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Checklist of vespid wasps (Hymenoptera: Vespidae) of Goa, India, with new records and a key to species

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Abstract

This study on the vespid fauna (Hymenoptera: Vespidae) reports 33 species belonging to 22 genera and four subfamilies from the state of Goa, India. Of these, 26 species, 18 genera, and two subfamilies are newly recorded from Goa. Illustrated keys to the genera and species of vespid wasps of Goa along with notes on their geographical distribution are provided.

Key words: Eumeninae, Stenogastrinae, Polistinae, Vespinae, new record

Introduction

Goa is the smallest state in India, located in the northern Western Ghats, which is one of the biodiversity hotspots in tropical regions and is home to diverse flora and fauna. Despite being part of Western Ghats, the fauna of Goa remains poorly studied. Except for a few regional studies on butterflies (Gaonkar 1996, Rangnekar 2007), dragonflies and damselflies (Rangnekar *et al*. 2010, Rangnekar & Naik 2014), ants (Bharti *et al*. 2016), parasitic wasps (Gupta *et al.* 2015, Gupta & Gawas 2016), ants (Bharti *et al.* 2016), and praying mantids (Vyjayandi *et al*. 2010), the insect fauna of Goa is under-documented.

Vespid wasps belong to family Vespidae which is a cosmopolitan family of the order Hymenoptera. Indian Vespidae are represented by four subfamilies: Polistinae, Vespinae, Stenogastrinae, and Eumeninae. They comprise social and solitary wasps that are commonly called paper wasps, hornets, yellow-jackets, hover wasps, potter wasps, etc. They play an important role in ecosystem functioning by acting as predators and pollinators. They prey upon large lepidopteran larval pests of agricultural crops and have therefore been utilized as bio-control agents in different parts of the world (Das & Gupta 1989).

The vespid fauna of Goa prior to this study was represented by only seven species belonging to four genera (Das & Gupta 1989, Kojima *et al*. 2007, Girish Kumar & Carpenter 2013, Girish Kumar *et al.* 2016b). The present study was undertaken to document and contribute to the knowledge of the vespid fauna of Goa, India.

Materials and methods

The study area is the state of Goa, India. Specimens were collected using sweep net and yellow pan traps from July 2016 to November 2018. Identifications were made using Carpenter & Nguyen (2003), Das & Gupta (1989), Girish Kumar (2010, 2013a, 2013b, 2013c), Girish Kumar *et al*. (2013a, 2013b, 2014, 2015a, 2015b, 2016a, 2016b, 2016c, 2017a, 2017b, 2017c), Girish Kumar & Carpenter (2013), Girish Kumar & Sharma (2013), Kojima *et al.* (2007), Nguyen *et al.* (2016), Pannure *et al.* (2016), Srinivasan & Kumar (2010) and Tan *et al.* (2018). The materials examined for the study have been deposited in the ICAR—National Bureau of Agricultural Insect

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Resources (NBAIR), Bengaluru, India and Western Ghat Regional Centre of Zoological Survey of India, Kozhikode, India. Images of the wasps were taken with a Nikon D7000 with Nikkor 105 mm macro lens & Leica Stereo microscope model LEICA M 205A with LEICA DFC 500 Camera**.**

Abbreviations used for the type repositories : BMNH—British Museum of Natural History, London, England; HMUG—Hunterian Museum, University of Glasgow, Scotland; MHN—Muséum d'Histoire Naturelle, Genéve, Switzerland; MCZ—Museum of Comparative Zoology, Harvard University, Cambridge, USA; MP—Muséum National d'Histoire Naturelle, Paris, France; MRSN—Museo Regionale di Scienze Naturali di Torino, Italy; MSNG—Museo Civico di Storia Naturale di Genova Giacomo Doria, Genova, Italy; NHMB—Naturhistorisches Museum, Basel, Switzerland; NZC—National Zoological Collections of Zoological Survey of India, Kolkata, India; OLM—Biologiezentrum des Oberösterreichischen Landesmuseums, Linz, Austria; OUM—Oxford University Museum, Oxford, UK; RMNH—Nationaal Natuurhistorisch Museum (formerly Rijksmuseum van Natuurlijke Historie), Leiden, Netherlands; ZMB—Zoologisches Museum der Humboldt Universität, Berlin, Germany; ZMUC—Zoological Museum, University of Copenhagen, Denmark; ZMUK—Zoologisches Museum und Museum für Völkerkunde, Christian-Albrechts-Universität zu Kiel, Germany; ZSIK—Western Ghat Regional Centre, Zoological Survey of India, Kozhikode, India.

Results

Multiple surveys were carried out between July 2016 and November 2018 in the various regions within the political boundary of state of Goa, India. A total of 139 specimens belonging to 31 species were sampled and identified. Following is the taxonomic account of the collected species along with the illustrated key to Vespidae of Goa.

Taxonomic account of the sampled species

1) *Allorhynchium argentatum* (Fabricius, 1804)

(Figs 1 & 2)

Vespa argentata Fabricius, 1804: 260. Type: Male, "Sumatra" (ZMUC).

Material examined: INDIA: Goa: Sattari, Mhadei Wildlife Sanctuary, Surla Plateau, 10-15.i.2017, 2♂, coll. Sandesh M. Gawas; Tiswadi, Salim Ali Bird Sanctuary, mangroves, 1♀, 19.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. No. ZSI/WGRC/I.R.-INV.11665; Sanguem, Netravali Wildlife Sanctuary, 1♂, 16.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. No. ZSI/WGRC/I.R.-INV.11666.

Distribution. India: Andaman & Nicobar Islands, Arunachal Pradesh, Assam, Chhattisgarh, Goa (new record), Himachal Pradesh, Karnataka, Kerala, Meghalaya, Mizoram, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. Global: Bhutan; Indonesia; Laos; Malaysia; Myanmar; Nepal; Pakistan; Philippines; Singapore; Thailand. (Girish Kumar *et al.* 2016a, Nidup *et al.* 2018).

2) *Antepipona ceylonica* (de Saussure, 1867)

(Figs 3 & 4)

Odynerus ceylonicus de Saussure, 1867: 12, female, male (in subgenus *Leionotus* division *Epsilon*). Type "Ceylon" (MHN).

Material examined: INDIA: Goa: Sattari, Ambedem, 12.xi.2016, 1♀, coll. Sandesh M. Gawas; Dharbandora, Bhagwan Mahaveer Wildlife Sanctuary & Mollem National Park, 11-15.v.2017, 1♀, coll. Sandesh M. Gawas; Dharbandora, Bhagwan Mahaveer Wildlife Sanctuary & Mollem National Park, 10-14.iii.2017, 2♀, coll. Sandesh M. Gawas; Dharbandora, Bhagwan Mahaveer Wildlife Sanctuary & Mollem National Park, 1-3.i.2017, 3♀, coll. Sandesh M. Gawas; Sattari, Mhadei Wildlife Sanctuary, 1♂, 15.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. No. ZSI/WGRC/I.R.-INV.11667; Ponda, Bondla Wildlife Sanctuary, 2♂, 16.v.2018, coll. P. Girish Kumar & Party,

ZSIK Regd. Nos. ZSI/WGRC/I.R.-INV.11668 & 11669; Canacona, Cotigao Wildlife Sanctuary, 1♂, 18.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. No. ZSI/WGRC/I.R.-INV.11670.

Distribution. India: Andhra Pradesh, Chhattisgarh, Goa, Gujarat, Jharkhand, Karnataka, Kerala, Maharashtra, Odisha, Rajasthan, Sikkim, Tamil Nadu, Telangana, Uttarakhand, Uttar Pradesh, West Bengal. Global: Myanmar; Sri Lanka, Thailand. (Girish Kumar *et al*. 2016b, Pannure *et al.* 2016).

3) *Antepipona ovalis* (de Saussure, 1853)
(Figs 5 & 6)

Odynerus ovalis de Saussure 1853: 215, ♂, "Les Indes Orientales. Pondichery" (MSNG).

Material examined: INDIA: Goa: Dharbandora, Bhagwan Mahaveer Wildlife Sanctuary & Mollem National Park, 10-14.iii.2017, 1♀, coll. Sandesh M. Gawas; Dharbandora, Bhagwan Mahaveer Wildlife Sanctuary & Mollem National Park, 1-3.i.2017, 1♀, coll. Sandesh M. Gawas; Dharbandora, Bhagwan Mahaveer Wildlife Sanctuary & Mollem National Park, 1♂, 17.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. No. ZSI/WGRC/I.R.-INV.11671.

Distribution. India: Andhra Pradesh, Chhattisgarh, Goa (new record), Gujarat, Jharkhand, Karnataka, Kerala, Maharashtra, Odisha, Puducherry, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal. Global: Afghanistan; Bangladesh; China; Pakistan; Sri Lanka. (Girish Kumar *et al*. 2016b, Rafi *et al.* 2017).

4) *Antepipona pruthii* Giordani Soika, 1882
(Figs 7 & 8)

Antepipona pruthii Giordani Soika, 1982: 205, 208 & 248, ♂, "Kashmir: Daksum, 7500 ft." (RMNH).

Material examined: INDIA: Goa: Dharbandora, Bhagwan Mahaveer Wildlife Sanctuary & Mollem National Park, 12.ix.16, 1♀, coll. Sandesh M. Gawas; Dharbandora, Bhagwan Mahaveer Wildlife Sanctuary & Mollem National Park, 10-14.iii.2017, 8♀, coll. Sandesh M. Gawas; Dharbandora, Bhagwan Mahaveer Wildlife Sanctuary & Mollem National Park, 11-15.v.2017, 1♀, coll. Sandesh M. Gawas.

Distribution. India: Goa (new record), Himachal Pradesh, Jammu & Kashmir, Uttarakhand, West Bengal. Global: Pakistan. (Girish Kumar *et al*. 2016b).

5) *Antepipona sibilans* (Cameron, 1903)
(Figs 9 & 10)

Odynerus sibilans Cameron, 1903: 129, [♂], "Barrackpore" (OUM).

Material examined: INDIA: Goa: Tiswadi, Salim Ali Bird Sanctuary, mangroves, 1♂, 19.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. No. ZSI/WGRC/I.R.-INV.11672.

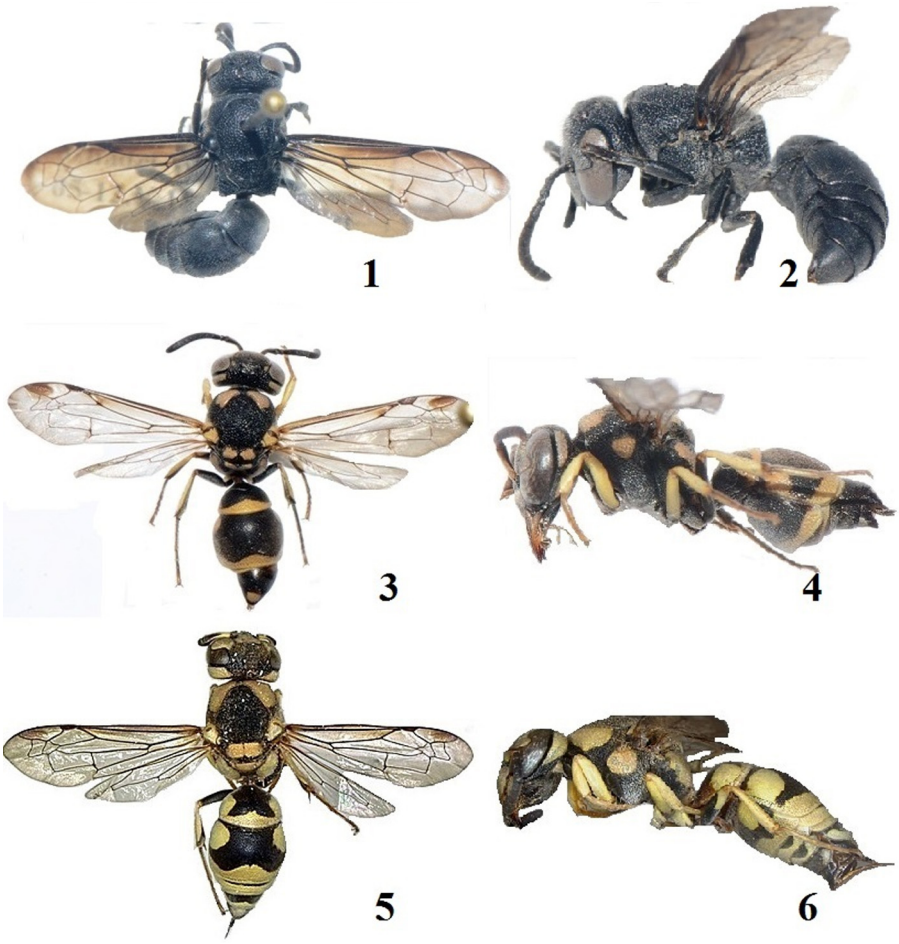
Distribution. India: Andhra Pradesh, Chhattisgarh, Goa (new record), Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Maharashtra, Odisha, Puducherry, Rajasthan, Tamil Nadu, Telangana, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. Global: Nepal; Pakistan. (Girish Kumar *et al*. 2016b).

