

Research Article

Taxonomic study of family Vespidae Fauna in Gujranwala District, Punjab, Pakistan

Sabahat Naheed¹, Aniq Tariq¹, Sumera Afsheen¹, Anam Javed^{2*}, Gulshan Ashfaq² and Gul E Saman²

1. Department of Zoology, University of Gujrat, Hafiz Hayat Campus, Gujrat, Pakistan

2. School of Zoology, Minhaj University Lahore, Hamdard Chowk, Township, Lahore, Pakistan

*Corresponding author's email: dranam.zoology@mul.edu.pk

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Abstract

Wasps under family Vespidae, order Hymenoptera are commonly known as paper wasps, hornets, yellow jackets and potter wasps. They are cosmopolitan in distribution, playing role of major predators of insect pest larvae and many spiders. The aim of the research was to explore wasp fauna and their relative abundance in district Gujranwala, Punjab, Pakistan. During this study a total of 10 species of wasps belonging to family Vespidae were identified under three subfamilies (Vespinae, Polistinae, Eumeninae). Among these Vespinae represents three species *Vespa orientalis* Linnaeus, 1771, body length 1.5-2.5cm; *Vespa tropica* Linnaeus, 1758, body length 1.8-2.5 cm; and *Vespa velutina* Lepeletier, 1836. While subfamily Eumeninae was represented by *Delta dimidiatipenne* De Saussure, 1852, body 2.3-2.6cm and *Delta esuriens* Fabricus, 1787, body 1.5-1.7cm in length. The subfamily Polistinae was represented by *Polistes wattii* Cameron, 1900, body 1.7-1.9 cm; *Polistes olivaceus* De Geer, 1773, body 1.9-2.1 cm, *Polistes rothneyi* Carletoni Vander Vecht, 1968, body 1.5-1.9 cm and *Polistes indicus* Stolfa, 1934 body 1.5-1.6 cm in length, and *Ropalidia (Anthreneida) brevita* Das & Gupta, 1989. The data analysis showed members of subfamily Polistinae and Vespinae to be more abundant while that of subfamily Eumeninae are solitary in nature. But the way, wasps are always considered to play pivotal role of predators of a wide range of arthropods in an ecosystem. So the currently studied fauna of Gujranwala of family vespidae may serve as biological pest controllers for the crops and cultivation of this region parallel to its ecological value in control of natural arthropod populations in near future as replacements of harmful pesticides.

Keywords: Diversity; Gujranwala; Paper Wasps; Social Wasps; Vespidae

Introduction

The order Hymenoptera is an order of class Hexapoda which is an extremely diverse group with over 153,000 described species [1]. The order has 27 super families and 132 families [2]. The Vespidae is the family of the Hymenopterans which includes hornets, yellow jackets, predatory wasp, social wasp and paper wasp [3]. The wasps are the

efficient predators and parasitoids found in all biomes and in high diversity all over the world playing an important role in ecosystem. They are also being used in pest control management [4, 5].

Vespidae is one of the largest, highly diverse and cosmopolitan wasp families which include almost all the social and solitary wasps and many of the parasitoid wasps. It

the basis of morphological characters as well their size.

Photography

The photographs of their taxonomic characters were taken with Canon digital camera, Nikon Camera (D3200) and Vivo y15 Quad-core A1 triple rear camera with 24MP.

Results and Discussion

In the research conducted a total of 1312 specimens were collected from tehsils of district Gujranwala during 2017 to 2019. In the collection 10 species of wasps were identified. These species belong to the family Vespidae of order Hymenoptera. These species of family Vespidae were identified under three subfamilies (Vespinae, Polistinae, Eumeninae). Among this subfamily Vespinae represents three species (*Vespa orientalis*, *Vespa velutina* and *Vespa tropica*); two species were identified in subfamily Eumeninae under genus *Delta* de Saussure (*Delta dimidiatipenne* and *Delta esuriens*). Five species were identified in subfamily Polistinae under genus *Ropalidia* Guerin-Meneville (*Ropalidia brevita*) and genus *Polistes* Latreille (*Polistes wattii*, *Polistes olivaceus*, *Polistes rothneyi*, and *Polistes indicus*).

