Belenois aurota</i> , Moore, 1881	Pioneer	46	C
		<i>Colotis etridae</i> , Boisduval, 1836	Little orange tip	10	C
		<i>Colotis calais</i> , Cramer, 1775	Small salmon arab	1	R
		<i>Colias eratae</i> , Butler, 1880	Pale clouded yellow	7	FC
	Coliadinae	<i>Colias fieldii</i> , Menetries, 1855	Fiery clouded yellow	29	C
		<i>Catopsilia crocalae</i> , Cramer 1775	Common emigrant	14	C
		<i>Catopsilia pomona</i> , Fabricius, 1775	Lemon emigrant	137	C
		<i>Catopsilia florella</i> , Fabricius, 1775	Common Vagrant	8	FC
		<i>Catopsilia pyranthae</i> , Linnaeus, 1758	African / Mottled emigrant	211	C
		<i>Eurema hecabe</i> , Linnaeus, 1758	Common grass yellow	112	C
		Lycaenidae (7.37%)	Polyommatainae	<i>Tarucus theophrastus</i> , Fabricius, 1793	Blue Pierrot
<i>Zizeera maha</i> , Kollar, 1844	Pale grass blue			1	R
<i>Euchrysope cnejus</i> , Fabricius, 1798	Gram blue			9	C
Nymphalidae (43.75%)	Danainae	<i>Danaus chrysippus</i> , Linnaeus, 1758	Plain tiger	162	C
		<i>Tirumala limniace</i> , Cramer, 1775	Blue Pansy	2	R
	Satyrinae	<i>Ypthima narenda</i> , Kollar, 1844	Large three ring	6	FC
		<i>Ypthima aestrope</i> , Klug, 1829	Common three ring	12	C
		<i>Melanitis leda</i> , Linnaeus, 1758	Common evening brown	3	UC
		<i>Hipparchia parisatis</i> , Kollar, 1849	White edge rock brown	1	R
	Charaxinae	<i>Polyura agraria</i> , Swinhoe, 1887	Nawab butterflies	2	R
	Biblidinae	<i>Ariadne merione</i> , Moore, 1884	Common Castor	45	C
	Limenitidinae	<i>Neptis Sappho</i> , Pallas, 1771	Common glider	2	R
	Nymphalinae	<i>Vanessa cardui</i> , Linnaeus, 1758	Painted lady	2	R
		<i>Junonia orithya</i> , Linnaeus, 1758	Blue Pansy	28	C
		<i>Junonia hierta</i> , Fabricius, 1798	Yellow Pansy	3	UC
	Nymphalinae	<i>Junonia almana</i> , Linnaeus, 1758	Peacock Pansy	22	C
Heliconinae	<i>Phalanta phalantha</i> , Drury, 1770	Common leopard	2	R	

specimens, of which 13 species, belonging to 11 genera and three families, were identified. *Cynthia cardui*, *Junonia orithya*, *Danaus chrysippus*, *Junonia almana*, *Catopsilia pyranthae*, *Cercyonis sthenela* and *Phalanta phalantha* were the seven species of the Nymphalidae family that were identified. Five species of the family Pieridae have been identified: *Colias croceus*, *Eurema hecabe*, *Catopsilia pomona*, *Pieris canidia* and *Colotis amata*. Only one species, *Papilio demoleus* of the family Papilionidae has been documented (Haroon *et al.*, 2014).

list of Sindh, Pakistan's butterfly fauna (Lepidoptera: Rhopalocera) during 2012-2013. They collected 1964 specimens from different study sites of Sindh, Pakistan. They identified 67 species which belonged to 41 genera, 16 subfamilies and 6 families. Highest number of butterflies were reported from the family *Lycaenidae* that was 28% which includes 19 species, followed by the family *Pieridae* that was 27% which included 18 species, followed by the two families *Nymphalidae* and *Hesperidae*, each of which comprised of 16% butterflies specimens and included 11 species. Then subfamily Danainae of the family Nymphalidae included five species that was 8% and minimum num-

Bhojoo Mal and colleagues worked on the check-

ber of butterflies were reported from the family *Papilionidae* which included only three species that was 5% (Mal et al., 2014).