6) *Anterhynchium* (*Anterhynchium*) *abdominale abdominale* (Illiger, 1802)
(Figs 11 & 12)

Vespa abdominalis Illiger, 1802: 192. Type: "Bengalen" (?ZMB).

Material examined: INDIA: Goa: Sattari, Honda, 16.x.2016, 1♀, coll. Sandesh M. Gawas.

Distribution. India: Chhattisgarh, Delhi, Goa (new record), Jharkhand, Karnataka, Kerala, Odisha, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal. Global: Pakistan; Myanmar; Sri Lanka; Vietnam. (Pannure *et al.* 2016, Rafi *et al.* 2017).



FIGURES 1–6. Habitus. ♀, l–2, *Allorhynchium argentatum*; ♀, 3–4, *Antepipona ceylonica*; ♀, 5–6, *Antepipona ovalis*.

7) *Apodynerus troglodytes troglodytes* (de Saussure, 1855)
(Figs 13 & 14)

Odynerus troglodytes de Saussure, 1855, 3: 249, [♂], "Le Sénégal" (MRSN).

Material examined: INDIA: Goa: Tiswadi, Salim Ali Bird Sanctuary, mangroves, 1♂, 19.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. No. ZSI/WGRC/I.R.-INV.11673.

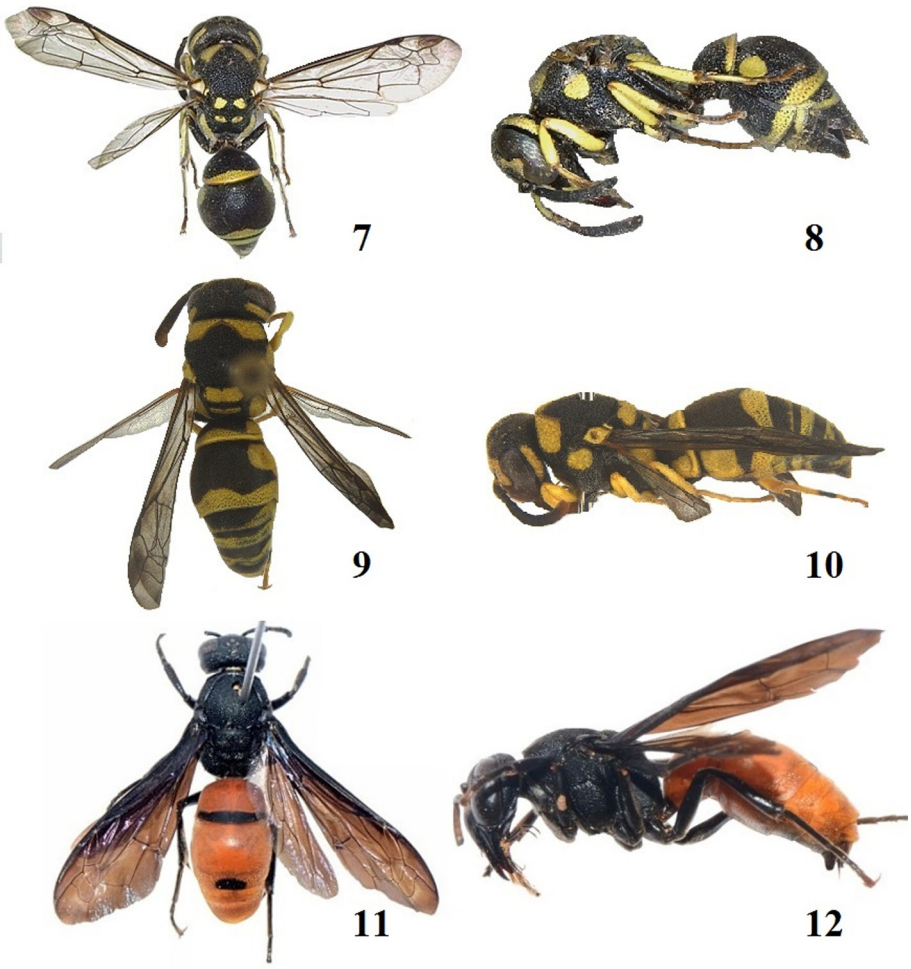
Distribution. India: Andaman & Nicobar Islands, Arunachal Pradesh, Assam, Goa (new record), Karnataka, Kerala, Tamil Nadu, West Bengal. Global: Bhutan; Borneo; China; Indonesia; Laos; Malaysia; Myanmar; Philippines; Singapore; Thailand; Vietnam. (Pannure *et al.* 2016, Nidup *et al.* 2018).

8) *Cyrtolabulus interstitialis* (Cameron, 1902)
(Figs 15 & 16)

Zethus interstitialis Cameron, 1902: 291, female, male, "Matheran" (BMNH).

Material examined: INDIA: Goa: Sattari, Mhadei Wildlife Sanctuary, Surla Plateau, 10-15.i.2017, 2♂, coll. Sandesh M. Gawas.

Distribution. India: Goa (new record), Maharashtra. (Girish Kumar *et al.* 2015a).



FIGURES 7–12. Habitus. ♀, 7–8, *Antepipona pruthii*; ♂, 9–10, *Antepipona sibilans*; ♀, 11–12, *Anterhynchium* (*Anterhynchium*) *abdominale abdominale*.

9) *Delta conoideum* (Gmelin, 1790)
(Figs 17 & 18)

Vespa conica Fabricius, 1787: 293, "China" (BMNH).

Material examined: INDIA: Goa: Sattari, Honda, 27.xi.2018, 1 ♂, coll. Sandesh M. Gawas.

Distribution. India: Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Diu, Goa (new record), Gujarat, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Odisha, Puducherry, Rajasthan, Sikkim, Tamil Nadu, Telangana, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. Global: Arabia; Bhutan; China; Laos; Malaysia; Myanmar; Nepal; Pakistan; Sri Lanka; Thailand; Vietnam. (Girish Kumar & Mazumdar 2015, Nidup *et al.* 2016, Rafi *et al.* 2017).

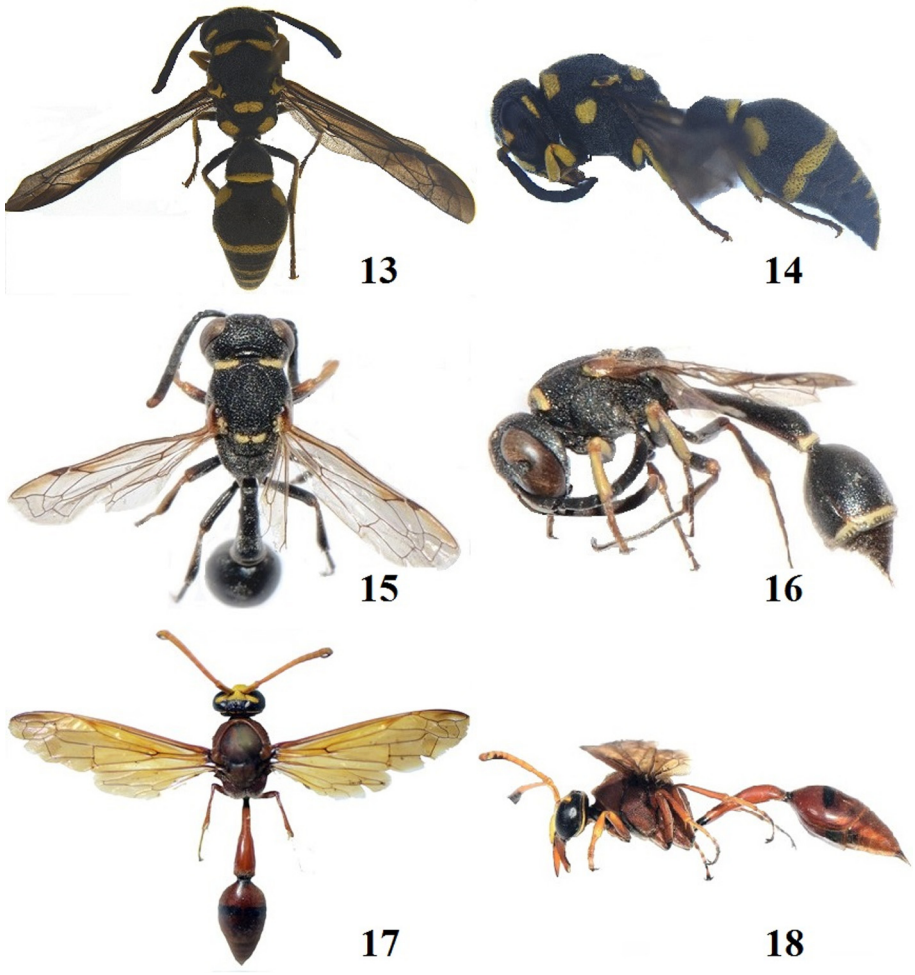
10) *Delta pyriforme pyriforme* (Fabricius, 1775)
(Figs 19 & 20)

Vespa pyriformis Fabricius, 1775: 371—"in China" (type depository unknown).

Material examined: INDIA: Goa: Sattari, Honda, 10.xi.2016, 1 ♀, coll. Sandesh M. Gawas.

Distribution. India: Andhra Pradesh, Andaman & Nicobar Islands, Arunachal Pradesh, Assam, Chhattisgarh, Delhi, Goa (new record), Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Maharashtra, Manipur,

Meghalaya, Mizoram, Nagaland, Odisha, Puducherry, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. Global: Bangladesh; Bhutan; Cambodia; China; Hawaii; Hong Kong; Indonesia; Malaysia; Mauritius; Moluccas; Myanmar; Nepal; New Guinea; Pakistan; Sri Lanka; Taiwan; Thailand; Vietnam. (Pannure *et al.* 2016, Nidup *et al.* 2016).



FIGURES 13–18. Habitus. ♀, 13–14, *Apodynerus troglodytes troglodytes*; ♂, 15–16, *Cyrtolabulus interstitialis*; ♂, 17–18, *Delta conoideum*.

11) *Eumenes belli* Giordani Soika, 1973
(Figs 21 & 22)

Eumenes belli Giordani Soika, 1973: 125, [♀,♂], "*India meridionale*: Mysore, N. Kanara" (holotype ♀ BMNH).

Material examined: INDIA: Goa: Sattari, Mhadei Wildlife Sanctuary, 1♀, 15.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. No. ZSI/WGRC/I.R.-INV.11674.

