

## Genus *Delta* de Saussure (Hymenoptera: Eumeninae: Vespidae) From Punjab Province of Pakistan

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**Abstract.**-- Three species of the Genus *Delta* De Saussure have been reported from Punjab Province of Pakistan. Two species, *Delta pyriforme pyriforme* (Fabricius, 1775) and *Delta esuriens* (Fabricius, 1787) are recorded for the first time from Punjab Province. New locality records for the already reported species, *Delta dimidiatipenne* (de Saussure, 1852) have been added. A key to these three species has been developed. The species are described using micro-photographs along with their distribution range in Punjab.

**Key words:** *Delta*, Hymenoptera, Vespidae, potter wasps.

### INTRODUCTION

The subfamily Eumeninae (Potter wasps) is widely distributed with about 3,600 species in more than 200 genera (Pickett and Carpenter, 2010). The adults are small to large (7-28 mm) with petiolate metasoma in some species and in most of the species not petiolate, mesoscutum with parategula, tarsal claws bifid; hind coxa with a longitudinal dorsal carina or 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 (Srinivasan and Kumar, 2010). Adults feed on nectar. Among the genera of Eumeninae, the genus *Delta* is recognized with about 50 species and many subspecies, distributed through-out the Old World (Carpenter, 2008). It has been recorded from neighboring countries of Pakistan from Afghanistan to Nepal (van der Vecht and Fischer, 1972), and India with five species records (Srinivasan and Kumar, 2010). This genus can be easily recognized by the following combination of characters: metasoma petiolate; second metasomal tergum not apically lamellate; pronotum with pretegular carina; propodeum without fovea; petiole length less than

1.25x length of mesosoma, never shorter than mesosoma.

In Punjab, preliminary work on this genus has been done by Bodlah *et al.* (2011). A comprehensive survey was done during 2009-2011 to explore these beneficial creatures.

### MATERIALS AND METHODS

A survey was conducted during 2009-2011 from barani areas of Punjab Province of Pakistan. Adult wasps were collected from various weeds, grasslands, and houses with the help of collection net. Wasp nests were also taken to the laboratory and nests were observed for adult wasp emergence. Nests were also broken in order to observe the larve of the prey of the wasps. Prey larvae were also identified. Wasps were observed under a Swift sm-80 binocular microscope. The illustrations were prepared using a Nikon microscope (SMS-1500, with 30x 1-11.25x magnification). All the studied specimens are deposited in the Department of Entomology, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi, Pakistan. The morphological terminology used in this paper follows Goulet and Huber (1993).

### RESULTS AND DISCUSSION

Genus *DELTA* de Saussure

*Delta pyriforme pyriforme* (Fabricius, 1775)

*Delta esuriens* (Fabricius, 1787)

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*Delta companiforme gracilior* (Giordani Soika, 1986)

*Delta dimidiatipenne* (de Saussure, 1852)

*Delta conoideum* (Gmelin, 1790)

#### *Distinguishing characters*

Metasoma petiolate; Pronotum with pretegrular carina; Propodeum without fovea; Petiole length less than 1.25x length of mesosoma, never shorter than mesosoma.

Under this genus three species have been reported from Barani areas of Punjab Province of Pakistan.

#### KEY TO SPECIES OF *DELTA* DE SAUSSURE OF PUNJAB PROVINCE OF PAKISTAN

1. Posterior third of second metasomal tergum and visible part of remaining metasomal tergumterga yellow .....2
- Posterior third of second metasomal tergum and visible part of remaining metasomal tergumterga black or red ..  
.....*dimidiatipenne* (de Saussure)
2. Metasomal petiole without apical yellow band; body large and robust (usually more than 20mm); mesoscutum yellow anteriorly .....*pyriforme* (Fabricius)
- Metasomal petiole with apical yellow band; body small and slender (usually less than 20mm); mesoscutum either red or red variegated with black markings .....  
.....*esuriens* (Fabricius)

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

*Vespa pyriformis* Fabricius, 1775, Syst. Entomol.: 371 - "in China" (type depository unknown).

*Vespa petiolata* Fabricius, 1781, Spec. Ins. 1: 467 - "Malabar" (London) [junior primary homonym of *Vespa petiolata* DeGeer, 1778.

*Sphex pyriformis*; Christ, 1791, Naturg. Ins.: 312 (translation of original description).

