

A STUDY ON VESPID WASPS (INSECTA: HYMENOPTERA: VESPIDAE) OF ITANAGAR WILDLIFE SANCTUARY, ARUNACHAL PRADESH

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INTRODUCTION

Itanagar Wildlife Sanctuary is situated in Papumpare district of Arunachal Pradesh which is spread over an area of about 140.30 sq. km with rare and varied species of fauna and flora. This sanctuary is surrounded by Poma River in the East, Pachin River in the South, Neorch River in the North West. It is situated at 27° 5' 35.72" N 93°37' 30.72" E latitude and longitude coordinates having an altitude of 250-2000 msl receiving an average annual rainfall of ca 400 mm. The climate is moist and humid with the varying temperature range of 10-30° C.

The present paper includes the systematic account of the family Vespidae from Itanagar Wildlife Sanctuary. The family Vespidae belongs to the superfamily Vespoidea of the order Hymenoptera. The members of this family are commonly known as hornet wasps, yellow wasps, paper wasps, hover wasps, potter wasps, etc., in which potter wasps are solitary in behaviour and others are social wasps. In this paper, we are reporting about 17 species of Vespidae from Itanagar Wildlife Sanctuary.

MATERIAL AND METHODS

All the insects were collected from various localities of the Itanagar Wildlife Sanctuary by using sweep net specially made for the purpose. The collected specimens were killed by using ethyl acetate and preserved as dry specimens. The

pinned specimens were subjected to taxonomic studies by using Wild Heerbrugg Stereozoom microscope.

Most of the materials examined have been deposited at the museum of Arunachal Pradesh Regional Centre of Zoological Survey of India, Itanagar and two specimens at the 'National Zoological Collections' of Hymenoptera Section of Zoological Survey of India, Kolkata.

Acronyms for museums and depositories: APRC/ZSI = Arunachal Pradesh Regional Centre of Zoological Survey of India, Itanagar, India; BMNH = The Natural History Museum, London, England; MHNG = Muséum d'Histoire naturelle, Genève, Switzerland; MNHN = Museum National de Histoire Naturelle, Paris, France; NZSI = 'National Zoological Collections' of Hymenoptera Section, Zoological Survey of India, Kolkata, India; ZMB = Zoologisches Museum der Humboldt Universität, Berlin, Germany.

SYSTEMATIC ACCOUNT

Family VESPIDAE

Subfamily EUMENINAE

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

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

2010. *Delta pyriforme pyriforme* (Fabricius): Srinivasan and Girish Kumar, *J. Threatened Taxa*, 2 (12): 1314.

Diagnosis: Female: Size 25-27 mm. Head yellow, a broad black band between the eyes on the vertex; occiput black; antenna reddish brown; pronotum entirely and mesoscutum anteriorly yellow, the latter 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 latter 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 pyriform, its apex truncate; petiole broadening towards the apex and slightly flattened. *Male:* Size 20-25 mm. Similar to female in general appearance but slender, the fifth and sixth gastral segments at base and the whole of the seventh segment black.

Material examined: 1 F, ZSI Office, 5.xii.2004, Regd. No. IV/2139/APRC/ZSI; 1 F, ZSI Colony, 6.iii.2005, Regd. No. IV/2140/APRC/ZSI; 1 M, ZSI Colony, 19.vi.2005, Regd. No. IV/2141/APRC/ZSI; 2 F, ZSI Office, 21.vi.2005, Regd. Nos. IV/2142/APRC/ZSI & IV/2143/APRC/ZSI; 1 M, ZSI Office, 22.vi.2005, Regd. No. IV/2144/APRC/ZSI; 4 M & 1 F, ZSI Office, 5.x.2005, Regd. Nos. IV/2145/APRC/ZSI to IV/2149/APRC/ZSI; 1 F, ZSI Office, 28.vi.2006, Regd. No. IV/2150/APRC/ZSI; 1 F, ZSI Colony, 16.viii.2006, Regd. No. IV/2151/APRC/ZSI; 1 M, ZSI Colony, 24.viii.2006, Regd. No. IV/2152/APRC/ZSI; 1 F, ZSI Colony, 25.viii.2006, Regd. No. IV/2298/APRC/ZSI. 1 F, ZSI Colony, 27.viii.2006, Regd. No. IV/2153/APRC/ZSI; 1 M, ZSI Office, 30.viii.2006, Regd. No. IV/2154/APRC/ZSI; 1 F & 1 M, ZSI Colony, 4.ix.2006, Regd. Nos. IV/2155/APRC/ZSI & IV/2156/APRC/ZSI; 1 F, ZSI Colony, 5.ix.2006, Regd. No. IV/2157/APRC/ZSI; 1 F, ZSI Office, 20.ix.2006,