Family Vespidae

i) Subfamily Eumeninae (Potter wasps)

Genus *Delta* de Saussure, 1855

a) *Delta dimidiatipenne* (de Saussure, 1852)

Material examined

Wazirabad: Ahmed Nagar, 21.x.18, 3 (Female) ♀; Gujranwala: 15.x.18 Rahwali, 1(Male) ♂; Wazirabad: Dhaunkal, 31.xi.18 1♀; Kamoke: Kamoke city, 3.xi.18 1♂.

Previous Record from Pakistan: This species has been reported from Punjab (Faisalabad, Muree, Chakwal, Jhelum, Attock, Gujrat, Multan, Islamabad); Khyber-Pakhtunkhwa (Mingora, Abbotabad, Mansehra. Peshawar, Azad Jammu and Kashmir, Gilgit Baltistan, Sukkur) by [14].

Taxonomic Characters

Clypeus and lower part of frons is red. It has light brown body with last portion of metastomatal segment 2 and remaining is black as shown in (Fig. 2). Light brown wings with black mark on basal angle are present. Male is 2.3cm and its forewing is 2.1 cm while female is 2.6cm and its forewing is 2.2cm in length.

b) *Delta esuriens* Fabricus, 1787

Material examined

Wazirabad: Hassan wali, 5.iii.18, 20♂ and 1♀.

Previous record from Pakistan

Earlier this species was reported from Baluchistan: (Quetta) by (Gusenleitner, 2006a); Punjab: (Head Fareed, Khanpur, Attock, Bakhar, Layyah, Muzafargarh, Mianwali, Attock, Chakwal and Rawalpindi); Khyber-Pakhtunkhwa: (Swat, Dir, Islamabad, Mansehra, Abbottabad, and Balakot) [15].

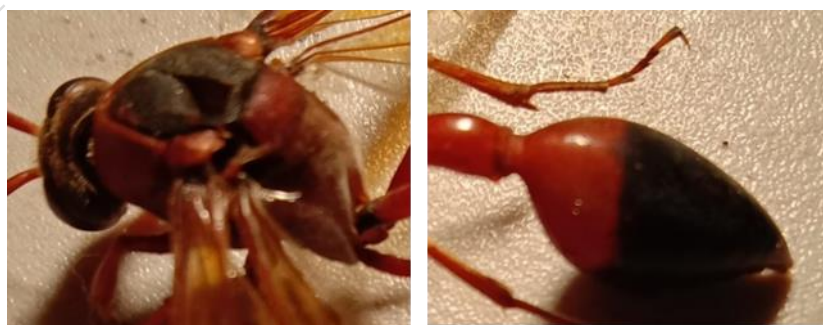


Figure 2: Metasoma and Mesosoma of *Delta dimidiatipenne*

Taxonomic characters

Parategulla is present. Body is petiolate having yellow band on apex and mesoscutum variegated with red and black marks as shown in (Fig. 3). Claws are bifid. Male is 1.5cm and its forewing is 1.1cm while female is 1.7cm and its forewing is 1.3cm in length.

ii) Subfamily Vespinae (Hornets and Yellow jackets)**Genus *Vespa* Linnaeus, 1758****a) *Vespa orientalis* Linnaeus, 1771****Material Examined**

Wazirabad: Hassan wali, 15.iv.17, 1♂ and 4♀; Gujranwala city: Ferozewala, 5.viii.17, 3♀; Gujranwala city: Gondlanwala, 6.ix.17, 2♂ and 1♀; Gujranwala Saddar: Rahwali Cantt, 12.ix.17, 2♀; Wazirabad: Ghakhar 2.x.17, 2♀; Kamoke: Harpoki 15.iii.18, 2♂; Nowshera Virkan: Kot Ladha 15.iv.18, 1♀; Gujranwala Saddar: Rahwali, 2.v.18, 4♂.

