



New records of potter wasps (Hymenoptera: Vespidae: Eumeninae) from Arunachal Pradesh, India: five genera and ten species

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Abstract: Six genera and eleven wasp species belonging to the subfamily Eumeninae of the family Vespidae are reported from the state of Arunachal Pradesh, of which five genera and 10 species are new records for the state.

Keywords: Arunachal Pradesh, *Delta*, *Eumenes*, Eumeninae, Hymenoptera, *Pareumenes*, *Phimenes*, *Rhynchium*, *Tropidodynerus*, Vespidae.

Potter wasps (or mason wasps) belong to the subfamily Eumeninae of the family Vespidae. It is a widely distributed subfamily which includes about 3,000 species in more than 150 genera (Brothers & Finnamore 1993). The adults are small to large (7-28 mm) and compact to elongate with a sessile to strongly petiolate metasoma. They are easily recognized by the following combination of characters: mesoscutum with a posterolateral projection known as parategula (Fig. 1); tarsal claws bifid; hind coxa with a longitudinal dorsal carina or folding (Fig. 2), often

developed into a lobe or tooth and forewing with three submarginal cells. All the known eumenine species are predators; most of them solitary mass provisioners, though some isolated species show primitive states of social behaviour and progressive provisioning. Adult feeds on nectar.

The knowledge of Indian potter wasps is scanty and fragmentary. The important work available on Indian potter wasps is by Bingham (1897). Van der Vecht (1937, 1959, 1961, 1963, 1981) made some important contribution. Recently, Gusenleitner (1996, 1998, 2001, 2006, 2008) also contributed to Eumeninae of India. Note worthy contributions to the taxonomy of potter wasps of India are by Chhotani & Ray (1975), Ray & Kundu (1985), Gupta (1997, 2003, 2007), Ray (2000, 2003), Lambert & Narendran (2002), Lambert (2004) and Lambert et al. (2007, 2008). In this paper, we present information on six genera and eleven species of potter wasps from Arunachal Pradesh, India, of which five genera and 10 species are new records for the state.

Materials and Methods

Samples were collected by sweep net, killed by ethyl acetate and preserved as dry specimens. The specimens were studied under Wild Heerbrugg Stereozoom microscope. All the studied specimens are deposited at Arunachal Pradesh Regional Centre of the Zoological Survey of India, Itanagar (APRC/ZSI).

Results

Systematic account

Family: Vespidae

Subfamily: Eumeninae

Genus *Delta* de Saussure

Delta pyriforme pyriforme (Fabricius, 1775)

Delta esuriens (Fabricius, 1787)

Delta companiforme gracillior (Giordani Soika, 1986)

Abbreviations: APRC/ZSI - Arunachal Pradesh Regional Centre of the Zoological Survey of India; BMNH - British Museum Natural History, London, United Kingdom; F - Female; M - Male; MNHN - Museum National de Histoire Naturelle, Paris, France; ZMB - Zoologisches Museum der Humboldt Universität, Berlin, Germany.

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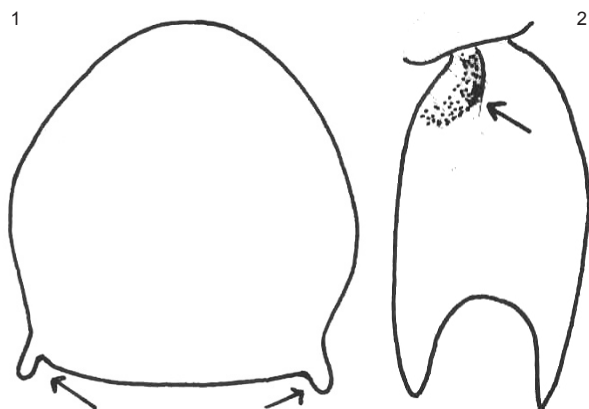
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Figures 1 & 2. *Delta dimidiatipenne* (de Saussure, 1852); female.

1 - mesoscutum with parategula; 2 - hind coxa with a longitudinal dorsal folding.



Image 1. *Delta pyriforme pyriforme* (Fabricius, 1775) female.

Delta dimidiatipenne (de Saussure, 1852)
Delta conoideum (Gmelin, 1790)
 Genus *Phimenes* Giordani Soika
Phimenes flavopictum continentale (Zimmermann, 1931)
 Genus *Eumenes* Latrielle
Eumenes architectus Smith, 1858
Eumenes punctatus de Saussure, 1852
 Genus *Pareumenes* de Saussure
Pareumenes quadrispinosus (de Saussure, 1855)
 Genus *Rhynchium* Spinola
Rhynchium brunneum (Fabricius, 1793)
 Genus *Tropidodynerus* Bluthgen
Tropidodynerus fraternus (Bingham, 1897)

***Delta pyriforme pyriforme* (Fabricius, 1775)**
 (Image 1)

1775. *Vespa petiolate* Fabricius, *Ent. Syst.*, ii, 278. Syntype, Sex not mentioned, Type locality Malabar, India (BMNH).