In addition, a checklist of the butterfly (Insecta: Lepidoptera) fauna found in tehsil Tangi, Khyber Pakhtunkhwa, Pakistan was prepared (Perveen and Haroon, 2015). A total of 506 specimens, representing 23 species, 18 genera, and three families, were gathered. Highest number of butterflies belong to Nymphalidae family that was 13 (49.8 %) species, moderate number of butterflies belong to family Pieridae that was 8 (42.89 %) species and minimum % of butterflies belong to family Papilionidae that was two (7.31 %) species. There were 13 species of the family Nymphalidae that were identified, including *Junonia orythya*, *Junonia hierta*, *Junonia almana*, *Danaus chrysippus*, *Hipparchia parisatis*, *Argyreus hyperbius*, *Caynthia cardui*, *Ariadne merione*, *Tirumala limniace*, *Neptis mahendra*, *Venesa indica*, *Lethe confuse*, and *Euthalia garuda*, and eight species of the family Pieridae, including *Catopsila pomona*, *Catopsila pyranthe*, *Pieris canidia*, *Eurema hecabe*, *Colias fieldii*, *Colias erate*, *Colotis etrida*, and *Belonias aurota*. While only two identified species of family Papilionidae were; *Papilio polytes* and *Papilio demoleus* (Perveen and Haroon, 2015).

In 2013–2014, butterfly fauna of district Gujrat, Punjab, Pakistan was explored (Iqbal et al., 2016). He collected 232 specimens by hand net sweep method and identified 12 species which belong to eight genera, four subfamilies and three families. The six identified species of the Pieridae family were; *Pieris canidia*, *Pieris brassicae*, *Catopsilia florela*, *Catopsilia pyranthae*, *Eurema hecabe* and *Anapheis aurota*; four identified species of the subfamily Nymphalinae of the family Nymphalidae family were; *Ergolis merione*, *Vanessa cardui*, *Junonia orithya* and *Junonia almana* and two identified species of the subfamily Danainae of the family Nymphalidae were; *Danaus genutia* and *Danaus chryssipus* (Iqbal et al., 2016).

An annotated list of the butterfly fauna of Quetta, Pakistan during April to October, 2012 was also prepared (Noor et al., 2018). They collected 249 specimens from different study sites of Quetta, Baluchistan, Pakistan. They identified 23 species which belong to six families. Seven identified species of the family Pieridae were; *Belenois aurota*, *Colotis fausta*, *Colias philodice*, *Colias erate*, *Catopsilia Pomona*, *Pieris rapae* and *Pieris brassicae*; six identified species of the family Nymphalidae were; *Cynthia cardui*, *Dannus chrysippus*, *Hipparchia parisatis*, *Pseudochazara alpine*, *Pseudochazara panjshria*, and *Pseudochazara kanishka*, six identified species of the family Lycaenidae were; *Aricia agestis*, *Cupido minimus*, *Hemiargus isola*, *Lampides boeticus*, *Lycaena phlaeas arctodon* and *Polyommatus icarus*, three identified species of family Hesperidae were; *Carcharodus dravira*, *Cymaenes l. laurelulus* and *Pelopidas agna agna* while only one identified species of the family Papilionidae

was *Papilio machaon* (Noor et al., 2018).

Although taxonomists have conducted research related to butterflies in the Pakistan but very little is known about the butterfly fauna with regard to occurrence and conservation status.