*Sphex rubicunda* Christ, 1791, Naturg. Ins.: 316, pl. 32 fig. 1 [female] - locality unknown. - Dalla Torre, 1894, Cat. Hym. 9: 28 (syn. of *E. petiolata*); 1904, Gen. Ins. 19: 24 (syn. of *E. petiolata*).

*Sphex thoracica* Christ, 1791, Naturg. Ins.: 324, pl. 32 fig. 9 [male] - locality unknown. - Dalla Torre, 1894, Cat. Hym. 9: 28 (syn. of *E. petiolata*); 1904, Gen. Ins. 19: 24 (syn. of *E. petiolata*).

*Eumenes petiolata*; Latreille, 1802, Hist. Nat. Crust. Ins. 3: 361 (example of new genus *Eumenes*).

*Eumenes pyriformis*; Fabricius, 1804, Syst. Piez.: 286.

*Eumenes pomiformis* var. *piriformis* [!]; Dalla Torre, 1894, Cat. Hym. 9: 30 (cat.) [confused with *E. piriformis* de Saussure, 1862, and erroneously placed under the "varieties" of *E. pomiformis*!]; 1904, Gen. Ins. 19: 24 (cat.) [id.].

*Eumenes piriformis*; Schulz, 1912, Berl. Entomol. Zeitschr. 57: 88, 101 (emendation; *E. petiolata* Fabricius differs in coloration only).

*Eumenes maxillosus* var. *petiolatus*; Bequaert, 1918, Bull. Am. Mus. Nat. Hist. 39: 59 (key), 63, fig. 49 (map), 281 (this an Oriental and Australian variety; recorded by Smith from the Cape of Good Hope, probably by mistake; the record, however, was reproduced by Dalla Torre).

*Eumenes maxillosus* var. *pyriformis*; Bequaert, 1926, Ann. S. Afr. Mus. 23: 562, 564 (key; India-southern China).

*Eumenes pyriformis pyriformis*; Iwata, 1965, Mushi 38: 105, pl.9 fig. 11 (anat. ovary), pl. 10 fig. 10 (egg).

*Delta pyriformis*; Giordani Soika, 1975, Entomol. Basil. 1: 393 (Bhutan).

*Delta pyriforme pyriforme*; Gusenleitner, 1988, Linz. Biol. Beitr. 20: 184 (Thailand).

#### *Identification characters*

Body 26-28 mm long, head yellow, a broad black band between the eyes on the vertex; occiput black. Antenna reddish-brown; pedicel about 2.67 times shorter than flagellum. Longitudinal eye diameter is about 1.3 times the transverse eye diameter and 1.8 times shorter than transfacial line. Pronotum entirely and mesoscutum yellow at anterior end, the later black posteriorly; mesopleuron, metapleuron scutellum and postscutellum reddish-brown.

Tergum-1 and basal third of the second metasomal 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. Tergum-1 about 4.5 times longer than wider. Propodeum

reddish-brown with a narrow medial vertical black line, as long as wider. Wings 20 mm long, 4 times longer than wider. Legs reddish-brown variegated with black.

#### Male

Structure similar to female excepting the fifth and sixth metasomal segments at base and the whole of the seventh segment black; male antennae (antennal flagellum 11 segmented) are also usually different from the females (antennal flagellum 10 segmented) in having a modified apex most often, a "hook" in which the last article is folded back against the penultimate one (Fig. 1A,B).

#### Material examined

Rawalpindi, 29.09.09, 4♀ and 2♂; Jhelum, 03.10.10, 6♀ and 20♂; Attock, 04.10.10, 4♀ and 10♂; Bakhar, 16-10-09, 3♀ and 8♂; Layyah, 21-10-11, 5♀ and 12♂; Muzafargarh, 20-9-09, 2♀ and 14♂; Mianwali, 21-10-19, 5♀ and 10♂; Islamabad, 04.10.11, 2♀♂; Jhang, 24-9-09, 2♀ and 18♂; Khushab, 26-10-19, 5♀ and 16♂; Sargodha, 08.10.09, 2♀ and 18♂; D.G. Khan, 12.10.11, 4♀ and 20♂; Rajanpure 02.10.10, 8♀ and 10♂; Bahawalpure, 10.10.10, 2♀ and 13♂.