Regd. No. IV/2158/APRC/ZSI; 5 M & 3 F, Police Colony, 24.x.2007, Regd. Nos. IV/2159/APRC/ZSI to IV/2166/APRC/ZSI; 6 M & 2 F, Police Colony, 30.x.2007, Regd. Nos. IV/2167/APRC/ZSI to IV/2174/APRC/ZSI; 1 M & 3 F, Police Colony, 30.x.2008, Regd. Nos. IV/2175/APRC/ZSI to IV/2178/APRC/ZSI. All the specimens were collected by the first author.

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

2. *Delta esuriens* (Fabricius, 1787)

1787. *Vespa esuriens* Fabricius, *Mant. Ins.*, 1: 293. Syntype, Sex not mentioned, Loc. India (BMNH).
2010. *Delta esuriens* (Fabricius, 1787): Srinivasan and Girish Kumar, *J. Threatened Taxa*, 2 (12): 1315.

Diagnosis: Female: Size 14-20 mm. 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 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

drown out) black. Wings flavohyaline with a narrow subapical dark infumation on forewing. Clypeus smooth, strongly convex, flattened at middle, its anterior margin transversely truncate at apex; frons, vertex and thorax with close fine but shallow punctures; gaster smooth, slightly shining. *Male*: Size 11.5 mm. Similar to female in general appearance but more slender.

Material examined: 1 F, ZSI Colony, 2.iii.2006, Regd. No. IV/2179/APRC/ZSI; 1 F, ZSI Colony, 5.iii.2006, Regd. No. IV/2180/APRC/ZSI; 1 F, ZSI Colony, 5.iv.2006, Regd. No. IV/2181/APRC/ZSI, 1 M, ZSI Colony, 6.iv.2006, Regd. No. IV/2182/APRC/ZSI; 1 F, ZSI Colony, 10.vi.2006, Regd. No. IV/2183/APRC/ZSI; 1 M, ZSI Colony, 12.iv.2006, Regd. No. IV/2184/APRC/ZSI; 2 F, Indira Gandhi Park, 5.iii.2008, Regd. Nos. IV/2185/APRC/ZSI & IV/2186/APRC/ZSI; 4 F, Police Colony, 6.iii.2008, Regd. Nos. IV/2187/APRC/ZSI & IV/2190/APRC/ZSI; 3 F, ZSI Colony, 27.x.2008, Regd. Nos. IV/2191/APRC/ZSI & IV/2193/APRC/ZSI. All the specimens were collected by the first author.

Distribution: *India*: Arunachal Pradesh, Delhi, Gujarat, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Uttarakhand and West Bengal. *Elsewhere*: Arabia, Indonesia, Iran, Iraq, Myanmar, Pakistan, Philippines, Sri Lanka and Thailand.

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

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

2010. *Delta companiforme gracilior* (Giordani Soika): Srinivasan and Girish Kumar, *J. Threatened Taxa*, 2(12): 1315, 1316.

Diagnosis: *Female*: Size 18-20 mm. Black. The following yellow parts: 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. *Male*: Size 16-18 mm. Similar to female in general appearance but more slender.

Material examined: 1 F, ZSI Colony, 20.iii.2006, Regd. No. IV/2194/APRC/ZSI; 1 F, ZSI Colony, 25.iii.2006, Regd. No. IV/2195/APRC/ZSI; 1 M, ZSI Office, 8.viii.2006, Regd. No. IV/2196/APRC/ZSI; 1 M, ZSI Colony, 10.viii.2006, Regd. No. IV/2197/APRC/ZSI; 1 M, ZSI Colony, 15.viii.2006, Regd. No. IV/2198/APRC/ZSI. All the specimens were collected by the first author.

Distribution: *India*: Arunachal Pradesh, Sikkim and West Bengal. *Elsewhere*: Australia, Egypt, Indonesia, Malaysia, Myanmar, Philippines, Senegal, Sumatra and Thailand.

