



RESEARCH PAPER

OPEN ACCESS

## Revision of vespid Wasps (Hymenoptera; Vespidae) in Iraq

Razzaq Shalan Augul\*

*Iraq Natural History Research Center and Museum, University of Baghdad, Iraq*

Article published on March 23, 2017

**Key words:** Eumeninae, Hymenoptera, Iraq, Polistinae, Vespidae, Vespinae

### Abstract

A key to the recognized subfamilies and genera of Vespidae that collected in current investigations from different localities of Iraq are presented. A total of 10 species are recorded: *Eumenes pomiformis* (Fabricius), *Odynerus spinipes* (Linnaeus), *Delta esuriens* (Fabricius), *D. dimidiatipenne* (de Saussure), *Stenodynerus* sp., *Polistes gallicus* (Linnaeus), *P. wattii* Cameron, *Vespa orientalis* Linnaeus, *Vespula germanica* (Fabricius) and *V. vulgaris* (Linnaeus).

\*Corresponding Author: Razzaq Shalan Augul ✉ [razzaqshalan@gmail.com](mailto:razzaqshalan@gmail.com)

## Introduction

The family of Vespidae (Order; Hymenoptera) is a large, diverse, cosmopolitan family of wasps, including nearly all the known eusocial wasps and many solitary wasps (Pickett and Wenzel, 2004).

In earlier literatures, this guild was consisted from two subfamilies: Polistinae and Vespinae; while the subfamilies Eumeninae and Masarinae were ranked as different families; currently are considered as subfamilies belong to Vespidae as well (Carpenter, 1982).

In general, the social wasps are foragers that collect water; plant fibers and carbohydrates hunt other arthropods and scavenge on animal proteins (Raveret Richter, 2000); for these reasons that some species are pests, interfering intensely with human

activities and domestic animals (Akre *et al.*, 1980). The occurrence of some species belonging to the genera: *Polistes* Latreille, *Vespa* Linnaeus and *Vespula* Thomson in the crop fields, urban and suburban areas and entertaining places, often results in a pest status that ranges from a gentle nuisance to harsh hazard for workers and people, who can be stung too (Chang, 1988; Seath, 1999).

According to Goulet and Huber (1993) the members of vespid wasps can be identified by many characters: compound eyes with inner margin deeply emarginated; pronotum with posterodorsal margin V-shaped, and with posterolaterally apex acute and strongly produced above the anterior margin of tegula; mesocoxae and metacoxae closest; hind wing without distinct claval lobe, and usually with distinct jugal lobe but sometimes without; inner spur of hind tibia weakly modified as a calcar.

First gastral sternite separated from the second by a deep constriction; eighth gastral sternite or hypopygium in male is simple, not concealed. In worker caste, usually no sterile; the sexual dimorphisms are slightly and both sexes macropterous.

In Iraq; there is not any paper that deals with the survey of Vespidae species or designed key to genera or species, this reason was confirmed by Haddad *et al.* (2007), so this study was suggested that for the purpose of identifying the actual number of species that are found in Iraq, with key design to diagnose it, in addition to be the basis for wider studies in this area.

## Materials and methods

*The Specimens collection:* The wasps were collected from different regions of Iraq, by using aerial and sweeping nets during 2016; in addition to, we used many specimens that unknown and preserved in the department of Entomology and Invertebrates, Iraq Natural History Research Center & Museum, University of Baghdad.

The specimens were killed by freezing, and mounting with insect pins, date and localities of sampling were provided.

The specimens and their morphological features were photographed by a Samsung galaxy S4, GT-19500 and used binocular dissecting microscope for clarification.

## Identification:

The wasps were diagnosed to subfamilies, genera and species by using various taxonomic keys and designed a key to genera and species is chiefly based upon: Archer (1989 a, b); Gusenleitner (1998); Tüzün *et al.* (2000); Carpenter and Nguyen (2003); Dvořák and Roberts (2006); Barthélémy (2008); Buck *et al.* (2008); Carpenter (2008); Ebrahimi and Carpenter (2008); Dvořák *et al.* (2012) and Nguyen (2015).

