



Diversity and Bio-Geography of Subfamily Eumeninae (Vespidae: Hymenoptera) in Sindh, Pakistan

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ABSTRACT

This study provides annotated list of 10 species and subspecies of subfamily Eumeninae in Sindh province under 5 genera i.e. *Delta*, *Knemodrynerus*, *Antepipona*, *Allorhynchium*, *Antodynerus*. Besides this, their bio-geographical affiliations have also been discussed. Of these species and subspecies 6 are part of the Oriental fauna, one is part of the Afrotropical and Palearctic Region and three belong to Oriental, Afrotropical and Palearctic Regions. This reconfirms the transitional bio-geographical position of the Pakistani fauna. However, more species of Subfamily Eumeninae are expected to be present in Sindh if more frequent survey would be carried out.

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Authors' Contribution

MTK performed the experiments. MAR and RS designed the study. AM and SA compiled the results.

Key words

Eumeninae, Vespidae, Wasps, Bio-geographical distribution

INTRODUCTION

Family Vespidae is one of the few groups that exhibit transitional social evolution and solitary status (Crespi and Yanega, 1995; Hunt, 2007). All wasps are aculeate Hymenoptera, which have a fully developed sting, hence known as true wasps. Most of these are solitary and harmless. They use their sting for defense and to paralyze their arthropod prey (Akreet *et al.*, 1980). Lot of information is available on this important family from different regions of the world (Archer, 1993; Kojima, 1993; Kojima and Carpenter, 1997; Carpenter and Starr, 2000; Nguyen and Carpenter, 2002; Carpenter and Nguyen, 2003; Devorak, 2007; Guseleitner, 2008; Guseleitner and Madl, 2009; Ebrahimi and Carpenter, 2008; Yildirim and Guseleitner, 2012; Kumar and Sharma, 2015; Kumar *et al.*, 2016), and from Punjab and northern areas of Pakistan (Chaudhary *et al.*, 1966; Guseleitner, 2006, 2007, 2008; Mahmood *et al.*, 2012; Siddiqui *et al.*, 2015; Bodlah *et al.*, 2015). However, vaspid fauna of Sindh is largely unexplored. The sub-family Eumeninae has been chosen for this study due to reasons that it might provide a

great opportunity to comprehend all aspects of insect life exhibited by this subfamily.

MATERIALS AND METHODS

Selection of localities

The basis of selection of localities for surveys was agro-ecological variations. The localities for surveys were selected out of three main agro-ecological zones of Sindh Province explicitly (A) wheat-rice zone of right-bank of Indus River in upper Sindh province, (B) wheat-cotton zone of left-bank of Indus River, and (C) sugarcane-wheat-rice zone in lower Sindh province. Detailed surveys were conducted in seven localities representing the seven sub agro-ecological zones: A-I, main area of rice-wheat in Sindh, District Larkana; A-II, piedmont soil region–Dadu Zone; B-I, non-perennial Guddu command area, Ghotki Zone; B-II, perennial Sukkur command area, Sukkur Zone; C Main area of Kotri command, Jamshoro Zone; D Thar and Nara deserts–Tharparkar Zone; and E, Kohistan/hilly area, Karachi Zone.

Collection and preservation

The wasp specimens were collected from each locality randomly from fields, gardens and other vegetation after a 20 days interval during the study. At each locality,

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collection of wasps were done from 8:00 AM to 12:00 PM. Aerial net of proper bag size, comprising of soft fabric to curtail the chances of harm to wings of wasps, was used for collection. Spot catching of the wasps sitting on the walls or any other objects, their nests and bait collection in markets was also opted. After collection in nets, the wasps were put into the killing-jars containing ethyl acetate or freezer for attaining their mortality. The collected wasp specimens were mounted on pins, labeled, and conserved in wooden-boxes with naphthalene as preservative. Field data of each locality such as date, location and coordinates were recorded. Besides this, description of localities in terms of flora and water resources etc. was also recorded (Table I).

Identification and repository

The wasp specimens were recognized in detail up to level of species and sub-species based on their morphological traits through using stereoscope (Labomet CZM-4-4X) and taxonomic keys provided by Archer (1989), Carpenter and Nguyen (2003) and Goulet and Hubner (1993). The wasp specimens after identification were deposited partially in Department of Zoology of Sindh University, Jamshoro and partially in NIM, NARC,

Islamabad.

Species diversity

Species diversity was measured by calculating its various parameters viz. species abundance, richness and evenness. For estimation of diversity-indices, rank lists were created for every locality based on maximum abundance of species. Likewise, collective rank lists of localities containing list of taxa were also prepared.

