Research Article

Faunal diversity of paper wasp species and oriental hornet from tehsil Killa Saifullah of Zhob division, Pakistan

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Abstract

The present study was conducted to determine the diversity of wasp fauna in various location of tehsil Killa Saifullah of Zhob division, Pakistan. Wasp are flying stinging Arthropods present all over the world except polar region. The fauna of wasp species were recorded during summer season, mostly from mid-April 2018 to the last week of September 2018. During this expedition about nine species of wasps were collected from orchards, gardens, open fields, and houses lies in the six selected localities. In a cumulative of 1518 wasp specimens collected, 886 (57.37%) were paper wasp and 632 (41.63%) oriental hornet. A total of 1518 wasp species, 1179 (71.1%) were males and 339 (28.92%) were females. Among different localities, Union council Barat Khail showed comparatively highest number both of male (313) and female (110) wasp species. The subfamily Polistinae (Vespidae) was the most abundant family having eight species, while subfamily Vespinae has one species; the *Vespa orientalis*. *Polistes flavus* was noted to be dominant (38.7%) followed by *P. watti* (19.83%) and *P. stigma* (19.66%). Pearson-correlation matrix is used to check the association between two species Paper wasp and Oriental hornet collected from different localities of Killa Saifullah. It showed that, there is a weak but positive correlation between paper wasp and oriental hornet. The P-value of Pearson correlation matrix was found to be statistically significant at 0.05% level of significance. Thus, the present study suggests that tehsil Killa Saifullah of Zhob division have a diverse wasp fauna, thence recommends similar research work on large scale to explore the wasp species left over in the study region and its surrounded areas.

Keywords: Diversity; Killa Saifullah; Rich fauna; Wasp species; Zhob Divison

Introduction

Wasp (Hymenoptera: Apocrita) are omnivores arthropods, some play a major role in pollination, some are serious pest of agriculture and can even survive in -6 °C depend on the climate variables [1, 2]. This is the most diverse and important group of Hymenopterans are chiefly small to medium or average sized insects [3, 4]. Wasp has three

body parts the head, mesosoma and metasoma and bear an exoskeleton which protects their three body parts, and there is stalk or peduncle called Petiole that joins their first and second segment of the abdomen [5, 6]. They possess peculiar glands lies around the sting have well developed muscles able to enter the potent venom to muscles or victim body. Female have stiff

ovipositor through which they inject venom and use them as a defensive organ [7, 8]. Wasp are found in many colors, adult wasps often possess yellow or white bands on the body but mostly are dark-brown or black in color [2, 9, 10-12].

Wasps of the family Vespidae are cosmopolitan. Vespidae include six subfamilies i.e. Vespinae, Polistinae, Masarinae, Stenogastrinae, Euparagiinae and Eumeninae) with 36 genera and around 5000 described species all over the world distributed mainly in the hot regions [13, 14]. The paper wasps and oriental hornets are from the two subfamilies Vespinae and Polistinae [11, 15]. The Polistinae or paper wasps comprise on more than 900 species in 25 genera worldwide [16, 17]. The common paper wasps live in the colonies and have nests with single or multiple combs, while the oriental hornet (*Vespa orientalis*) make nests in cavities to make a hole in the ground and walls. They have a tribe system include queens or fertile female, several potent males or drones, and infertile female known as workers [18]. The hornets regarded as main irritants to bees in order to get honey and the animal proteins [19].

Publications in the recent past on wasp fauna of Balochistan, Pakistan covers only two species *Polistes gallicus* (Linnaeus, 1767) and *Vespa germanica* (Fabricius, 1793) in the two subfamilies Polistinae and Vespinae

[20]. However, the exact distribution of wasps species from Balochistan province, Pakistan are still not completely referenced, hence the present research paper focuses on the collection of wasps of subfamilies Polistinae and Vespinae from tehsil Killa Saifullah, Zhob division, Balochistan, Pakistan. No evidence has been available to ascertain that such research was previously carried out in this region of Zhob Division.