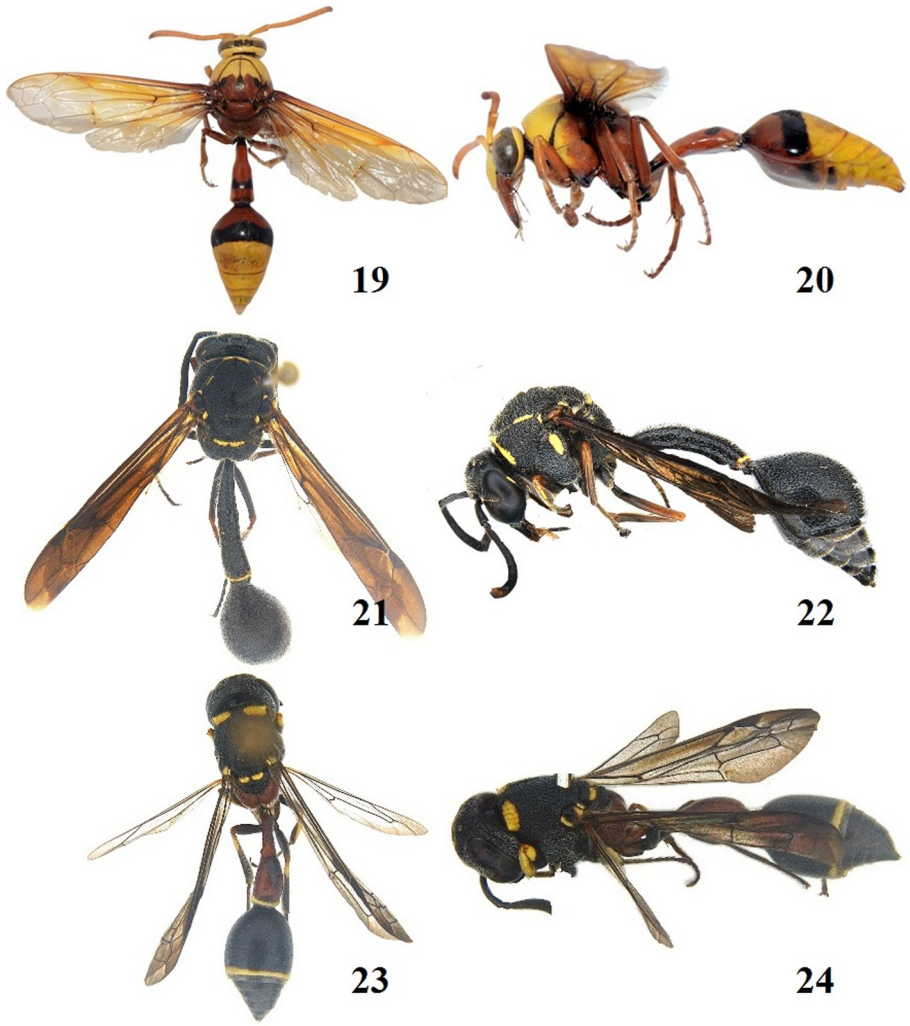
Distribution. India: Goa (new record), Karnataka, Kerala. (Girish Kumar *et al.* 2017c).

12) *Labus pusillus* van der Vecht, 1963
(Figs 23 & 24)

Labus pusillus van der Vecht, 1963: 6, [♀,♂], holotype ♀ "Deiyannewela, Kandy, Ceylon" (NHMB).

Material examined: INDIA: Goa: Dharbandora, Bhagwan Mahaveer Wildlife Sanctuary & Mollem National Park, 1♀, 17.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. No. ZSI/WGRC/I.R.-INV.11675.

Distribution. India: Andhra Pradesh, Assam, Goa (new record), Himachal Pradesh, Karnataka, Kerala, Maharashtra, Meghalaya, Mizoram, Puducherry, Sikkim, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal. Global: Bhutan; China; Nepal; Sri Lanka; Vietnam. (Pannure *et al.* 2016, Nidup *et al.* 2016, Li & Carpenter 2018).



FIGURES 19–24. Habitus. ♀, 19–20, *Delta pyriforme pyriforme*; ♀, 21–22, *Eumenes belli*; ♀, 23–24, *Labus pusillus*.

13) *Lissodynerus septemfasciatus septemfasciatus* (Smith, 1858)
(Figs 25 & 26)

Odynerus septem-fasciatus Smith, 1858: 111, ♂, Borneo (Sarawak) (OUM).

Material examined: INDIA: Goa: Sattari, Mhadei WLS, Surla Plateau, 5-12.v.2017, 6♀, coll. Sandesh M. Gawas.
Distribution. India: Goa (new record), Karnataka. Global: Indonesia; Malaysia. (Pannure *et al.* 2016).

14) *Oreumenoides edwardsii* (de Saussure, 1852)
(Figs 27 & 28)

Eumenes edwardsii de Saussure, 1852: 60, [♀],'Les Indes-Orientales, Bombay' (MP).

Material examined: INDIA: Goa: Tiswadi, Salim Ali Bird Sanctuary, 2♀, 19.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. Nos. ZSI/WGRC/I.R.-INV.11676 & 11677.
Distribution. India: Bihar, Chhattisgarh, Delhi, Goa (new record), Jharkhand, Karnataka, Kerala, Madhya

Pradesh, Maharashtra, Meghalaya, Puducherry, Rajasthan, Sikkim, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal. Global: Myanmar; Nepal; Pakistan; Thailand. (Selis 2018).

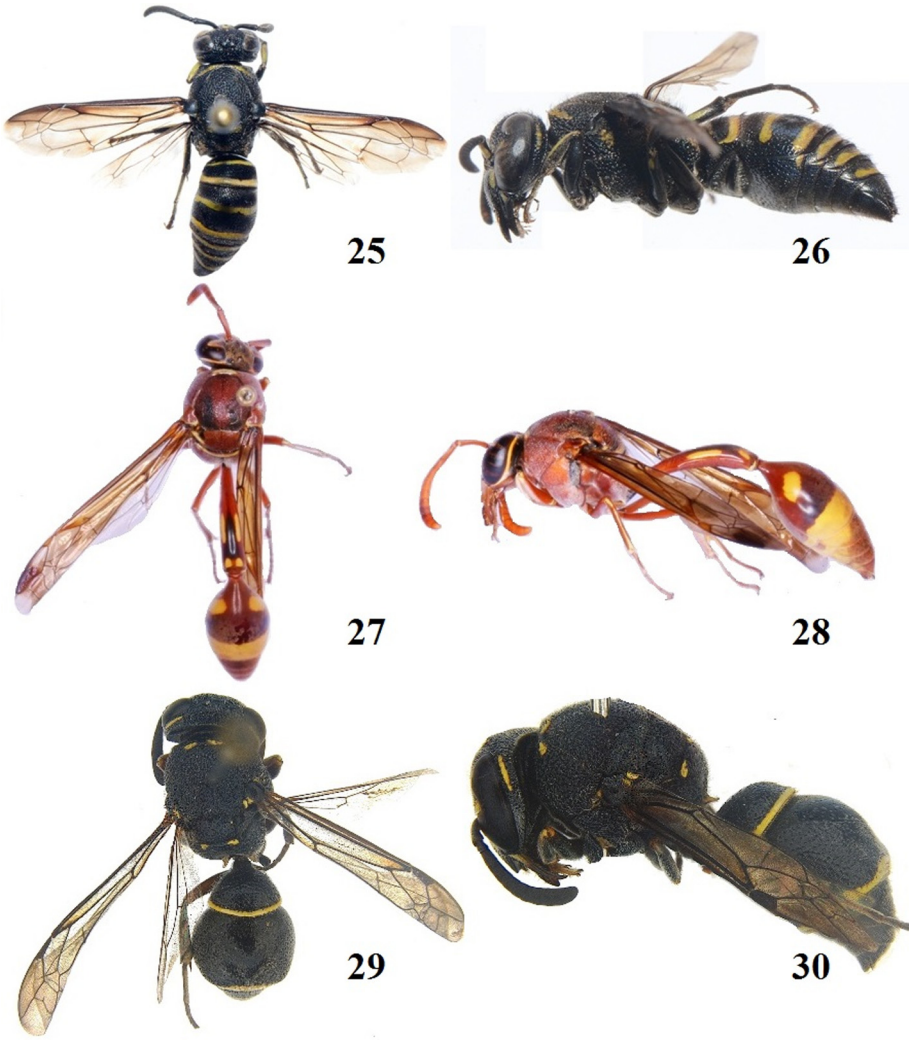
15) *Paraleptomenes humbertianus* (de Saussure, 1867)

(Figs 29 & 30)

Odynerus humbertianus de Saussure 1867: 13, [♀,♂], "Insula Ceylone" (MHN).

Material examined. INDIA: Goa: Tiswadi, Salim Ali Bird Sanctuary, 1♀, 19.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. No. ZSI/WGRC/I.R.-INV.11678.

Distribution. India: Andhra Pradesh, Goa (new record), Karnataka, Kerala, Odisha, Puducherry, Tamil Nadu. Global: Sri Lanka. (Pannure *et al.* 2016).



FIGURES 25–30. Habitus. ♀, 25–26, *Lissodynerus septemfasciatus septemfasciatus*; ♀, 27–28, *Oreumenoides edwardsii*; ♀, 29–30, *Paraleptomenes humbertianus*.

16) *Parancistrocerus vicinus* Giordani Soika, 1994

(Figs 31 & 32)

Parancistrocerus vicinus Giordani Soika, 1994: 159 (key), 194. Holotype: female, "India: Maharashtra, Matheran" (BMNH).

Material examined: INDIA: Goa: Sattari, Mhadei Wildlife Sanctuary, Surla Plateau, 5-12.v.2017, 3♀, coll. Sandesh M. Gawas.

Distribution. India: Goa (new record), Kerala, Maharashtra. (Girish Kumar *et al.* 2016c).

17) *Phimenes flavopictus* (Blanchard, 1849)

(Figs 33 & 34)

Eumenes flavopictus Blanchard, 1840, type locality Unknown (?MP).

Material examined: INDIA: Goa, Dharbandora, Bhagwan Mahaveer Wildlife Sanctuary & Mollem National Park, 10-14.iii.2017, 1♀, coll. Sandesh M. Gawas.

Distribution. India: Arunachal Pradesh, Assam, Chhattisgarh, Delhi, Goa (new record), Jharkhand, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tamil Nadu, Tripura, Uttarakhand, West Bengal. Global: China; Hong Kong; Indonesia; Malaysia; Myanmar; Nepal; Singapore; Sri Lanka; Thailand; Vietnam. (Pannure *et al.* 2016).

18) *Phimenes indosinensis* (van der Vecht, 1959)

(Figs 35 & 36)

Eumenes indosinensis van der Vecht, 1959: 12 (key), 18, figs. 2b. 5a, 6(, [♀,♂], "Thaungyin", holotype ♂ (OUM).

Material examined: INDIA: Goa: Tiswadi, Salim Ali Bird Sanctuary, 3♀, 19.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. Nos. ZSI/WGRC/I.R.-INV.11679–11681.

Distribution. India: Goa (new record), Meghalaya. Global: Myanmar; Laos; Vietnam. (Nguyen *et al.* 2016).

19) *Rhynchium brunneum* (Fabricius, 1793)

(Figs 37 & 38)

Vespa brunnea Fabricius, 1793: 264, "Tranquebariae, India (HMUG)".

Material examined: INDIA: Goa: Tiswadi, Salim Ali Bird Sanctuary, 1♀, 19.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. Nos. ZSI/WGRC/I.R.-INV.11682.

Distribution. India: Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Goa (new record), Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Odisha, Puducherry, Sikkim, Tamil Nadu, Tripura, Uttarakhand, West Bengal. Global: Afghanistan; Bangladesh; Bhutan; Cambodia; China; Guam; Indonesia; Iran; Iraq; Laos; Malaysia; Marianus; Marquesas Island; Myanmar; Nepal; New Britain; Pakistan; Palau; Seychelles; Society Islands; Sri Lanka, Taiwan; Thailand; Vietnam. (Pannure *et al.* 2016, Nidup *et al.* 2018).

20) *Stenodyneriellus praeclusus* (Nurse, 1903)

(Figs 39 & 40)

Odynerus praeclusus Nurse, 1903: 532, female—"Mount Abu" (lectotype BMNH).

Material examined: INDIA: Goa: Sattari, Mhadei Wildlife Sanctuary, Surla Plateau, 5-12.v.2017, 3♀, coll. Sandesh M. Gawas.

Distribution. India: Goa (new Record), Rajasthan. (Girish Kumar *et al.* 2017b).

FIGURES 31–36. Habitus. ♀, 31–32, *Parancistrocerus vicinus*; ♀, 33–34, *Phimenes flavopictus*; ♀, 35–36, *Phimenes indosinensis*.