1897. *Eumenes petiolate* (Fabricius): Bingham, *Fauna Brit. India, Hym.*, 1: 341, 342.

1991. *Delta pyriforme pyriforme* (Fabricius): Krombein, *Smithsonian Contrib. Zool.*, 515: 8.

2006. *Delta pyriforme pyriforme* (Fabricius): Gusenleitner, *Linzer Biol. Beitr.*, 38(1): 694.

Diagnosis: Female: Head yellow, a broad black band between the eyes on the vertex; occiput black; antenna reddish-brown; pronotum entirely and mesoscutum anteriorly yellow, the later posteriorly black; scutellum and postscutellum reddish-brown; propleuron black; mesopleuron, metapleuron and legs reddish-brown variegated with black; propodeum reddish-brown with a narrow medial vertical black line; the sutures between the scutellum, postscutellum and propodeum black; petiole and basal third of the second gastral segment reddish-brown, the former black at base and with a subapical

black band, the middle of the later black, its posterior third and the remaining abdominal segments yellow. Wings deep flavohyaline. Frons and vertex of the head and thorax with close shallow punctures, petiole smooth, the rest of the abdomen with the surface finely longitudinally aciculate; clypeus pyriforme, its apex truncate; petiole broadening towards the apex and slightly flattened.

Male: Structure similar to female in general appearance but slighter, the fifth and sixth gastral segments at base and the whole of the seventh segment black.

Size: Female: 25-27 mm; male: 20-25 mm. Forewing length: female: 19.5mm; male: 17.5mm.

Material examined: India: Arunachal Pradesh, Papumpare District, Itanagar, ZSI Office, 27°5'–35°72'N & 93°37'–30°72'E, coll. G. Srinivasan: 1 F, 5.xii.2004, IV/2139/APRC/ZSI; 1 M, 2 F, 21.vi.2005, IV/2142/APRC/ZSI & IV/2143/APRC/ZSI; 1 M, 22.vi.2005, IV/2144/APRC/ZSI; 4 M & 1 F, 5.x.2005, IV/2145/APRC/ZSI to IV/2149/APRC/ZSI; 1 F, 28.vi.2006, IV/2150/APRC/ZSI; 1 M, 30.viii.2006, IV/2154/APRC/ZSI; 1 F, 20.ix.2006, IV/2158/APRC/ZSI; ZSI Colony, coll. G. Srinivasan: 1 F, 6.iii.2005, IV/2140/APRC/ZSI; 1 F, 16.viii.2006, IV/2151/APRC/ZSI; 1 M, 24.viii.2006, IV/2152/APRC/ZSI; 1 F, 25.viii.2006, IV/2298/APRC/ZSI; 1 F, 27.viii.2006, IV/2153/APRC/ZSI; 1 F & 1 M, 4.ix.2006, IV/2155/APRC/ZSI & IV/2156/APRC/ZSI; 1 F, 5.ix.2006, IV/2157/APRC/ZSI; Police Colony, coll. G. Srinivasan: 5 M & 3 F, 24.x.2007, IV/2159/APRC/ZSI to IV/2166/APRC/ZSI; 6 M & 2 F, 30.x.2007, IV/2167/APRC/ZSI to IV/2174/APRC/ZSI; 1 M & 3 F, 30.x.2008, IV/2175/APRC/ZSI to IV/2178/APRC/ZSI.

Distribution: India (Arunachal Pradesh, Gujarat, Karnataka, Kerala, Orissa, Rajasthan, Sikkim, Tamil Nadu, West Bengal), Bhutan, Cambodia, China, Hawaii, Hong Kong, Indonesia, Malaysia, Moluccas, Myanmar, Nepal, New Guinea, Sri Lanka, Taiwan, Thailand, Vietnam.

Remarks: New record for Arunachal Pradesh.

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

(Image 2)

1787. *Vespa esuriens* Fabricius, *Mant. Ins.*, 1: 293. Syntype, Sex not mentioned, Locality India (BMNH).

1804. *Eumenes esuriens* Fabricius, *Syst. Piez.*, 286.

1897. *Eumenes esuriens* (Fabricius): Bingham, *Fauna Brit. India, Hym.*, 1: 342, 343.

1991. *Delta companiforme esuriens* (Fabricius): Krombein, *Smithsonian Contrib. Zool.*, 515: 6.

1992. *Delta esuriens* (Fabricius, 1787): Giordani Soika, *Lavori- Soc. Ven. Sc. Nat.*, 17:62.

Diagnosis: Female: Head yellow to brownish-yellow with following black markings: a broad band on vertex including upper half of frons extending behind vertex to outer side of temple and to occiput, a black mark on anterior tentorial pit extending to subantennal suture to dorsal side of antennal scrobe and touches to the black band on frons and vertex (this black markings highly variable and absent in some specimens); antennae light reddish (in some specimens a black mark present on scape dorsally and apical antennal segments more dark); pronotum and postscutellum yellow; propleuron and pronotal collar basally black or blackish-brown; mesopleuron yellow to brownish-yellow except mesepimeron brown to blackish-brown and mesosternum black; mesoscutum black except a large brown area posteriorly; scutellum, propodeum and legs light reddish (in some specimens fore coxa, all trochanters and mid and hind tarsal segments except basitarsus black); petiole light reddish except at base black, at apex a black band and then a yellow band; second gastral segment basally light reddish then a black band and remaining apical half yellow; all remaining gastral segments yellow, with their bases (when drawn out) black. Wings flavohyaline with a narrow subapical dark infumation on forewing. Clypeus smooth, strongly convex, flattened in middle, its anterior

margin transversely truncate at apex; frons, vertex and thorax with close fine but shallow punctures; gaster smooth, slightly shining.