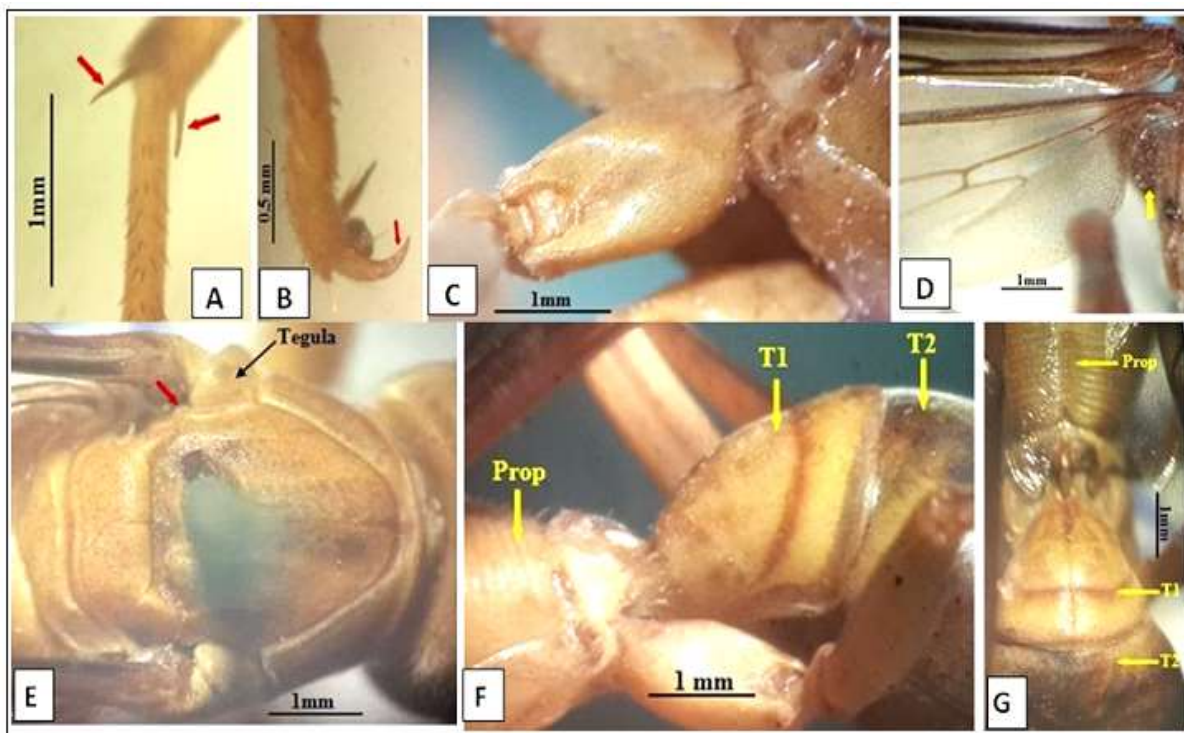
To confirm the diagnosis of some species of wasps, they compared with the known specimens that stored in collection of Iraq Natural History Research Center and Museum, University of Baghdad.