Materials and methods

Area of study

The present study was carried out in different location of tehsil Killa Saifullah (30° 42' 15" North, 68° 21' 40" East) where wasps were inhabiting in a large numbers. Selected locations were visited for collecting wasp species namely, Town Committee Ghuttai, Union Council Mirzai, Town committee Bazar, DCO Colony, Union Council Barathkhail, Union Council Sharan Jomezai. All the survey was done generally from 9:00 am to 4:00 pm during daytime in April-September 2018. Tehsil (district) Killa Saifullah is bounded by the districts of Zhob in the north and east, by Loralai and Pishin in the south and west respectively (Figure 1a). It is located on main National Highway (from Islamabad to Karachi via Dera Ismail Khan and Zhob) some 176 km away from Quetta, the capital of the province Balochistan (Figure 1b).

Figure 1a. Map of district (tehsil Killa Saifullah) show study sites. (UC, Union council & TC, Town committee)

Figure 1b. Map of Balochistan, red show district Killa Saifullah (Reliefweb.int>map> Pakistan)

Sampling method

Ariel net with long handle was used to catch flying or sitting wasp species especially the *Vespa orientalis*, which was effective enough to catch individuals as well as multiple specimens with each attempt. Simple plastic bag was also used to grab the whole comb of Polistin wasp during the period from April-September 2018.

Killing and preservation of specimen

Wasps were killed by in a plastic bottle having formalin and plaster of paris. Some specimen were preserved through refrigeration, while some were mounted on entomological pins in a collection box with volatile chemicals suspended near specimen.

Identification

Specimens were identified using taxonomic keys. Identified specimen were confirmed by comparing them with scholarly publications on the subject like the descriptions of [9, 21-24].

Statistical Analysis

Data was analyzed by using Pearson-correlation matrix to check the association between two species Paper wasp and Oriental hornet in relation to total number of males and females species collected from different localities of Killa Saifullah at 0.05% level of significance.

Result

A total of 1518 vespidae wasps (Vespidae) belonging to three genera, *Polistes*

(Latreille, 1802), *Ropalidia* (Guerin-Meneville, 1831) and *Vespa* (Linnaeus, 1758) were captured. This include 886 paper wasp and 632 oriental hornet. Eight species of the subfamily Polistinae and one of Vespinae were identified. Table 1 represents the locality wise total count of *Polistes*, *Ropalidia* and *Vespa* species collected in this study. Among locality wise, union council Sharan Jomezai showed highest number (83.4%) of paper wasp and least number (16.61%) of Oriental hornet. Polistinae was the most abundant with a relative ratio of 57.37% compare to the Vespinae (43.63%). Sex-wise count showed 71.1%, 28.92% abundance for male, and 81.02%, 38.5% for females of paper wasp and oriental hornet respectively (Table 2). At the species level *V. orientalis* had a comparative abundance 97.0% followed by *P. flavus* (38.7%) and *P. watti* (19.83%), while the least abundant observed (11.5%) was *P. fuscatus* (Table 3). Statistical analysis showed that, there is a weak but positive correlation between Paper wasp and Oriental hornet. The P-value of Pearson correlation matrix is statistically significant at 0.05% level of significance. The Number of total male and female (Paper wasp and oriental hornet) has been tested by P-correlation coefficient matrix, in which the results indicated that the total male and female (specimens) has positive correlation. The coefficient of male female specimens is

89%, meaning that increase total female results 89% increase in female across different localities of Killa Saifullah.

