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Wasps of subfamilies Eumeninae, Vespinae and Polistinae from Sindh-Pakistan

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Abstract

This study provided the first annotated check list of the vespid wasps of Sindh Province. It is based on the collection and previous reported species/subspecies of wasps from Sindh. A total of 34 species/subspecies under 17 genera of three sub-families of family Vespidae i.e. Eumeninae, Vespinae and Polistinae are recorded. Among them, eight species are reported first time from Sindh namely, *Antepipona sibilans*, *Antodynerus limbatus*, *Delta dimidiatipenne*, *Delta esuriens esuriens*, *Delta campaniforme campaniforme*, *Knemodynerus excellens*, *Ropalidia brevita*, *Vespa orientalis*. Out of the eight new to Sindh species *Delta campaniforme campaniforme* is also a new record for Pakistan.

Keywords: wasps, sindh, eumeninae, vespinae, polistinae, vespidae, new records, Pakistan

Introduction

Family Vespidae is the second most well studied group among the members of aculeates hymenoptera, after the family Formicidae [1]. It consists of more than 5000 species and 257 genera under six subfamilies, namely Eumeninae, Euparagiinae, Vespinae, Polistinae, Stenogastrinae and Masarinae, which are reported in all the biogeographical regions [2, 3]. Despite the public health issues associated with vespids like aggressiveness, stinging, injecting venom, and making nests near human dwellings, this family has a very significant role in ecosystem as part of food web as well as pollinators, biological control agents, scavengers and pests of grapes and larvae of honey bee [4-6].

Geographically, Sindh lies between latitude of 25.8943° N and longitude of 68.5247° E with an area of 140,915 km and stands third among provinces of Pakistan. The eastern regions of Sindh is comprising of Thar Desert, West is Kirthar Mountains, South is coastal areas along with Arabian sea, and centre is fertile plains around Indus river. Sindh spreads in tropical to subtropical terrain. Climate is largely arid with scant vegetation except irrigated Indus valley.

Despite the fact, wasp fauna of Pakistan is studied by various authors [7-30] but the fauna of Sindh is still incompletely documented. Earlier few authors studied the vespid fauna of Sindh such as Schulthess, Dover, Das, Gupta, Soika, Gusenleitner, Mahmood, Aziz, Hasan, Inayatullah, Blüthgen, Kumar and Sharma [7-9, 11, 12, 16-18, 23, 31, 32]. Recently Rafi *et al.* (2017) reported 26 species from different localities of Sindh [29].

The present study was aimed to explore the vespid fauna of Sindh province in detail and to formulate a formal taxonomic description of the collected specimen collected from various regions of Sindh.

Materials and Methods

Detail surveys were conducted during 2014-2016 to study the vespid fauna of Sindh. The wasp specimens were collected from fields, gardens, vegetation, urban areas and markets of selected localities. The collected specimens were identified up to the species/subspecies level on the basis of their morphological characters with the help of available literature. Moreover, identified species were confirmed with identified specimens of wasps housed at National Insect Museum, National Agricultural Research Centre, Islamabad, Pakistan. Previously reported species of wasps by various authors from various localities of Sindh are also included in this paper.

Results and Discussion

Subfamily: Eumeninae

Genus: *Allorhynchium* van der Vecht, 1963

1. *Allorhynchium argentatum* Fabricius, 1804

Material Examined: PAKISTAN: Sindh: Halaji Lake, 10.viii.2014, Leg. M. T. Khan, 2♀; Malir, 02-05-2015, Leg. M. T. Khan, 1♀; Mirpur Khas, 14.v.2016, Leg. M. T. Khan, 1♂.

Remarks: Already this species were reported from Sindh: Halaji Lake; Khyber-Pakhtunkhwa: Bronze, Chitral, Kalash, Abbottabad; Islamabad; Punjab: Attock, Lahore (Changa Manga), Jhelum, Rawalpindi and Chakwal; Gilgit-Baltistan: Skardu and Ghizer [10, 17, 18, 24, 26, 29].

Distribution: Indonesia; India; Singapore; Malaysia; Laos; Nepal; Myanmar; Pakistan; Thailand; Philippines [10, 17, 24, 32, 33, 35].

2. *Allorhynchium metallicum* (de Saussure, 1852)

Material Examined: PAKISTAN: Sindh: Hyderabad, 09-ix-2015, Leg. M. T. Khan, 2♀.