## Result and discussion

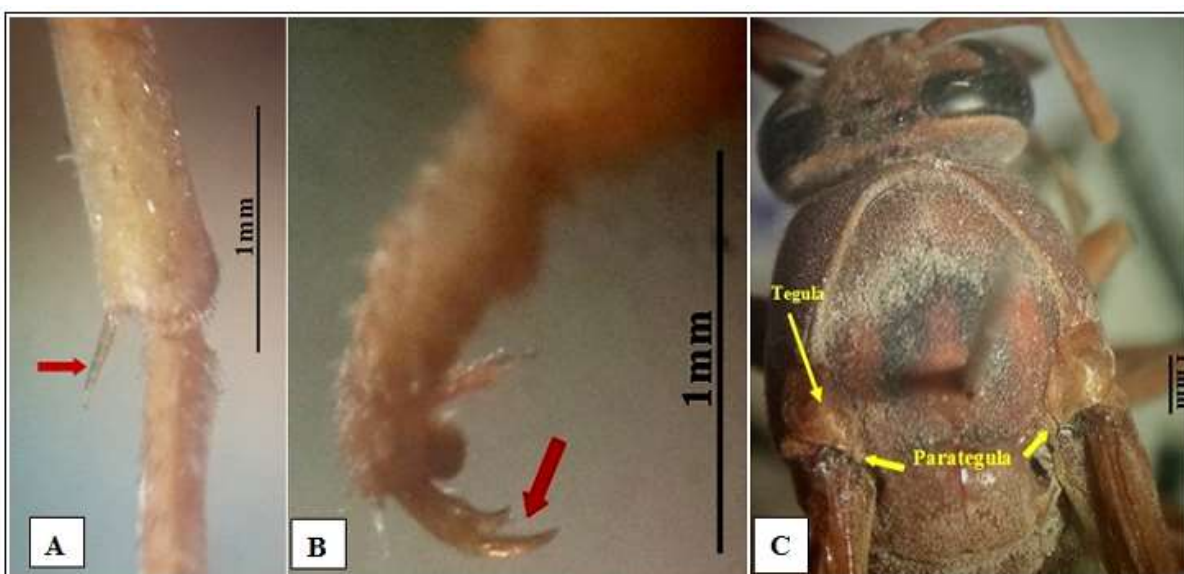
### Key to subfamilies and genera

1-Apical of mid tibiae with two spurs (Fig. 1A), claws simple (Fig. 1B), parategula missing (Fig. 1E) (social species) .....2

Apical of mid tibiae with one spur (Fig. 2A), claws bifid (Fig. 2B), parategula present (Fig. 2C). ..... subfamily: Eumeninae ..... 3.



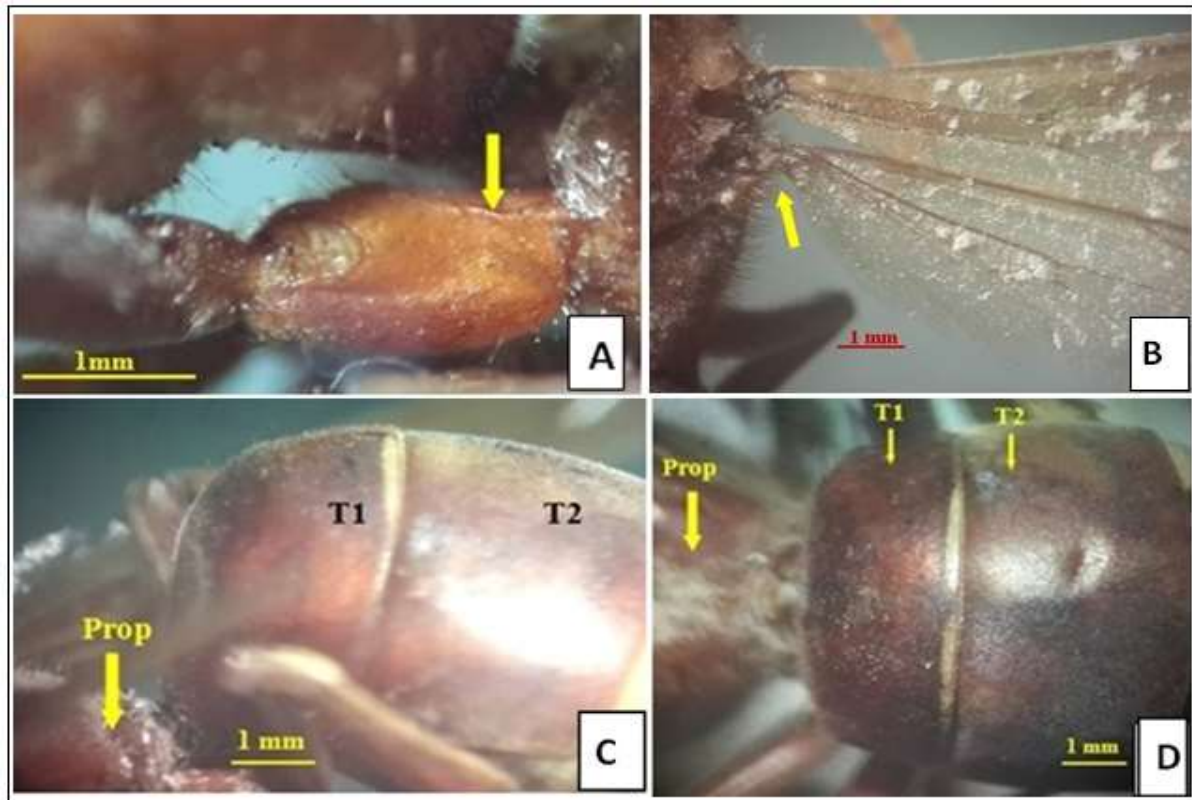
**Fig. 1.** The species of *Polistes wattii*, A: two spurs on apical part of mid tibia; B: claws of mid tibia; C: dorsal surface of hind coxa; D: basal part of hind wing that shown jugal lobe (yellow pointer), E: dorsal surface of thorax that shown no parategula (red pointer); F and G: lateral and dorsal view of propodeum and anterior parts of gaster (Prop: propodeum; T: tergite).