Table 1. Locality wise count of wasp species collected from Tehsil Killa Saifullah during 2018

Locality of collection	Regions of Tehsil	No. of specimens collected			Average		Temp. (°C)
		Paper wasp	Oriental hornet	Total	Paper wasp	Oriental hornet	
Town committee Guttai	North east	79	101	180	40.55	56.11	38
Union council Mirzai	North west	155	48	203	76.35	23.64	37
Town committee Bazar	South east	99	72	171	57.9	42.10	34
Zilla DCO Colony	Central	102	138	240	42.5	57.5	31
Union council Barat khail	South west	200	223	423	47.28	57.72	28
Union council Sharan Jomezai	North east	251	50	301	83.4	16.61	23
Total		886 (57.37 %)	632 (41.63 %)	1518			

Table 2. Sex wise count of wasp species during 2018

Locality	Region	Sex ratio					
		Total No. of Male	Paper wasp	Oriental hornet	Total No. of Female	Paper wasp	Oriental hornet
Town committee Guttai	North east	145	105	40	35	27	8
Union council Mirzai	North west	173	123	50	30	23	7
Town committee Bazar	South east	125	87	38	46	30	16
Zilla DCO Colony	central	198	142	56	42	24	18
Union council Barat khail	South west	313	217	96	110	77	33
Union council Sharan Jomezai	North east	225	164	61	78	48	30
Total		1179	838	341	339	299	142
Average			71.1	28.92		81.02	38.5

Table 3. Species wise count of collected wasps during 2018

Species	Sites of collection						Average
	*TC Guttai	*UC Mirzai	*TC Bazar	Zilla DCO Colony	*UC Barat Khail	*UC Sharan Jogezai	
<i>Polistes flavus</i>	19	39	23	21	62	68	38.7
<i>P. greeniptica</i>	8	14	12	14	17	31	16.0
<i>P. wattii</i>	10	23	15	15	23	33	19.83
<i>P. fuscatus</i>	9	13	9	13	13	12	11.5
<i>P. olivaceus</i>	6	11	16	16	27	27	17.16
<i>P. indicus</i>	7	16	8	11	16	26	14.0
<i>P. stigma</i>	11	20	17	17	24	29	19.66
<i>Ropalidia. brevata</i>	7	19	14	15	18	25	16.33
Sub-total	79	155	99	102	200	251	
Total							886
<i>Vespa orientalis</i>	101	48	72	138	223	50	97.0
							632

*TC indicates Town committee & *UC for Union council

***Polistes flavus* Cresson, 1868**

Polistes flavus is the most familiar of the paper wasps. It is widely distributed wasp species in Tehsil Killa Saifullah, Zhob division. It is also known as yellow paper wasp have thin body and almost entirely bright yellow color which helps to separate this species from every other paper wasp [25]. Body size of male and female are varies in measurement. Brown thorax and yellowish abdomen with brown strips prominent eyes and short antennae are the main diagnostic features (Figure 1, 2).

Measurement

Male (n=81). Figure 1: Body length (13-19 mm), Fore wing (4.6-16mm), fore leg (5-9mm), mid leg (6-10.5mm), hind leg (7-18mm), Antenna (3-.5mm).

Female (n=141). Figure 2: Body length (13-20mm), Fore wing (12-18mm), fore leg (5.2-10.5mm), mid leg (5.3-11.2mm), hind leg (7-14mm), Antenna (2.3-4.1mm).

Distribution

The *P. flavus* is the most common type of paper wasps. It is cosmopolitan in distribution. Pakistan, Iran, Afghanistan, Indonesia, Australia, New Caledonia, Chile, Myanmar, Cambodia, Malaysia Egypt, New Zealand, India, Nepal, Oman, Mauritius,

Philippines, Madagascar, Singapore, Japan, Sri Lanka, Magnolia, Tanzania, Fiji, Thailand, Laos, Tonga, Vietnam and introduced into Hawaii, Australia and New Zealand [9, 11, 14, 26-28].