Male: Structure similar to female in general appearance but slender.

Size: Female: 14-20 mm; male: 14-17 mm. Forewing length: female: 12.5mm; male: 11.5mm.

Material examined: India: Arunachal Pradesh, Papumpare District, Itanagar, ZSI Colony, 27°5'–35°72'N & 93°37'–30°72'E, coll. G. Srinivasan: 1 F, 2.iii.2006, IV/2179/APRC/ZSI; 1 F, 5.iii.2006, IV/2180/APRC/ZSI; 1 F, 5.iv.2006, IV/2181/APRC/ZSI; 1 M, 6.iv.2006, IV/2182/APRC/ZSI; 1 F, 10.vi.2006, IV/2183/APRC/ZSI; 1 M, 12.iv.2006, IV/2184/APRC/ZSI; 3 F, 27.x.2008, IV/2191/APRC/ZSI & IV/2193/APRC/ZSI; Indira Gandhi Park, coll. G. Srinivasan: 2 F, 5.iii.2008, IV/2185/APRC/ZSI & IV/2186/APRC/ZSI; Police Colony, coll. G. Srinivasan: 4 F, 6.iii.2008, IV/2187/APRC/ZSI & IV/2190/APRC/ZSI.

Distribution: India (Arunachal Pradesh, Delhi, Gujarat, Maharashtra, Orissa, Rajasthan, Tamil Nadu, Uttarakhand, West Bengal), Arabia, Indonesia (Borneo, Java), Iran, Iraq, Myanmar, Pakistan, Philippines, Sri Lanka, Thailand.

Remarks: Distributed throughout India. New record for Arunachal Pradesh.

***Delta companiforme gracilior* (Giordani Soika, 1986)**

(Image 3)

1852. *Eumenes gracilis* de Saussure, *Et. Fam. Vesp.*, i, 57. Female, Male, Syntypes, Type Locality Egypt and Senegal (MNHN).

1897. *Eumenes gracilis* de Saussure: Bingham, *Fauna Brit. India, Hym.*, 1: 343.

2006. *Delta companiforme gracilior* (Giordani Soika): Gusenleitner, *Linzer Biol. Beitr.*, 38(1): 694.

Diagnosis: Female: Black. The following yellow parts:

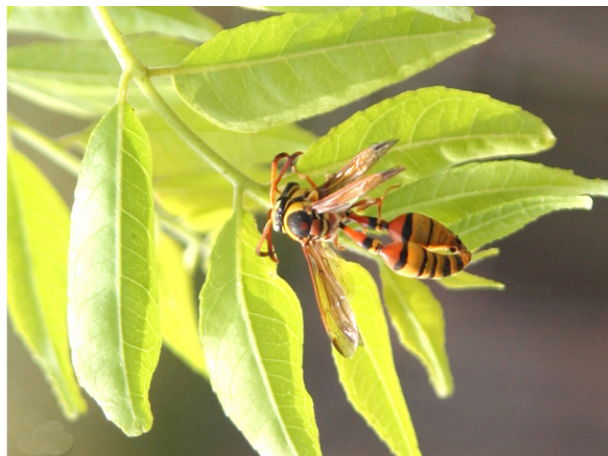


Image 2. *Delta esuriens* (Fabricius, 1787) male and female in mating.



Image 3. *Delta companiforme gracilior* (Giordani Soika, 1986) male.

Clypeus and frons up to the sinus of eyes, a line on the inner side of temple, pronotum, a large spot on mesopleuron, postscutellum except basal part, sides of propodeum, a narrow subapical band on petiole, posterior half of the second and following abdominal segments. The following reddish portions: antenna (sometimes a black mark on scape and blackish apical antennal segments), scutellum (sometimes yellow), legs, remaining parts of petiole and basal part of second abdominal segment. A small band on the petiole near to yellow apical band, on the middle of the second gastral segment, bases of the remaining gastral segments (usually not visible externally) black. In some specimens fore coxa, all trochanters, mid and hind tarsal segments except basitarsus, black. Closely resembles to *Delta companiforme esuriens* (Fabricius) but with comparatively a broader clypeus, a longer petiole and darker wings.

Male: Structure similar to female in general appearance but slender.

Size: Female: 18-20 mm; male: 16-18 mm. Forewing length: female: 12mm; male: 11mm.