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

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

2010. *Delta dimidiatipenne* (de Saussure): Srinivasan and Girish Kumar, *J. Threatened Taxa*, 2(12): 1316.

Diagnosis: *Female*: Size 24-27 mm. 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*: Size 22-25 mm. Similar to female in general appearance except the clypeus and the lower half of frons yellow, smaller and slender.

Material examined: 2 M, ZSI Office, 5.x.2005, Regd. Nos. IV/2216/APRC/ZSI & IV/2217/APRC/ZSI; 1 F, ZSI Office, 3.xi.2005, Regd. No. IV/2218/APRC/ZSI; 1 M, ZSI Colony, 3.iii.2006, Regd. No. IV/2219/APRC/ZSI; 1 M & 1 F, ZSI Colony, 14.iii.2006, Regd. Nos. IV/2220/APRC/ZSI & IV/2221/APRC/ZSI; 1 F, ZSI Colony, 11.xi.2006, Regd. No. IV/2222/APRC/ZSI. All the specimens were collected by the first author.

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

5. *Delta conoideum* (Gmelin, 1790)

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

2010. *Delta conoideum* (Gmelin): Srinivasan and Girish Kumar, *J. Threatened Taxa*, 2(12): 1316, 1317.

Diagnosis: Female: Size 23-26 mm. 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 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 pyriform, its apex truncate; gaster smooth and shining with the surface minutely aciculate. *Male:* Size 18-22 mm. Similar to female in general appearance but smaller and slender.

Material examined: 1 F, ZSI Colony, 3.xii.2004, Regd. No. IV/2223/APRC/ZSI; 1 F, ZSI Colony, 10.iii.2005, Regd. No. IV/2224/APRC/ZSI; 1 M, Police Colony, 28.iii.2005, Regd. No. IV/2225/APRC/ZSI; 1 F, Police Colony, 28.vi.2005, Regd. No. IV/2226/APRC/ZSI; 1 F & 1

M, ZSI Office, 5.x.2005, Regd. Nos. IV/2227/APRC/ZSI & IV/2228/APRC/ZSI; 1 F, Police Colony, 13.xi.2005, Regd. No. IV/2229/APRC/ZSI; 1 M, ZSI Colony, 2.iii.2006, Regd. No. IV/2230/APRC/ZSI; 1 F, ZSI Colony, 16.xii.2006, Regd. No. IV/2231/APRC/ZSI; 2 F, ZSI Colony, 21.iii.2006, Regd. Nos. IV/2232/APRC/ZSI & IV/2233/APRC/ZSI; 1 F, Police Colony, 24.vi.2006, Regd. No. IV/2234/APRC/ZSI; 1 F, ZSI Colony, 1.ix.2006, Regd. No. IV/2235/APRC/ZSI; 1 F, ZSI Colony, 5.ix.2006, Regd. No. IV/2236/APRC/ZSI; 1 F, ZSI Office, 5.iii.2007, Regd. No. IV/2237/APRC/ZSI; 6 F, Police Colony, 24.x.2007, Regd. Nos. IV/2238/APRC/ZSI to IV/2243/APRC/ZSI. 4 M & 2 F, Police Colony, 27.x.2007, Regd. Nos. IV/2244/APRC/ZSI to IV/2249/APRC/ZSI; 2 M, Indira Gandhi Park, 3.iii.2008, Regd. Nos. IV/2250/APRC/ZSI & IV/2251/APRC/ZSI; 3 M, Indira Gandhi Park, 4.iii.2008, Regd. Nos. IV/2252/APRC/ZSI to IV/2254/APRC/ZSI; 1 M, Indira Gandhi Park, 5.iii.2008, Regd. No. IV/2255/APRC/ZSI; 1 M, ZSI Office, 28.iii.2008, Regd. No. IV/2256/APRC/ZSI; 4 F, Police Colony, 24.x.2008, Regd. Nos. IV/2257/APRC/ZSI to IV/2260/APRC/ZSI; 1 M & 7 F, Police Colony, 30.x.2008, Regd. Nos. IV/2261/APRC/ZSI to IV/2268/APRC/ZSI. All the specimens were collected by the first author.

Distribution: India: Arunachal Pradesh, Odisha, Sikkim, Tamil Nadu, Tripura and Uttar Pradesh. *Elsewhere:* Arabia, China, Malaysia, Myanmar, Pakistan, Sri Lanka and Thailand.