Comments

***Polistes greeniptica* Panzer (1799) 1806**

These wasp were less prevailed in the study region (Killa Saifullah). These are moderate sized paper wasps and commonly 2 to 2.5 cm (20-25 mm) long, slender, narrow-waisted, and its paper like wings are light brown in color projected backwardly lengthwise when at rest [29]. *P. greeniptica* have complete yellow body with the brown dots on head, thorax and bands on the abdomen. These wasps are overall have green eyes (Figure 3 & 4). The green eyes are a characteristic feature of the genus

Measurement

Male (n=30). Figure 3: Body length (14-20.2 mm), Fore wing (4.6-17mm), fore leg (6-11mm), mid leg (5-12mm), hind leg (7-13.3mm), Antenna (5-13.33mm).

Female (n=62). Figure 4: Body length (12-20.5mm), Fore wing (12-16.1mm), fore leg (5.3-12mm), mid leg (5.4-13mm), hind leg (6.5-14.3mm), Antenna (3.2-8mm).

Distribution

Pakistan, Iran, Afghanistan, Iraq, India, China and Oman [9, 14, 26, 30].

Comments

This species provided new locality records. Shah *et al.* [25] reported from Abbottabad and Mansehra and from Gilgit Baltistan by Faiz [29]. While Siddiqui *et al.* [28] reported the same species from Islamabad and Mardan, Pakistan.

Polistes watti Cameron, 1903

This wasp species is also known as Arabian paper wasp. General body color is yellowish and have powerful mandibles with dark brown margin ring like structure at the base of antennal flagellum [30]. Eyes prominent and white, straight abdomen with brown strips. Head and thorax almost uniform yellow in colour; In some specimens brownish yellow; mesosoma almost yellow while metasoma is evidently yellowish brown (Figure 5 & 6).

Measurement

Male (n=48). Figure 5: Body length (19-26 mm), Fore wing (11-23mm), fore leg (2.7-10mm), mid leg (5-11.2 mm), hind leg (6-14mm), Antenna (2.5-5mm).

Female (n=71). Figure 6: Body length (9-21mm), Fore wing (7-16mm), fore leg (2.5-9 mm), mid leg (4-15mm), hind leg (3-13mm), Antenna (1.75-3mm).

Distribution

Pakistan, Iraq, India, China, Oman, Iran, Saudi Arabia, Mauritius and Afghanistan [9, 14, 26, 27].

Comments

New locality records have been provided for this species. Siddiqui *et al.* [28] reported *Polistes watti* from Islamabad, Mardan and Peshawar. Mahmood *et al.* [14] reported this species from Gari Habibullah, Dir, Mansehra, Abbottabad, Miadam, Peshawar, Mardan and Punjab while Shah *et al.* [25] reported it from Abbottabad, Battagram and Mansehra. Faiz [29] recorded *P. watti* from Gilgit Baltistan.

Polistes fuscatus Fabricius, 1793

This wasp species is also known as golden paper wasp. The body length of *P. fuscatus* often ranges between 15 and 21 mm [31]. The facial and abdominal markings of *P. fuscatus* are highly variable. Small dots, long stripes, clypeus blotches, yellow abdominal dots, are striking characters [32]. The fore wing length ranges between 11.5 and 17.0 mm; in general, the fore wing of males is above 13.0 mm, of females above 11.0 mm [31]. Both males and females have rather slender bodies and have a waist that connects the thorax to the abdomen [32]. With length and coloration also varies throughout the seasonal year of when the wasps emerge [17].

Measurement

Male (n=21). Figure 7: Body length (16-19 mm), Fore wing (4-11.0mm), fore leg (4-7mm), mid leg (5-9 mm), hind leg 8-13mm), Antenna (4-6.4mm). Female (n=48). Figure 8: Body length (16-23mm), Fore wing (14-21mm), fore leg (3-8 mm), mid leg (5.4-9 mm), hind leg (5-11.3mm), Antenna (2.5-6mm).

Distribution

Canada, British Columbia, North and Central American countries (Carpenter [26]. The most northern range is Chilcotin, British Columbia, and reaches as far south as Honduras [4].