Material examined: India: Arunachal Pradesh, Papumpare District, Itanagar, ZSI Colony, 27°5'–35°72'N & 93°37'–30°72'E, coll. G. Srinivasan: 1 F, 20.iii.2006, IV/2194/APRC/ZSI; 1 F, 25.iii.2006, IV/2195/APRC/ZSI; 1 M, 10.viii.2006, IV/2197/APRC/ZSI; 1 M, 15.viii.2006, IV/2198/APRC/ZSI; ZSI Office, coll. G. Srinivasan: 1 M, 8.viii.2006, IV/2196/APRC/ZSI.

Distribution: India (Arunachal Pradesh, Sikkim, West Bengal), Australia, Egypt, Indonesia (Sulawesi), Malaysia, Myanmar, Philippines, Senegal, Sumatra, Thailand.

Remarks: New record for Arunachal Pradesh.

Delta dimidiatipenne (de Saussure, 1852)

(Image 4)

1852. *Eumenes dimidiatipennis* de Saussure, *Et. Fam. Vesp., Mon. Guep. Sol.* : 51. Female, Male, Syntypes, Type locality Arabia (Djidda), The East Indies (India),



Image 4. *Delta dimidiatipenne* (de Saussure, 1852) female.

Egypt (MNHN).

1897. *Eumenes dimidiatipennis* de Saussure: Bingham, *Fauna Brit. India, Hym.*, 1: 342.

1918. *Delta dimidiatipenne* (de Saussure): Bequaert, *Bull. Amer. Mus. Nat. Hist.*, 39: 59-62.

Diagnosis: Female: Body obscure dull red with following black markings: vertex, extending to occiput usually at the apex of antennae, propleuron, mesopleuron except two red patches, metapleuron except a red patch on upper metapleuron, mesoscutum, base of petiole, apical half of second tergite and whole of the remaining tergites. Wings ferruginous, with apical half of forewing fuscous having a purple reflection. Clypeus smooth, oval, convex, anterior margin transverse; abdomen smooth and shiny.

Male: Beside from the usual sexual dimorphism of Vespidae structure similar to female in general appearance except the clypeus and the lower half of frons yellow, smaller and slighter.

Size: Female: 24-27 mm; male: 22-25 mm. Forewing length: female: 21.5mm; male: 16.5mm.

Material examined: India: Arunachal Pradesh, Papumpare District, Itanagar, ZSI Office, 27°5'–35°72'N & 93°37'–30°72'E, coll. G. Srinivasan: 2 M, 5.x.2005, IV/2216/APRC/ZSI & IV/2217/APRC/ZSI; 1 F, 3.xi.2005, IV/2218/APRC/ZSI; ZSI Colony, coll. G. Srinivasan: 1 M, 3.iii.2006, IV/2219/APRC/ZSI; 1 M & 1 F, 14.iii.2006, IV/2220/APRC/ZSI & IV/2221/APRC/ZSI; 1 F, 11.xi.2006, IV/2222/APRC/ZSI.

Distribution: India (Arunachal Pradesh, Delhi, Gujarat, Kerala, Maharashtra, Punjab, Uttarakhand, Uttar Pradesh), Afghanistan, Africa, Algeria, Arabia, Central Africa, Central Sahara, Egypt, Ethiopia, Iran, Madagascar, Pakistan, Palestine, Somalia, South Africa, Syria, Yemen.

Remarks: New record for Arunachal Pradesh

Delta conoideum (Gmelin, 1790)

(Image 5)

1787. *Vespa conica* Fabricius, *Mant. Ins.*, 1-293. Female, Syntype. Type loc. China (BMNH).

1897. *Eumenes conica* (Fabricius): Bingham, *Fauna Brit. India, Hym.*, 1: 343, 344.

1991. *Delta emarginatum conoideum* (Gmelin): Krombein, *Smithsonian Contrib. Zool.*, 515: 8.

2006. *Delta conoideum* (Gmelin): Gusenleitner, *Linzer Biol. Beitr.*, 38(1): 694.

Diagnosis: Female: Head yellow except mandibles and antenna reddish, a broad transverse band across the apex between the tops of the eyes black, black mark extends behind the vertex to occiput; thorax dark red with black patches on mesoscutum, metapleuron and median area of propodeum, propleuron entirely black; legs pale reddish; gaster dark red with base of the second tergite and a short transverse medially interrupted band on its



Image 5. *Delta conoideum* (Gmelin, 1790) female.

middle above black; forewing basally flavohyaline and apically fuscohyaline, with a slight purplish refringes. Head above the antenna and thorax closely and lightly punctured; clypeus pyriforme, its apex truncate; gaster smooth and shining with the surface minutely aciculate.

Male: Structure similar to female in general appearance but smaller and slighter.

Size: Female: 23-26 mm; male: 18-22 mm. Forewing length: female: 19mm; male: 16mm.

