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## TAXONOMIC IDENTIFICATION OF BEES AND WASPS (HYMENOPTERA) FAUNA OF DISTRICT MASTUNG, BALOCHISTAN

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### Abstract

*This study aimed to provide a comprehensive taxonomic identification of the bee and wasp fauna in Mastung district of Balochistan, an ecologically significant region in southwestern Pakistan. The region's diverse habitats, ranging from arid zones to semi-arid landscapes, offer a unique environment for pollinator species, yet entomological diversity, particularly among Hymenoptera, remains underexplored. Field surveys were conducted during the peak activity seasons from October 2019 to May 2020, with entomological techniques. Taxonomic identification was based on morphological traits, with confirmation using available taxonomic keys and relevant literature. A total of 515 species of bees and wasps were identified, representing 10 species of wasp and 8 species of bees (a total of 18), which were distributed into 14 genera and 6 families. The families into which bees were identified are Apidae, Halictidae and Megachilidae. The wasps were identified under the families Vespidae, Evaniidae, Crabronidae and Chrysididae. The study highlights the ecological importance of these pollinators in local agriculture and biodiversity, emphasising their role in the pollination of native flora and crops. The results highlight the importance of this region for supporting a diverse range of bees and wasps, and underscore the need for conservation efforts to protect these vital predators and pollinators.*

**Keywords:** Apidae, Balochistan, Hymenoptera, Mastung, Vespidae

## INTRODUCTION

Insects have a very important role in terrestrial ecosystem as, pollinators, predators, herbivores and parasites (1). For maintenance of biodiversity and production of food insects are very important as they perform about 70% pollination service of the world. Hymenoptera is the most diverse order of insects. Hymenoptera is a very beneficial order to humans in many ways and play a vital role in functioning and balancing ecosystems of earth (2). Around 100,000 species of Hymenoptera have been recorded (3).

According to estimation more than 80% of insect pollination is accomplished by bees. More 16,000 bees are described as pollinators worldwide (4). Bees are classified into seven families, and family Apidae is one of them. Apidae is further divided into three subfamilies including Apinae, Xylocopinae and Nomadinae (4). Wasps are dispersed throughout the world. Wasps are insect that neither bee nor ant and belongs to suborder Apocita and order Hymenoptera. The first wasp was originated in Jurassic Period (5). Wasps are considered as omnivores arthropods. They play a vital role in pollination. They can survive in diverse climate and can tolerate up to -6°C temperature. Wasps are small to medium or average sized insects (6). Evidence of population and seasonal fluctuation in wasps are available. In one year wasp population fluctuated in tropical region and various studies were carried out on this topic (7).

The knowledge about bees and wasps fauna of Balochistan, Pakistan is not so good. Balochistan lacks the exact data about its hymenoptera fauna. The exact distribution of bees and wasps fauna of Balochistan is not yet referenced completely, hence this work focused on the bees and wasps collection from district Mastung, Balochistan. District Mastung is located at 735km (aerial distance) south-west (235 degree bearing) of Pakistan capital city Islamabad and 45km (aerial distance) south-west (200 degree bearing) from Quetta, the capital city of Balochistan (8). Mastung has mountainous and barren area with rocky landscapes and varying ground elevation with 934-3414 meters above sea level (9). According to the Agriculture



Statistics, 2008-09, Mastung is a tropical agro-ecological region with a total of 255,208 hectares of agricultural area, approximately 37% of the total geographical area of Mastung (Fig. 1). District Mastung as a “biosphere reserve” offers an opportunity to develop a methodology for taxonomical identification of Hymenoptera. Many studies were carried to identify different insect species throughout the world. The wasp fauna of Pothwar region, Pakistan was studied. This study identified nine species within six genera of *Eumeninae*, six species under two genera of *Polistinae* and four species of *Vespiniae* (10-12).