This species is recorded for the first time from Punjab Province of Pakistan

*Delta esuriens* (Fabricius, 1787)  
(Fig. 1H)

*Vespa esuriens* Fabricius, 1787, Mant. Ins. 1: 293 - "India" (København).

*Vespa pediculata* Olivier, 1792 (1791), Encycl. Méthod., Ins. 6: 671 - "Indes orientales". - de Saussure, 1852, Ét. Fam. Vesp. 1: 56 (syn. of *Eumenes esuriens* (Fabricius)).

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

*Eumenes boscii* de Saussure, 1855, Ét. Fam. Vesp. 3: 132 (MS name, as a synonym of *E. esuriens*).

*Eumenes caffer* var. *esuriens*; Bequaert, 1918, Bull. Am. Mus. Nat. Hist. 39: 275 (cat.; in part; not p. 73).

*Eumenes campaniformis* var. *esuriens*; Bequaert, 1926, Ann. S. Afr. Mus. 23: 541 (key), 542 (India). - Giordani Soika, 1934, Mem. Soc. Entomol. Ital. 12: 227.- Iwata 1965, Mushi

38: 105 (*campaniformis* [!]), pl. 9 fig. 12 (anat. ovary), pl. 10 fig. 13 (egg).

*Delta campaniforme esuriens*; Giordani Soika, 1957, Brit. Mus. Exp. S. W. Arabia 1: 474; 1970, Boll. Mus. Civ. Stor. Nat. Venezia 20/21: 175 (Iran; Iraq; Oman; Saudi Arabia).

*Delta esuriens esuriens*; Giordani Soika, 1992, Lavori Soc. Ven. Sci. Nat. 17: 62 (separation from *campaniforme*), 63 (distr.).

*Delta esuriens*; Castro and Dvořák, 2009, Bol. Soc. Entomol. Aragon. 44: 296 (Israel).

#### Identification characters

Body 15-20 mm long, head yellow to brownish-yellow with black markings like 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). Antenna light reddish (in some specimens a black mark present on scape dorsally and apical antennal segments more dark); pedicel about 3 times shorter than flagellum. Longitudinal eye diameter is about 1.5 times the transverse eye diameter and 1.33 times shorter than transfacial line.

Pronotum and postscutellum yellow; propleuron and pronotal collar basally black to 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 light reddish.

Tergum-1 (petiole light) reddish except at base black, at apex a black band and then a yellow band; second metasomal segment basally light reddish then a black band and remaining apical half yellow; all remaining metasomal segments yellow, with their bases (when drawn out) black. Tergum-1 about 3 times longer than wider. Propodeum light reddish, about as long as wider. Forewing 20 mm long, flavohyaline with a narrow subapical dark infumation on forewing, 3.8 times longer than wider. Legs light reddish (in some specimens fore coxa, all trochanters and mid and hind tarsal segments except basitarsus black).