Material examined: India: Arunachal Pradesh, Papumpare District, Itanagar, ZSI Colony, 27°5'–35°72'N & 93°37'–30°72'E, coll. G. Srinivasan: 1 F, 3.xii.2004, IV/2223/APRC/ZSI; 1 F, 10.iii.2005, IV/2224/APRC/ZSI; 1 M, 2.iii.2006, IV/2230/APRC/ZSI; 1 F, 16.xii.2006, IV/2231/APRC/ZSI; 2 F, 21.iii.2006, IV/2232/APRC/ZSI & IV/2233/APRC/ZSI; 1 F, 1.ix.2006, IV/2235/APRC/ZSI; 1 F, 5.ix.2006, IV/2236/APRC/ZSI; Police Colony, coll. G. Srinivasan: 1 M, 28.iii.2005, IV/2225/APRC/ZSI; 1 F, 28.vi.2005, IV/2226/APRC/ZSI; 1 F, 13.xi.2005, IV/2229/APRC/ZSI; 1 F, 24.vi.2006, IV/2234/APRC/ZSI; 6 F, 24.x.2007, IV/2238/APRC/ZSI to IV/2243/APRC/ZSI. 4 M & 2 F, 27.x.2007, IV/2244/APRC/ZSI to IV/2249/APRC/ZSI; 4 F, 24.x.2008, IV/2257/APRC/ZSI to IV/2260/APRC/ZSI; 1 M & 7 F, 30.x.2008, IV/2261/APRC/ZSI to IV/2268/APRC/ZSI; ZSI Office, coll. G. Srinivasan: 1 F & 1 M, 5.x.2005, IV/2227/APRC/ZSI & IV/2228/APRC/ZSI; 1 F, 5.iii.2007, IV/2237/APRC/ZSI; 1 M, 28.iii.2008, IV/2256/APRC/ZSI; Indira Gandhi Park, coll. G. Srinivasan: 2 M, 3.iii.2008, IV/2250/APRC/ZSI & IV/2251/APRC/ZSI; 3 M, 4.iii.2008, IV/2252/APRC/ZSI to IV/2254/APRC/ZSI; 1 M, 5.iii.2008, IV/2255/APRC/ZSI.

Distribution: India (Arunachal Pradesh, Orissa, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh), Arabia, China, Malaysia, Myanmar, Pakistan, Sri Lanka, Thailand.

Remarks: New record for Arunachal Pradesh

***Phimenes flavopictum continentale*
(Zimmermann, 1931)
(Plate 6)**

1931. *Eumenes arcuata continentalis* Zimmermann, *Ziensch. Morph. Oek. Tiere*, 22: 203, Female, Male, Syntypes, Type Loc. Sikkim (ZMB).

1959. *Eumenes flavopictus continentalis* Zimmermann: van der Vecht, *Zool. Verh. Leiden*, 41: 36.

2006. *Phimenes flavopictum continentale* (Zimmermann): Gusenleitner, *Linzer Boil. Beitr.*, 38(1): 694.

Diagnosis: **Female:** Black. The following yellow markings: Clypeus, interantennal space, inner orbit, ocular sinus, a line behind the eyes, pronotum in front, two curved spots and two parallel longitudinal lines on mesoscutum, a broad outer border to the tegula, a spot on each side of the scutellum, a broad line on the posterior margin of postscutellum, a broad vertical mark on mesopleuron, sides of dorsum of propodeum (with median Maltese cross-shaped black mark), two small lateral spots at the base of the petiole, two about the middle and a subapical band of the same above, two large pyriforme spots near the base of second gastral segment, two minute lateral spots on second gastral sternites, subapical interrupted bands on the posterior margins of second and the following segments. Legs black, variegated with yellow. Wings fuscohyaline. Clypeus smooth, pyriforme, the apex sharply truncated; frons, vertex and thorax with fine shallow punctures, petiole and gaster smooth.

Male: Beside from the usual sexual dimorphism of Vespidae structure similar to female in general appearance but slighter, with last abdominal segment entirely black. Depth of yellow markings varies in different individuals.

Size: Female: 24-26 mm; male: 19-22 mm. Forewing length: female: 17mm; male: 16mm.

Material examined: India: Arunachal Pradesh, Papumpare District, Itanagar, ZSI Office, 27°5'–35°72'N



Image 6. *Phimenes flavopictum continentale* (Zimmermann, 1931) female.

& 93°37'-30°72'E, coll. G. Srinivasan: 1 F, 3.xi.2005, IV/2199/APRC/ZSI; ZSI Colony, coll. G. Srinivasan, 1 M, 18.iii.2006, IV/2210/APRC/ZSI; 2 F, 24.iii.2006, IV/2211/APRC/ZSI & IV/2212/APRC/ZSI; 1 M, 25.viii.2006, IV/2213/APRC/ZSI; 1 M, 28.viii.2006, IV/2214/APRC/ZSI; 1 M, 15.iii.2008, IV/2215/APRC/ZSI; India: Arunachal Pradesh, East Kameng District, Seijosa, Pakke River, 92°35"-93°10" N & 26°55"-27°15"E, coll. G. Srinivasan, 6 M & 2 F, 13.xi.2005, IV/2200/APRC/ZSI to IV/2207/APRC/ZSI; India: Arunachal Pradesh, West Kameng District, Bhalukpong, 91°31"-92°40"E & 26°41"-28°21"N, coll. G. Srinivasan, 2 M, 15.xi.2005, IV/2208/APRC/ZSI to IV/2209/APRC/ZSI;

Distribution: India (Arunachal Pradesh, Karnataka, Kerala, Meghalaya, Sikkim, Uttarakhand, West Bengal), China, Hong Kong, Indonesia (Bangka, Sumatra, Sunda), Malaysia, Myanmar, Singapore, Thailand (Siam).