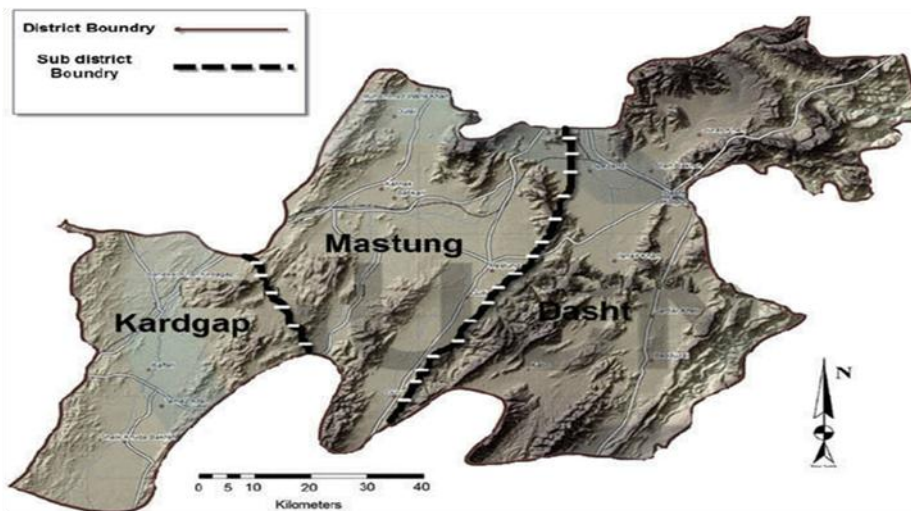


Fig. 1. Map showing different areas of district Mastung

## METHODOLOGY

Three localities of district Mastung were selected for the collection of specimens. The selected areas were Mastung city, Kardgap and Dasht (Fig. 1). The selected areas of district Mastung were visited regularly from October 2019 to May 2020. With the help of trapping net samples were collected. For killing and preservation specimens were kept in ethyl acetate jars. The specimens were pinned with entomological pins into insect box. The features of the preserved specimens were visualized using a stereoscope. New and old keys, as well as online literature, were used to identify the specimens.

Specimens were then sent to NARC Islamabad for additional identification. The abundance bar charts of the collected specimens were calculated using Microsoft Excel. Percentage abundance calculated by following simple percentage formula:

$$\frac{\text{Number of selected specie}}{\text{Total number of collected specimens}} \times 100$$

## RESULTS AND DISCUSSION

In the course of this study, 515 individuals of bees and wasp were collected and identified over various seasons. Among which 10 species of wasp and 8 species of bees (total 18) were collected which were distributed into 14 genera and 6 families (Table I), the families into which bees were identified are Apidae, Halictidae and Megachilidae. The identified species of bees were *Apis florea* Fabricius, *Ceratina binghami* Cockerell, *Thyreus ramosus* Lepeletier, *Xylocopa fenestrata* Fabricius, *Amegilla* sp., *Halictus vishnu* Cameron, *Megachile* sp. *Pseudoanthidium orientale* Bingham were recorded from district Mastung. The wasps were identified under the families Vespidae, Evaniidae, Crabronidae and Chrysididae and the wasp’s species, *Delta esuriens* Fabricius, *Delta dimidiatipenne* de Saussure, *Vespa orientalis* Linnaeus, *Vespula germanica* Fabricius, *Polistes watti* Cameron, *Polistes indicus* Stolfa, *Polistes rothneyi* Van der Vecht, *Evania appendigaster*, *Bembix oculata* Panzer, *Chrysididae* sp. were recorded.

Table I. Species abundance (relative percentage) of collected insect species

| S. no.               | Species                  | No. of species with location | Per species abundance | Relative percentage |
|----------------------|--------------------------|------------------------------|-----------------------|---------------------|
| <b>Family Apidae</b> |                          |                              |                       |                     |
| 1                    | <i>Apis florea</i>       | L1=4 L2=3 L3=3               | 10                    | 1.94                |
| 2                    | <i>Ceratina binghami</i> | L1=19 L2=14 L3=12            | 45                    | 8.73                |
| 3                    | <i>Thyreus ramosus</i>   | L1=6 L2=5 L3=4               | 15                    | 2.91                |