Wazirabad: Khanki, 24.ix.18, 22♀ and 12♂; Kamoke: Sadhoke, 4.x.18, 3♀ and 3♂; Nowshera Virkan: Tatlay Aali, 18.x.18, 8♀ and 5♂; Gujranwala: Aroop, 25.x.18, 5♀ and 3♂; Wazirabad: Ahmed Nagar; 4.xi.18, 11♀ and 6♂; Nowshera Virkan: Jajokey, 22.xi.18, 4♀ and 12♂; Kamoke: Kali Suba Khan, 7.iv.19, 5♀ and 5♂; Gujranwala: Aroop, 18.iv.19, 5♀ and 1♂; Kamoke: Sadhoke, 7.v.19, 4♀; Nowshera Virkan: Jajokey, 16.v.19, 4♀.

Previous record from Pakistan

Previously the species has been recorded from Khyber-Pakhtunkhwa (Abbotabad, Chitral, Peshawar, Mansehra, Kohat, Mardan, Balakot, Gilgit-Baltistan, Astore, Islamabad); Punjab (Attock, Rawalpindi, Chakwal, Muree, Rawalkot); Azad Jammu and Kashmir [16].



Figure 3: Mesosoma and Metasoma of *Delta esuriens*

Taxonomic characters

Body is thick and large covered with stiff hairs. Closely punctate clypeus with broad emargination is present. Antennae and head have reddish brown color, pronotum and scutellum also has reddish brown color. Lower area of pronotum is with transverse ridges. Narrow yellow band on first metasomal segment, yellow color on third and fourth metasomal segment is present with dots. Metasomal segment 2, 5, 6 are red or dark brown in color, as can be seen in (Fig. 4). Male is 1.5 to 1.9 cm in length female is 2.0 to 2.5 cm in length.

b) *Vespa tropica* Linnaeus, 1758**Material examined**

Wazirabad: Hassan wali, 1.v.18, 2♂.

Previous record from Pakistan

The species has been reported from Khyber-Pakhtunkhwa and Punjab [17].

Taxonomic characters

Metasomal segments 2, 5, 6 are dark brown or red color, 3, 4 metasomal segments are yellow, shown in (Fig. 5). Carina is complete. Body is large, thick and covered with hairs and it has pointed clypeus. Scutellum and dorsal pronotum is reddish brown in color. Two reddish brown lines on the anterior mesoscutum are present. Legs are reddish

brown and S2 is yellow with brown basal portion. Male is 1.8 cm while female is 2.5 cm in length.

c) *Vespa velutina* Lepeletier, 1836

Material examined

Wazirabad: Ghakhar 2.x.17, 2♂; Wazirabad: Hassan wali, 5.viii.18, 3♀.

Previous record from Pakistan

The specie has been reported from Khyber-Pakhtunkhwa; Punjab and Gilgit-Baltistan [18].

Taxonomic characters

Body is brownish with small black hair. Black marks on mandibles and scope are present. Clypeus is convex. Yellow bands on first two metasomal segments are present. Uniformly golden colored 4th and 6th segments are present. Metasoma is with light orange and velvety appearance as shown in (Fig. 6).



Figure 4: Metasoma and Mesosoma of *Vespa orientalis*



Figure 5: Metasoma, Mesosoma and clypeus of *Vespa tropica*

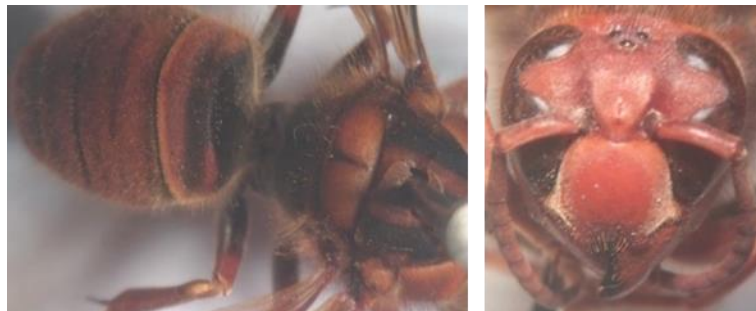


Figure 6: Metasoma, Mesosoma and Clypeus of *Vespa velutina*

iii) Subfamily Polistinae (Paper wasps)

Genus *Polistes* Latreille, 1802

a) *Polistes olivaceus* De Geer, 1773

Material examined

Gujranwala city: Ferozewala1a, 20.viii.17, 4♀; Gujranwala city: Gondlanwala, 6.ix.17, 15♂; Gujranwala Saddar: Rahwali Cantt, 12.ix.17, 2♀; Kamoke: Eminabad, 22.ix.17,