Remarks: New record for Arunachal Pradesh

Eumenes architectus Smith, 1858

(Image 7)

1858. *Eumenes architectus* Smith, *J. Linn. Soc.*, 3: 20. Female, Male, Syntypes. Type locality Celebes (BMNH).

1897. *Eumenes architectus* Smith: Bingham, *Fauna Brit. India, Hym.*, 1: 339.

Diagnosis: Female: Black with the following yellow marks: a spot between the antenna, an obscure very short line behind the eyes at top, a narrow interrupted line on the pronotum, a mark on the postscutellum, a narrow line on the apical margins of the petiole and the segment of the abdomen. Legs black variegated with yellow. Wings fuscohyaline with coppery reflections. Head, thorax and abdomen finely and densely punctured, obscurely pubescent; clypeus convex, apex deeply emarginate.

Male: Structure similar to female in general appearance but clypeus yellow.

Size: Female: 11-12 mm. Forewing length: female: 8.5mm.



Image 7. *Eumenes architectus* Smith, 1858 female.

Material examined: India: Arunachal Pradesh, Papumpare District, Itanagar, ZSI Office, 27°5'-35°72'N & 93°37'-30°72'E, coll. G. Srinivasan: 1 F, 3.xi.2005, IV/2269/APRC/ZSI; 1 F, 10.iv.2007, IV/2272/APRC/ZSI; ZSI Colony, coll. G. Srinivasan: 1 F, 2.iv.2007, IV/2270/APRC/ZSI; 1 F, 4.iv.2007, IV/2271/APRC/ZSI; 2 F, 14.iii.2008, IV/2281/APRC/ZSI & IV/2282/APRC/ZSI; Police Colony, coll. G. Srinivasan: 2 F, 11.iii.2008, IV/2273/APRC/ZSI & IV/2274/APRC/ZSI; 2 F, 12.iii.2008, IV/2275/APRC/ZSI & IV/2276/APRC/ZSI; 4 F, 13.iii.2008, IV/2277/APRC/ZSI to IV/2280/APRC/ZSI;

Distribution: India (Arunachal Pradesh, Assam, Meghalaya, Sikkim), Indonesia, Japan, Malaysia, Myanmar, South Korea, Thailand.

Remarks: New record for Arunachal Pradesh

Eumenes punctatus de Saussure, 1852

(Image 8)

1852. *Eumenes punctata* de Saussure, *Et. Fam. Vesp., Mon. Guep. Sol.*: 37. Female, Male, Syntypes, Type locality China (BMNH).

1897. *Eumenes punctata* de Saussure: Bingham, *Fauna Brit. India, Hym.*, 1: 339, 340.

2001. *Eumenes punctatus* de Saussure: Kim and Yamane, *Entomol. Sci.*, 4(2): 139-155.

Diagnosis: Female: Black. The following yellow markings: clypeus, interantennal space, antennal scape at base ventrally, behind the eyes at top, basal margin of pronotum broadly, tegula, postscutellum, a mark on mesopleuron below tegula, propodeum on sides (sometimes reduced or absent), lateral spots on the middle of petiole (sometimes absent), large spot on lateral sides of second gastral tergite, posterior margins of all tergites. Yellow band on the second gastral tergite deeply emarginate at middle; tegula sometimes yellowish brown; legs yellowish-brown except coxa, trochanters and base of femora black, fore femur and fore tibia yellow dorsally. Wings hyaline suffused with brown. Head, thorax and



Image 8. *Eumenes punctatus* de Saussure, 1852 female.

abdomen finely and densely punctured, obscurely pubescent; clypeus convex, deeply emarginate.

Male: Structure similar to female in general appearance.

Size: Female: 11-13 mm; male: 10-11 mm. Forewing length: female: 8.5mm; male: 7mm.

Material examined: India: Arunachal Pradesh, Papumpare District, Itanagar, ZSI Colony, 27°5'–35°72'N & 93°37'–30°72'E, coll. G. Srinivasan: 1 F, 4.iv.2007, IV/2283/APRC/ZSI; 1 M & 1 F, 15.iii.2008, IV/2285/APRC/ZSI & IV/2286/APRC/ZSI; Police Colony, coll. G. Srinivasan: 1 F, 11.iii.2008, IV/2284/APRC/ZSI.

Distribution: India (Arunachal Pradesh, Sikkim, Uttarakhand), Myanmar, Russia, South Korea.

Remarks: New record for Arunachal Pradesh

***Pareumenes quadrispinosus* (de Saussure, 1855)
(Plate 9)**

1855. *Eumenes quadrispinosus* de Saussure, *Et. fam. vesp.*, 3: 134. Female, Male, Syntypes, Type loc. The East Indies (India) (BMNH).