RESULTS AND DISCUSSION

Diagnostic features

Adults are minute to sizeable and compacted; body long having sessile to strong petiolate metasoma. These wasps are clearly recognizable due to a blend of traits like: mesoscutum contains posterolateral projection which is called parategula; bifid tarsal claws; hind-coxa having dorsal carina longitudinally or with folding, mostly transformed tooth-like lobe; forewing having three number of sub-marginal cells. Almost all identified species of Eumeninae are solitary whereas few taxa exhibit primitive social behavior. During this study five genera were reported. Bio-Geographical Affiliations of Eumeninae Species found in Sindh Province are presented in Table I.

Table I. Subfamily eumeninae collected in Sindh Province.

Subfamily eumeninae									
Genus	Species	AI: Main Area	AII: Pied-mont Soil Region	BI: Non-Perennial Guddu Command area	BII: Perennial Sukkur Command area	C: Main Kotri Command area	D: Thar and Nara Deserts	E: Kohistan and Coastal area	Bio-geographical affiliations
<i>Allorhynchium</i>	<i>Argentatum</i>	-	-	-	-	+	+	+	Oriental region
	<i>Metallicum</i>	-	-	-	-	+	-	+	Oriental region
<i>Antepipona</i>	<i>Sibilans</i>	+	-	+	+	-	-	-	Oriental region
	<i>Ceylonica</i>	-	-	+	-	-	-	-	Oriental region
<i>Antodynerus</i>	<i>Flavescens</i>	+	-	-	+	-	-	-	Oriental region
	<i>Limbatus</i>	+	-	-	+	-	-	-	Oriental region
<i>Delta</i>	<i>Dimidiatipenne</i>	+	+	-	+	+	+	+	Afrotropical and palearctic region
	<i>Campaniforme</i>	-	-	+	-	-	-	-	Oriental and afrotropical regions
	<i>Campaniforme</i>	-	-	+	-	-	-	-	Oriental and afrotropical regions
	<i>Esuriens</i>	+	-	+	+	-	-	+	Oriental, afrotropical, and palearctic region
<i>Knemodynerus</i>	<i>Excellens</i>	+	-	+	+	-	-	-	Oriental, afrotropical and palearctic region

KEY TO THE VARIOUS GENERA OF SUBFAMILY EUMENINAE

1. Metasoma continuously petiolate; 1st Segment with width half or lesser than that of 2nd segment, while longer than width; T2 having apical lamella without more thickening.....*Delta*
 - Metasoma not petiolate; 1st Segment broader than half 2nd segment, longer slightly less than double of width.....2
2. Parategula invisible from upwards; tegulae bent inwardly from posterior.....*Knemodynerus*
 - Parategula visible from above3
3. Metanotum having stunted tuberclesor teeth laterally; flattened in between.....*Antepipona*
 - Metanotum without tuberclesor teeth.....4
4. Tegula short or equal sized of parategula posteriorly; Metanotum flattened; propodeum having raised shelf-like dorsum.....*Allorhynchium*
 - Tegula exceeding parategula posteriorly; Metanotum raised disc, having semi-circular ridge amid vertical and horizontal exteriors on dorsal view. *Antodynerus*

Genus: *Allorhynchium* van der Vecht, 19605 *Allorhynchium argentatum* Fabricius, 1804

Material examined

Pakistan: Sindh: C: Main Kotri Command Area Halaji Lake, 10.vii.2014, Leg. M. T. Khan, 2♀; E: Kohistan and Coastal Area: Malir, 03.v.2015, Leg. M. T. Khan, 1♀; D: Thar and Nara Deserts: Mirpur Khas, 15.v.2016, Leg. M. T. Khan, 1♂.

Remarks

Previously this species were stated from Sindh: Halaji Lake; Khyber-Pakhtunkhwa: Bronze, Kalash, Abbottabad; Chitral, Islamabad; Punjab: Attock, Lahore (Changa Manga), Jhelum, Rawalpindi and Chakwal; Gilgit-Baltistan: Skardu and Ghizer [Chaudhry et al., 1966](#); [Gusenleitner, 2006, 2007](#); [Siddiqui et al., 2015](#); [Faiz et al., 2016](#); [Rafi et al., 2017](#)).

Distribution

Indonesia; India; Singapore; Malaysia; Laos; Nepal; Myanmar; Pakistan; Thailand; Philippines ([van der Vecht, 1963](#); [Chaudhry et al., 1966](#); [Gusenleitner, 2006](#); [Kumar and Sharma, 2015](#); [Kumar et al., 2016](#)).

Allorhynchium metallicum (de Saussure, 1852)

Material examined

Pakistan: Sindh: E: Kohistan and Coastal Area:

University of Karachi, 25-xi-2014, Leg. M. T. Khan, 1♀; C: Main Kotri Command Area: Hyderabad, 09.ix.2015, Leg. M. T. Khan, 2♀.