Remarks: This species was already reported from Sindh: Karachi [32].

Distribution: India; Maldives; Indonesia; Malaysia; Pakistan; Myanmar; Sri Lanka; Taiwan [32, 35].

Genus: *Antepipona* de Saussure, 1855

3. *Antepipona luteipes* Gusenleitner, 2006

Remarks: Already this species was reported from Sindh: Kirithar National Park [17].

Distribution: Pakistan [17].

4. *Antepipona praeclara* Giordani Soika, 1970

Remarks: Earlier this species was reported from Sindh: Karachi [16].

Distribution: Pakistan; Iran [16, 32].

5. *Antepipona sibilans* Cameron, 1903

Material Examined: PAKISTAN: Sindh: Larkana, 03-vii-2015, Leg. M. T. Khan, 2♀; Ratodero, 06-vi-2014, Leg. M. T. Khan, 1♀; Ghotki, 25-vi-2016, Leg. M. T. Khan, 1♀; Sukkur, 05-vii-2015, Leg. M. T. Khan, 1♂.

Remarks: This species is recorded first time from Sindh. Earlier this species were reported from Punjab: Rawalpindi, Multan, Attock and Chakwal; Islamabad [17, 24, 29].

Distribution: Pakistan; India; Nepal [17, 36, 37].

Genus: *Anterhynchium* de Saussure, 1863

6. *Anterhynchium* (*Anterhynchium*) *abdominale* *abdominale* (Illiger, 1802)

Remarks: Earlier this species was reported as *Odynerus abdominalis* from Sindh: Karachi; Islamabad; Punjab: Rawalpindi, Faisalabad and Attock [8, 24, 29].

Distribution: Myanmar; India; Sri Lanka, Pakistan and Vietnam [33, 37, 38, 39].

Genus: *Antodynerus* de Saussure, 1855

7. *Antodynerus flavescens flavescens* Fabricius, 1775

Material Examined: PAKISTAN: Sindh: Garhi Khuda Bakhsh, 07-viii-2016, Leg. M. T. Khan, 2♀; Ghotki, 05-vii-2015, Leg. M. T. Khan, 1♀.

Remarks: This species was already reported from Sindh: Karachi [16].

During present study this species are found from Sindh: Garhi Khuda Bakhsh and Ghotki.

Distribution: Pakistan [16].

8. *Antodynerus flavescens karachiensis* Giordani Soika, 1970

Remarks: This species was reported from Sindh: Karachi [16].

Distribution: Pakistan [16].

9. *Antodynerus limbatus* de Saussure, 1852

Material Examined: PAKISTAN: Sindh: Dokri, 26-vi-2014, Leg. M. T. Khan, 2♀; Mehrabpur, 18-x-2016, Leg. M. T. Khan, 1♀; Thari Mirwah, 25-vi-2015, Leg. M. T. Khan, 1♀.

Remarks: This species is recorded first time from Sindh. Earlier this species was reported from Punjab: Taxila; Khyber-Pakhtunkhwa: Abbottabad; Azad Jammu and Kashmir: Muzafarabad (Shahadra) [18, 29].

Distribution: India; China; Myanmar; Laos; Nepal; Thailand and Pakistan [18, 40].

Genus: *Chlorodynerus* Blüthgen, 1951

10. *Chlorodynerus loeffleri* Giordani Soika 1958

Remarks: This species was recorded from Baluchistan: Quetta and Sindh: Karachi [16].

Distribution: Iran; India; Pakistan [16].

11. *Chlorodynerus xanthus* (Cameron, 1907)

Remarks: Earlier reported from Sindh: Karachi [31].

Distribution: Pakistan; India [31].

Genus: *Cyphodynerus* van der Vecht, 1971

12. *Cyphodynerus sculpturatus* (Dover, 1925)

Remarks: Already this species was reported from Sindh: Karachi [9].

Distribution: Pakistan and Iran [9, 34].

Genus: *Cyrtolabulus* van der Vecht, 1969

13. *Cyrtolabulus karachiensis* Gusenleitner, 2006

Remarks: Earlier this species was reported from Sindh: Karachi [17].

Distribution: Pakistan [17].

14. *Cyrtolabulus syriacus* (Giordani Soika, 1968)

Remarks: Earlier this species was reported from Baluchistan: Quetta: Chiltan National Park and Sindh: Jamshoro: Kirithar National Park [17].

Distribution: Pakistan; Israel; Syria ^[17].