|                            |                                  |                   |      |       |
|----------------------------|----------------------------------|-------------------|------|-------|
| 4                          | <i>Xylocopa fenestrata</i>       | L1=2 L2=1 L3=2    | 5    | 0.97  |
| 5                          | <i>Amegilla</i> sp.              | L1=15 L2=10 L3=10 | 35   | 6.79  |
| <b>Family Halictidae</b>   |                                  |                   |      |       |
| 6                          | <i>Halictus vishnu</i>           | L1=5 L2=6 L3=4    | 15   | 2.91  |
| <b>Family Megachilidae</b> |                                  |                   |      |       |
| 7                          | <i>Megachile</i> sp.             | L1=12 L2=10 L3=11 | 33   | 6.40  |
| 8                          | <i>Pseudoanthidium orientale</i> | L1=4 L2=4 L3=4    | 12   | 2.33  |
| <b>Family Vespidae</b>     |                                  |                   |      |       |
| 9                          | <i>Delta esuriens</i>            | L1=3 L2=4 L3=4    | 11   | 2.1   |
| 10                         | <i>Delta dimidiatipenne</i>      | L1=8 L2=4 L3=5    | 17   | 3.3   |
| 11                         | <i>Vespa orientalis</i>          | L1=30 L2=28 L3=24 | 82   | 15.9  |
| 12                         | <i>Vespula germanica</i>         | L1=32 L2=17 L3=23 | 72   | 13.8  |
| 13                         | <i>Polistes watti</i>            | L1=20 L2=20 L3=15 | 55   | 10.67 |
| 14                         | <i>Polistes indicus</i>          | L1=19 L2=15 L3=18 | 52   | 10.09 |
| 15                         | <i>Polistes rothmeyri</i>        | L1=5 L2=5 L3=5    | 15   | 2.91  |
| <b>Family Evaniidae</b>    |                                  |                   |      |       |
| 16                         | <i>Evania appendigaster</i>      | 20                | 3.88 |       |
| <b>Family Crabronidae</b>  |                                  |                   |      |       |
| 17                         | <i>Bembix oculata</i>            | L1=5 L2=3 L3=3    | 11   | 2.13  |
| <b>Family Chrysididae</b>  |                                  |                   |      |       |
| 18                         | <i>Chrysis</i> sp.               | L1=3 L2=3 L3=4    | 10   | 1.94  |

*Cematina binghami* and *Vespa orientalis* were the most abundant species that were collected from three different locations.