1897. *Eumenes quadrispinosa* de Saussure: Bingham, *Fauna Brit. India, Hym.*, 1: 336.

1904. *Pareumenes quadrispinosa* de Saussure: Dalla Torre, *Gen. Ins.*, 19: 19.

Diagnosis: **Female:** Black with the following yellow markings: clypeus, interantennal space extends up to anterior ocellus, ocular sinus, elongated mark on temple, antennal scape ventrally, large area of pronotum except posterior angle, two parallel lines of mesoscutum, two marks on scutellum, a band on postscutellum posteriorly, tegula except a black spot on middle, parategula, a spot at the base of the mesopleuron, a spot above and a large spot below, on each side of propodeum, propodeal valvulae, two spots on apex of petiole above, two linear subapical marks on petiole ventrally, an interrupted band on the posterior half of second abdominal tergite, a broad mark basally on second abdominal sternite, remaining gastral tergites. Legs black variegated with yellow, wings fuscohyaline. Head and thorax sparsely punctured



Image 9. *Pareumenes quadrispinosus* (de Saussure, 1855) female.

except at side of frons closely punctured; abdomen densely pruinose; clypeus broadly pyriforme, convex, the apex sharply incised; propodeum with a broad median longitudinal furrow with two sharp teeth on each side of it at apex.

Size: Female: 21-23 mm. Forewing length: Female: 16 mm.

Material examined: India: Arunachal Pradesh, Papumpare District, Itanagar, ZSI Colony, 27°5'–35°72'N & 93°37'–30°72'E, coll. G. Srinivasan: 1 F, 16.iii.2006, IV/2287/APRC/ZSI; 1 F, 18.iii.2006. IV/2288/APRC/ZSI; 1 F, 9.iv.2007, IV/2289/APRC/ZSI; India: Arunachal Pradesh, Upper Siang District, Jengging, 94°42'–95°51'E & 28°28'–28°43'N, coll. G. Srinivasan, 1 F, 5.vi.2008, IV/2290/APRC/ZSI.

Distribution: India (Arunachal Pradesh, Assam, Karnataka, Sikkim, Tamil Nadu, Uttarakhand, West Bengal), Bhutan, China, Hong Kong, Indonesia, Malaysia, Myanmar, Vietnam.

Remarks: New record for Arunachal Pradesh

***Rhynchium brunneum* (Fabricius, 1793)
(Image 10)**

1793. *Vespa brunnea* Fabricius, *Ent. Syst.*, 2: 264. Syntype, sex not mentioned. Type Locality Tranquebariae, India (BMNH).

1897. *Rhynchium brunneum* (Fabricius): Bingham, *Fauna Brit. India, Hym.*, 1: 355, 356.

Diagnosis: **Female:** Brownish-red with the following black marks: a spot on interantennal space, a vertical line on lower frons, around ocelli, occiput, a large triangular mark on mesoscutum in front, a transverse line along its apex, propleuron, mesopleuron (except brownish-red below tegula), metapleuron, propodeum in the middle and lateral sides below, basal two thirds of the first and the basal half of second abdominal tergite, first and second abdominal sternites, base of third abdominal sternite. Legs brownish-red with variegated black markings. The

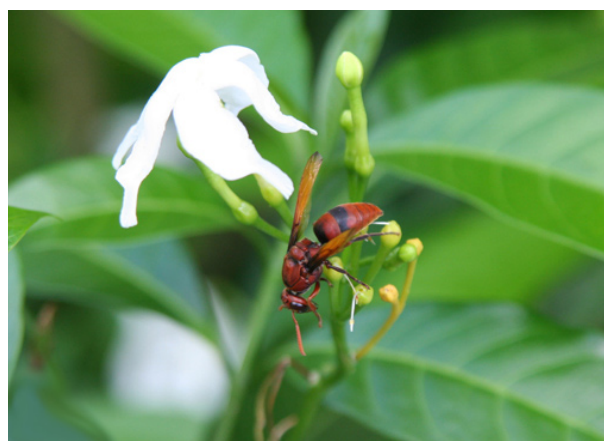


Image 10. *Rhynchium brunneum* (Fabricius, 1793) female.

black markings are highly variable. Wings yellowish hyaline, deeper and darker towards base. Clypeus strongly convex, pyriform, the apical third with a broad medial vertical groove, the extreme apex truncate or slightly incised; mesoscutum posteriorly and scutellum impunctate; metanotum somewhat compressed medially.

Male: Structure similar to female in general appearance but clypeus and scape in front light fulvous red to bright yellow; midfemur basally emarginate.

Size: Female: 17-20 mm; male: 12-15 mm. Forewing length: female: 16mm; male: 12mm.

Material examined: India: Arunachal Pradesh, Papumpare District, Itanagar, ZSI Office, 27°5'–35°72'N & 93°37'–30°72'E, coll. G. Srinivasan: 4 F, 3.xi.2005, IV/2291/APRC/ZSI to IV/2294/APRC/ZSI; 1 F, 8.iii.2006, IV/2295/APRC/ZSI; 1 F, 27.x.2007, IV/2296/APRC/ZSI; Indira Gandhi Park, coll. G. Srinivasan: 1 F, 4.iii.2008, IV/2297/APRC/ZSI.