Genus: *Delta* de Saussure, 1885

15. *Delta dimidiatipenne* (de Saussure, 1852)

Material Examined: PAKISTAN: Sindh: Larkana, 09-vii-2016, 17-vii-2016, Leg. M. T. Khan, 3♀; Dadu City, 17-06-2015, Leg. M. T. Khan, 1♀; Sukkur, 05-vi-2015, 13-v-2016, Leg. M. T. Khan, 2♀; Kotri, 19-viii-2014, Leg. M. T. Khan, 1♀; Hyderabad, 08-v-2014, Leg. M. T. Khan, 3♀; Umarkot, 03-vii-2014, Leg. M. T. Khan, 1♀; Nagarparkar, 17-viii-2015, Leg. M. T. Khan, 1♀; Mithi, 02-v-2015, Leg. M. T. Khan, 1♀; Korangi, 27-vi-2015, Leg. M. T. Khan, 2♀.

Remarks: This species is recorded first time from Sindh. Already this species was reported from different localities of Pakistan such as Punjab: Faisalabad, Chakwal, Gujranwala, Murree, Jhelum, Attock, Gujrat, Jhang and Multan; Islamabad; Khyber-Pakhtunkhwa: Mingora, Battagram, Abbottabad, Dir, Balakot, Mansehra, Noshkey and Peshawar; Azad Jammu and Kashmir: Rawalakot, Bagh; Gilgit-Baltistan: Astore (Doyan), Ghizer, Sukkur and Hunza ^[17, 21-28].

Distribution: Afghanistan; Egypt; Chad; Djibouti; Ethiopia; Algeria; Iran; Eritrea; India; Mauritania; Jordan; Tajikistan; Turkmenistan; Niger; Morocco; Sudan; Syria; Nepal; Pakistan; Qatar; Oman; Somalia; South Africa; Saudi Arabia; Spain; Turkey; Uganda; U.A.E.; Yemen ^[2, 21, 41].

16. *Delta esuriens esuriens* (Fabricius, 1787)

Material Examined: PAKISTAN: Sindh: Qambar, 18-vii-2015, Leg. M. T. Khan, 1♀; Ubauro, 19-iv-2015, Leg. M. T. Khan, 1♀; Pano Aqil, 15-x-2015, Leg. M. T. Khan, 1♀; Nagarparkar, 08-vii-2015, Leg. M. T. Khan, 1♀; Gorakh Hills, 04-vi-2014, Leg. M. T. Khan, 1♀.

Remarks: This species is recorded first time from Sindh. Earlier this species was reported from Baluchistan: Quetta; Islamabad; Punjab: Rawalpindi, Kusaab, Chakwal, Attock, Khanpur, Head Fared, Muzafargarh, Bakhar, Mianwali and Layyah; Khyber-Pakhtunkhwa: Swat, Dir, Mansehra, Balakot and Abbottabad; Azad Jammu and Kashmir: Kohala, Kotli ^[17, 22-25, 29].

Distribution: India; Iran; Iraq; Indonesia; Israel; Laos; Myanmar; Oman; Mauritius; New Caledonia; Pakistan; Saudi Arabia; Philippines; Qatar; Thailand; Sri Lanka; U. A. E.; Vietnam ^[17, 41, 22, 23].

17. *Delta campaniforme campaniforme* (Fabricius, 1775)

Material Examined: PAKISTAN: Sindh: Ghotki, 02-vii-2015, Leg. M. T. Khan, 1♀.

Remarks: New record for Pakistan.

Distribution: Australia; China; Cambodia; India; Indonesia; Guangdong; Laos; Myanmar; Nepal; Malaysia; Palawan; Philippines; Thailand, Papua New Guinea; Singapore and adventive in U. S. A. Vietnam and Pakistan^[42].

Genus: *Euodynerus* Dalla Torre, 1904

18. *Euodynerus (Euodynerus) niloticus ebneri* (von Schulthess, 1921)

Remarks: Earlier this species was reported as a *Odynerus*

ebneri from Sindh: Karachi, among other places ^[7].

Distribution: Chad; Eritrea; Egypt; Pakistan; Israel; Sudan; Saudi Arabia; Sudan; Yemen; United Arab Emirates ^[43, 44].

Genus: *Eustenancistrocerus* Bluthgen, 1938

19. *Eustenancistrocerus (Parastenancistrocerus) khuzestanicus* (Giordani Soika, 1970)

Remarks: Earlier this species was reported from Sindh: Kirthar National Park ^[17].