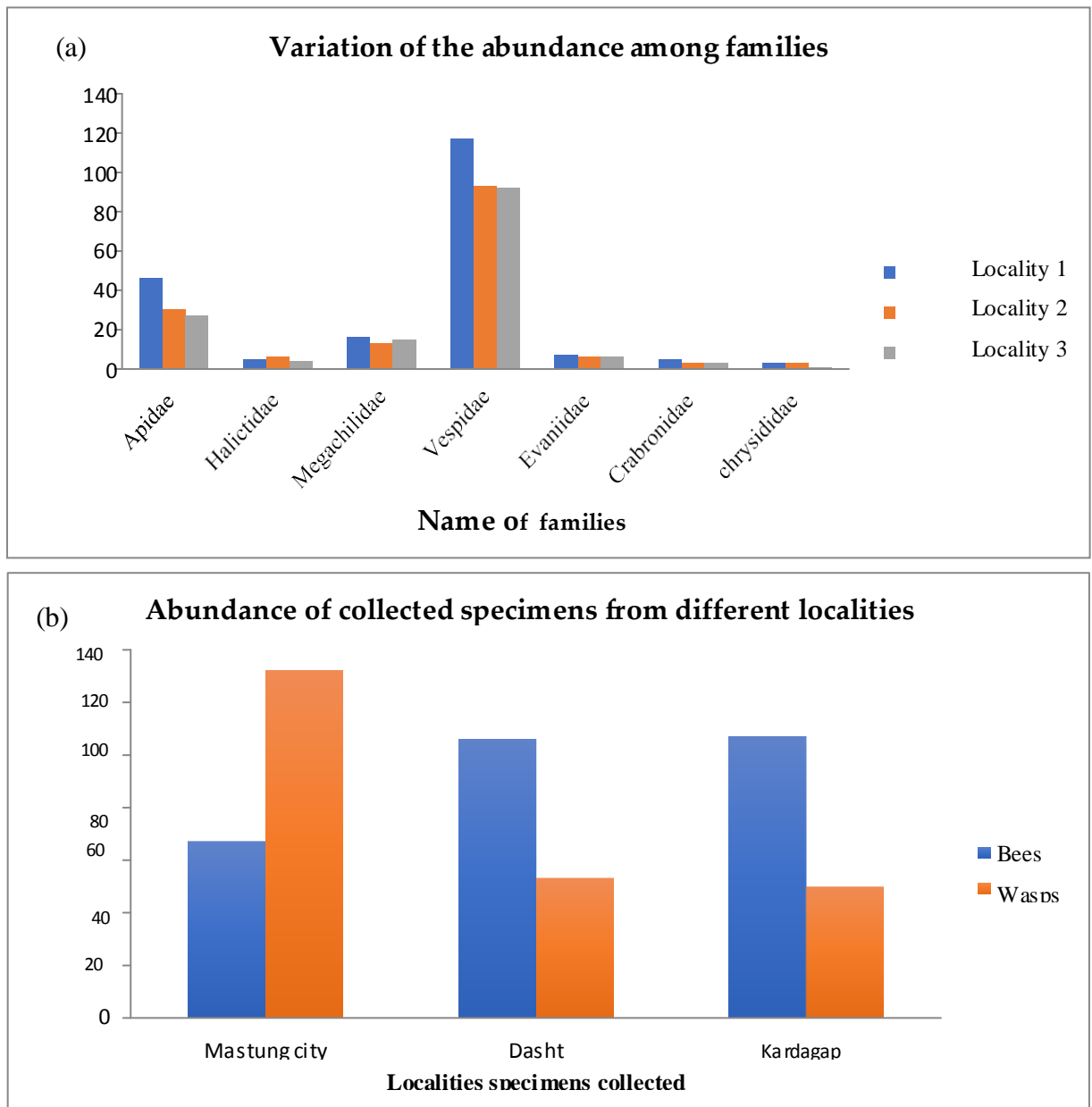


Fig. 2 (a). Location wise variation of the abundance among families; (b). City wise abundance of bees and wasps

**Table II.** Combined rank list with taxa

| Sr.no | Taxa name                        | L1  | L2  | L3  | Total abundance |
|-------|----------------------------------|-----|-----|-----|-----------------|
| 1     | <i>Apis florea</i>               | 4   | 3   | 3   | 10              |
| 2     | <i>Ceratina binghami</i>         | 19  | 14  | 12  | 45              |
| 3     | <i>Thyreus ramosus</i>           | 6   | 5   | 4   | 15              |
| 4     | <i>Xylocopa fenestrata</i>       | 2   | 1   | 2   | 5               |
| 5     | <i>Amegilla</i> sp.              | 15  | 10  | 10  | 35              |
| 6     | <i>Halictus vishnu</i>           | 5   | 6   | 4   | 15              |
| 7     | <i>Megachile</i> sp.             | 12  | 10  | 11  | 33              |
| 8     | <i>Pseudoanthidium orientale</i> | 4   | 4   | 4   | 12              |
| 9     | <i>Delta esuriens</i>            | 3   | 4   | 4   | 11              |
| 10    | <i>Delta dimidiatipenne</i>      | 8   | 4   | 5   | 17              |
| 11    | <i>Vespa orientalis</i>          | 30  | 28  | 24  | 82              |
| 12    | <i>Vespula germanica</i>         | 32  | 17  | 23  | 72              |
| 13    | <i>Polistes wattii</i>           | 20  | 20  | 15  | 55              |
| 14    | <i>Polistes indicus</i>          | 19  | 15  | 18  | 52              |
| 15    | <i>Polistes rothmeyeri</i>       | 5   | 5   | 5   | 15              |
| 16    | <i>Evania appendigaster</i>      | 7   | 7   | 6   | 20              |
| 17    | <i>Bembix oculata</i>            | 5   | 3   | 3   | 11              |
| 18    | <i>Chrysis</i> sp.               | 3   | 3   | 4   | 10              |
| Total |                                  | 199 | 159 | 157 | 515             |