In Potohar Plateau, Pakistan, Syed Waqar Shah worked on butterfly fauna (Shah and Rafi, 2016). He worked on Pierid (Lepidoptera: Pieridae) pests and their new crucifer's hosts during January, 2012 to December, 2013. He has found four species of butterflies belonging to Pieridae family on cultivated and non-cultivated cruciferous plants that were *Pontia daplidice*, *Pieris brassicae*, *Pieris canidia* and *Pieris rapae*. These four species of butterflies belong to two genera and one family. *Pieris rapae* and *Pontia daplidice* were reported from the study area for the first time (Shah and Rafi, 2016). In addition, he worked on the biogeographical aspect of pierids butterflies (Lepidoptera: Pieridae) in Potohar Plateau of Pakistan during January 2012 to February 2015. He reported 17 species that belonged to one family, two subfamilies, and two genera. Pierinae and Coliadae are two of the subfamilies of the family Pieridae. Subfamily Pierinae includes 10 species that were; *Pontia daplidice*, *Delias eucharis*, *Anapheis aurota/Belenois aurota*, *Pieris brassicae*, *Pieris canidia*, *Pieris rapae*, *Colotis amata*, *Colotis etrida*, *Colotis protractus* and *Ixias pyrene*. Subfamily Coliadae included seven species that were; *Catopsilia pyranthae*, *Catopsilia pomona*, *Colias fieldii*, *Colias eratae*, *Eurema laeta*, *Eurema hecabe* and *Gonepteryx nepalensis*. Six species that were *Colotis protractus*, *Colotis amata*, *Colotis etrida*, *Delias eucharis* and *Anapheis aurota/Belenois aurota* were firstly reported in the study area (Shah et al., 2017).

The current study was the second attempt to gather data on the butterfly fauna of Pakistan's Potohar Plateau. Prior to this, Shah et al. (2017) conducted a survey of the butterfly fauna alongside their host plants from 75 chosen sites of the Potohar Plateau, Pakistan, and discovered 17 butterfly species, all of which belonged to the Pieridae family, during January 2012 and February 2015 (Shah et al., 2017). While the current entomological study was carried out in the same study region and involved a total of 32 butterfly species from 4 families found in 53 different locations across Pakistan's Potohar Plateau from July 2017 to September 2019.

Out of 17 butterfly species reported by Shah et al., 2017, six species were reported previously but not found in the present study were; *Gonepteryx nepalensis*, *Eurema laeta*, *Delias eucharis*, *Pieris rapae*, *Ixias pyrene* and *Colotis protractus* (Shah et al., 2017). While, 11 butterfly species reported by Shah et al. (2016) were also reported in this study and these 11 commonly reported butterfly species (in both studies) were; *Pieris canidia*, *Pieris brassicae*, *Pon-*

tia daphidice, *Belenois aurota*, *Colotis etridae*, *Colotis calais*, *Colias eratae*, *Colias fieldii*, *Catopsilia pomona*, *Catopsilia pyranthae* and *Eurema hecabe*. However, in the current study, butterfly species which were not reported previously were; *Papilio polytes*, *Papilio demoleus*, *Catopsilia crocalae*, *Catopsilia florella*, *Tarucus theophrastus*, *Zizeeria maha*, *Euchrysops cnejus*, *Danaus chrysippus*, *Tirumala limniace*, *Ypthima nareda*, *Ypthima asterope*, *Melanitis leda*, *Hipparchia parisatis*, *Polyura agraria*, *Ariadne merione*, *Neptis sappho*, *Vanessa cardui*, *Junonia orithya*, *Junonia hierta*, *Junonia almana* and *Phalanta phalantha*. This difference may be due to harsh weather extremities during study period as a result of global environmental changes.

Conclusions and Recommendations

During the present study, 32 species of butterflies from 22 genera, 11 subfamilies, and four families were reported. The most abundant family was Nymphalidae family with 14 species (11 genera), followed by the Pieridae with 13 species (seven genera), the Lycaenidae with three species (three genera), and the Papilionidae with two species (one genus). As for as percentage of family composition is concerned, most of the butterfly (n=14) 43.75% species belonged to the family Nymphalidae then second most abundant butterfly (n=13)40.56% species belonged to the family Pieridae; whereas, least butterfly (n= 2) 6.25% species was recorded from family Papilionidae and moderate butterfly (n= 3) 9.35% species was reported from family Lycaenidae.