Comments

New locality record for tehsil and District Killa Saifullah. In *P. fuscatus* the extent of yellow markings can vary independently on head, meso and metasoma [32]. The male is easily distinguished from other members of the *P. fuscatus* group by the complete darkening of the apical flagellomeres. In other species only the dorsal surface of the apical flagellomeres is darkened whereas tyloids and the anterior surfaces are essentially the same light colour (yellow-orange) as the basal flagellomeres. Females are easily identified by the largely black

colouration of the whole body, with or without well-developed yellow markings.

***Polistes olivaceus* De Geer, 1773**

Polistes olivaceus or yellow oriental paper wasp is an average to large sized wasp, it is deeply yellowish or somewhat light brown in colour from antennae to abdomen and has fine black pattering on the abdomen [33]. Thorax dorsal shield black with two long and wide longitudinal yellow stripes, expanded anteriorly, and yellow patches laterally. Diagnostic features indicates the presence of propodeal striations but not reaching the inner margin; median groove not deep (narrower). Females with complete occipital carina; ocellocular distance greater than interocellar distance. Legs yellow-brown, inner segment with black in male [34].

Measurement

Male (n=32). Figure 9: Body length (19-25 mm), Fore wing (14-18mm), fore leg (7-11.3mm), mid leg (9-11.4 mm), hind leg (8-14.2mm), Antenna (6-12.2mm).

Female (n=71). Figure 10: Body length (9-23.4mm), Fore wing (6-11.2mm), fore leg (5-11.2 mm), mid leg (5-12.1mm), hind leg (6-15mm), Antenna (1.3-5mm).

Distribution

Afghanistan, Argentina, Australia, China, Chile, Europe, Turkey, northern Africa, Israel, Syria, Russia, Iran, Pakistan, Turkmenistan, India, Mongolia, Uzbekistan and USA [20, 35-38].

Comments

First time recorded from Killa Saifullah, Balochistan province. Earlier reported from Muzaffarabad (Azad Jammu & Kashmir), Islamabad (Federal Capital Area); Khyber-Pakhtunkhwa: Baffa, Naran, Allae, Mansehra, Balakot, Oghi, Battagram, Abbottabad, Ayubia and Havelian; Gilgit-Baltistan: Nagar, Astore, Doyan. Punjab: Attock, Rawalpindi, Chakwal and Jhelum [15, 14, 25, 28].

***Polistes indicus* Stolfa, 1934**

Polistes indicus is part of the genus of paper wasps, and the family Vespidea (Petersen, 1990). This wasp species was described by Stolfa [39]. Body of *P. indicus* is almost yellowish brown with shiny gray (Figure 11 & 12), clypeus with strong hairs; abdomen brownish in colour, apical margin of the clypeus rounded in the middle, frons yellow, vertex black with two yellow spots, pronotum yellow with brown spots [40].

Measurement

Male (n=23). Figure 11: Body length (14-21 mm), Fore wing (10-15mm), fore leg (6-13.2mm), mid leg (8-12.5 mm), hind leg (9-14.2mm), Antenna (3-6mm).

Female (n=53). Figure 12: Body length (7-24.2mm), Fore wing (6-17mm), fore leg (5-17 mm), mid leg (4-13mm), hind leg (5-15.1mm), Antenna (1.1-7mm).

Distribution

Afghanistan, Pakistan, Iran, Iraq, United Arab Emirates and Oman [41].

Comments

Polistes indicus is new locality records for tehsil Kila Saifullah. The *P. indicus* was first reported from Pakistan by Das and Gupta [9] and then by Carpenter [26]. Gusenleitner [42] reported *P. indicus* from Gilgit and Dvorak [20] reported it from Peshawar, Khyber Pakhtunkhwa. Later it was identified from other regions of Pakistan viz Peshawar, Kohat, Abad Khel, Mansehra, Balakot, Baffa, Oghi, Battagram, Alia, Abbottabad, Havelian and Ayubia (Khyber-Pakhtunkhwa province); Chilas, Gsdas, Ghizar valley, Hunza, Jaglot, Gilgit and Astore (Gilgit-Baltistan); Sukkur, Ghotki, Allahyar Pinhwar, Taj Mohammad Ruk (Sindh province), Bahawalpur, Attock, Rawalpindi, Jhelum and Chakwal (Punjab province) [14, 25, 28, 29].