Distribution: Pakistan and Iran ^[17].

Genus: *Knemodynerus* Blüthgen, 1940

20. *Knemodynerus excellens* (Pérez, 1907)

Material Examined: PAKISTAN: Sindh: Dokri, 12-vi-2014, Leg. M. T. Khan, 1♀; Jacobabad, 13-viii-2015, Leg. M. T. Khan, 2♀; Khipro, 05-viii-2016, Leg. M. T. Khan, 1♀; Shahdadpur, 12-vii-2015, Leg. M. T. Khan, 1♂.

Remarks: This species is recorded first time from Sindh. Earlier this species was reported from Punjab: Multan and Baluchistan: Quetta ^[17, 29].

Distribution: Iran; India; Turkmenistan; Saudi Arabia; Pakistan; Qatar; Oman; U.A.E. ^[17, 44].

Genus: *Leptochilus* de Saussure, 1853

21. *Leptochilus (Neoleptochilus) insitivus* (Gusenleitner, 1976)

Remarks: Already this species was reported from Sindh: Karachi ^[45].

Distribution: Pakistan; India ^[45, 46].

22. *Leptochilus (Neoleptochilus) mirificus* Gusenleitner, 2006

Remarks: Earlier this species was reported from Sindh: Malir River and Karachi ^[17].

Distribution: Pakistan ^[17].

Genus: *Rhynchium* Spinola, 1806

23. *Rhynchium acromum* Giordani Soika, 1952

Remarks: Earlier this species was described from Sindh: Karachi ^[15].

Distribution: Pakistan; Iran ^[15, 47].

24. *Rhynchium carnaticum* (Fabricius, 1798)

Remarks: This was earlier recorded from Sindh: Karachi; Khyber-Pakhtunkhwa: Swat: Takhtaband ^[37, 27].

Distribution: India; Pakistan; Indonesia; Sri Lanka ^[37, 27].

Genus: *Tachyancistrocerus* Giordani Soika, 1952

25. *Tachyancistrocerus komarowi komarowi* (Morawitz, 1885)

Remarks: Earlier this species was reported as a subspecies of this species, now considered a synonym from Baluchistan and

Sindh: Karachi. This species also reported from Punjab: Bahawalpur and Sindh: Kirthar National Park ^[16, 17].

Distribution: Afghanistan; Pakistan; Kazakhstan; Turkey; Iran; Oman; Turkmenistan ^[17].

26. *Tachyancistrocerus pakistanus* Gusenleitner, 2006

Remarks: This species was reported from Sindh: Kirthar National Park ^[17].

Distribution: Pakistan ^[17].

Subfamily: Polistinae

Genus: *Polistes* Latreille, 1802

27. *Polistes (Polistes) indicus* Stolfa, 1934

Remarks: Earlier Das and Gupta reported this species from Salt Range, Punjab. However from various localities of Pakistan this species was reported from Sindh: Allahyar Pinhwar, Sukkur, Ghotki, Taj Mohammad Ruk; Khyber-Pakhtunkhwa: Peshawar, Abad Khel, Kohat, Balakot, Mansehra, Oghi, Baffa, Alia, Battagram, Abbottabad, Havelian and Ayubia; Gilgit-Baltistan: Chilas, Hunza, Thiee, Gasdas, Ghizar valley, Jaglot, Gilgit and Astore; Punjab: Attock, Bahawalpur, Chak, 28 BC, Jhelum, Rawalpindi and Chakwal ^[11, 18, 20, 23-26].

Distribution: Afghanistan; India; Pakistan; Iran; Iraq; Oman; U.A.E ^[14, 18, 20, 24].

28. *Polistes (Polistella) stigma tamula* (Fabricius, 1798)

Material Examined: PAKISTAN: Sindh: Badin, 17-ix-2015, Leg. M. T. Khan, 1♀; Manjhand, 24-vi-2015, Leg. M. T. Khan, 2♀.

Remarks: This species was already reported from Khyber-Pakhtunkhwa: Abbottabad, Madain, Havelian, Battagram, Ayubia, Mansehra, Siadu Sharif and Swat; Punjab: Murree (Patriata); Sindh: Karachi (Malir) ^[23, 25, 29].

Distribution: Sri Lanka; India; Pakistan ^[17, 23].