10♂ and 2♀; Wazirabad: Ghakhar, 2.x.17, 20♂ and 35♀; Nowshera Virkan: Nokhar, 2.iii.18, 2♀; Kamoke: Harpoki 15.iii.18, 2♂; Nowshera Virkan: Kot Ladha, 15.iv.18, 14♀; Gujranwala Saddar: Rahwali Talwandi, 2.v.18, 4♂ and 10♀; Wazirabad: Ahmed Nagar, 25.ix.18, 6♂; Kamoke: Sadhoke, 4.x.18, 5♀ and 2♂; Nowshera Virkan: Tatlay Aali, 18.x.18, 7♀ and 3♂; Gujranwala: Rahwali, 27.x.18, 4♀; Wazirabad: Khanki, 13.xi.18, 7♀ and 2♂, Ahmed Nagar, 13.xi.18, 6♀ and 3♂; Kamoke: Kamoke city, 21.xi.18, 13♀ and 5♂, Kali Suba Khan, 18.iv.19, 11♀ and 2♂; Nowshera Virkan: Tatlay Aali, 25.iv.19, 7♀, Gobind Pura, 25.iv.19, 7♀ and 9♂; Gujranwala: Rahwali, 7.v.19, 8♂, Aroop, 7.v.19, 2♀ and 1♂; Wazirabad: Dhaunkal, 19.v.19, 4♀ and 2♂; Kamoke: Kamoke city, 27.v.19, 8♀ and 5♂; Nowshera Virkan: Jajokey, 4.vi.19, 9♀ and 3♂; Gujranwala: Nandi Pur, 10.vi.19, 6♀ and 2♂; Wazirabad: Dhaunkal, 14.vi.19, 3♀ and 2♂.



Figure 7: Metasoma and Mesosoma of *Polistes olivaceus*

b) *Polistes wattii* Cameron, 1900

Material examined

Wazirabad: Hassan wali, 5.viii.17, 20♂ and 8♀; Gujranwala city: Ferozewalala, 5.viii.17, 1♀; Gujranwala city: Gondlanwala, 6.ix.17, 24♂; Gujranwala Saddar: Rahwali Cantt, 12.ix.17, 15♂ and 27♀; Kamoke: Eminabad, 22ix.17, 10♂ and 11♀; Wazirabad: Ghakhar 2.x.17, 3♂; Nowshera Virkan: Nokhar, 2.iii.18, 33♀; Kamoke: Harpoki 15.iii.18, 15♂; Nowshera Virkan: Kot Ladha 15.iv.18, 30♀; Gujranwala

Previous record from Pakistan

The species has been previously recorded from Punjab: (Islamabad, Chakwal, Rawalpindi, Attock, and Jhelum); Gilgit-Baltistan: (Nagar) and Khyber-Pakhtunkhwa: (Narran) [14].

Taxonomic characters

Yellow orange color of thorax and mesopleuron and black color markings on them are present. Clypeus is higher and less wide finely and densely punctate, few punctures interposed and largely scattered temple frons and vertex has scattered fine punctures. Pronotum and mesoscutuni is also punctate. Mesoscutum, propodeum and last three tergites has distinct striations possess much coloration as shown in (Fig. 7). This species is differentiated from others due to incomplete carina in females. In males apophyses of sub genital plate is flattened and spatulate at tip and have shiny surface with variable color pattern. Female is 2.1 cm while its forewing is 1.91 cm and male is 1.9 cm while its forewing is 1.8 in length.