***Polistes stigma tamula* Fabricius, 1793**

Polistes stigma is a species of paper wasp from Southeast Asia, these wasps species are provided with an apically spotted fore

wing, female colour dark brown; following parts yellow to orange-yellow [43]: Body coarsely punctate, mainly brown. Males are larger and stouter than females (Figures 13, 14), antenna of male more slender than in female (Figure 13), curved at tip in female (Figure 14); scape about 2.7 times as long as its maximum width; Antennal sockets closer to inner eye margin than to each other [44]; inter-antennal space weakly raised. Clypeus in lateral view slightly wider, produced ventrally into blunt angle.

Measurement

Male (n=35). Figure 13: Body length (11-23 mm), Fore wing (3.4-10.5mm), fore leg (4-7 mm), mid leg (3.5-8mm), hind leg (9-15mm), Antenna (2.5-4mm).

Female (n=48). Figure 14: Body length (7-21mm), Fore wing (7-13mm), fore leg (5-13mm), mid leg (3.5-14mm), hind leg (4-15.1mm), Antenna (1.1-5mm).

Distribution

India, Pakistan and Sri Lanka, Nepal, Bhutan, Vietnam [43, 46].

Comments

First time recorded from Killa Saifullah. Previously this species was reported from Khyber-Pakhtunkhwa: Balakot, Siadu Sharif, Abbottabad, Swat, Miadam, Oghi, Battagram, Mansehra, Baffa, Allae, Havelian and Ayubia [14, 25, 46], Punjab: Murree, Parriata [28]; Sindh: Karachi, Badin, Manjhand; Azad Jammu and Kashmir: district Poonch: Rawalakot, Khaigala, Paniola, Hajira, Banjosa and Ali Sojal [38].

Ropalidia brevata Das and Gupta, 1989

This wasp species is the member of eusocial paper wasps in the subfamily Polistinae and tribe Ropalidiini. Nearly 27 species of *R. brevata* have been recorded from the Indian subcontinent (Pakistan, India, Bangladesh) as well as from Nepal, Bhutan, Sri Lanka, and the eastern part of Myanmar, including 16 species so far known to be endemic to the subcontinent [23, 47]. Head and thorax black and yellow. Body color red with following

yellow portions: antennal, mandible (except at tip), inner orbit below ocular sinus (Figure 15 & 16). Tarsal segments of all legs (highly variable), narrow apical band on abdominal terga and broad apical band on abdominal sterna. In some portions black patches are mixed with reddish body. The extents of yellow and black markings are variable.

Distribution

India, Pakistan and Sri Lanka, Nepal, Bhutan, Eastern Myanmar [26, 48, 49].

Measurement

Male (n=33). Figure 15: Body length (11-21 mm), Fore wing (7-11.2mm), fore leg (1.2-5.2 mm), mid leg (2.5-8 mm), hind leg (6-11.5mm), Antenna (1.5-6mm).

Female (n=65). Figure 16: Body length (5-21.2mm), Fore wing (6-11.7mm), fore leg (1-6mm), mid leg (1.4-9mm), hind leg (2.5-12.5mm), Antenna (1.1-7mm).

Comments

New record to the locality of Killa Saifullah. Das and Gupta [9] reported this species for the first time from Pakistan. Aziz [48] reported *Ropalidia brevata* for the first from Islamabad, Mardan and Peshawar. The same species was reported by several other authors from Gilgit-Baltistan [29], from Garihabibullah, Dir, Mansehra, Abbottabad, Miadam, Peshawar, Mardan [14]. It was reported from Punjab province (Islamabad, Rawalpindi, Chakwal, and Jehlum) by Siddiqi et al. [28] and from Swat [49].