With regard to occurrence status, species of butterfly fauna found to be 17(53.12%) as common, four (12.5%) are fairly common, three (9.38%) are uncommon and eight (25%) are rare ones species in the study area. The commonly found 17 species of butterfly fauna are as follow; *Papilio demoleus*, *Pieris canidia*, *Pieris brassicae*, *Pontia daphidice*, *Belenois aurota*, *Colotis etridae*, *Colias fieldii*, *Catopsilia crocalae*, *Catopsilia pomona*, *Catopsilia pyranthae*, *Eurema hecabe*, *Euchrysops cnejus*, *Danaus chrysippus*, *Ypthima asterope*, *Ariadne merione*, *Junonia orithya* and *Junonia almana*; four Fairly Common (F.C.) species are; *Colias eratae*, *Catopsilia florella*, *Tarucus theophrastus* and *Ypthima nareda*; three Un-Common (U.C.) species are; *Papilio polytes*, *Melanitis leda* and *Junonia hierta* and eight Rare (R) species are; *Colotis calais*, *Zizeeria maha*, *Tirumala limniace*, *Hipparchia parisatis*, *Polyura agraria*, *Neptis sappho*, *Vanessa cardui* and *Phalanta phalantha*. However, in the current study; butterfly species which were not reported previously by Shah *et al.*, 2017, were; *Papilio polytes*, *Papilio demoleus*, *Catopsilia crocalae*, *Catopsilia florella*, *Tarucus theophrastus*, *Zizeeria maha*, *Euchrysops cnejus*, *Danaus chrysippus*, *Tirumala limniace*, *Ypthima nareda*, *Ypthima asterope*, *Melanitis leda*, *Hipparchia parisatis*, *Polyura agraria*, *Ariadne merione*, *Neptis sappho*, *Vanessa cardui*, *Junonia orithya*, *Junonia hierta*, *Junonia almana* and *Phalanta phalantha*.

A description of the butterfly species found in Punjab, Pakistan's Potohar Plateau, was made in this paper. In this regard, a great deal more effort is required, and more collections are important for obtaining a precise estimate of the faunal richness of butterfly species in this region on a regular basis. In the end, it is hoped that this research will result in the creation of standardized monitoring techniques that could be useful in assessing the environmental stability of the area under cultivation for various crops and forecasting the impact of tropical forest destruction on the structure of the butterfly (lepidopteran insect) population (Aslam, 2013; Barlow and Woiwod, 1989). In the future, it is recommended that butterfly fauna and its habitat of the said research area in Pakistan should be preserved and protective measures should be adopted by the government, biodiversity, and wild life conservation agencies.

Declarations

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Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary Table 1: Study sites along its coordinates & altitude during July, 2017 to September, 2019 in Potohar Plateau, Pakistan.