21) *Subancistrocerus sichelii* (de Saussure, 1855)
(Figs 41 & 42)

Odynerus sichelii de Saussure, 1855: 206, [♂], Indes Orientales (MP).

Material examined: INDIA: Goa : Tiswadi, Salim Ali Bird Sanctuary, 1♂, 19.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. No. ZSI/WGRC/I.R.-INV.11683.

Distribution. India: Andaman & Nicobar Islands, Arunachal Pradesh, Assam, Bihar, Goa (new record), Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Odisha, Puducherry, Sikkim, Tamil Nadu, Tripura, Uttarakhand, West Bengal. Global: Bangladesh; Cambodia; Chagos Archipelago; China; Malaysia; Mauritius; Myanmar; Nepal; Seychelles; Singapore; Sri Lanka; Thailand; Vietnam. (Pannure *et al.* 2016).

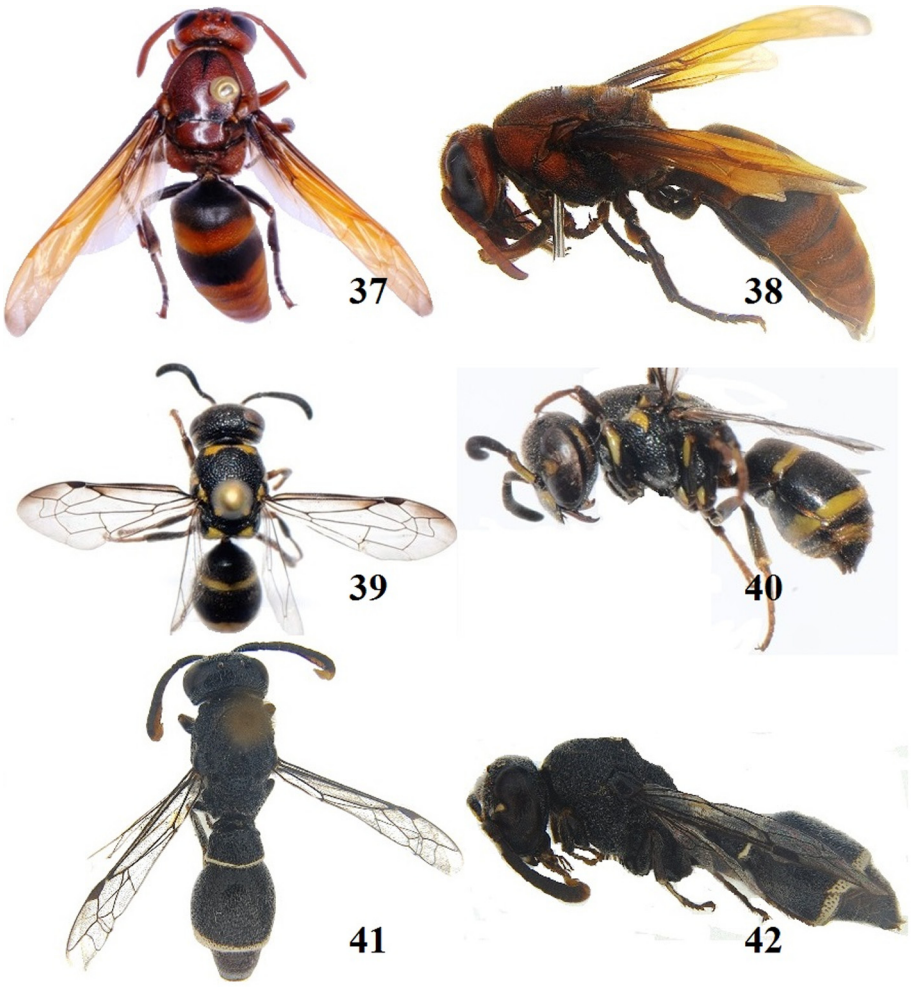
22) *Xenorhynchium nitidulum* (Fabricius, 1798)
(Figs 43 & 44)

Vespa nitidula Fabricius, 1798: 262, Syntype: India Orientalis (ZMUK).

Material examined: INDIA: Goa: Sattari, Mhadei Wildlife Sanctuary, Surla Plateau, 5-12.v.2017, 5 ♀, coll. Sandesh M. Gawas.

Distribution. India: Andhra Pradesh, Bihar, Chhattisgarh, Goa (new record), Gujarat, Himachal Pradesh,

Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Puducherry, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal. Global: Bangladesh; Myanmar; Pakistan. (Pannure *et al.* 2016).



FIGURES 37–42. Habitus. ♀, 37–38, *Rhynchium brunneum*; ♀, 39–40, *Stenodyneriellus praeclusus*; ♂, 41–42, *Subancistrocerus sichelii*.

23) *Polistes (Polistella) nigritarsis* Cameron, 1900
(Figs 45 & 46)

Polistes nigritarsis Cameron, 1900: 413. Type ♂, West Bengal: Barrackpore (OUM).

Material examined: INDIA: Goa: Sattari, Mhadei Wildlife Sanctuary, Surla Plateau, 5-12.v.2017, 1♀, coll. Sandesh M. Gawas; Sattari, Mhadei Wildlife Sanctuary, 1♀, 15.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. No. ZSI/WGRC/I.R.-INV.11647.

Distribution. India: Goa (new record), Karnataka, Kerala, Meghalaya, Tamil Nadu, West Bengal. Global: Bhutan; Vietnam. (Gusenleitner 2006; Nguyen & Carpenter, 2016; Dorji *et al.* 2017).

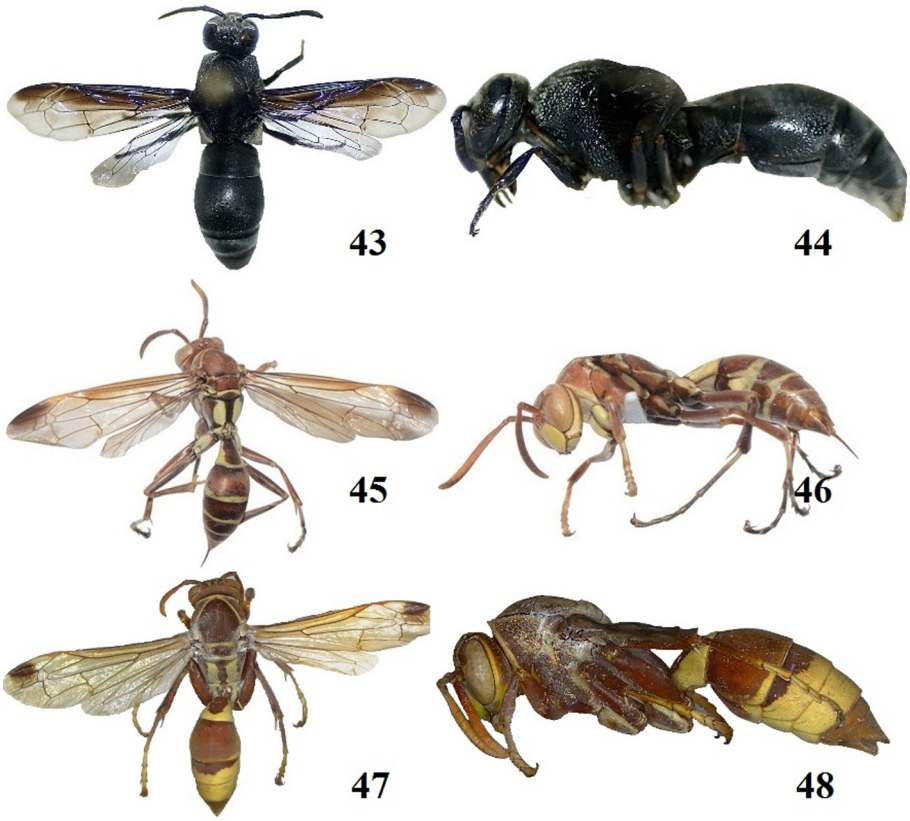
24) *Polistes* (*Polistella*) *stigma tamulus* (Fabricius, 1798)
(Figs 47 & 48)

Vespa tamula Fabricius, 1798: 263. Holotype—♀, India Orientali (ZMUK).

Material examined: INDIA: Goa: Sattari, Mhadei Wildlife Sanctuary, Surla Plateau, 5-12.v.2017, 7♀, coll.

Sandesh M. Gawas; Tiswadi, Salim Ali Bird Sanctuary, mangroves, 4♀, 14 & 19.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. Nos. ZSI/WGRC/I.R.-INV.11648 & 11662–11664; Sattari, Mhadei Wildlife Sanctuary, 5♀, 15.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. Nos. ZSI/WGRC/I.R.-INV.11649–11653; Ponda, Bondla Wildlife Sanctuary, 3♀, 16.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. Nos. ZSI/WGRC/I.R.-INV.11654–11656; Dharbandora, Bhagwan Mahaveer Wildlife Sanctuary & Mollem National Park, 3♀, 16.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. Nos. ZSI/WGRC/I.R.-INV.11657–11659; Sanguem, Netravali Wildlife Sanctuary, 2♀, 16.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. Nos. ZSI/WGRC/I.R.-INV.11660–11661.

Distribution. Bihar, Chhattisgarh, Delhi, Goa, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Odisha, Puducherry, Rajasthan, Sikkim, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal. Global: Pakistan; Sri Lanka; Vietnam. (Girish Kumar & Sharma 2014, Girish Kumar & Sharma 2015, Sheikh *et al.* 2017, Nguyen *et al.* 2017, Rafi *et al.* 2017).



FIGURES 43–48. Habitus. ♀, 43–44, *Xenorhynchium nitidulum*; ♀, 45–46, *Polistes* (*Polistella*) *nigritarsis*; ♀, 47–48, *Polistes* (*Polistella*) *stigma tumulus*.

25) *Ropalidia brevita* Das and Gupta, 1989
(Figs 49 & 50)

Ropalidia (*Anthreneida*) *brevita* Das & Gupta, 1989: 121. Holotype ♂, India: Delhi, University ridge (NZC).

Material examined: INDIA: Goa: Sattari, Honda, 12.i.2017, 2♀, coll. Sandesh M. Gawas; Bicholim, Sanquelim, 18.iii.2017, 3 ♀ & 1♂, coll. Sandesh M. Gawas; Tiswadi, Salim Ali Bird Sanctuary, 3♀ & 5♂, 14 & 19.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. Nos. ZSI/WGRC/I.R.-INV.11638–11645; Tiswadi, Carambolim lakeside, 1♀, 19.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. No. ZSI/WGRC/I.R.-INV.11646.

Distribution. India: Assam, Chhattisgarh, Delhi, Goa, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Odisha, Rajasthan, Sikkim, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal. Global: Pakistan. (Girish Kumar *et al.* 2017a).

26) *Ropalidia cyathiformis* (Fabricius, 1804)
(Figs 51 & 52)

Eumenes cyathifornis Fabricius, 1804: 289, Java (ZMUC).