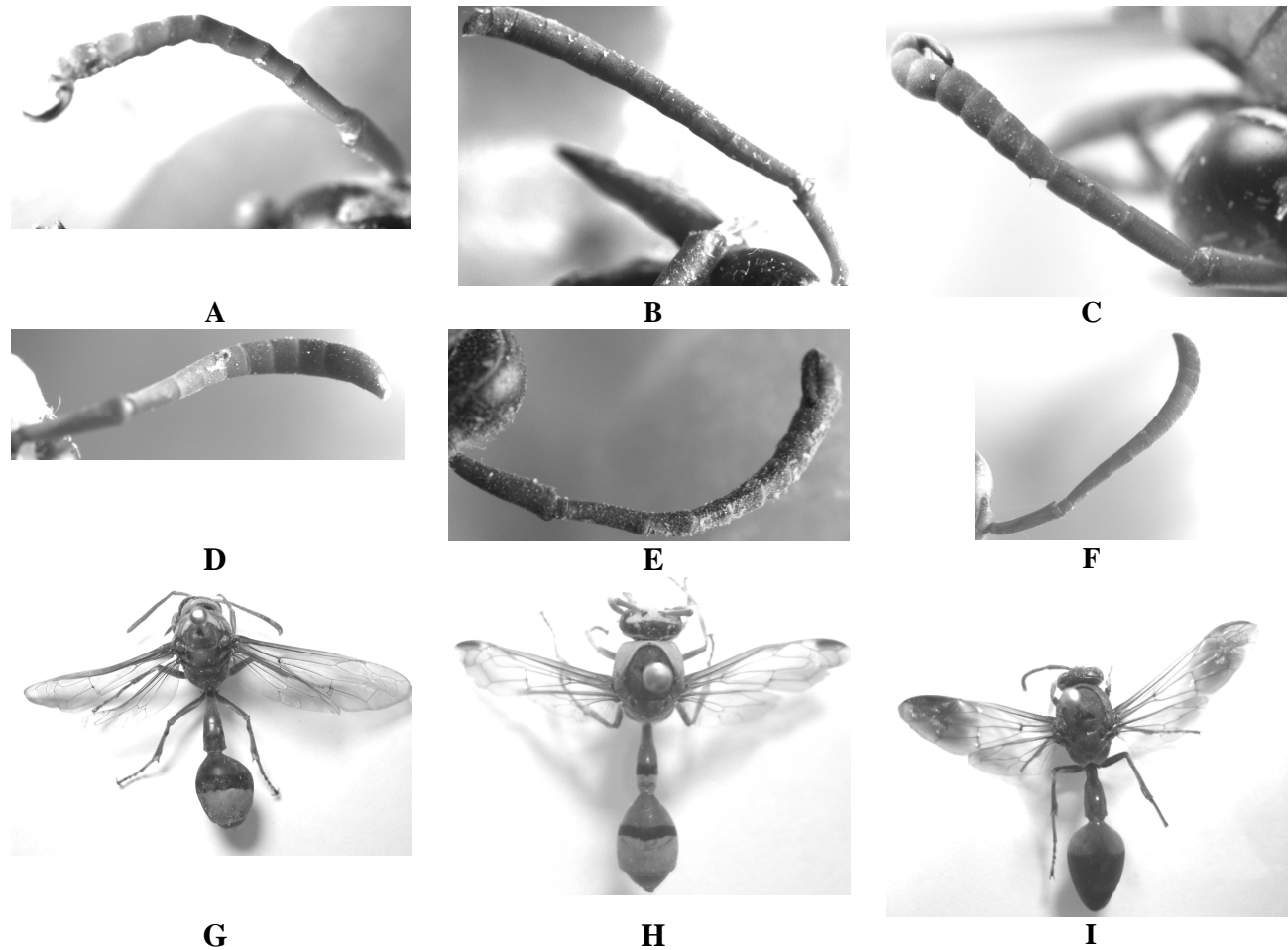


Fig. 1. Male and female antennae of the genus *Delta*; A, B, male and female antennae of *Delta pyriforme*; C, D, male and female antennae of *Delta esuriens*; E, F, male and female antennae of *Delta dimidiatipenne*; G, adult *Delta pyriforme pyriforme*; H, adult *Delta esuriens*; I, adult of *Delta dimidiatipenne*.

#### Male

Structure similar to female in general appearance but slender; male antennae (antennal flagellum 11 segmented) are also usually different from the females (antennal flagellum 10 segmented) in having a modified apex most often, a “hook” in which the last article (different colour than other articles) is folded back against the penultimate one (Figs. 1C,D).

#### Material examined

Rawalpindi, 28.09.09, 4♀ and 2♂; Attock, 04.10.10, 4♀ and 10♂; Bakhar, 16-10-09, 3♀ and 8♂; Layyah, 21-10-11, 5♀ and 12♂; Muzafargarh,

20-9-09, 2♀ and 14♂; Mianwali, 21-10-19, 5♀ and 10♂; Islamabad, 04.10.09, 2♀.

This species is recorded for the first time from Punjab Province of Pakistan

#### *Delta dimidiatipenne* (de Saussure, 1852) (Figs. 1E, F, I)

*dimidiatipenne* (de Saussure) Savigny, 1812, Descr. Egypte, Atlas, Zool., Ins. Hym.: pl. VIII fig. 5, female, male.

*Eumenes dimidiatipennis* de Saussure, 1852, Ét. Fam. Vesp. 1: 51, female, male - “Djidda (Arabie), les Indes Orientales, l’Egypte” (Paris).