Remarks

This species was previously testified from Sindh: Karachi ([Kumar and Sharma, 2015a](#)).

Distribution

Pakistan; India; Myanmar; Maldives; Indonesia; Malaysia; Sri-Lanka; Taiwan ([Kumar and Sharma, 2015a](#); [Kumar et al., 2016](#)).

Genus: *Antepipona* de Saussure, 1855 *Antepipona ceylonica* de Saussure, 1867

Material examined

Pakistan: Sindh: BI: Non-Perennial Guddu Command Area: Ubauro, 14-vi-2016, Leg. M. T. Khan, 1♀.

Remarks

It is new evidence from Sindh. Recently [Qasim \(2018\)](#) in his thesis recorded this species from Punjab: Lodhran.

Distribution

Sri Lanka, India, Pakistan; and Myanmar.

Antepipona sibilans Cameron, 1903

Material examined

Pakistan: Sindh: AI: Main Area: Larkana, 03.vii.2015, Leg. M. T. Khan, 2♀; Ratodero, 06-vi-2014, Leg. M. T. Khan, 1♀; BI: Non-Perennial Guddu Command Area: Ghotki, 25-vi-2016, Leg. M. T. Khan, 1♀; BII: Perennial Sukkur Command Area: Sukkur, 03.vii.2015, Leg. M. T. Khan, 1♂.

Remarks

This species is recognized firstly from Sindh province. Earlier this species were reported from Punjab: Chakwal, Multan, Rawalpindi and Attock; Islamabad ([Gusenleitner, 2006](#); [Siddiqui et al., 2015](#); [Rafi et al., 2017](#)). Recently [Qasim \(2018\)](#) in his thesis recorded this species from several areas of Punjab: Khanewal, Lodhran and Multan.

Distribution

Pakistan; Nepal; India ([Gusenleitner, 2006](#); [Kumar et al., 2016](#)).

Genus: *Antodynerus* de Saussure, 1855
***Antodynerus limbatus* de Saussure, 1852**

Material examined

Pakistan: Sindh: AI: Main Area: Dokri, 26-vi-2014, Leg. M. T. Khan, 2♀; GarhiKhuda Bakhsh, 07-viii-2016, Leg. M. T. Khan, 2♀; BII: Perennial Sukkur Command Area: Mehrabpur, 18-x-2016, Leg. M. T. Khan, 1♀; ThariMirwah, 25-vi-2015, Leg. M. T. Khan, 1♀.

Remarks

This species is documented initially from Sindh. Earlier this species reported from Punjab: Taxila; Khyber-Pakhtunkhwa: Abbottabad; Azad Jammu and Kashmir: Muzafarabad (Shahadra) (Gusenleitner, 2007; Rafi *et al.*, 2017).

Distribution

India; China; Myanmar; Laos; Nepal; Thailand and Pakistan (Gusenleitner, 2007).

***Antodynerus flavescens flavescens* Fabricius, 1775**

Material examined

Pakistan: Sindh: AI: Main Area: GarhiKhuda Bakhsh, 05-vii-2015, Leg. M. T. Khan, 2♀; BII: Perennial Sukkur Command Area: Ghotki, 07-viii-2016, Leg. M. T. Khan, 1♀.

Remarks

This species was already reported from Sindh: Karachi (Giordani-Soika, 1970). During present study this species are found from Sindh: GarhiKhuda Bakhsh and Ghotki.

Distribution

Pakistan (Giordani-Soika, 1970).

Genus: *Delta* de Saussure, 1885

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

Material examined

Pakistan: Sindh: BI: Non-Perennial Guddu Command Area: Ghotki, 02-vii-2015, Leg. M. T. Khan, 1♀.

Remarks

New record for Sindh as well as for Pakistan.

Distribution

Indonesia; Australia; China; Cambodia; Guangdong; Laos; Myanmar; Nepal; Malaysia; India; Palawan; Philippines; Singapore, Thailand, Papua New Guinea; and adventive in Vietnam, Pakistan and USA (Nguyen, 2015).