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

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

2010. *Phimenes flavopictum continentale* (Zimmermann): Srinivasan and Girish Kumar, *J. Threatened Taxa*, 2(12): 1317, 1318.

Diagnosis: Female: Size 24-26 mm. 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 pyriform 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, pyriform, the apex sharply truncated; frons, vertex and thorax with fine shallow punctures, petiole and gaster smooth. *Male*: Size 19-22 mm. Similar to female in general appearance but slighter, with last abdominal segment entirely black. Depth of yellow markings varies in different individuals.

Material examined: 1 F, ZSI Office, 3.xi.2005, Regd. No. IV/2199/APRC/ZSI; 1 M, ZSI Colony, 18.iii.2006, Regd. No. IV/2210/APRC/ZSI; 2 F, ZSI Colony, 24.iii.2006, Regd. Nos. IV/2211/APRC/ZSI & IV/2212/APRC/ZSI; 1 M, ZSI Colony, 25.viii.2006, Regd. No. IV/2213/APRC/ZSI; 1 M, ZSI Colony, 28.viii.2006, Regd. No. IV/2214/APRC/ZSI; 1 M, ZSI Colony, 15.iii.2008, Regd. No. IV/2215/APRC/ZSI. All the specimens were collected by the first author.

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

7. *Eumenes architectus* Smith, 1858

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

2010. *Eumenes architectus* Smith: Srinivasan and Girish Kumar, *J. Threatened Taxa*, 2 (12): 1317, 1318.

Diagnosis: Female: Size 11-12 mm. 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.

Material examined: 1 F, ZSI Office, 3.xi.2005, Regd. No. IV/2269/APRC/ZSI; 1 F, ZSI Colony, 2.iv.2007, Regd. No. IV/2270/APRC/ZSI; 1 F, ZSI Colony, 4.iv.2007, Regd. No. IV/2271/APRC/ZSI; 1 F, ZSI Office, 10.iv.2007, Regd. No. IV/2272/APRC/ZSI; 2 F, Police Colony, 11.iii.2008, Regd. Nos. IV/2273/APRC/ZSI & IV/2274/APRC/ZSI; 2 F, Police Colony, 12.iii.2008, Regd. Nos. IV/2275/APRC/ZSI & IV/2276/APRC/ZSI; 4 F, Police Colony, 13.iii.2008, Regd. Nos. IV/2277/APRC/ZSI to IV/2280/APRC/ZSI; 2 F, ZSI Colony, 14.iii.2008, Regd. Nos. IV/2281/APRC/ZSI & IV/2282/APRC/ZSI. All the specimens were collected by the first author.

Distribution: *India*: Arunachal Pradesh, Assam, Meghalaya and Sikkim. *Elsewhere*: Indonesia, Japan, Malaysia, Myanmar, South Korea and Thailand.

8. *Eumenes punctatus* de Saussure, 1852

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

2010. *Eumenes punctatus* de Saussure: Srinivasan and Girish Kumar, *J. Threatened Taxa*, 2 (12): 1318, 1319.

Diagnosis: Female: Size 11-13 mm. 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 abdomen finely and densely punctured, obscurely pubescent; clypeus convex, deeply emarginate. *Male*: Size 10-11 mm. Similar to female in general appearance.

Material examined: 1 F, ZSI Colony, 4.iv.2007, Regd. No. IV/2283/APRC/ZSI; 1 F, Police Colony, 11.iii.2008, Regd. No. IV/2284/APRC/ZSI; 1 M & 1 F, ZSI Colony, 15.iii.2008, Regd. Nos. IV/2285/APRC/ZSI & IV/2286/APRC/ZSI. All the specimens were collected by the first author.

Distribution: *India*: Arunachal Pradesh, Sikkim and Uttarakhand. *Elsewhere*: Myanmar, Russia and South Korea.

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

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

2010. *Pareumenes quadrispinosus* (de Saussure, 1855): Srinivasan and Girish Kumar, *J. Threatened Taxa*, 2(12): 1319.

Diagnosis: *Female*: Size 21-23 mm. 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 except at side of frons closely punctured; abdomen densely pruinose; clypeus broadly pyriform, convex, the apex sharply incised; propodeum with a broad median

longitudinal furrow with two sharp teeth on each side of it at apex.