Saddar: Rahwali Talwandi, 2.v.18, 20♂ and 19♀; Wazirabad: Khanki, 24.ix.18, 7♀ and 3♂; Kamoke: Sadhoke, 4.x.18, 8♀ and 4♂, Kali Suba Khan, 4.x.18, 23♀; Gujranwala: Aroop, 20.x.18, 5♂; Nowshera Virkan: Jajokey, 29.x.18, 3♀ and 3♂; Wazirabad: Dhaunkal, 9.xi.18, 15♀ and 6♂, Khanki, 13.xi.18, 4♀ and 4♂; Kamoke: Kali Suba Khan, 21.xi.18, 6♂; Nowshera Virkan: Tatlay Aali, 26.iv.19, 1♀ and 4♂; Gujranwala: Rahwali, 7.v.19, 5♀ and 2♂, Aroop, 8.v.19, 5♂; Kamoke: Kamoke city,

18.v.19, 4♀ and 1♂; Nowshera Virkan: Tatlay Aali, 6.vi.19, 11♀ and 1♂; Gujranwala: Nandi Pur, 10.vi.19, 3♀ and 6♂.

Previous record from Pakistan

Previously it is recorded in Punjab: (Salt range, Murree, Taxila, Bahawalpur, Islamabad); Sindh: (Karachi, and Sukkur); Khyber Pakhtunkhwa: (Kohat, Mansehra, Hunza); and Gilgit-Baltistan [15].

Taxonomic characters

Punctate clypeus is present. Dorsal and ventral part of metapleuron is without

punctures. Black marks on ocellus are present. Complete occipital carina is present. Mesonotum is brown in color and no yellow lines are present. The metasoma has brown and yellow color. Narrow lines of red color are present on T2-T5 and S2-S5 as shown in (Fig. 8). Weak striations on propodeum are present. Male is 1.7 cm while its forewing is 1.63 cm and female is 1.9 cm while its forewing is 1.84 cm in length.



Figure 8: Metasoma and Mesosoma of *Polistes wattii*

c) *Polistes indicus* Stolfa, 1934

Material Examined

Wazirabad: Hassan wali, 5.viii.17, 20♂ and 14♀; Gujranwala city: Ferozewala, 5.viii.17, 20♂ and 3♀; Gujranwala city: Gondlanwala, 6.ix.17, 24♂, 10♀; Gujranwala Saddar: Rahwali Cantt, 12.ix.17, 15♂, 17♀, 21♀; Kamoke: Eminabad, 22.ix.17, 15♂, 11♀; Wazirabad: Ghakhar, 2.x.17, 6♂, 14♀; Nowshera Virkan: Nokhar, 2.iii.18, 13♀; Kamoke: Harpoki, 15.iii.18, 19♂ and 20♀; Nowshera Virkan: Kot Ladha, 15.iv.18, 15♀; Gujranwala Saddar: Rahwali Talwandi, 2.v.18, 19♂ and 6♀; Wazirabad: Khanki, 24.ix.18, 3♀; Kamoke: Sadhoke, 4.x.18, 5♀ and 6♂, Kali Suba Khan, 9.x.18, 2♀ and 2♂; Nowshera Virkan: Tatlay Aali, 18.x.18, 2♀; Gujranwala: Aroop, 25.x.18, 4♀ and 3♂; Wazirabad: Ahmed Nagar, 4.xi.18, 3♀ and 3♂, Khanki, 13.xi.18, 4♀; Nowshera Virkan: Gobind Pura, 25.iv.19, 1♀ and 4♂; Gujranwala: Rahwali, 7.v.19, 8♀ and 9♂; Kamoke: Sadhoke, 20.v.19, 9♀; Kamoke

city, 18.v.19, 8♀ and 6♂; Wazirabad: Dhaunkal, 19.v.19, 3♀ and 4♂, 14.vi.19, 4♀ and 1♂.

Previous record from Pakistan

Previously it was recorded from Punjab: (Rawalpindi, Jhelum, Attock, Bahawalpur); Khyber Pakhtunkhwa: (Kohat, Peshawar, Gilgit-Baltistan); Sindh: (Ghotki, Sukkur, Allahyar Pinhwar) [14].