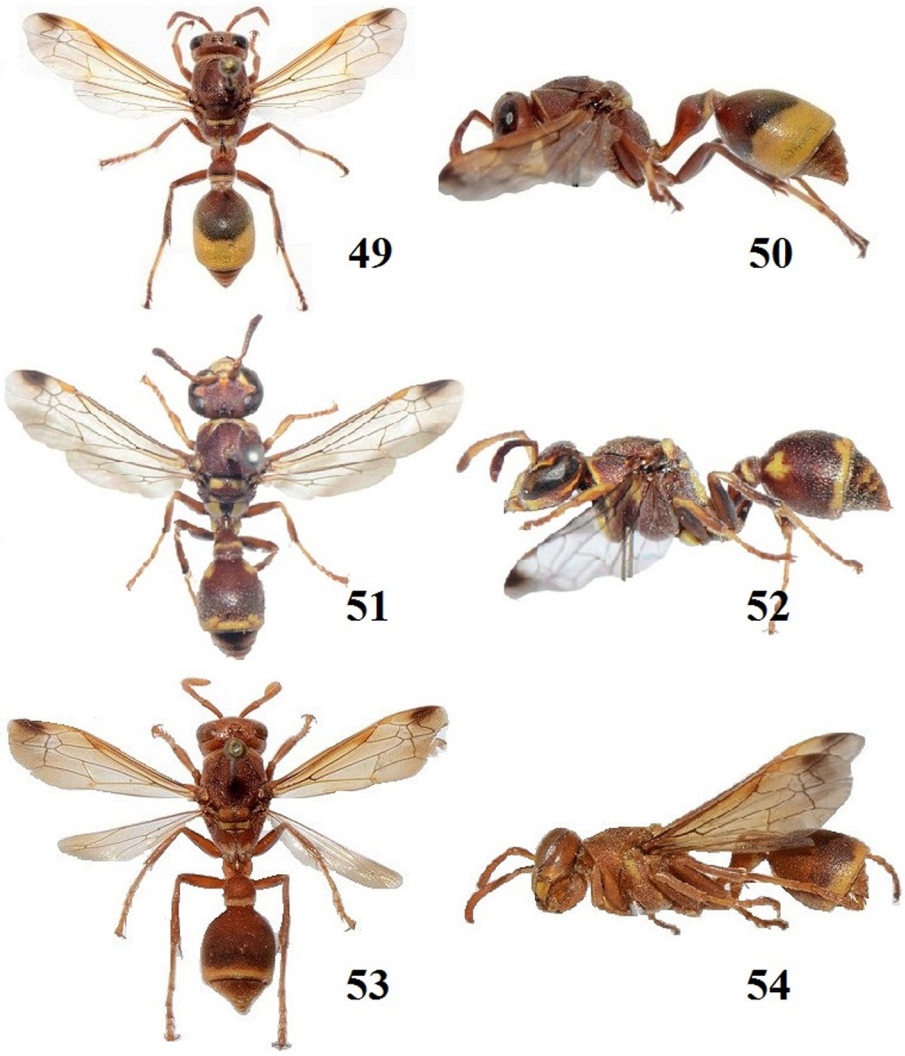
Material examined: INDIA: Goa: Sattari, Honda, 27.xi.2018, 1♀, coll. Sandesh M. Gawas.

Distribution. India: Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Goa, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Uttarakhand, West Bengal. Global: China; Indonesia; Malaysia; Myanmar; Nepal; Pakistan; Philippines; Sri Lanka; Thailand; Vietnam. (Tan *et al.* 2014, Rafi *et al.* 2017, Girish Kumar *et al.* 2017a).

27) *Ropalidia marginata* (Lepeletier, 1836)
(Figs 53 & 54)

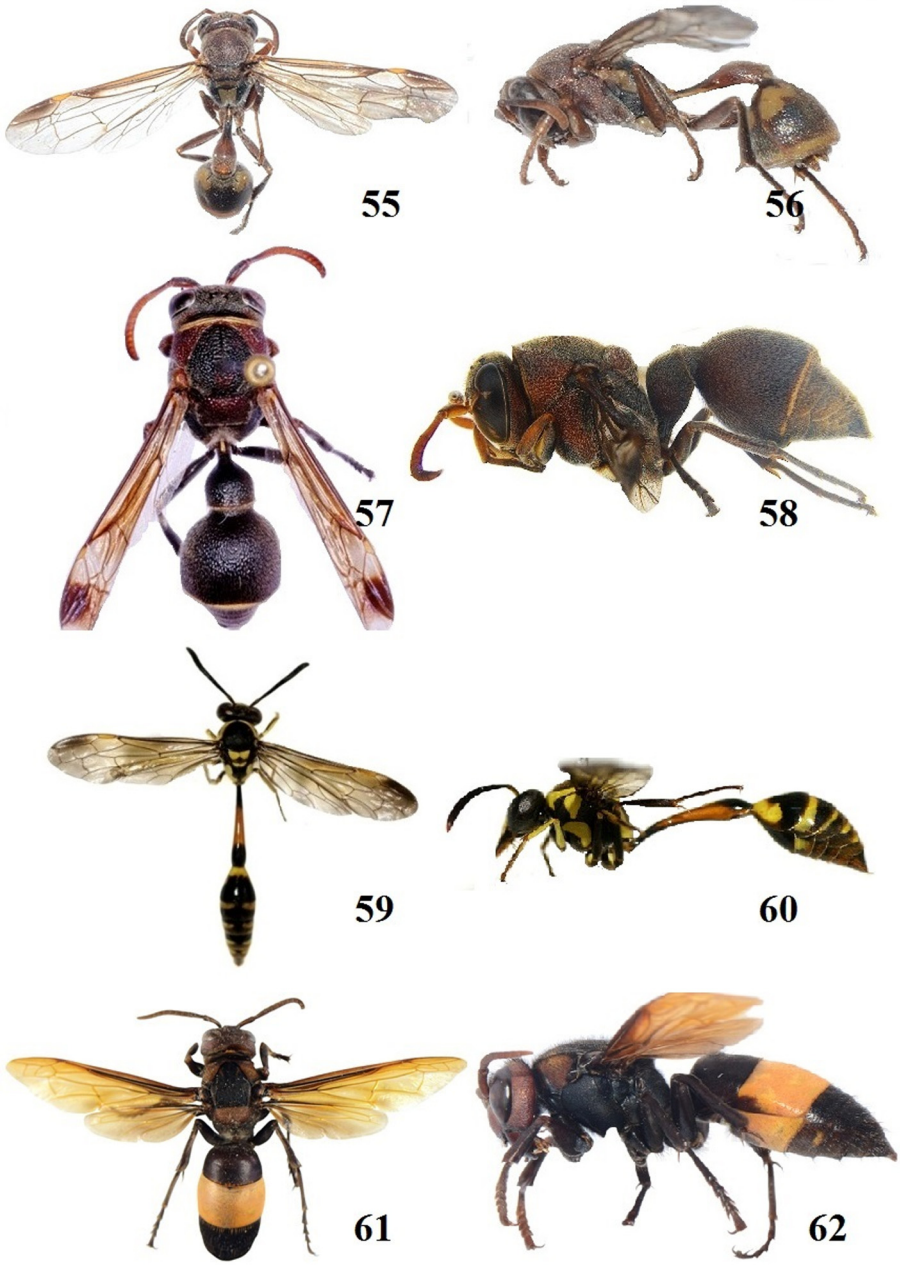
Vespa ferruginea Fabricius, 1793: 280 (junior primary homonym of *Vespa ferruginea* Gmelin, 1790). Type locality: India (ZMUC).

Material examined. INDIA: Goa: Dharbandora, Bhagwan Mahaveer Wildlife Sanctuary & Mollem National Park, 10-14.iii.2017, 4♀, coll. Sandesh M. Gawas.



FIGURES 49–54. Habitus. ♀, 49–50, *Ropalidia brevita*; ♀, 51–52, *Ropalidia cyathiformis*; ♀, 53–54, *Ropalidia marginata.*

Distribution. India: Andhra Pradesh, Bihar, Goa (new record), Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttarakhand, West Bengal. Global: Australia; China; Indonesia; Japan; Malaysia; Marianas; Myanmar; Pakistan; Palau; Papua New Guinea; Philippines; Sri Lanka; Vietnam. (Girish Kumar & Sharma 2015, Girish Kumar *et al.* 2017a).



FIGURES 55–62. Habitus, ♀, 55–56, *Ropalidia stigma*; ♀, 57–58, *Ropalidia tamila*; 59–60, *Eustenogaster eximia eximioides*; ♀, 61–62, *Vespa tropica haematodes*.

28) *Ropalidia stigma* (Smith, 1858)
(Figs 55 & 56)

Polybia stigma Smith, 1858: 114. Type locality: Borneo:Sarawak (OUM).

Material examined: Material examined. INDIA: Goa: Sattari, Ambedem, 9.i.2017, 1♀, coll. Sandesh M. Gawas.

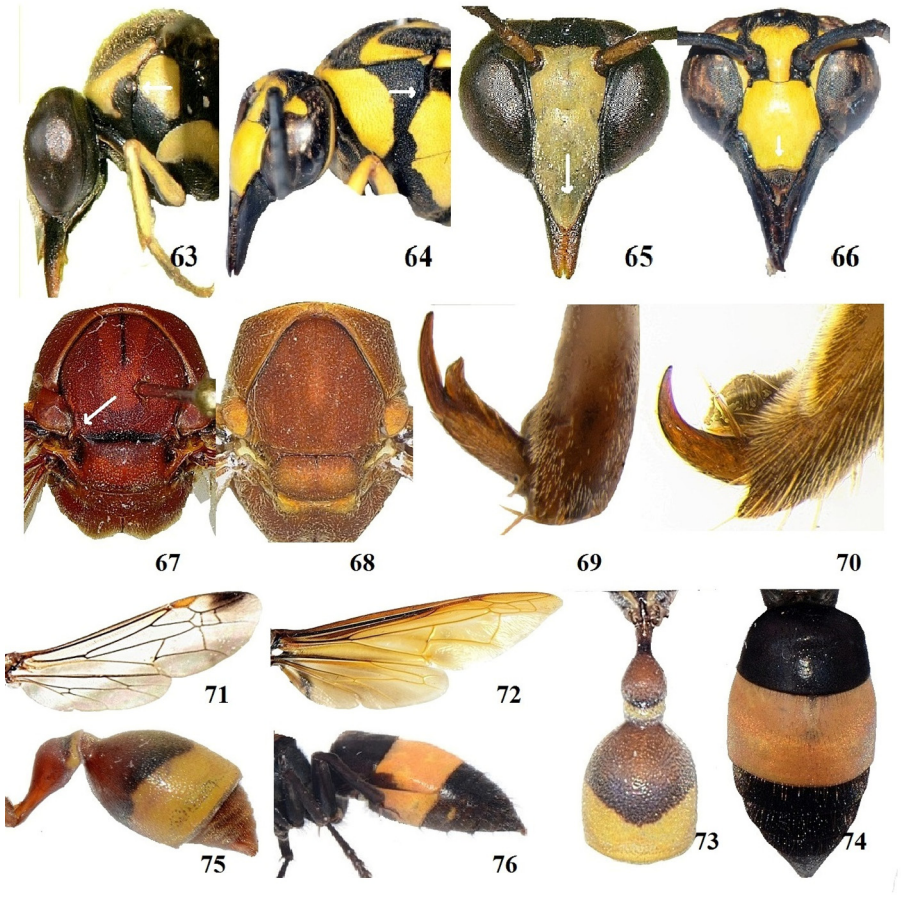
Distribution. India: Arunachal Pradesh, Assam, Chhattisgarh, Goa, Himachal Pradesh, Jharkhand, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Sikkim, Tripura, Uttarakhand, West Bengal. Global: Bhutan; China; Indonesia; Laos; Malaysia; Myanmar; Nepal; Philippines; Singapore; Sri Lanka; Thailand; Vietnam. (Girish Kumar *et al.* 2017a).

29) *Ropalidia tamila* Gusenleitner, 2004
(Figs 57 & 58)

Ropalidia tamila Gusenleitner, 2004: 1089, ♂, ♀. Holotype ♀, Tamil Nadu: 11 km SE Kotagin Kunchapani (OLM).

Material examined: INDIA: Goa: Sattari, Mhadei Wildlife Sanctuary, 7♂, 15.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. Nos. ZSI/WGRC/I.R.-INV.11616–11622; Ponda, Bondla Wildlife Sanctuary, 3♂, 16.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. Nos. ZSI/WGRC/I.R.-INV.11623–11625; Dharbandora, Bhagwan Mahaveer Wildlife Sanctuary & Mollem National Park, 8♂, 17.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. Nos. ZSI/WGRC/I.R.-INV.11626–11633; Sanguem, Netravali Wildlife Sanctuary, 4♂, 18.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. Nos. ZSI/WGRC/I.R.-INV.11634–11637.

Distribution. India: Goa (new record), Kerala, Tamil Nadu. (Girish Kumar *et al.* 2017a).