Vespa orientalis Linnaeus, 1771

Vespa orientalis is from the subfamily Vespinae [26]. This species can be identified on the basis of following characters: first metasomal segment with narrow yellow band at the apex dorsally; third and fourth metasomal segments completely yellow. General appearance of body reddish brown in color (Figure 17 & 18), front of head with thick transverse band between eyes, last abdominal segment with thick yellow band,

and have moderate punctures on extended or elongated clypeus.

Measurement

Male (n=121). Figure 17: Body length (10-21 mm), Fore wing (7-21.0mm), fore leg (3.1-7 mm), mid leg (2.5-8.1 mm), hind leg (4-18mm), Antenna (2.5-11m).

Female (n=411). Figure 18: Body length (8-22.2mm), Fore wing (7-21.2mm), fore leg (6-12mm), mid leg (4-18mm), hind leg (5-21.5mm), Antenna (3-7.5mm).

Distribution

Pakistan, Afghanistan, Sri Lanka, Bhutan, India, Nepal, Myanmar, Thailand, Cambodia, Laos, Vietnam, China, Indonesia, Malaysia, Philippines, Papua New Guinea, Algeria, Libya, Egypt, Ethiopia; Somalia, Russia, Turkmenistan, Uzbekistan, Tajikistan, Iran, [14, 20, 26, 45]. It is also reported from Italy, Sicily, Malta, Albania,

Romania, Greece, including Crete; Bulgaria, Turkey, Cyprus, Syria, Lebanon [50]; Iraq, Israel, Jordan, Saudi Arabia [51], Bahrain, Yemen, Oman, United Arab Emariets [52].

Comments

New locality records have been provided for this species. Collected specimens were compared with other species of the genus *Vespa*. Archer [53] reported this species for the first from Pakistan. Khan *et al.* [38] has recorded *V. orientalis* from Diامر (Chillas), Nomal (Gilgit), Islamabad, Hajjira, Rawalakot (Azad Jammu and Kashmir), Quetta, Peshawar, Kohat, Abbotabad, Mansehra, Kohistan and Mardan. Arsalan *et al.* [54] recorded several species of the genus *Vespa* viz *Vespa mandarinia*, *V. orientalis*, *V. tropica* *V. velutina* from district Karak, Khyber Pakhtunkhwa.

Figure 1. *Polistes flavus* male

Figure 2. *P. flavus* female

Figure 3. *P. greeniptica* male

Figure 4. *P. greeniptica* female

Figure 5. *P. wattii* male

Figure 6. *P. wattii* female

Discussion

In this research study, eight species of wasp were recorded from six localities of tehsil Killa Saifullah (Zhob division) as shown in (Figure 19 & 20). This is the first report of wasp fauna from this region and it seems that there are more species of stinging Vespidae in Killa Saifullah. However, Dvorak [20] reported wasp of the two genera namely, *Polistes gallicus* (Linneus, 1767) and *Vespula germanica* (Fabricius 1793) from Balochistan province. The former was reported from Hazarganji (Quetta) and Ziarat, and the later one's was from Ziarat (Balochistan). The first mentioned species inhabits the southern part of Europe, North Africa, and the Middle East to South West Siberia. The Pakistani specimens have a completely yellow clypeus as in the form *Polistes g. fuscatus omissus* (Weyrauch, 1939). The second species (*V. germanica*) was noted to be the first record for Pakistan. A common Palaearctic species, which has been introduced into all continents except Antarctica [20].