29. *Polistes (Gyrostoma) wattii* Cameron, 1900

Material Examined: PAKISTAN: Sindh: Dokri, 12-vi-2015, 03-ix-2016, Leg. M. T. Khan, 2♀; Khairpur Nathan Shah, 09-viii-2015, Leg. M. T. Khan, 2♀; Mirpur Mathelo, 12-ix-2015, Leg. M. T. Khan, 3♀; Jacobabad, 26-vii-2015, Leg. M. T. Khan, 3♀; Kirthar National Park, 11-vii-2015, Leg. M. T. Khan, 2♀; Malir, 23-ix-2016, Leg. M. T. Khan, 3♀; Umarmkot, 19-x-2015, Leg. M. T. Khan, 3♀; Mirpur Khas, 10-vii-2014, Leg. M. T. Khan, 2♀.

Remarks: This species was already reported from Sindh: Sukkur, Karachi, Ghotki, Rajab Ali Bharo, Drago, Allahyar; Punjab: Abbaspur, Habib Massan, Bahawalpur (Chak 28 BC), Rawalpindi, Salt Range (Khewra), Taxila, Attock, Murree; Islamabad: Khyber-Pakhtunkhwa: Dir, Abbottabad, Mansehra, Peshawar, Warsak, Kohat, Mardan; Gilgit-Baltistan: Diamer, Hunza-Nagar, Basha, Gilgit, Chillas, Dassu, Ghizer and Skardu ^[11, 12, 18, 23-26].

Distribution: Afghanistan; Iran; China; Iraq; India; Pakistan; Saudi Arabia; Oman; Mauritius; Tajikistan; Turkmenistan; U.A.E. ^[11, 18, 14, 48].

Genus: *Ropalidia* Guerin-Meneville, 1831

30. *Ropalidia brevita* Das & Gupta, 1989

Material Examined: PAKISTAN: Sindh: Hyderabad, 07.vi.2015, Leg. M. T. Khan, 2♀; Mirpur Khas, 20-iv-2015, Leg. M. T. Khan, 1♀; Umarmkot, 04.vii.2015, Leg. M. T. Khan, 1♀.

Remarks: This species is reported first time from Sindh. Earlier this species was reported from Islamabad; Khyber-Pakhtunkhwa: Battagram, Alai, Ghari Habibullah, Mansehra, Balakot, Oghi, Havelian, Abbottabad; Punjab: Murree, Attock, Chakwal, Rawalpindi and Jhelum ^[23-25].

Distribution: Pakistan; India ^[12, 23].

31. *Ropalidia marginata marginata* (Lepelletier, 1836)

Remarks: Earlier reported this species from Sindh ^[12, 23].

Distribution: Australia; India; China; Vietnam; Indonesia; Marianas; Malaysia; Myanmar; Palau; New Britain; Pakistan; Papua New Guinea; Sri Lanka; Philippines; Volcano Islands ^[12, 50].

32. *Ropalidia spatulata* van der Vecht, 1962

Remarks: Earlier reported this species from Sindh: Karachi: Maripur; Punjab: Murree (Ghora Gali) ^[11, 18].

Distribution: India; Pakistan; Myanmar ^[11, 18, 50].

33. *Ropalidia variegata variegata* (Smith, 1852)

Remarks: Earlier reported it from Sindh: Karachi; Punjab: Rawalpindi ^[11, 29].

Distribution: China; Myanmar; India; Nepal; Indonesia; Malaysia; Pakistan ^[11, 50].

Subfamily: Vespinae

Genus: *Vespa* Linnaeus, 1758

34. *Vespa orientalis* Linnaeus, 1771

Material Examined: PAKISTAN: Sindh: Dadu City, 17.vii.2015, Leg. M. T. Khan, 1♀; Mirpur Mathelo, 12.ix.2015, Leg. M. T. Khan, 2♀; Kandhkot, 14-vii-2016, Leg. M. T. Khan, 2♀; Thari Mirwah, 28-ix-2016, Leg. M. T. Khan, 1♀; Kirthar National Park, 11-vii-2015, Leg. M. T. Khan, 1♀; Mirpur Khas, 10-vii-2014, Leg. M. T. Khan, 1♀.