Material examined: 1 F, ZSI Colony, 16.iii.2006, Regd. No. IV/2287/APRC/ZSI; 1 F, ZSI Colony, 18.iii.2006. Regd. No. IV/2288/APRC/ZSI; 1 F, ZSI Colony, 9.iv.2007, Regd. No. IV/2289/APRC/ZSI. All the specimens were collected by the first author.

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

10. *Rhynchium brunneum* (Fabricius, 1793)

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

2010. *Rhynchium brunneum* (Fabricius): Srinivasan and Girish Kumar, *J. Threatened Taxa*, 2(12): 1319, 1320.

Diagnosis: *Female*: Size 17-20 mm. 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 the second abdominal tergite, first and second abdominal sternites, base of third abdominal sternite. Legs brownish red with variegated black markings. The 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.

Material examined: 4 F, ZSI Office, 3.xi.2005, Regd. Nos. IV/2291/APRC/ZSI to IV/2294/APRC/ZSI; 1 F, ZSI Office, 8.iii.2006, Regd. No. IV/2295/APRC/ZSI; 1 F, ZSI Office, 27.x.2007, Regd. No. IV/2296/APRC/ZSI; 1 F, Indira Gandhi Park, 4.iii.2008, Regd. No. IV/2297/APRC/ZSI. All the specimens were collected by the first author.

Distribution: India: Arunachal Pradesh, Delhi, Meghalaya, Sikkim, Uttarakhand and West Bengal. *Elsewhere:* Afghanistan, Indonesia, Iran, Malaysia, Myanmar, Nepal, Pakistan, Sri Lanka and Thailand

Subfamily STENOGASTRINAE

11. *Eustenogaster scitula* (Bingham, 1897)

1897. *Ischnogaster scitula* Bingham. *Fauna Brit. India, Hym.*, 1: 377 (Key), 379, female-“Rangit Valley, Sikkim; Margherita, Assam” (BMNH).

2009. *Eustenogaster scitula* (Bingham): Srinivasan and Girish Kumar, *Rec. zool. Surv. India*, 109 (Part-3): 38, 39.

Diagnosis: Female. Size 16- 20 mm. Body black. Yellow markings as follows: A large mark on clypeus, propodeum with one circular small yellow mark on each side at apex, a line on fore tibia below, an elongated mark on each side of third gastral segment basally. Yellowish brown markings as follows: pronotum with an apical band interrupted in middle and not reaching tegula; a large mark on mesepisternum ventrally. Legs largely and gastral petiole laterally and ventrally with reddish tinch. Wings fusco- hyaline and iridescent. Body covered with silvery pubescence; supraclypeal area reticulate; interantennal space, frons, vertex up to posterior ocelli, pronotum on sides, mesoscutum, scutellum, mesepisternum above dorsal episternal groove and mesepimeron rugoso-reticulate. Vertex behind posterior ocelli with close large and small punctures. Pronotum smooth with moderately close deep punctures; postscutellum, dorsal and ventral metapleuron and propodeum with fine close superficial punctures.

Material examined: 1 F, Doimukh, 29.vi. 2005, Coll. G. Srinivasan, Regd. No. IV/10/APRC/ZSI.

Distribution: India: Arunachal Pradesh, Assam, Meghalaya and Sikkim. *Elsewhere:* Malaysia and Myanmar.

12. *Parischnogaster mellyi* (de Saussure, 1852)

1852. *Ischnogaster mellyi* de Saussure. *Ann. Soc. Ent. France.*, (2) 10: 25, Pl. 2, Fig. 1, Male- “Java” (MHNG).

2009. *Parischnogaster mellyi* (de Saussure): Srinivasan and Girish Kumar, *Rec. zool. Surv. India*, 109 (Part-3): 39, 40.