Distribution: India (Arunachal Pradesh (new record), Delhi, Meghalaya, Sikkim, Uttarakhand, West Bengal), Afghanistan, Indonesia, Iran, Malaysia, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand.

Remarks: New record for Arunachal Pradesh

Tropidodynerus fraternus (Bingham, 1897)

1897. *Odynerus fraternus* Bingham, *Fauna Brit. India, Hym.*, 1: 366, 367. Female, Syntype, Type locality Tenasserim (BMNH).

2007. *Tropidodynerus fraternus* (Bingham): Gusenleitner, *Linzer Biol. Beitr.*, 39(1): 97, 98.

Diagnosis: **Female:** Black with the following yellow markings: clypeus (except a large black spot), a spot above it, the emargination of eyes, a stripe behind them, a squarish spot on each side of the pronotum nearly meeting in the middle, a spot on the mesopleuron, tegula (except a fuscous spot at centre), a spot on the lateral angles of scutellum, postscutellum, propodeum (except a broad black line at the middle), narrow subapical transverse bands on the margins of first to fifth abdominal segments, a free spot on each side of the basal abdominal segment, a round spot on the sides of the second segment. Legs reddish brown variegated with yellow. Wings hyaline with infumation on costal margin. Clypeus very broad, grooved at apex, ending in two distinct teeth; propodeum more sloping, less concave posteriorly, sides rounded; abdomen very sparsely punctured, nearly glabrous.

Size: Female: 10mm.

Material examined: Nil.

Distribution: India (Arunachal Pradesh), Myanmar, Thailand.

Remarks: Roy & Kundu (1985) reported this species from Namdhapa National Park, Arunachal Pradesh.

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Key to genera of Eumeninae of Arunachal Pradesh

1. Metasoma petiolate; first gastral tergite in dorsal view with width half or less than that of second gastral tergite, and at least twice as long as wide, usually longer. 2
- Metasoma not petiolate; first gastral tergite with width more than half that of second gastral tergite, much less than twice as long as wide. 5
2. Propodeum dorsally with longitudinal fovea from which carina runs to orifice, usually with dentiform projections above valvulae; axillary fossa narrower than long, slit-like; tegula with narrow posterior lobe which about equals parategula posteriorly; mesepisternum without epicnemial carina; following with prestigma longer than pterostigma; female with cephalic foveae.....*Pareumenes* de Saussure
- Propodeum without fovea or dentiform projections; axillary fossa broader than long; tegula convex, not equalling parategula posteriorly; other characters partly or completely different..... 3
3. Pronotum without pretegular carina. *Eumenes* Latrielle
- Pronotum with pretegular carina. 4
4. Petiole length less than 1.25x length of mesosoma, never shorter than mesosoma. *Delta* de Saussure
- Petiole length 1.25x or more than 1.25x length of mesosoma. *Phimenes* Giordani Soika
5. Tegula evenly rounded posteriorly, not emarginate adjoining parategula; female without cephalic foveae; third to seventh male gastral sternites with conspicuous fringe of hairs; male midfemur not basally emarginate*Tropidodynerus* Bluthgen
- Tegula not evenly rounded posteriorly, emarginate adjoining parategula; female with cephalic foveae; third to seventh male gastral sternites without conspicuous fringe of hairs; male midfemur basally emarginate*Rhynchium* Spinola

Key to species of *Delta* de Saussure of Arunachal Pradesh

1. Posterior third of second gastral tergite and visible part of remaining gastral tergites yellow. 2
- Posterior third of second gastral tergite and visible part of remaining gastral tergites black or red..... 4
2. Gastral petiole without apical yellow band; body large and robust (usually more than 20mm); mesoscutum yellow anteriorly..... *pyriforme* (Fabricius)
- Gastral petiole with apical yellow band; body small and slender (usually less than 20mm); mesoscutum black or red anteriorly. 3
3. Forewing with a brown infumation on radial cell; mesoscutum either red or red variegated with black markings. *esuriens* (Fabricius)
- Forewing without brown infumation on radial cell; mesoscutum entirely black..... *companioniforme* (Fabricius)
4. Apical half of second gastral tergite and whole of the remaining tergites black; in female, clypeus and lower half of frons red. *dimidiatipenne* (de Saussure)
- Apical half of second gastral tergite and whole of the remaining tergites red; in female, clypeus and lower half of frons yellow. *conoideum* (Gmelin)

Key to species of *Eumenes* Latrielle of Arunachal Pradesh

1. Clypeus black in female; antenna entirely black; thorax almost entirely black except a narrow interrupted line on pronotum and a mark on postscutellum yellow; second abdominal tergite without a lateral yellow spot *architectus* Smith, 1858
- Clypeus yellow in female; antenna black except scape yellow at base ventrally; thorax black with broad yellow broad yellow markings on pronotum, postscutellum, tegula, a mark on mesopleuron below tegula and sides of propodeum; second abdominal tergite with a lateral yellow spot.....*punctatus* de Saussure, 1852

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