Site	Detail of Study Sites	Latitude	Longitude	Altitude
S1	Sangohi , district Jhelum	32.861663°	73.601565°	224m
S2	Loke Virsa Shakar Parrian, Islamabad, Capital	33.687668°	73.072515°	350m
S3	Attock city, district Attock	33.760359°	72.365081°	357m
S4	Murid village, district Chakwal	32.910508°	72.754254°	534m
S5	Rawat, district Rawalpindi	33.489100°	73.194168°	574m
S6	Rohtas fort Road, tehsil Dina, district Jhelum	32.965638°	73.575757°	309m
S7	Dhok Faqiran, tehsil Tala Gang, district Chakwal	32.890371°	72.228938°	482m
S8	Haji Shah village, tehsil Hazro, district Attock	33.879719°	72.333988°	314m
S9	Noor Pur Shahan , Islamabad ,Capital	33.742503°	73.111447°	583m
S10	Lehri village, tehsil Sohawa, district Jhelum.	33.153095°	73.557831°	504m
S11	Dalwal, tehsil Choa Saidan Shah, district Chakwal.	32.700181°	72.893839°	697m
S12	Mandra, tehsil Gujar Khan, district Rawalpindi.	33.364174°	73.242187°	521m
S13	Hassan Abdal City, district Attock.	33.815956°	72.678880°	420m
S14	Bari Imam village, Islamabad, Capital.	33.745360°	73.110307°	597m
S15	Khewra, tehsil Pinddan Khan, district Jhelum.	32.617732°	73.020069°	237m
S16	Chakora village, tehsil Kallar Kahar, district Chakwal.	32.787965°	72.713167°	648m
S17	Choha Khalsa, tehsil Kallar Syedan, district Rawalpindi.	33.414150°	73.480198°	523m
S18	Fateh Jang city, tehsil Fateh Jang, district Attock.	33.568242°	72.635690°	514m
S19	Golra Sharif village, Islamabad ,Capital	33.689862°	72.970152°	570m
S20	Kala Gujran village, tehsil & district Jhelum.	32.970719°	73.685761°	353m
S21	Lawa, tehsil Lawa, district Chakwal.	32.701976°	71.925096°	423m
S22	Wah Cantt, tehsil Rawalpindi, district Rawalpindi.	33.759987°	72.772582°	474m
S23	Pindi Gheb city, tehsil Pindi Gheb, district Attock.	33.262791°	72.284501°	320m
S24	Kotli Sattian, tehsil Kotli Sattian, district Rawalpindi.	33.808317°	73.526932°	146m
S25	Akhori village, tehsil Attock, district Attock.	33.683228°	72.451049°	362m
S26	Saagri, tehsil & district Rawalpindi.	33.461519°	73.263880°	575m
S27	Jan Waal village, tehsil & district Chakwal.	32.945466°	72.879562°	515m
S28	Garden avenue, Shakar Parrian, Islamabad, Pakistan	33.692715°	73.099666°	530m
S29	Chakwal road, Kallar Kahar, district Chakwal.	32.773957°	72.721745°	723m
S30	Bagga, tehsil Jhelum, district Jhelum.	32.906345°	73.686866°	225m
S31	Musa village, tehsil Hazro, district Attock.	33.881399°	72.492623°	323m
S32	Sector H-8, Islamabad, Pakistan	33.681812°	73.063403°	526m
S33	Mallot, tehsil Dina, district Jhelum.	32.944763°	73.611962°	255m
S34	Dhok Pathan, tehsil Tala Gang, district Chakwal.	33.130170°	72.346822°	315m
S35	Jatli, tehsil Gujar Khan, district Rawalpindi.	33.205638°	73.103409°	532m
S36	Kamra city GT Road, tehsil Hassan Abdal, district Attock.	33.853225°	72.418007°	330m
S37	Said Pur village, Islamabad, Capital	33.742263°	73.068444°	629m
S38	Choa Saidan Shah city, district Chakwal.	32.721565°	72.977791°	630m
S39	Domeli village, tehsil Sohawa, district Jhelum.	33.013281°	73.355031°	328m
S40	Shah Bagh, tehsil Kallar Syedan, district Rawalpindi.	33.472634°	73.285370°	576m
S41	Rawal lake, Islamabad, Capital	33.711309°	73.106834°	533m
S42	Pind Dadan Khan Road Jalal Pur Sharif, district Jhelum.	32.658805°	73.395465°	213m
S43	Kot Sarang, tehsil Tala Gang, district Chakwal.	33.033393°	72.383464°	387m
S44	Pind Bahadur Khan, tehsil Fateh Jang, district Attock.	33.707649°	72.697341°	486m
S45	Maldev, district Jhelum.	32.993911°	73.600233°	272m