Diagnosis: Female. Size 10- 11.5 mm. Head black, thorax dark brown. Yellow markings are: mandible (except basal area and teeth reddish), antennal scape below, interrupted band on pronotal collar, broad apical uninterrupted band on pronotum, two oval marks at base and a circular mark at apex of mesoscutum, two circular marks on scutellum, a band on post scutellum at base, two marks on mesepisternum, one on dorsal metapleuron, two circular marks on propodeum at apex, a mark on fore and mid femora apically, a line below fore and mid tibia. Antenna, pronotum, mesopleuron and metapleuron (except the yellow marks), sides of propodeum, legs (except yellow marks) reddish brown. Gaster reddish brown. Yellow portions are: one short line on gastral petiole on sides towards apex, another on the side of petiolate second gastral tergite, two vertical lines on second gastral sternite on sides, third to sixth sternites with large marks on sides. Body narrow covered with fine silvery pubescence. Clypeus with a characteristic pointed tooth apically, basal two- thirds rugoso-reticulate, apical one- third with a few scattered large punctures; supraclypeal area, interantennal space, frons, vertex up to posterior ocelli, mesoscutum, scutellum, mesopleuron almost entirely rugoso- reticulate; inner orbit, ocular sinus almost smooth. Postscutellum with a few punctures in the middle; metapleuron with a few punctures in the middle; metapleuron mat; propodeum with irregular narrow striations and narrow but distinct median groove. Gastral petiole long, strongly swollen towards apex, slightly narrowed again at apex; maximum width of gaster lies at both second and third gastral segment.

Material examined: 2 F, ZSI Office, 20.ii.2005, Coll. G. Srinivasan, Regd. Nos. IV/12/APRC/ZSI& IV/13/APRC/ZSI.

Distribution: India: Arunachal Pradesh, Assam, Meghalaya and Sikkim. *Elsewhere:* Indonesia, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam.

Subfamily VESPINAE

13. *Vespa soror* du Buysson, 1905

1905. *Vespa ducalis* var. *soror* du Buysson, *Ann. Soc. Ent. France*, **73**: 490 (key), 519.

2010. *Vespa soror* du Buysson: Girish Kumar and Srinivasan, *Rec. zool. Surv. India*, **110** (2): 63.

Diagnosis: Sterile female: Size: 23- 29 mm. Head, scutellum, postscutellum, two large marks on propodeum, area around propodeal spiracle and often anterior border of pronotum yellow or brownish yellow; area around ocelli black; first and second gastral tergites yellow with reddish brown stripe in the middle; third and sixth gastral tergites wholly black. Head strongly widened and produced behind the eyes; temple in profile more than 1.8x as wide as eye; posterior ocelli 3x farther from occiput than from eye; clypeus coarsely punctate; clypeus strongly emarginate apically, lateral lobes largely and broadly rounded.

Material examined: 1 F, ZSI Colony, 26.xi.2004, Regd. No. IV/1/APRC/ZSI; 1 F, ZSI Colony, 6.x.2005, Regd. No. IV/2/APRC/ZSI; 1 F, Ganga lakeside, 23.xi.2007, Reg. No. IV/4/APRC/ZSI; 1 F, Ganga lakeside, 24.ii.2008, Regd. No. IV/5/APRC/ZSI. All the specimens were collected by the first author.

Distribution: India: Arunachal Pradesh and Meghalaya. *Elsewhere:* China, Laos, Myanmar, Thailand and Vietnam.

14. *Vespa tropica* (Linnaeus, 1758)

1758. *Sphex tropica* Linnaeus, *Syst. Nat.*, ed. 10, 1-517.

2010. *Vespa tropica* (Linnaeus): Girish Kumar and Srinivasan, *Rec. zool. Surv. India*, **110** (2): 63, 64, 65.

Diagnosis: Sterile female: Size: 19- 30 mm. Head and thorax black. Body rather large and thick, covered with strong and stiff hairs; clypeus coarsely punctate, apical margin hairy; clypeus apically with a broad emargination, its apicolateral angle triangular; lower vertical area of pronotum with strong transverse ridges near pronotal pit; second gastral tergite yellow with a slight brown area basally.

Material examined: 1 F, ZSI Colony, 2.xi.2004, Regd. No. IV/14/APRC/ZSI; 3 F, ZSI Complex, 6.x.2005, Regd. Nos. IV/15/APRC/ZSI to

IV/15/APRC/ZSI; 3 F, ZSI Colony, 6-10.x.2008, Regd. Nos. IV/19/APRC/ZSI to IV/19/APRC/ZSI. All the specimens were collected by the first author.

Distribution: India: Andaman & Nicobar Islands, Arunachal Pradesh, Assam, Bihar, Haryana, Himachal Pradesh, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Pondicherry, Sikkim, Tamil Nadu, Uttarakhand and West Bengal. *Elsewhere:* Afghanistan, Bhutan, Cambodia, China, Indonesia, Japan, Laos, Malaysia, Myanmar, Nepal, Pakistan, Papua New Guinea, Philippines, Sri Lanka, Thailand and Vietnam.