\*Most abundant number of individuals was collected from the Mastung (locality # 1) and least number of individuals was evident from the Kardgap (location # 3)

The identification method classified the collected species into families, such as Apidae, Halictidae and Megachilidae Vespidae, Evaniidae, Crabronidae and Chrysididae. *Apis florea*, *Amegilla* sp. and *Evania appendigaster*. The Vespidae family was the most prevalent in the environment, with Mastung city serving as the primary habitat for these insects (Fig. 2 a & b). *Ceratina binghami* and *Vespa orientalis* were found to be the most abundant species in all three locations (Table II). The relative percentages of these species were calculated to understand their distribution and dominance in various places. Table III provides taxonomic identification for each species, including distribution, remarks, and references. This comprehensive taxonomic breakdown improves understanding of the geographical presence and characteristics of each identified bees and wasp species.

**Table III.** Family wise distribution of species

| Family | Genera   | Distribution   | Remarks  | References |
|--------|--|--|--|------------|
| Apidae | <b>Ap (Linnaeus, 1767)</b><br>Balochistan Mastung city<br>3.iii.2021 1 adult Dasht,<br>21.iii.2021, 2 adults,<br>Kardgap 22.iii.2021, 1<br>adults  | <i>Apis florea</i> is<br>distributed in<br>India, Iran,<br>Indonesia, Saudi<br>Arabia<br>and Sri Lanka<br>China, Vietnam,<br>Afghanistan | Species were<br>identified from<br>Peshawar. Punjab. | 13, 14     |
|        | <b><i>Ceratina</i> Latreille, 1802</b><br><b><i>Ceratina binghami</i></b><br><b>Cockereli, 1908</b><br><b>(The small carpenter bee)</b><br>found at Balochistan:<br>Mastung city 17.iii.2021 6<br>adults Dasht, 21.iii.2021<br>5 adults, Kardgap<br>7.iii.2021, 4 adults |  | These species<br>have been raised<br>in Pakistan     | 15-18      |
|        | <b><i>Thyreus</i> Panzer, 1806</b><br><b><i>Thyreus ramosus</i></b>  | Pakistan Arabia,<br>South Africa,  | These species<br>were informed in                    | 19-21      |