Taxonomic characters

There are macropunctures on the lower half region of the clypeus. Interocular distance is larger on vertex than clypeus and a distinct carina is present in inter-antennal space. Possess entirely yellowish brown body. Reddish-brown vertex is present. Reddish-Orange antenna having first two entirely black article and third article is partly black as shown in (Fig. 9). Male and female are almost similar in size 1.5 to 1.6 cm and their forewing is 1.2cm in length.

d) *Polistes rothneyi* Carletoni Vander Vecht, 1968

Material examined

Ghakhar, 3.ix.17, 1♂; Wazirabad: Ahmed Nagar, 24.ix.18, 5♀; Kamoke: Sadhoke, 4.x.18, 2♀ and 3♂; Wazirabad: Dhaunkal, 26.x.18, 5♀ and 2♂; Nowshera Virkan: Jajokey, 29.x.18, 2♀ and 2♂, Gobind Pura, 25.iv.19, 10♀ and 8♂; Gujranwala: Aroop, 7.v.19, 4♀ and 2♂; Wazirabad: Dhaunkal, 19.v.19, 1♀ and 2♂; Gujranwala: Aroop, 8.vi.19, 3♀ and 3♂, Nandi Pur, 10.vi.19, 6♀ and 8♂.

Previous record from Pakistan

Previously it was recorded from Punjab: (Jhelum, Rawalpindi, Islamabad and Attock); Khyber Pakhtunkhwa: (Chitral, Hazara, Dir, Peshawar, Gilgit Baltistan) [15].

Taxonomic characters

Main color of body is reddish brown or yellow while its mesopleuron, metapleuron and mesoscutum is black as shown in (Fig. 10). Mesopleuron is punctate. Head is reddish brown in color with black color on first three articles. The coxae, femur and antennae have extensive black markings. Punctate and hairy clypeus is present. Propodeum is having strong transverse striations that reach the lower margin of side. The male is 1.5 to 1.6cm while its forewing is 1.52 cm and female is 1.9 cm while its forewing is 1.7 cm in length.



Figure 9: Metasoma and Mesosoma of *Polistes indicus*

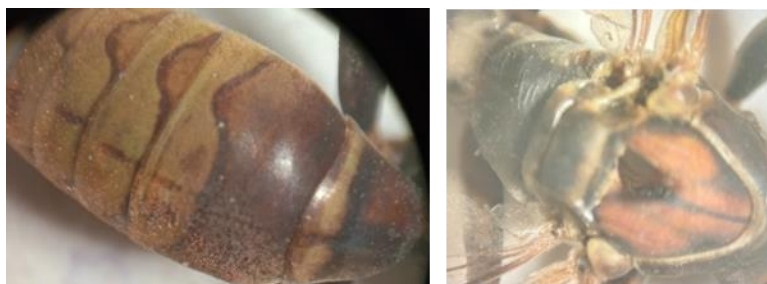


Figure 10: Metasoma and Mesosoma of *Polistes rothneyi*

e) *Ropalidia (Anthreneida) brevita* Das & Gupta, 1989

Material examined

Wazirabad: Hassan wali, 20.v.18, 1♂; Wazirabad: Ghakhar, 16.v.18, 1♀; Kamoke: Harpoki, 20.vi.18, 1♂; Gujranwala Saddar: Rahwali Talwandi, 10.vi.18, 1♀.

Previous record from Pakistan

Previously it was recorded from Punjab: (Islamabad); Khyber-Pakhtunkhwa:

(Abbottabad, Ghari Habibullah and Mansehra); Gilgit-Baltistan [14].

Taxonomic characters

In dorsal view T1 approximately nearly half as wide as that of T2; body red with the yellow portions; propodeum with longitudinal, paired basal carina. Clypeus is red with yellow stripes at its apex as shown in (Fig. 11). Inner orbit under ocular sinus are entirely yellow.



Figure 11: Metasoma and clypeus of *Ropalidia brevita*

Conclusion

According to this research the members of subfamily Polistinae were more abundant. As these species are known to be social in nature so their abundance can be supported with their behavior. As Potter wasp has Solitary lifestyle so they are represented by little number of species. Subfamily Vespinae also showed quite good ratio of abundance and they were mostly seen on fruits and vegetables which shows their crop favorability. All these species are widely distributed in this area. Gujranwala being the agricultural land gives the habitat favorability to various wasps' species also being supported by its climatic factors. However; there is large diversity of wasps existing in the area which needs to be studied and explored on large scale to get its benefit not only to maintain ecological balance of arthropods' population but also to indulge these selected insects for biological pest control to replace harmful pesticides in near future.

Authors contributions

All the authors have equally contributed in the research work.

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