15. *Vespa affinis* (Linnaeus, 1764)

1764. *Apis affinis* Linnaeus, *Mus. Ludov. Ulricae*: 417.

2010. *Vespa affinis* (Linnaeus): Girish Kumar and Srinivasan, *Rec. zool. Surv. India*, **110** (2): 65, 66, 67.

Diagnosis: Sterile female: Size: 16- 23 mm. Body slender and moderate in size; apical margin of clypeus less hairy and with short broadly rounded lobes on each side of the median emargination; punctures on vertex, temple, mesoscutum, scutellum, postscutellum, metapleuron and propodeum small and crowded; second gastral tergum largely or entirely orange yellow; body hairs fine, shorter and comparatively dense.

Material examined: 7 F, ZSI Colony, 6.x.2005, Coll. G. Srinivasan, Regd. Nos. IV/22/APRC/ZSI to IV/28/APRC/ZSI.

Distribution: India: Arunachal Pradesh, Assam, Bihar, Himachal Pradesh, Karnataka, Kerala, Maharashtra, Meghalaya, Nagaland, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh and West Bengal. *Elsewhere:* China, Indonesia, Japan (in Ryukyu Island), Laos, Malaysia, Myanmar, Papua New Guinea, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam and New Zealand.

16. *Vespa basalis* Smith, 1852

1852. *Vespa basalis* Smith, *Trans. Ent. Soc. Lond.*, **2** (2): 46.

2010. *Vespa basalis* Smith: Girish Kumar and Srinivasan, *Rec. zool. Surv. India*, **110** (2): 69, 70.

Diagnosis: Sterile female: Size: 15-21mm. Head and antenna orange to reddish brown; mandible concolorous with head except at apex including teeth and baso-lateral corner black; thorax black with following reddish brown patches: a long band on pronotal collar, pronotum almost entirely, a large spot on mesoscutum posteromedially, scutellum, postscutellum, tegula and mesepimeron anteriorly; legs predominantly reddish brown with black areas on coxa, trochanter and femur of all legs; gaster black except a narrow reddish brown stripe at the apex of first gastral tergum; posterior ocelli 0.77x farther from occiput than from eye; clypeus almost impunctate; vertex depressed medially, depression more strong in fertile females; ovipositor sheath strongly curved; body hairs rather long and dense, yellowish brown in colour.

Material examined: 3 F, Ganga Lakeside, 28.ii.2008, Coll. G. Srinivasan, Regd. Nos. IV/29/APRC/ZSI to IV/31/APRC/ZSI.

Distribution: India: Arunachal Pradesh, Assam, Himachal Pradesh, Meghalaya, Mizoram, Odisha, Sikkim, Uttarakhand, Uttar Pradesh and West Bengal. *Elsewhere:* China, Indonesia, Laos, Myanmar, Nepal, Pakistan, Taiwan, Thailand and Vietnam.

17. *Vespa bicolor* Fabricius, 1787

1787. *Vespa bicolor* Fabricius, *Mant. Ins.*, 1: 288.

2010. *Vespa bicolor* Fabricius: Girish Kumar and Srinivasan, *Rec. zool. Surv. India*, 110 (2): 70, 71.

Diagnosis: Sterile female: Size: 15- 19 mm. Body sulphur yellow; Black colour as follows: apex of mandible including teeth, head dorsally including antennal scrobe and lateral margins of clypeus, mesoscutum entirely, a mark below

tegula, a median line on scutellum, margins of postscutellum, a Y- shaped mark at junction of postscutellum and propodeum, mesopleuron ventrally near to fore coxa, line between mesopleuron and metapleuron and base of first tergite. Antenna black dorsally; brownish bands on first gastral tergum subapically and base of second tergum widely; legs yellow; wings flavohyaline, darker along costal margin of fore wing; clypeus almost impunctate; body dorsally covered with fine, rather stiff erect blackish hairs.

Material examined: 1F, Ganga Lakeside, 3.xi.1981, Coll. S. K. Gupta & Party, NZSI Regd. No. 11241/H3; 1 F, Konkon Nallah, Nahar Lagun, 11.ix.2003, Coll. N. Tahar, NZSI Regd. No. 11252/H3.

Distribution: India: Arunachal Pradesh, Assam, Manipur, Meghalaya, Sikkim, Uttarakhand and West Bengal. *Elsewhere:* Bhutan, Cambodia, China, Laos, Myanmar, Nepal, Thailand and Vietnam.