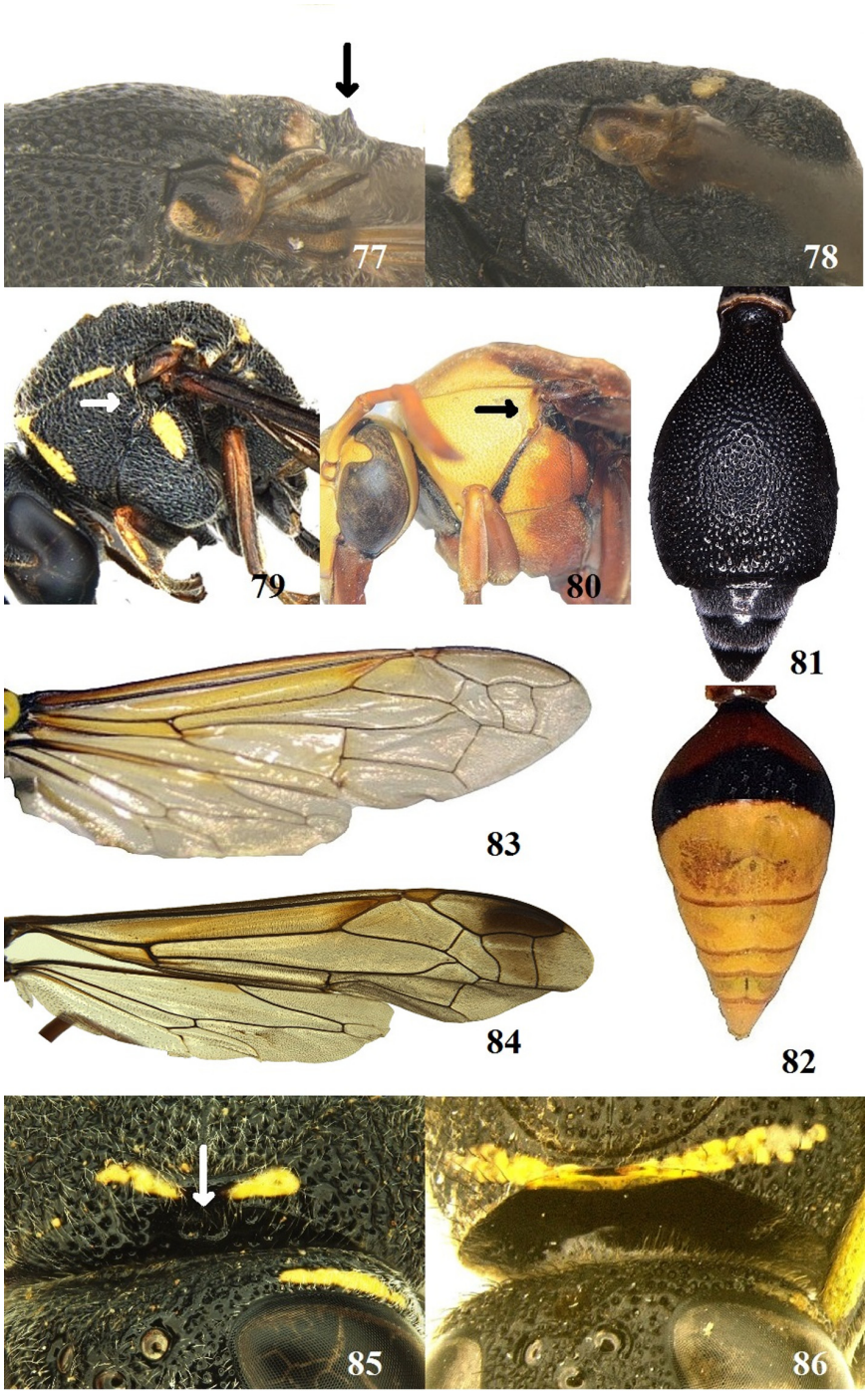
FIGURES 63–76. 63–64 Mesosoma, lateral view. 63, *Eustenogaster eximia eximioides*; 64, *Phimenes flavopictus.* 65–66 Head, frontal view. 65, *Eustenogaster eximia eximioides*; 66, *Phimenes flavopictus.* 67–68 Mesosoma, dorsal view. 67, *Delta conoideum*; 68, *Ropalidia marginata*. 69–70 Tarsal claw. 69, *Delta conoideum*; 70, *Ropalidia marginata.* 71–72 Wings. 71, *Ropalidia cyathiformis*; 72, *Vespa tropica haematodes*. 73–74 Metasoma, dorsal view. 73, *Ropalidia brevita*; 74, *Vespa tropica haematodes*. 75–76 Metasoma, lateral view. 75, *Ropalidia brevita*; 76, *Vespa tropica haematodes*.

30) *Eustenogaster eximia eximioides* (Dover & Rao, 1922)
(Figs 59 & 60)

Stenogaster eximioides Dover & Rao, 1922: 242. Lectotype ♂, "Nadgani, Nilgiri Hills. 2,500 ft." (NZC).

Material examined: INDIA: Goa: Sanguem, Netravali Wildlife Sanctuary, 1♂, 18.v.2018, coll. P. Girish Kumar & Party, ZSIK Regd. No. ZSI/WGRC/I.R.-INV.11684; Mollem, 3♀ & 1♂, 25.viii.18, coll. Sandesh M. Gawas.

Distribution. India: Goa (new record), Kerala, Karnataka, Tamil Nadu. (Carpenter & Kojima 1996, Gusenleitner 2006)



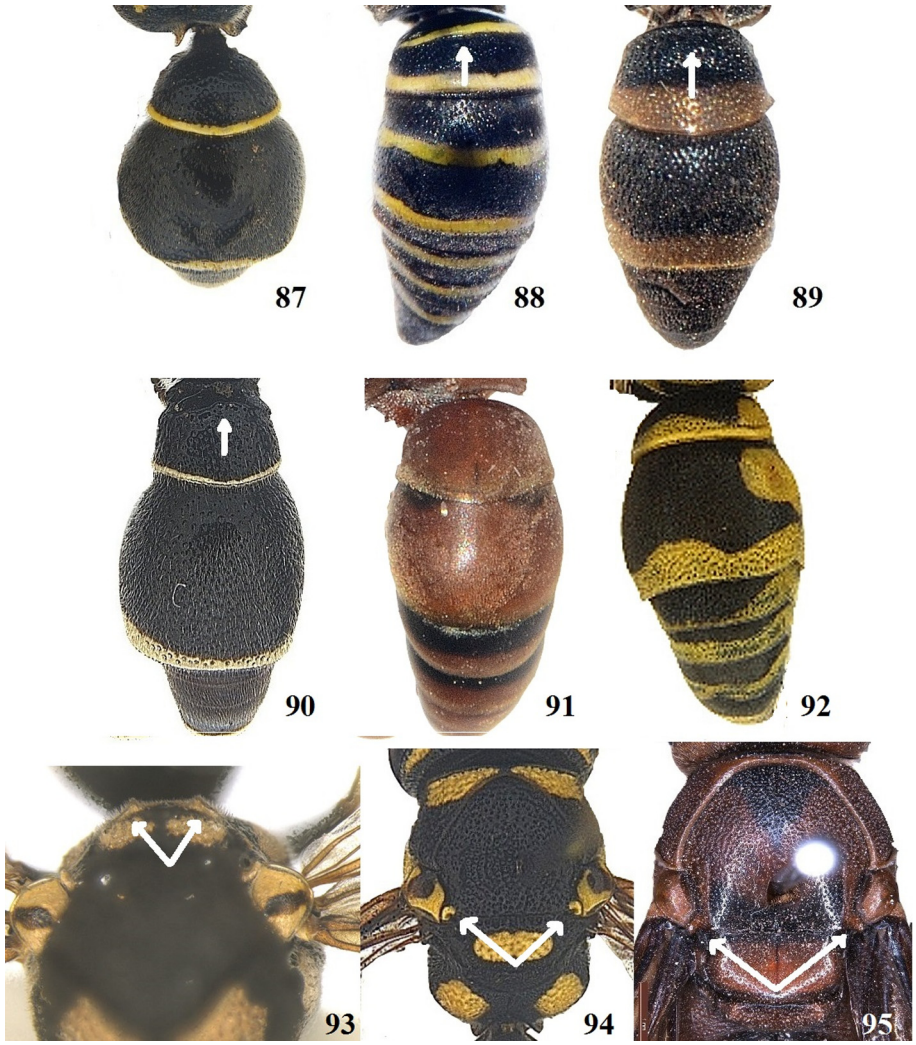
FIGURES 77–86. 77–80 Mesosoma, lateral view. 77, *Labus pusillus*; 78, *Cyrtolabulus interstitialis.* 79, *Eumenes belli*; 80, *Delta pyriforme pyriforme.* 81–82 Metasoma, dorsal view. 81, *Eumenes belli*; 82, *Delta pyriforme pyriforme*. 83–84 Fore wing. 83, *Phimenes flavopictus*; 84, *Oreumenoides edwardsii.* 85–86 Anterior face of pronotum. 85, *Paraleptomenes humbertianus;* 86, *Lissodynerus septemfasciatus septemfasciatus.*

31) *Vespa tropica haematodes* Bequaert, 1936
(Figs 61 & 62)

Vespa tropica var. *haematodes* Bequaert, 1936: 336, 338. Holotype ♀, India: "Kooloo" (MCZ).

Material examined: INDIA: Goa: Sattari, Honda, 12.i.2017, 2♀, coll. Sandesh M. Gawas.

Distribution. India: Bihar, Chhattisgarh, Goa (new record), Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Odisha, Puducherry, Sikkim, Tamil Nadu, Tripura, Uttarakhand, West Bengal. Global: Bhutan; China; Myanmar; Nepal; Pakistan; Sri Lanka; Vietnam. (Girish Kumar & Sharma 2015).



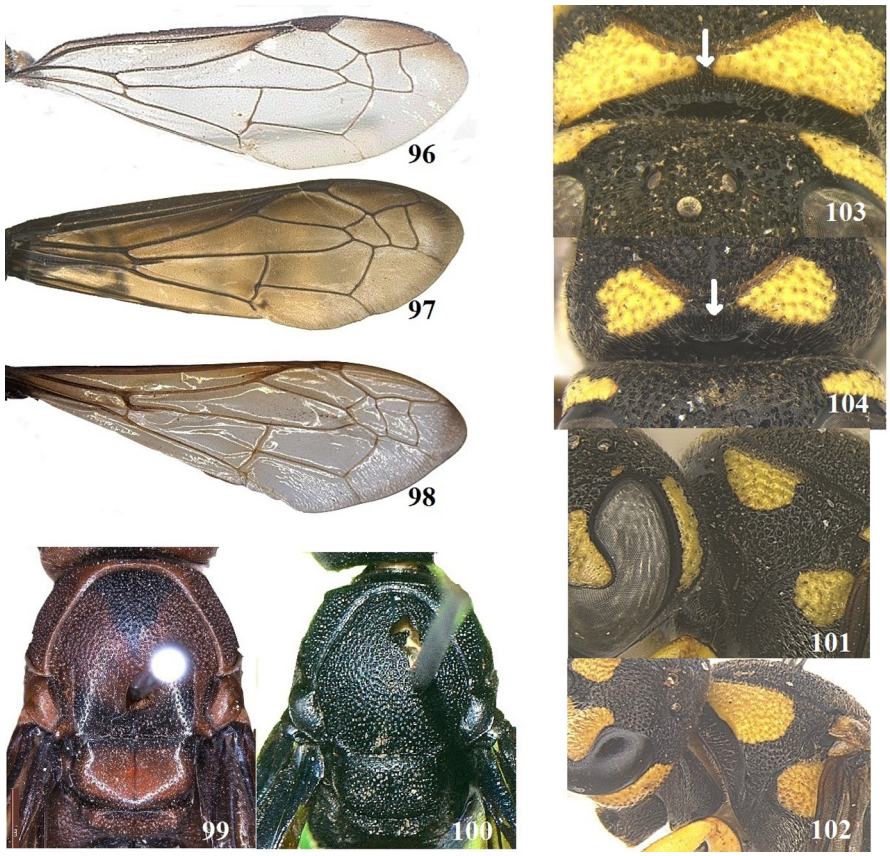
FIGURES 87–95. 87–92 Metasoma, dorsal view. 87, *Paraleptomenes humbertianus*; 88, *Lissodynerus septemfasciatus septemfasciatus*; 89, *Parancistrocerus vicinus*; 90, *Subancistrocerus sichelii*; 91, *Antodynerus flavescens flavescens*; 92, *Antepipona sibilans*. 93–95 Mesosoma, dorsal view. 93, *Antepipona ceylonica*; 94, *Apodynerus troglodytes troglodytes*; 95, *Rhynchium brunneum*.