|                     |  |   |  |        |
|---------------------|--|---|--|--------|
|                     | <i>Lepeletier, 1841 (The cuckoo bee)</i> found at Pakistan Balochistan Mastung city , 31.v.2021, 2 adults, Dasht 4.v.2021, 1 adults, Kardagap, 11.v.2021, 2 adults   | India, Sri Lanka, Europe, Egypt, Myanmar  | Pakistan   |        |
|                     | <i>Xylocopa Latrellie Xylocopa fenestrata, Fabricius, 1798 (The large carpenter bee)</i> found at Pakistan: Balochistan: Mastung city, 17.iii.2021, 6 adults, Dasht 21.iii.2021, 5 adults, Kardagap, 7.iii.2021, 4 adults  | Pakistan, India, Nepal, Sri Lanka, Iran, Myanmar, Brazil, China, Afghanistan, and Madagascar                  | Studied these species from Pakistan                      | 21-23  |
|                     | <i>Amegilla Friese, 1897 Amegilla sp. (The banded bee)</i> found at Pakistan: Balochistan: Mastung city 16.iv.2021, 3 adults, Dasht 19.iv.2021, 2 adults, Kardagap 9.iv.2021, 2 adults                                     | Pakistan: Brunei, Burma, Sri Lanka, Singapore, Malaysian, Indonesia   | Reported these species from different cities of Pakistan | 24-26  |
| <b>Halictidae</b>   | <i>Halictus Latreile, 1804 Halictus vishnu Cameron, 1897 (The mining bee)</i> found at Pakistan: Balochistan: Mastung city 2.v.2021, 2 adults, Dasht, 4.v.2021, 2 adults, Kardagap 26.iv.2021, 2 adults                    | Southeast Asia and Pakistan   | This specie reported from Pakistan                       | 27     |
| <b>Megachilidae</b> | <i>Megachile Latrielle, 1802 Megachile sp. (The leafcutter bee)</i> found at Pakistan: Balochistan: Mastung city 17.x.2020, 2 adults, Dasht 20.x.2020, 2 adults, Kardagap 7.x.2020, 3 adults                               | Sri Lanka, India, Pakistan  | Reported this specie from Quetta Pakistan                | 28     |
|                     | <i>Pseudoanthidium Fabricius, 1804 Pseudoanthidium orientale Bingham, 1897 (The potter bee)</i> found at Pakistan: Balochistan: Mastung city, 1.iv.2021, 1 adult, Dasht, 6.iv.2021, 2 adults, Kardagap 9.iv.2021, 3 adults | Myanmar, Pakistan, India, Thailand  | This specie reported from Pakistan                       | 21, 23 |
| <b>Vespidae</b>     | <i>Delta de Saussure, 1855 Delta esuriens Fabricius, 1787</i> found at Pakistan: Balochistan: Mastung city 2.v.2021, 2 adults, Dasht, 4.v.2021, 2 adults,  | Iran, Indonesia, Oman, India, Iraq, Myanmar, Pakistan, Saudi Arabia, Philippines, Qatar, Thailand, Sri Lanka, | Reported these species from different cities of Pakistan | 29-32  |

|   |  |   |        |
|---|--|---|--------|
| Kardagap 26.iv.2021, 2 adults   | U.A.E and Vietnam.   |   |        |
| <i>Delta dimidiatipeme de Saussure, 1852</i> found at Pakistan: Balochistan: Mastung city 17.iii.2021, 2 adults, Dasht 6.iv.2021, 2 adults, Kardagap 7.iii.2021, 2 adults,                          | Algeria, Afghanistan, Ethiopia, Egypt, Iran, India, South Africa, Saudi Arabia, Syria, Palestine, Pakistan, Madagascar, Somalia, Yemen and Turkmenistan  | Reported from Pakistan                              | 33, 34 |
| <i>Vespa Vespa orientalis</i>   | Afghanistan, Albania, Algeria, Saudi Arabia, Bhutan, Indonesia, India, China, Cambodia, Vietnam, Turkmenistan, Iran, Uzbekistan, Tajikistan, Philippines, Malaysia, Egypt, Libya, Ethiopia, Turkey, Lebanon, Iraq, Jordan, Greece, Romania, Italy, Malta, Russia, Somalia, Nepal, Oman, Yemen and Pakistan | listed this specie from Pakistan                    | 35, 36 |
| <b>Linnaeus, 1771 (Hornets)</b> found at Pakistan: Balochistan: Mastung city 2.x.2020, 4 adults, Dasht 5.x.2020, 2 adults, Kardagap 7.x.2019, 2 adults  |  |   |        |
| <i>Vespula Vespula germanica</i> <b>Fabricius, 1793 (Yellow jackets)</b> found at Pakistan: Balochistan: Mastung city 17.x.2020, 5 adults, , Dasht 20.x.2020, 3 adults Kardagap 9.xi.2020, 3 adults | Austria, Albania, Armenia, Bulgaria, Norway, Sweden, , Germany, Switzerland, Turkey, Romania, Iran, Mongolia, China, Israel, Kazakhstan, Pakistan, 59 India, Kashmir, Syria, Tajikistan, Uzbekistan, Afghanistan, Turkmenistan   | This specie recorded from Gilgit Baltistan Pakistan | 33     |
| <i>Polistes Polistes indicus</i> <b>Stolfa, 1934 (The paper wasp)</b> found at Pakistan: Balochistan: Mastung city 2.x.2020, 2 adults, Dasht 5.x.2020, 3 adults, Kardagap 7.x.2020, 2 adults        | Afghanistan, Pakistan, Oman, Iran, Iraq, Nepal, and India  | This specie recorded from all over Pakistan.        | 31, 37 |
| <i>Polistes watti</i> <b>Cameron, 1903</b> found at Pakistan: Balochistan: Mastung city 2.x.2020, 2 adults, Dasht, 5.x.2019, 3 adults, Kardagap, 7.x.2019, 2 adults                                 | Saudi Arabia, Oman, Afghanistan, India, China, Iraq, Pakistan, Mauritius and Iran  | Recorded from different cities of Pakistan          | 36, 38 |
| <i>Polistes rothneyi</i> <b>Van</b>   | Pakistan, Nepal and  | Described this                                      | 31, 32 |