Remarks: This species is recorded first time from Sindh. Earlier this species was reported from Khyber-Pakhtunkhwa: Abbottabad, Chitral, Battagram, Bannuu, Bamboret valley, Warsak, Havelian, Brun, Peshawar, Charsada, Mansehra, Kohat, Mardan, Baffa and Balakot; Gilgit-Baltistan: Chillas, Gilgit, Astore, Dassu, Nomal, Ghizer, Jaglot; Islamabad; Punjab: Attock, Rawalpindi, Chakwal, Fort Abbas, Murree; Azad Jammu and Kashmir: Rawalakot ^[18, 20, 23-26, 28].

Distribution: Afghanistan; Algeria; Albania; China; Cyprus; Bulgaria; Bahrain; Bosnia & Herzegovina; Croatia; Ethiopia; Georgia; Egypt; Greece; Iraq; India; Italy; Israel; Iran; Kazakhstan; Jordan; Kyrgyzstan; Libya; Macedonia; Lebanon; Malta; Montenegro; Pakistan; Oman; Nepal; Romania; Saudi Arabia; Russia; Somalia; Syria; Turkey; Tajikistan; Turkmenistan; U.A.E.; Yemen; Uzbekistan; Spain;

introduced into Czech Republic; Madagascar; Mexico; U.S.A. (not established) ^[20, 11, 12, 49].

Conclusion

This study resulted in a detail formal taxonomic description vespidae fauna collected from Sindh province. A total of 34 species/subspecies under 17 genera are recorded. Among them, eight species are reported first time from Sindh viz. *Antepipona sibilans*, *Antodynerus limbatus*, *Delta dimidiatipenne*, *Delta esuriens esuriens*, *Delta campaniforme campaniforme*, *Knemodynerus excellens*, *Ropalidia brevita*, *Vespa orientalis*. Out of these eight new to Sindh species, *Delta campaniforme campaniforme* is found as a new record for Pakistan.