SUMMARY

Seventeen species of Vespidae were identified and reported from Itanagar Wildlife Sanctuary, Arunachal Pradesh, India.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. K. Venkataraman, Director, Zoological Survey of India for providing necessary facilities to carryout this research work. The authors are also grateful to Dr. G. Maheswaran, Former Officer-in-Charge, Arunachal Pradesh Regional Centre, Zoological Survey of India for providing the specimens on loan for our studies.

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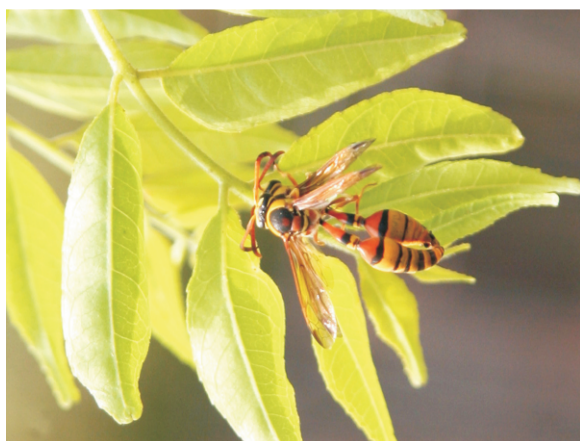


Fig. 1 : *Delta companiforme gracilior* (Giordani Soika, 1986).

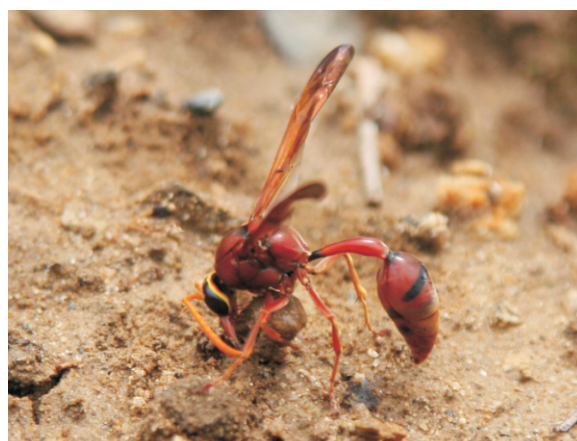


Fig. 2 : *Delta conoideum* (Gmelin, 1790),



Fig. 3 : *Delta dimidiatipenne* (de Saussure, 1852)



Fig. 4 : *Delta esuriens* (Fabricius, 1787)



Fig. 5 : *Delta pyriforme pyriforme* (Fabricius, 1775)



Fig. 6 : *Eumenes architectus* Smith, 1858



Fig. 7 : *Eumenes punctatus* de Saussure, 1852



Fig. 8 : *Eustenogaster scitula* (Bingham, 1897)

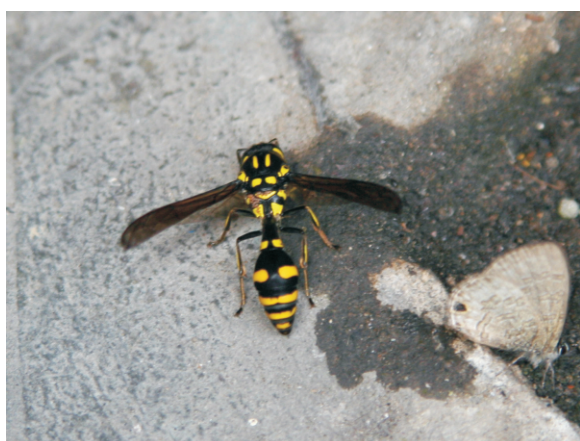


Fig. 9 : *Pareumenes quadrispinosus* (de Saussure, 1855)



Fig. 10 : *Parischnogaster mellyi* (de Saussure, 1852)



Fig. 11 : *Phimenes flavopictum continentale*
(Zimmermann, 1931)



Fig. 12 : *Rhynchium brunneum* (Fabricius, 1793)



Fig. 13 : *Vespa affinis* (Linnaeus, 1764)



Fig. 14 : *Vespa basalis* Smith, 1852



Fig. 15 : *Vespa bicolor* Fabricius, 1787



Fig. 16 : *Vespa soror* du Buysson, 1905



Fig. 17 : *Vespa tropica* (Linnaeus, 1758)