**Fig. 2.** The different parts of *Delta dimidiatipenne*, A: One spurs on apical part of mid tibia; B: Claw of mid tibia (red pointer on bifid); C: Dorsal surface of thorax.

2-Coxa with longitudinal carina dorsally (Fig. 3A); jugal lobe absent on hind wing (Fig. 3B); first gastral segment truncate anteriorly in dorsal view, so that gaster appears sessile, sharply angular in lateral view (Fig. 3C, D) ..... subfamily: Vespinae .....6.

Coxa without longitudinal carina dorsally (Fig. 1 C); jugal lobe present on hind wing (Fig. 1 D); first gastral segment not anteriorly truncate dorsally, gaster sub-sessile and semi-petiolate, gradually sloping in lateral view (Fig. 1 F, G) ..... subfamily: Polistinae ..... Genus of *Polistes* Latreille, 1802.



**Fig. 3.** The species of *Vespa orientalis*, A: dorsal surface of hind coxa (the pointer on carina); B: base of wings; C, D: lateral and dorsal view of propodeum and anterior parts of gaster, (Prop: propodeum; T: tergite).

3-Gaster not petiolate; first gastral segment relatively short, always wider than long (Fig. 4A, B) .....4

Gaster clearly petiolate; the first gastral segment at least two times as long as wide (Fig. 4C, D) ..... 5.

4- Anterior face of pronotum with two small, close set, deeply impressed medial pits (Fig. 5 A); tegula campanulate, abruptly expanded and broadly rounded posterolaterally (Fig. 5B) ..... Genus of *Stenodynerus* de Saussure, 1863

Anterior face of pronotum without pits; tegula variously shaped, posteriorly rounded (Fig. 4A) ..... Genus of *Odynerus* Latreille, 1802.

5-Pronotum with pretegular carina (Fig 6 A); first gastral sternite gradually widening toward the apex, usually clear along the full petiole length, never appearing as a posterior crescent like-shaped sclerite, lateral margins of first gastral tergite not meeting ventrally (Fig 6C); first gastral tergite without clearly punctate (Fig. 6E) ..... Genus of *Delta* de Saussure, 1855.