|                    |   |   |   |        |
|--------------------|---|---|---|--------|
|                    | <b>der Vecht, 1968)</b> found at Pakistan: Balochistan: Mastung city 17.x.2020, 2 adults, Dasht, 4.xi.2020, 3 adults, Kardagap, 23.x.2020 2 adults  | India   | specie form Pakistan                      |        |
| <b>Evaniidae</b>   | <b>Evania Evania appendigaster (Linnaeus, 1758)</b> found at Pakistan: Balochistan: Mastung city, 2.v.2021, 2 adults, Dasht, 19.iv.2021, 2 adults, Kardagap 26.iv.2021, 3 adults                      | Africa, America, eastern Russia, Australia, India, Pakistan and Saudi Arabia  | Reported from Punjab and Karachi Pakistan | 32, 39 |
| <b>Crabronidae</b> | <b>Bembix Fabricius, 1775 Bembix oculata Panzer, 1801 (The sand wasp)</b> found at Pakistan: Balochistan: Mastung city 31.v.2021, 2 adults, Dasht, 19.iv.2021, 2 adults, Kardagap 9.iv.2021, 2 adults | Azerbaijan, Afghanistan, Abkhazia, Russia, Africa, Europe, Jordan, Syria, Lebanon, Oman, Saudi Arabia, central Asia, Pakistan, Mongolia, china and Kazakhstan | Stated this specie from Pakistan          | 32     |
| <b>Chrysididae</b> | <b>Chrysis Chrysis sp (The cuckoo wasp)</b> found at Pakistan: Balochistan: Mastung city, 31.v.2021, 2 adults, Dasht 19.iv.2021, 2 adults, Kardagap 9.iv.2021, 2 adults                               | Siberia, Pakistan, India, Nepal, Iran Turkey and China  | Reported from different areas of Pakistan | 40     |

## CONCLUSION

During this research study 515 species were collected among which 10 species were wasps and 8 species of bees were identified. These species were distributed in 15 genera and 7 families. Identification was accomplished under the families: Apidae, Halictidae and Megachilidae Vespidae, Evaniidae, Crabronidae and Chrysididae. *Apis florea*, *Amegilla sp.* and *Evania appendigaster* were reported from Balochistan for the first time. Further study should be done to explore the taxonomic fauna of bees and wasps of other areas of Balochistan. Studies should be conducted on the importance of hymenopteran species as pollinators.

Pesticides that are used improperly in farming harm pollinators like bees and wasps. Research should be done on the usage of environmentally friendly pesticides that do not harm these pollinators. Research should be done on criteria to preserve hymenopteran species native environment. Future research on wasps and bees at the molecular level should be done. These insects could be raised for commercial purposes since their products, including as honey, wax, royal jelly, propolis, and bee venom, can have medicinal uses.

### Conflict of Interest:

The authors report no conflicts of interest

### Author's Contributions:

SLS Conducted the experimental work and data collection; GM Supervised the study and reviewed the manuscript; DKH Performed data analysis and interpretation; SGM Assisted in laboratory assays; NR Contributed to sample collection and processing; NT Participated in manuscript drafting and editing.



## Declaration of generative AI-Assisted Tools:

No AI-assisted tools were used.

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