S46	Taxila city, district Rawalpindi.	33.748989°	72.777477°	504m
S47	Jhelum city Railway Road district Jhelum.	32.942726°	73.722114°	231m
S48	Sad Waal village, tehsil & district Chakwal.	32.879671°	72.827190°	544m
S49	Mohra Noori, tehsil & district Rawalpindi.	33.116654°	73.209045°	507m
S50	Dandi village, tehsil Pindi Gheb, district Attock.	33.258789°	72.238431°	333m
S51	Tarnol, Islamabad, Capital	33.651739°	72.909359°	603m
S52	Jabar Pur, tehsil & district Chakwal.	32.924387°	72.887900°	514m
S53	Sohawa GT Road, tehsil Sohawa, district Jhelum.	33.131883°	73.420928°	449m

Supplementary Table 2(P1): Site wise distribution of butterflies in Potohar plateau, Pakistan during July 2017 to September, 2019.

Species #	Name of butterflies	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
Sp.1	<i>Papilio polytes</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sp.2	<i>Papilio demoleus</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sp.3	<i>Pieris canidia</i>	0	0	0	0	0	0	0	1	1	0	4	4	4	5	5	6
Sp.4	<i>Pieris brassicae</i>	0	0	0	0	0	1	2	2	2	2	2	2	2	2	0	0
Sp.5	<i>Pontia daphidice</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sp.6	<i>Belenois aurota</i>	0	0	0	3	0	0	0	0	2	2	2	3	0	0	0	0
Sp.7	<i>Colotis etridae</i>	0	0	0	0	0	1	0	0	3	0	0	0	0	0	0	0
Sp.8	<i>Colotis calais</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sp.9	<i>Colias eratae</i>	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sp.10	<i>Colias fieldii</i>	5	4	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Sp.11	<i>Catopsilia crocalae</i>	0	4	3	0	1	3	0	0	0	0	0	0	0	0	0	0
Sp.12	<i>Catopsilia pomona</i>	0	0		2	1	2	1	3	0	3	0	2	2	0	2	3
Sp.13	<i>Catopsilia florella</i>	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Sp.14	<i>Catopsilia pyranthae</i>	1	2	2	3	4	8	7	9	8	9	5	7	4	3	0	0
Sp.15	<i>Eurema hecabe</i>	0	0	1	2	2	1	1	2	1	2	0	0	1	2	0	0
Sp.16	<i>Tarucus theophrastus</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sp.17	<i>Zizeeria maha</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sp.18	<i>Euchryops cnejus</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sp.19	<i>Danaus chrysippus</i>	2	3	2	3	0	0	0	0	2	2	2	3	0	0	3	0
Sp.20	<i>Tirumala limniace</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sp.21	<i>Ypthima nareda</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sp.22	<i>Ypthima asterope</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sp.23	<i>Melanitis leda</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sp.24	<i>Hipparchia parisatis</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sp.25	<i>Polyura agraria</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sp.26	<i>Ariadne merione</i>	1	1	0	0	0	1	2	0	2	2	3	0	0	0	0	0
Sp.27	<i>Neptis Sappho</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sp.28	<i>Vanessa cardui</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sp.29	<i>Junonia orithya</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sp.30	<i>Junonia hierta</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sp.31	<i>Junonia almana</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sp.32	<i>Phalanta phalantha</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	9	15	9	16	8	18	13	17	21	22	18	21	13	12	10	9

Supplementary Table 2(P2): Site wise distribution of butterflies in Potohar plateau, Pakistan during July 2017 to September, 2019.