***Delta dimidiatipenne* de Saussure, 1852**

Material examined

Pakistan: Sindh: AI: Main Area: Larkana, 09-vii-2016, 17-vii-2016, Leg. M. T. Khan, 3♀; AII: Piedmont Soil Region: Dadu City, 17-06-2015, Leg. M. T. Khan, 1♀; BII: Perennial Sukkur Command Area: Sukkur, 05-vi-2015, 13-v-2016, Leg. M. T. Khan, 2♀; C: Main Kotri Command Area: Kotri, 19-viii-2014, Leg. M. T. Khan, 1♀; University of Sindh, 04-v-2016, Leg. M. T. Khan, 1♀; Hyderabad, 08.v.2014, Leg. M. T. Khan, 3♀; D: Thar and Nara Deserts: Umarmkot, 03-vii-2014, Leg. M. T. Khan, 1♀; Nagarparkar, 17-vii-2015, Leg. M. T. Khan, 1♀; Mithi, 02-vi-2015, Leg. M. T. Khan, 1♀; E: Kohistan and Coastal Area: Korangi, 29.vi.2015, Leg. M. T. Khan, 2♀; Keamari, 29-iv-2015, Leg. M. T. Khan, 1♀.

Remarks

This taxon is documented for the first time from Sindh province. Already this species were found from different areas of Pakistan like Punjab: Faisalabad, Chakwal, Gujranwala, Murree, Jhelum, Attock, Gujrat, Jhangand Multan; Islamabad; Khyber-Pakhtunkhwa: Mingora, Battagram, Abbottabad, Dir, Balakot, Mansehra, Noshkey and Peshawar; Azad Jammu and Kashmir: Rawalakot, Bagh; Gilgit-Baltistan: Astore (Doyan), Ghizer, Sukkhur, and Hunza (Gusenleitner, 2006; Rafi *et al.*, 2017). Freshly Qasim (2018) in his thesis recorded this species from various territories of Punjab: Lodhran, Khanewal, Multan districts.

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 (Pickett and Carpenter, 2010; Srinivasan and Kumar, 2010).

***Delta esuriens* Fabricius, 1787**

Material examined

Pakistan: Sindh: AI: Main Area: Qambar, 18-viii-2015, Leg. M. T. Khan, 1♀; BI: Non-Perennial Guddu Command Area: Khangarh, 09-viii-4, Leg. M. T. Khan, 1♀; Ubauro, 19-iv-2015, Leg. M. T. Khan, 1♀; BII: Perennial Sukkur Command Area: Pano Aqil, 15.x.2015, Leg. M. T. Khan, 1♀; Shikarpur, 08-vi-2014, Leg. M. T. Khan, ♀; D: Thar and Nara Deserts: Umarmkot, 21-v-2016, Leg. M. T. Khan, ♀; Nagarparkar, 08-vii-2015, Leg. M. T. Khan, 1♀; E: Kohistan and Coastal Area: Gorakh Hills,

04-vi-2014, Leg. M. T. Khan, 1♀; Malir, 17-viii-2015, Leg. M.T. Khan, 1♀.

Remarks

This taxon is documented first time from Sindh province. Previously this species were described from Balochistan: Quetta; Islamabad; Punjab: Rawalpindi, Kussaab, Chakwal, Attock, Khanpur, Head Fareed, Muzafargarh, Bakhar, Mianwali and Layyah; Khyber-Pakhtunkhwa: Dir, Swat, Mansehra, Abbottabad and Balakot; Azad Jammu and Kashmir: Kohala, Kotli (Gusenleitner, 2006; Mahmood *et al.*, 2012; Shah, 2015; Siddiqui *et al.*, 2015; Rafi *et al.*, 2017).

Distribution

Iran; India; Iraq; Sri Lanka; Indonesia; Laos; Israel; U.A.E.; Myanmar; Oman; Mauritius; Pakistan; Qatar; Saudi Arabia; Caledonia; Philippines; Thailand (Gusenleitner, 2006; Kumar and Srinivasan, 2010; Mahmood *et al.*, 2012).

Genus: *Knemodynerus* Blüthgen, 1940
***Knemodynerus excellens* Pérez, 1907**

Material examined

Pakistan: Sindh: AI: Main Area: Dokri, 12-vi-2014, Leg. M. T. Khan, 1♀; BI: Non-Perennial Guddu Command Area: Jacobabad, 13-viii-2015, Leg. M. T. Khan, 2♀; Qadirpur, 15.x.2014, Leg. M. T. Khan, 1♂; BII: Perennial Sukkur Command Area: Khipro, 05-yiii-2016, Leg. M. T. Khan, 1♀; Shahdampur, 13-viii-2015, Leg. M. T. Khan, 1♂.

Remarks

This taxon is documented first time from Sindh province. Earlier this species was reported from Punjab: Multan and Balochistan: Quetta (Gusenleitner, 2006; Rafi *et al.*, 2017). Qasim (2018) in his thesis recorded this species from various localities of Punjab: Multan, Khanewal and Vehari district.

Distribution

Iran; India; Turkmenistan; U.A.E., Saudi Arabia; Pakistan; Qatar; Oman (Gusenleitner, 2006, 2013).

Statement of conflict of interest

The authors have declared no conflict of interest.

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