Identification keys

Key to the subfamilies of Vespidae occurring in Goa, India
(modified from Carpenter & Nguyen 2003)

1. Pronotal lobe separated from tegula by a distance several times its length (Fig. 63); clypeus projecting ventrally in a point or rounded (Fig. 65); fore wing not longitudinally folded at rest . . . . . Stenogastrinae
- Pronotal lobe separated from tegula by a distance equal to its length or less (Fig. 64); clypeus variable, pointed, truncate or

rounded in males of some species (Fig. 66); fore wing longitudinally folded at rest 2
2. Mesoscutum with parategula (Fig. 67); tarsal claws bifid (Fig. 69); solitary or subsocial . . . . . Eumeninae
- Mesoscutum without parategula (Fig. 68); tarsal claws simple (Fig. 70); eusocial 3
3. Hind wing with jugal lobe (Fig. 71); metacoxa with even dorsal surface; metasoma petiolate to subsessile or funnel shaped in dorsal view (Fig. 73); tergum 1 with gradual declivity (Fig. 75) . . . . . Polistinae
- Hind wing without jugal lobe (Fig. 72); metacoxa with carina on dorsal surface; metasoma sessile (Fig. 74); tergum 1 with abrupt declivity (Fig. 76) . . . . . Vespinae



FIGURES 96–104. 96–98 Fore wing. 96, *Stenodyneriellus praeclusus*; 97, *Allorhynchium argentatum*; 98, *Rhynchium brunneum*. 99–100 Mesosoma, dorsal view. 99, *Rhynchium brunneum*; 100, *Anterhynchium* (*Anterhynchium*) *abdominale abdominale.* 101–102 Pronotum, lateral view. 101, *Antepipona ceylonica*; 102, *Antepipona ovalis*. 103–104 Anterior face of pronotum. 103, *Antepipona sibilans*; 104, *Antepipona pruthii.*

Key to the genera of the subfamily Eumeninae occurring in Goa, India

(extracted from Pannure *et al.* 2016)

1. First metasomal segment petiolate (Figs 15, 17, 19) 2
- First metasomal segment not petiolate (Figs 1, 3, 5, 7, 9) 7
2. Mesosoma dorso-ventrally flattened, longer than high (Figs 16, 24) 3
- Mesosoma globular, as wide as high (Figs 18, 20, 22, 28, 34, 36) 4
3. Metanotum unidentate (Fig. 77); first metasomal segment swollen in apical half (Fig. 23) . . . . . *Labus* de Saussure
- Metanotum not unidentate (Fig. 78); first metasomal segment not swollen in apical half (Figs 15, 16) . . . . . *Cyrtolabulus* van der Vecht
4. Pronotum without pretegular carina (Fig. 79); Tergum 2 with apical lamella (Fig. 81) . . . . . *Eumenes* Latreille
- Pronotum with pretegular carina (Fig. 80); Tergum 2 without apical lamella (Fig. 82) 5
5. First metasomal segment equal to the mesosoma in length (Figs 18, 20) . . . . . *Delta* de Saussure
- First metasomal segment much longer than (1.25x or more) mesosoma (Figs 28, 34) 6
6. Fore wing with prestigma longer than pterostigma (Fig. 83); apical antennal article of male long and hooked . . . . . *Phimenes* Giordani Soika
- Fore wing with prestigma shorter or equal to pterostigma (Fig. 84); apical antennal article of male short, not hooked . . . . . *Oreumenoides* (de Saussure)
7. Anterior face of pronotum with paired foveae (Fig. 85) 8

- Anterior face of pronotum without paired foveae (Fig. 86) 10
8. Tergum 1 without transverse carina (Fig. 87) . . . . . *Paraleptomenes* Giordani Soika
- Tergum 1 with transverse carina (Figs 89, 90) 9
9. Tergum 1 with one transverse carina (Fig. 89). . . . . *Parancistrocerus* Bequaert
- Tergum 1 with two transverse carina (Fig. 90) . . . . . *Subancistrocerus* de Saussure
10. Tergum 1 with transverse carina (Fig. 88). . . . . *Lissodynerus* Giordani Soika
- Tergum 1 without transverse carina (Fig. 91) 11
11. Tergum 1 with transparent or translucent apical border (Fig. 91). . . . . *Antodynerus* de Saussure
- Tergum 1 without transparent or translucent apical border (Fig. 92) 12
12. Metanotum bidentate (Fig. 93) . . . . . *Antepipona* de Saussure
- Metanotum not bidentate. 13
13. Tegula exceeds parategula posteriorly (Fig. 94) 14
- Tegula never exceeds parategula (Fig. 95) 15
14. Tergum 1 subsessile, in dorsal view narrower than tergum 2 (Fig. 13) . . . . . *Apodynerus* Giordani Soika
- Tergum 1 sessile, in dorsal view about as wide as 2 (Fig. 43) . . . . . *Xenorhynchium* van der Vecht
15. Fore wing with prestigma half or less than the length of the pterostigma (Fig. 96) . . . . . *Stenodyneriellus* Giordani Soika
- Fore wing with prestigma more than half the length of the pterostigma (Fig. 97) 16
16. Third submarginal cell separated from the apex of marginal cell by distance shorter than its minimum width (Fig. 97) . . . . . *Allorhynchium* van der Vecht
- Third submarginal cell separated from the apex of marginal cell by distance longer than its minimum width (Figs 98). 17
17. Mesoscutum posteriorly and scutellum anteriorly smooth and impunctate (Fig. 99). . . . . *Rhynchium* Spinola
- Mesoscutum and scutellum punctuate (Fig. 100) . . . . . *Anterhynchium* de Saussure

Key to the species of the genus *Antepipona* occurring in Goa, India
(extracted from Girish Kumar *et al*. 2016b)

1. Pronotal carina developed on lateral sides, not reaching dorsal side, bent inwards before reaching dorsal side, dorsal side completely rounded, with additional carina (Fig. 101) . . . . . *ceylonica* (de Saussure)
- Pronotal carina not as above (Fig. 102). 2
2. Anterior face of pronotum with horizontal series of large or medium sized punctures on middle third, close to each other and separated by subtle carinae (Fig. 103). . . . . *sibilans* Cameron
- Anterior face of pronotum not as above (Fig. 104). 3
3. Propodeum with a pair of horizontal carinae (Fig. 105) . . . . . *pruthii* Giordani Soika
- Propodeum without horizontal carinae (Fig. 106) . . . . . *ovalis* (de Saussure)

Key to the species of the genus *Delta* occurring in Goa, India
(extracted from Srinivasan & Girish Kumar 2010)

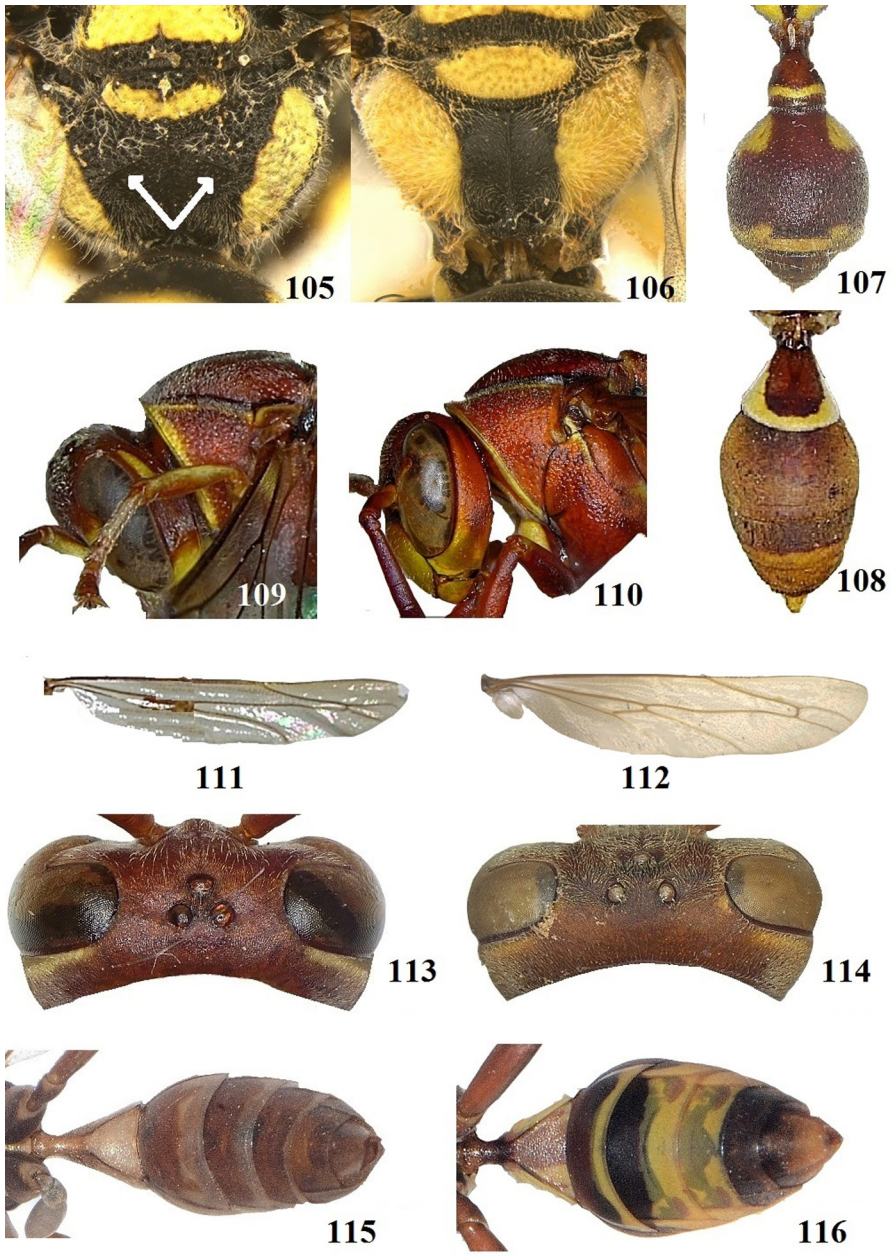
1. Posterior region of tergum 2 and remaining tergites yellow (Fig. 19) . . . . . *pyriforme pyriforme* (Fabricius)
- Posterior region of tergum 2 and remaining tergites red (Fig. 17) . . . . . *conoideum* (Gmelin)

Key to the species of the genus *Phimenes* occurring in Goa, India
(Extracted from Nguyen *et al.* 2016)

1. Body with coarse punctures and long hairs; male clypeus with deep emargination; body black with extensive yellow marks (Figs 33, 34) . . . . . *flavopictus* (Blanchard)
- Body with less coarse punctures and short hairs; male clypeus with shallow emargination; body almost entirely black (Fig. 35, 36) . . . . . *indosinensis* (van der Vecht)

Key to the genera of the subfamily Polistinae occurring in Goa, India
(modified from Carpenter & Nguyen 2003**)**

1. First metasomal segment petiolate at the base and strongly swollen apically (Fig. 107); pretegular carina absent (Fig. 109). . . . . *Ropalidia* Guérin-Méneville
- First metasomal segment subsessile, funnel shaped in dorsal view (Fig. 108); pretegular carina present (Figs 110). . . . . *Polistes* Latreille