Species #	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32	S33	S34	S35	S36	S37
Sp.1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Sp.2	0	0	0	0	0	0	0	0	0	0	1	2	0	1	1	1	1	0	0	0	0
Sp.3	9	10	10	7	4	3	4	2	0	0	0	0	0	0	0	0	0	1	4	6	6
Sp.4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	3	3	4	9
Sp.5	2	1	1	1	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0
Sp.6	0	2	0	0	0	2	0	2	0	0	0	1	0	0	0	0	0	2	2	2	3
Sp.7	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
Sp.8	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Sp.9	0	0	1	1	0	0	0	0	0	0	0	1	0	1	2	0	0	0	0	0	0
Sp.10	0	0	0	0	0	0	0	0	2	2	1	1	0	3	0	0	2	1	0	0	0
Sp.11	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0
Sp.12	0	1	0	0	2	2	1	1	2	3	7	8	3	5	2	6	3	3	3	4	7
Sp.13	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Sp.14	0	0	0	0	0	0	0	0	2	4	2	5	2	5	7	11	7	7	7	6	8
Sp.15	0	0	0	0	1	1	0	1	4	2	2	2	2	4	5	6	4	3	4	4	6
Sp.16	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0
Sp.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Sp.18	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0
Sp.19	6	8	9	5	3	4	3	6	2	2	4	4	3	4	4	7	3	1	5	2	2
Sp.20	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sp.21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Sp.22	0	0	0	0	0	0	0	0	0	6	0	2	0	0	1	2	0	0	0	0	0
Sp.23	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
Sp.24	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Sp.25	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
Sp.26	0	0	0	0	0	0	0	0	0	1	2	2	0	1	3	3	4	0	0	0	0
Sp.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Sp.28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sp.29	0	0	0	0	0	0	0	0	2	0	0	2	0	1	1	4	1	4	1	0	0
Sp.30	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0
Sp.31	0	0	0	0	0	0	0	0	0	0	1	3	0	1	2	1	3	2	0	0	0
Sp.32	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
Total	17	23	22	14	10	12	8	12	14	20	20	40	27	31	31	49	32	27	30	28	41

Supplementary Table 2 (P3): Site wise distribution of butterflies in Potohar plateau, Pakistan during July 2017 to September, 2019.

Species #	S38	S39	S40	S41	S42	S43	S44	S45	S46	S47	S48	S49	S50	S51	S52	S53	Total
Sp.1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	3
Sp.2	0	0	0	0	1	1	1	0	2	1	0	1	0	0	0	1	15
Sp.3	5	5	2	4	2	0	2	3	3	2	0	0	0	0	0	0	124
Sp.4	7	4	5	6	0	0	0	1	8	5	0	0	0	0	0	0	77
Sp.5	0	0	0	0	2	0	1	0	1	0	0	0	0	0	0	0	13
Sp.6	0	0	0	2	0	0	2	7	2	3	2	0	0	0	0	0	46
Sp.7	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3	10
Sp.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Sp.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
Sp.10	0	0	0	3	0	0	0	2	0	0	0	0	0	0	0	0	29
Sp.11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
Sp.12	2	4	5	3	5	4	6	4	8	3	3	2	3	0	0	0	137
Sp.13	0	0	2	0	0	0	0	3	0	0	0	0	1	0	0	0	8
Sp.14	8	8	6	4	5	7	4	3	6	3	2	1	2	2	3	2	211
Sp.15	3	3	4	4	2	2	7	7	5	3	2	2	2	0	0	0	112
Sp.16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
Sp.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Sp.18	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	9
Sp.19	3	3	2	4	6	3	4	2	5	3	1	2	2	3	6	4	162
Sp.20	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
Sp.21	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	3	6
Sp.22	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	12
Sp.23	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3
Sp.24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Sp.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Sp.26	0	0	0	0	0	0	3	0	5	1	1	0	0	1	2	4	45
Sp.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2
Sp.28	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	2
Sp.29	0	0	0	1	2	0	2	0	3	1	2	0	0	0	0	1	28
Sp.30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Sp.31	0	0	1	0	1	2	3	0	2	0	0	0	0	0	0	0	22
Sp.32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Total	28	27	27	33	26	20	35	34	54	25	14	8	10	6	12	19	1117