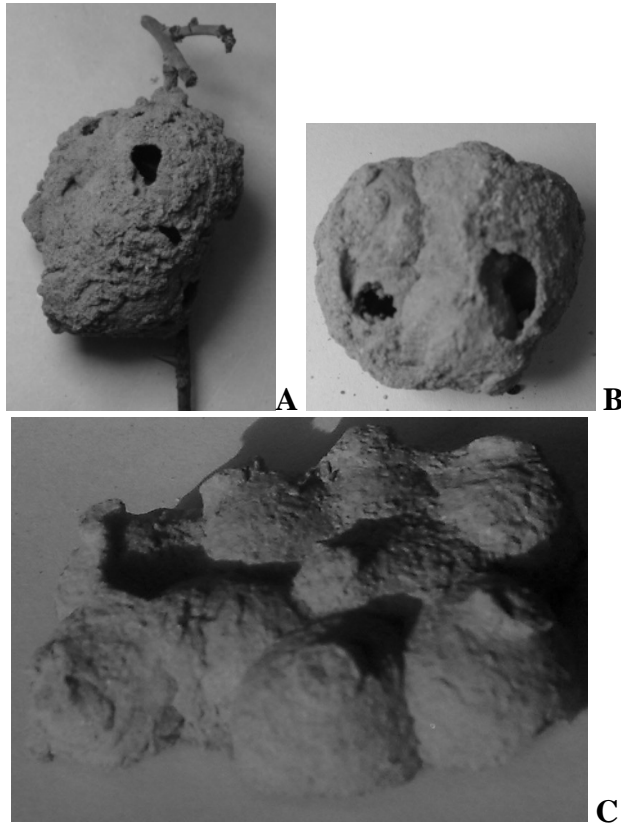


Fig. 2. Various shapes of nests made by Genus *Delta* on various substrates.

*Eumenes transcaspicus* Morawitz, 1895, Hor. Soc. Entomol. Ross. 29: 414, female, male - "Transcaspia: Kasandshik; Pul-i-chatun" (? St. Petersburg). - Blüthgen, 1961, Beitr. Naturk. Forsch. Südwest Deutschl. 19: 279 (syn. of *D. dimidiatipennis*).

*Eumenes maxillosus* var. *dimidiatipennis*; von Schulthess, 1910, Soc. Ent. 25: 17.

*Eumenes maxillosus dimidiatipennis*; Giordani Soika, 1951, Riv. Biol. Colon. 11: 77; 1952, Boll. Soc. Venez. Stor. Nat. 6: 20; 1953, Bull. Soc. Sci. Nat. Phys. Maroc 32: 240 (Morocco).

*Delta dimidiatipenne*; Blüthgen, 1961, Beitr. Naturk. Forsch. SüdwestDeutschl. 19: 279 (*dimidiatipennis*; syn. *Transcaspicus* (Morawitz); Afghanistan)

*Delta emarginatus dimidiatipennis*; Blüthgen and Gusenleitner, 1970, Stuttg. Beitr. Naturk. 223: 6 (Iran).

#### Material examined

Chakwal, 28.09.11, 4♀ and 2♂; Jhelum, 04.10.11, 4♀ and 10♂; Jhang, 16-10-11, 3♀ and 8♂; Faisalabad, 21-10-10, 5♀ and 12♂; Multan, 20-9-11, 2♀ and 14♂; Gujrat, 21-10-19, 5♀ and 10♂; Gujranwala, 04.10.09, 2♀.

*Delta dimidiatipenne* has already been recorded by Bodlah *et al.* (2011) from Punjab Province of Pakistan. In the current study, new locality records have been added.

#### General remarks

Wasps specimens collected from Punjab were compared with the descriptions given by Srinivasan and Kumar (2010), and found to be similar excepting slight size and colour variations.

These wasps showed the usual sexual dimorphism like other Eumeninae wasps by the variation in number of antennal segments (higher number in males than females); variation in coloration and backward direction of last flagellar segment. These wasps mostly appear during the months of October to December in various Districts of Punjab. Female wasps collect various larval instars of American bollworm and cabbage butterfly etc. from various crops and preserve them in nests of free mud cells attached to a variety of substrates like walls and roofs of houses, branches of trees and flowers. Nests are of different shapes (Fig. 2). Female lay eggs in their nests and after hatching from eggs, immature wasps start to feed on these preserved lepidopterous pests. Adults emerge from these nests during the months of April- July. Adult feed on the nectar of various unknown weeds and various flowers. Nests of these wasps also act as breeding places for various unknown cuckoo wasps and flies.

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