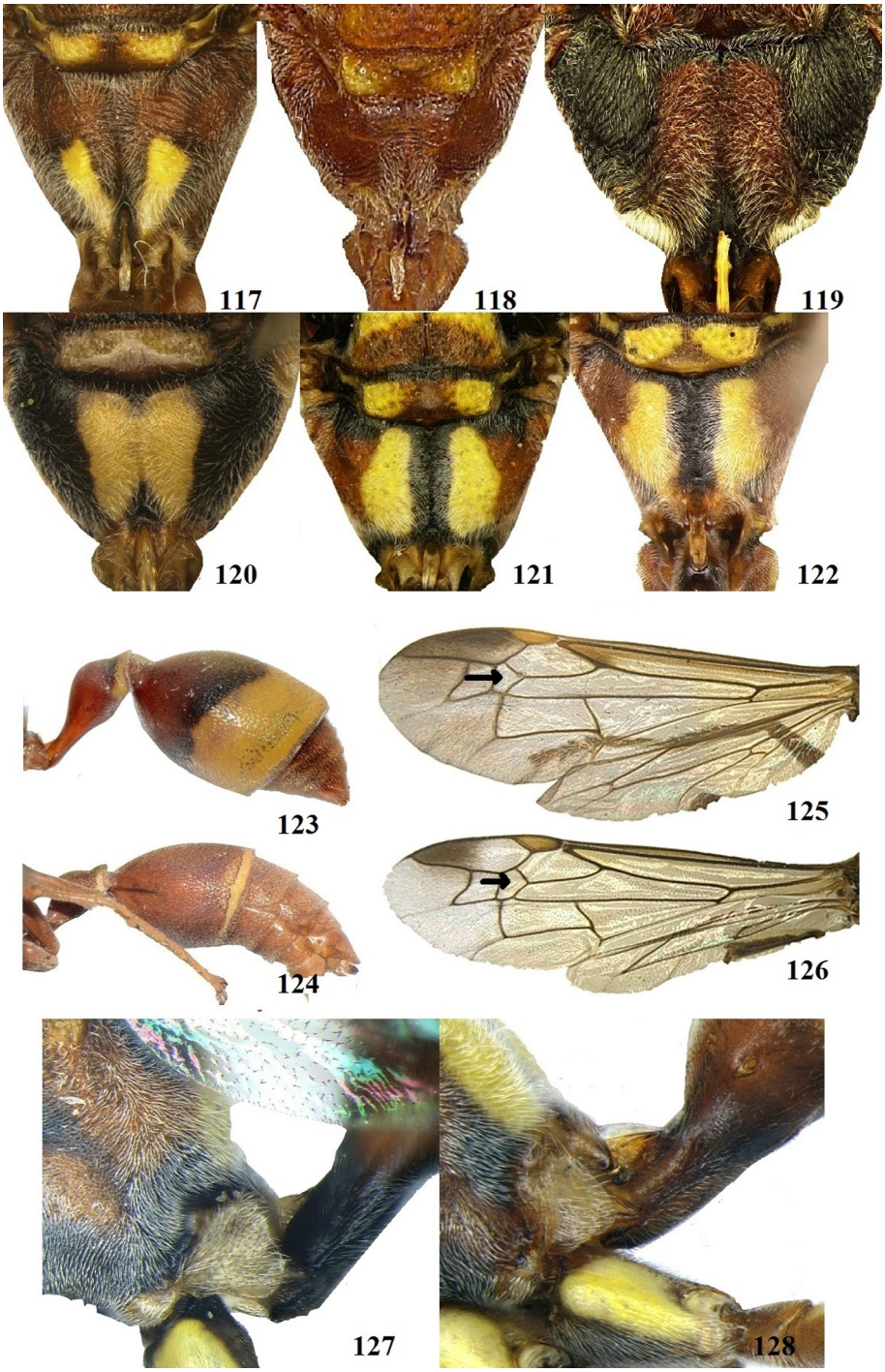


FIGURES 105–116. 105–106 Propodeum. 105, *Antepipona pruthii*; 106, *Antepipona ovalis*. 107–108 Metasoma, dorsal view. 107, *Ropalidia cyathiformis*; 108, *Polistes* (*Polistella*) *stigma tumulus*. 109–110 Mesosoma, lateral view. 109, *Ropalidia cyathiformis*; 110, *Polistes* (*Polistella*) *stigma tumulus*. 111–112 Hind wing. 111, *Polistes (Polistella) nigritarsis*; 112, *Polistes* (*Polistella*) *stigma tumulus*. 113–114 Head, dorsal view. 113, *Polistes (Polistella) nigritarsis*; 114, *Polistes* (*Polistella*) *stigma tumulus*. 115–116 Metasoma, ventral view. 115, *Polistes (Polistella) nigritarsis*; 116, *Polistes* (*Polistella*) *stigma tumulus*.

Key to the species of genus *Polistes* occurring in Goa, India

(modified from Das & Gupta 1989)

1. Jugal lobe on hind wing reduced (Fig. 111); interocellar distance equal or less than diameter of the posterior ocellus (Fig. 113); first metasomal sternite without margin at base (Fig. 115) . . . . . *nigritarsis* Cameron
- Jugal lobe on hind wing large (Fig. 112); interocellar distance more than diameter of the posterior ocellus (Fig. 114); first metasomal sternite with well developed margin at base (Fig. 116) . . . . . *stigma tamulus* (Fabricius)



FIGURES 117–128. 117–122 Propodeum. 117, *Ropalidia brevita*; 118, *Ropalidia marginata*; 119, *Ropalidia tamila*; 120, *Ropalidia stigma*; 121, *Ropalidia jacobsoni*; 122, *Ropalidia cyathiformis*. 123–124 Metasoma, lateral view. 123, *Ropalidia brevita*; 124, *Ropalidia marginata*. 125–126 Fore wing. 125, *Ropalidia stigma*; 126, *Ropalidia cyathiformis.* 127–128 Propodeal valvula. 127, *Ropalidia jacobsoni*; 128, *Ropalidia cyathiformis*.

Key to the species of genus *Ropalidia* occurring in Goa, India

(modified from Kojima *et al*. 2007)

1. Propodeum with paired basal carinae, propodeal orifice narrow dorsally (Figs 117, 118, 119). 2
- Propodeum without paired basal carinae, propodeal orifice round dorsally (Figs 120, 121, 122) 4
2. Propodeum with strong punctures between basal carinae; striations lateral to carinae strong (Fig. 119) . . . *tamila* Gusenleitner
- Propodeum with weak transverse striations and scattered shallow punctures between basal carinae; striations lateral to carinae

weak (Figs 117, 118) 3
3. Broad yellow apical band on second tergum, band width in the middle more than one-fourth the length of second tergum (Fig. 123) . . . . . *brevita* Das and Gupta
- Narrow yellow apical band on second tergum, band width in the middle less than one-fifth the length of second tergum (Fig. 124) . . . . . *marginata* (Lepeletier)
4. Basal angle of second submarginal cell less than 90° (Fig. 125) . . . . . *stigma* (Smith)
- Basal angle of second submarginal cell more than 90° (Fig. 126) 5
5. Large propodeal valvula with semicircular or rounded-triangle border covering the majority of the part of propodeal teeth in lateral view (Fig. 127) . . . . . *jacobsoni* (du Buysson)
- Small propodeal valvula barely covering the propodeal teeth (Fig. 128) . . . . . *cyathiformis* (Fabricius)

Discussion

The study resulted in the addition of significant knowledge to the vespid fauna of Goa, India. The vespid fauna of Goa is now represented by 33 (Table 1) species belonging to 22 genera, and four subfamilies. Twenty-six species, 18 genera, and two subfamilies (Stenogastrinae and Vespinae) are newly recorded from the state of Goa (Table 1). The subfamily Eumeninae has the highest diversity with 23 species belonging to 18 genera, followed by subfamily Polistinae with eight species belonging to two genera, whereas subfamilies Stenogastrinae and Vespinae are represented by a single species each. The genus *Ropalidia* Guérin-Méneville has the maximum number of species: six, followed by the genus *Antepipona* de Saussure with four species. Most of the vespid species reported from Goa are common and widely distributed within India, however there are some species which are not common and have rarely been collected. The species *Antepipona pruthii* was previously recorded from the Himalayan states of Himachal Pradesh, Jammu & Kashmir, Uttarakhand, and West Bengal. This is first report from Western Ghats (Goa). *Cyrtolabulus interstitialis* was first collected and described in 1902 from Maharashtra, this is the second time it has been collected and recorded from India and extends its distribution to Goa. It was collected from Surla Plateau in Goa at an altitude of 800 meters above Mean Sea Level. *Lissodynerus septemfasciatus septemfasciatus* has previously been documented from Karnataka; this is the second record from India. *Phimenes indosinensis* is another rare species which was reported earlier from the Himalayan state of Meghalaya, this is the second record from India where it was collected in coastal mangrove vegetation of Goa. *Stenodyneriellus praeclusus* also has been recorded a second time from India, earlier distribution being Rajasthan. The other uncommon species recorded are as follows: *Eumenes belli*, *Parancistrocerus vicinus*, *Ropalidia tamila,* and *Eustenogaster eximia eximioides.*

The vespid fauna of Goa is compared with the neighbouring states and states which are part of Western Ghats: Karnataka (60 species), Maharashtra (44 species), Kerala (75 species), Tamil Nadu (61 species) (Carpenter & Nguyen (2003), Das & Gupta (1989), Girish Kumar (2010, 2013a, 2013b, 2013c), Girish Kumar *et al*. (2013a, 2013b, 2014, 2015a, 2015b, 2016a, 2016b, 2016c, 2017a, 2017b, 2017c), Girish Kumar & Carpenter (2013), Girish Kumar & Sharma (2013), Kojima *et al.* (2007), Nguyen *et al.* (2016), Pannure *et al.* (2016), Srinivasan & Kumar (2010) and Tan *et al.* (2018)). This shows that despite being very small geographical region, Goa harbours rich diversity of vespid wasps and there is need for further comprehensive study in order to increase our knowledge of the insect fauna of Goa.

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TABLE 1. Checklist of Vespidae of Goa, India

Sl. No. Species
Subfamily: Eumeninae
1) *Allorhynchium argentatum* (Fabricius, 1804)*
2) *Antepipona ceylonica* (de Saussure, 1867)
3) *Antepipona ovalis* (de Saussure, 1853)*
4) *Antepipona pruthii* Giordani Soika, 1882*
5) *Antepipona sibilans* (Cameron, 1903) *
6) *Anterhynchium* (*Anterhynchium*) *abdominale abdominale* (Illiger, 1802)*
7) *Antodynerus flavescens flavescens* (Fabricius, 1775)
8) *Apodynerus troglodytes troglodytes* (de Saussure, 1856)*
9) *Cyrtolabulus interstitialis* (Cameron, 1902)*
10) *Delta conoideum* (Gmelin, 1790)*
11) *Delta pyriforme pyriforme* (Fabricius, 1775)*
12) *Eumenes belli* Giordani Soika, 1973*
13) *Labus pusillus* van der Vecht, 1963*
14) *Lissodynerus septemfasciatus septemfasciatus* (Smith, 1858)*
15) *Oreumenoides edwardsii* (de Saussure, 1852) *
16) *Paraleptomenes humbertianus* (de Saussure, 1867)*
17) *Parancistrocerus vicinus* Giordani Soika, 1994*
18) *Phimenes flavopictus* (Blanchard, 1849)*
19) *Phimenes indosinensis* (van der Vecht, 1959)*
20) *Rhynchium brunneum* (Fabricius, 1793)*
21) *Stenodyneriellus praeclusus* (Nurse, 1903)*
22) *Subancistrocerus sichelii* (de Saussure, 1856)*
23) *Xenorhynchium nitidulum* (Fabricius, 1798)*
Subfamily: Polistinae
24) *Polistes (Polistella) nigritarsis* Cameron, 1900*
25) *Polistes* (*Polistella*) *stigma tumulus* (Fabricius, 1798)
26) *Ropalidia brevita* Das and Gupta, 1989
27) *Ropalidia cyathiformis* (Fabricius, 1804)
28) *Ropalidia jacobsoni* (du Buysson, 1908)
29) *Ropalidia marginata* (Lepeletier, 1836)*
30) *Ropalidia stigma* (Smith, 1858)
31) *Ropalidia tamila* Gusenleitner, 2004*
Subfamily: Stenogastrinae
32) *Eustenogaster eximia eximioides* (Dover & Rao, 1922)*
Subfamily: Vespinae
33) *Vespa tropica haematodes* Bequaert, 1936*
* New distribution record from Goa, India

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