References

- Persson S. Phylogeny and taxonomy of the subfamily Vespinae (Hymenoptera: Vespidae), based on five molecular markers. Project for Master of Science, Department of Biological and Environmental Sciences University of Gothenburg. 2015, 44.
- Pickett KM, Carpenter JM. Simultaneous analysis and the origin of eusociality in the Vespidae (Insecta: Hymenoptera). *Arthropod Syst. Phylog.* 2010; 68(1):3-33.
- Carpenter JM. The phylogenetic relationships and natural classification of the Vespoidea. *Syst. Entomol.* 1981, 1982; 7:11-38.
- Fateryga A. Trophic relations between vespidae wasps (Hymenoptera, Vespidae) and flowering plants in the Crimea. *Entomol. Rev.* 2010; 90(6):698-705.
- Richter MR. Hunting social wasp interactions: Influence of prey size, arrival order and wasp species ecology. 1990; 71(3):1018-1030.
- Goulet H, Huber JT. Hymenoptera of the world: An identification guide to the families. Agriculture Canada. Canada Comm Group, Ottawa. 1993, 668.
- Von. Schulthess, A. Sitzung der mathematisch-naturwissenschaftlichen Klasse vom 16, Decem ber 1920. *Anzeiger Akad. Wiss. Wien, Math. Natur. Kl.* 1921, 1920; 27:285-286.
- Dover C, Rao HS. A note on the diplopterous wasps in the collection of the Indian Museum. *J Asiatic Soc. Bengal.* 1922; 18:235-249.
- Dover C. Further notes on the Indian Diplopterous wasps. *J Asiatic Soc. Bengal.* 1925, 1924; 22:289-305.
- Chaudhry GU, Chaudhry MI, Khan SM. Survey of Insect fauna of forests of Pakistan. *Pak. For. Inst. Peshawer*, 1966; pp. 167.
- Das BP, Gupta VK. A catalogue of the families Stenogastridae and Vespidae from the Indian subregion (Hymenoptera: Vespidae). *Orient. Insects.* 1984 ["1983"]; 17: 395-464. <http://dx.doi.org/10.1080/00305316.1983.10433698>.
- Das BP and Gupta VK. The social wasps of India and the adjacent countries. *Orient. Insect Monogr.* 1989; 11:1-292.
- Archer ME. A key to the world species of the Vespinae (Hymenoptera). Academic Board Research Committee, Res. Monographs. 1989; 31:291-339.
- Carpenter JM. Distributional checklist of species of the genus *Polistes* (Hymenoptera: Vespidae; Polistinae; Polistini). *Am. Mus. Novit.* 1996; 3188:1-39.
- Giordani Soika A. Sulle caratteristiche biogeografiche della Palestina, Arabia ed Egitto, con un contributo alla conoscenza degli Zethinied Eumenini della Palestina. *Bollettino del Museo Civico di Storia Naturale di Venezia.* 1952; 6(1):5- 62.
- Giordani Soika A. Contributo alla conoscenza degli Eumenidi del Medio Oriente. *Bollettino del Museo Civico di Storia Naturale di Venezia.* 1970; 41:27-183.
- Gusenleitner J. Über Eumeninae, aufgesammelt in Pakistan (Hymenoptera: Vespidae). *Linz. Biol. Beitr.* 2006; 38(2):1295-1305.
- Gusenleitner J. Über Vespidae aus Pakistan (Hymenoptera: Vespidae). *Linz. Biol. Beitr* 2007; 39(2):969-972.
- Gusenleitner J. Bemerkenswerte Faltenwespen-Funde aus der Orientalischen Region Teil 4. Miteinem Anhang übereine Art aus Neu-Kaledonien (Hymenoptera: Vespidae, Eumeninae). *Linz. Biol. Beitr.* 2008; 40(2):1495-1503.
- Dvořák L. The social wasp fauna of Pakistan (Hymenoptera, Vespidae). *Linz. Biol. Beitr.* 2007; 39(1):51-55.
- Bodlah I, Bodlah MA, Akhtar T, Naeem M, Khan MR. Record of *Delta dimidiatipenne* (de Saussure, 1852) (Hymenoptera: Vespidae: Eumeninae) from Barani areas of Punjab province of Pakistan. *Pak. J. Zool.* 2011; 43(5):1018-1020.
- Bodlah I, Naeem M, Khan MR, Bodlah MA, Akhter T. Genus *Delta* de Saussure (Hymenoptera: Eumininae: Vespidae) from Punjab province of Pakistan. *Pak. J. Zool.* 2012; 44(3):759-764.
- Mahmood K, Ullah M, Aziz A, Hasan SA, Inayatullah M. To the knowledge of Vespidae (Hymenoptera) of Pakistan. *Zootaxa.* 2012; 3318:26-50.
- Siddiqui JA, Bodlah I, Carpenter JM, Naeem M, Ahmad M, Bodlah MA. Vespidae (Hymenoptera) of the Pothwar region of Punjab, Pakistan. *Zootaxa.* 2015; 3914(5): 501-524.
- Shah M. Biosystematics of wasps species (Hymenoptera: Vespidae) from Hazara Region, Khyber-Pakhtunkhwa, Pakistan. Ph. D Thesis, Hazara University Mansehra. 2015, 152.
- Faiz A, Rafi MA, Zia A, Shah A, Shah SW, Khan RU. Wasp fauna of (Eumeninae: Vespinae and Polistinae) in forests of Gilgit-Baltistan (Pakistan). *Pure Appl. Biol.* 2016; 5(4), (accepted). Online <http://dx.doi.org/10.19045/bspab.2016.50073>.
- Rasool M, Zahid M, Shah M. Solitary Wasps (Hymenoptera: Vespidae: Eumeninae) of Swat Pakistan, with two species newly reported from the country and three unidentified species. *J Entomol. Zool. Stud.* 2017; 5(2):648-653.
- Khan AK, Khan MR, Rafi MA, Qasim M. Wasp fauna of (Eumeninae, Vespinae and Polistinae) of district Poonch, Azad Jammu and Kashmir (Pakistan). *J Entomol. Zool. Studies.* 2017; 5(6):1587-1590.
- Rafi MA, Carpenter JM, Qasim M, Shehzad A, Zia A, Khan MR. The vespidae fauna of Pakistan. *Zootaxa.* 2017; 4362 (1):001-028.
- Qasim M, Carpenter JM, Rafi MA, Khan MR, Khan MR. A new species of *Stenodynerus* (Hymenoptera, Vespidae, Eumeninae) from Pakistan. *Zootaxa*, 2018; (Accepted).
- Blüthgen P. Untersuchungen über palaearktische Eumenidae (Hym., Diploptera). *Deutsche Entomologische Zeitschrift.* 1954; III/ IV/ V:224-268.
- Girish Kumar P, Sharma G. A review of the genus *Allorhynchium* van der Vecht, 1963 (Hymenoptera:

- Vespidae: Eumeninae) from the Indian subcontinent. *Prommalia*. 2015 3:20-34.
33. Van der Vecht J. Studies on Indo-Australian and East-Asiatic Eumenidae (Hymenoptera, Vespoidea). *Zoologische Verhandelingen*. 1963; 60:1-116.
 34. Van der Vecht J. Notes on Palearctic Eumenidae (Hymenoptera) (part 2). *Entomologische Berichten*. 1971; 31:127-134.
 35. Girish Kumar P, Carpenter JM, Sureshan P. Additions to the knowledge of the genus *Allorhynchium* van der Vecht from the Indian subcontinent with the description of a new species from Kerala (Hymenoptera: Vespidae: Eumeninae). *Halteres*. 2016a; 7: 29-34.
 36. Girish Kumar P, Carpenter JM, Sureshan PM. A taxonomic review of the genus *Antepipona* de Saussure, 1855 (Hymenoptera: Vespidae: Eumeninae) from India. *Zootaxa*. 2016b; 4150 (5):501-536.
 37. Girish Kumar P, Sharma G. Taxonomic Studies on vespid wasps (Vespidae: Vespoidea: Hymenoptera: Insecta) of Rajasthan, India with six new records from the State. *J New Biol. Rep*. 2014; 3(3): 240-258.
 38. Bingham CT. Fauna of British India, including Ceylon and Burma, Hymenoptera, I. Wasps and Bees. Taylor and Francis, London, 1897; 579 +1-xxix.
 39. Nguyen LTP. Taxonomic notes on the species of the genus *Anterhynchium* de Saussure, 1863 (Hymenoptera: Vespidae: Eumeninae) from Vietnam, with description of a new species. *Zootaxa*. 2015a; 3915(1):132-138. <https://doi.org/10.11646/zootaxa.3915.1.7>
 40. Girish Kumar P and Carpenter JM. A taxonomic review of the genus *Antodynerus* de Saussure, 1855 (Hymenoptera: Vespidae: Eumeninae) from the Indian subcontinent. *Zootaxa*. 2013; 3731(2):267-278. <https://doi.org/10.11646/zootaxa.3731.2.7>
 41. Srinivasan G and Girish Kumar P. New records of potter wasps (Hymenoptera: Vespidae: Eumeninae) from Arunachal Pradesh, India: five genera and ten species. *J Threatened Taxa*. 2010; 2(12): 1313-1322.
 42. Nguyen LTP. Taxonomic Notes on the Genus *Delta* de Saussure (Hymenoptera: Vespidae: Eumeninae) from Vietnam. *Animal Systematics, Evaluation and Diversity*. 2015b; 31(2):95-100.
 43. Carpenter JM, Gusenleitner J and Madl M. A catalogue of the Eumeninae (Hymenoptera: Vespidae) of the Ethiopian region excluding Malagasy subregion. Part II: genera *Delta* de Saussure 1885 to *Zethus* Fabricius 1804 and species in certae sedis. *Linz. Biol. Beitr*. 2010; 42(1):95-315.
 44. Gusenleitner J. Die Gattungen der Eumeninae im Nahen Osten, in Nordafrika und in Arabien (Hymenoptera: Vespidae: Eumeninae). *Linz. Biol. Beitr*. 2013; 45:5-107.
 45. Gusenleitner J. Bemerkenswertes über Faltenwespen VI (Diptera, Hymenoptera). *Nachrichtenblatt der Bayerischen Entomologen*. 1976; 25(6):112-119.
 46. Gusenleitner J. Über Eumeniden aus dem Nahen Osten und Arabien sowie Beschreibung einer neuen Subspecies aus Zanzibar. *Linz. Biol. Beitr*. 1994; 26(1):307-324.
 47. Blüthgen P, Gusenleitner J. Über Faltenwespen aus dem Iran (Hym., Diptera). *Stuttgarter Beiträge zur Naturkunde*. 1970; 223:1-13.
 48. Girish Kumar P. New distributional records of some species of the subgenus *Polistes Gyrostoma* Kirby (Hymenoptera: Vespidae) from various states of India and adjacent countries. *Zool. Surv. India*. 2010; 110(4):41-45.
 49. Carpenter JM, Kojima JI. Checklist of the species in the subfamily Vespinae (Insecta: Hymenoptera: Vespidae). *Nat. Hist. Bull. Ibaraki Uni*. 1997; 1: 51-92.
 50. Kojima JI and Carpenter JM. Catalog of species in the Polistine tribe Ropalidiini (Insecta: Hymenoptera: Vespidae). *Am. Mus. Novit*. 1997; 3199:1-96.