In the present study two genera of the subfamily Polistinae and one genera Vespinae were identified. The genus *Polistes* include seven species: *Polistes flavus*, *P. greeniptica*, *P. wattii*, *P. fuscatus*, *P. olivaceous*, *P. indicus*, *P. stigma*. One species was in the genus *Ropalidia*, *R. brevata*. The genus *Vespa* let in one species *Vespa orientalis* (Oriental hornets). *V. orientalis*, *P. flavus* and *P. indicus* are widely distributed throughout the province. *P. greeniptica* and *P. fuscatus* is new record for Pakistan. This indicate that despite being small geographical region, Killa Saufullah has rich diversity of vespid wasps and there is necessity for

further broad study to increase knowledge of the people about insect fauna of this region of Pakistan. The wasp fauna of the study region was compared with the other areas of Pakistan. Azad Jammu and Kashmir: 11 species which belong from 3 sub-families of family Vespidae. Eumeninae, Polistinae and Vespinae [38], Khyber Pakhtunkhwa: 24 species which belongs from 3 families Vespidae (11 species), Pompilidae (12 species), Ichneumonidae has one species [54], Sindh: 19 species [47] which include 4 species of genus *Polistes* like *Polistes wattii* (Cameron, 1900), *P. indicus* (Stolfa, 1934), *P. stigma tamula* (Fabricius, 1798), *Ropalidia brevata* (Das & Gupta, 198), *R. marginata marginata* (Lepeletier, 1836), *R. spatulata* (van der Vecht, 1962), *R. variegata variegata* (Smith, 1852), *Vespa orientalis* (Linnaeus, 1771), *Antepipona sibilans*, *A. limbatus*, *Delta esuriens esuriens*, *D. campaniforme* *campaniforme*, *Knemodrynerus excellens*, Pothwar region Punjab: 10 species such as *Polistes wattii* (Cameron), *P. olivaceus* (De Geer), *P. rothneyi carletoni* (van der Vecht), *P. indicus* (Stolfa), *Ropalidia brevata* (Das and Gupta), *R. cyathiformis* (Fabricius), and one genus and four species of Vespinae (*Vespa basalis* (Smith), *V. orientalis* (Linnaeus), *V. tropica* (Linnaeus), *V. velutina* (de Saint Fargeau) [28], Karak, Khyber Pakhtunkhwa: 11 species which belongs from 3 subfamilies, Polistinae include *Polistes wattii*, *P. flavus*, *P. stigma*, *P. indicus*. *P. olivaceous*, *P. rothneyi*, *Ropalidia cyathiformis*, *R. brevata*; Vespinae include *Vespa mandarinia*, *V. orientalis*, *V. tropica* *V. velutina*, *Vespula flaviceps*; *Delta* sp. *Antepipona* sp. *Rhynchium* sp. *Antodynerus flavescens* [54].

Figure 19. Wasp species abundance collected from different locality of Tehsil Killa Saifullah in 2018

Figure 20. Number of male and female wasp species collected from different locality in the present study 2018

Conclusion

Result of the present study showed that the area of Tehsil Killa Saifullah (Zhob division), Balochistan, Pakistan has rich wasps fauna of different families. To explore the new species, new wasp family and subfamilies in the region it can be concluded that the climatic factors of district (tehsil) Killa Saifullah are suitable for wasp fauna. Furthermore, the same research on a large scale is recommended to find out the

remaining wasp fauna in the entire district of Killa Saifullah. For the conservation of wasp fauna in these areas of district it is suggested that those crops and flowers should be grown which are rich in nectar because some species of wasps feed on nectar but mostly wasps are carnivores and omnivores. Hope present work will provide understanding, techniques as well as some new titles and approaches to study the faunal diversity of this important group of Hymenoptera.

Authors' contributions

Conceived and designed the experiments: F Naz & A Kakar, Performed the experiments: M Naseem, W Muhammad, Zafarullah & A Khan, Analyzed the data: F Naz, A Kakar & W Muhammad, Contributed materials/analysis/ tools: M Naseem, N Naseeb & A Khan, Wrote the paper: A Kakar & F Naz.

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