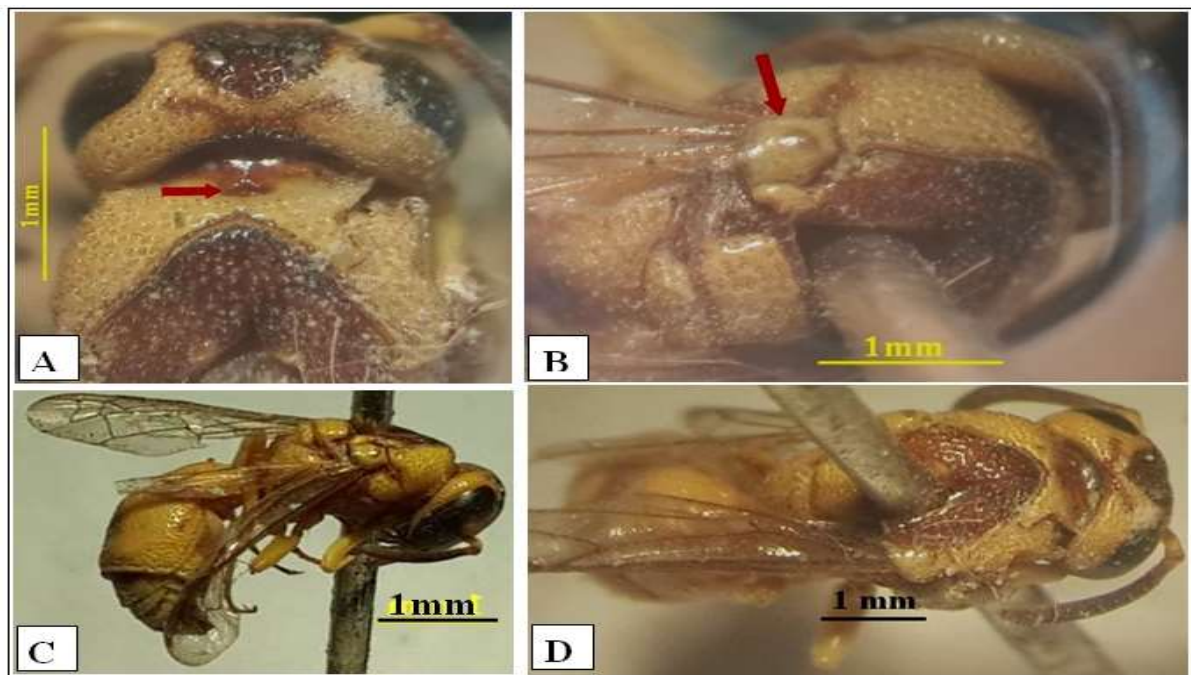
Pronotum without pretegular carina (Fig. 6B); first gastral sternite suddenly widening at near apex, forming a posterior crescent like-shaped sclerite, lateral margins of first gastral tergite very closely from each to other ventrally (Fig. 6D); first gastral tergite usually densely punctate (Fig. 6F)..... Genus of *Eumenes* Latreille, 1802.

6-Vertex long, distance between posterior ocelli and occiput greater than distance between posterior ocelli

and compound eyes (Fig. 7A) ..... Genus of *Vespa* Linnaeus, 1758.



**Fig. 4.** A, B: Dorsal and lateral body of *Odynerus* sp.; C, D: Dorsal and ventral view of *Delta* sp.



**Fig. 5.** Genus of *Stenodynerus* , A: dorsal surface of anterior parts (pointer refer to pits that found on anterior margin of pronotum), B: tegula; C, D: female habit, lateral and dorsal view.

Vertex shorter, distance between posterior ocelli and occiput shorter than or equal to distance between posterior ocelli and compound eyes (Fig. 7B)..... Genus of *Vespula* Thomson, 1869.

#### Subfamily

#### Eumeninae

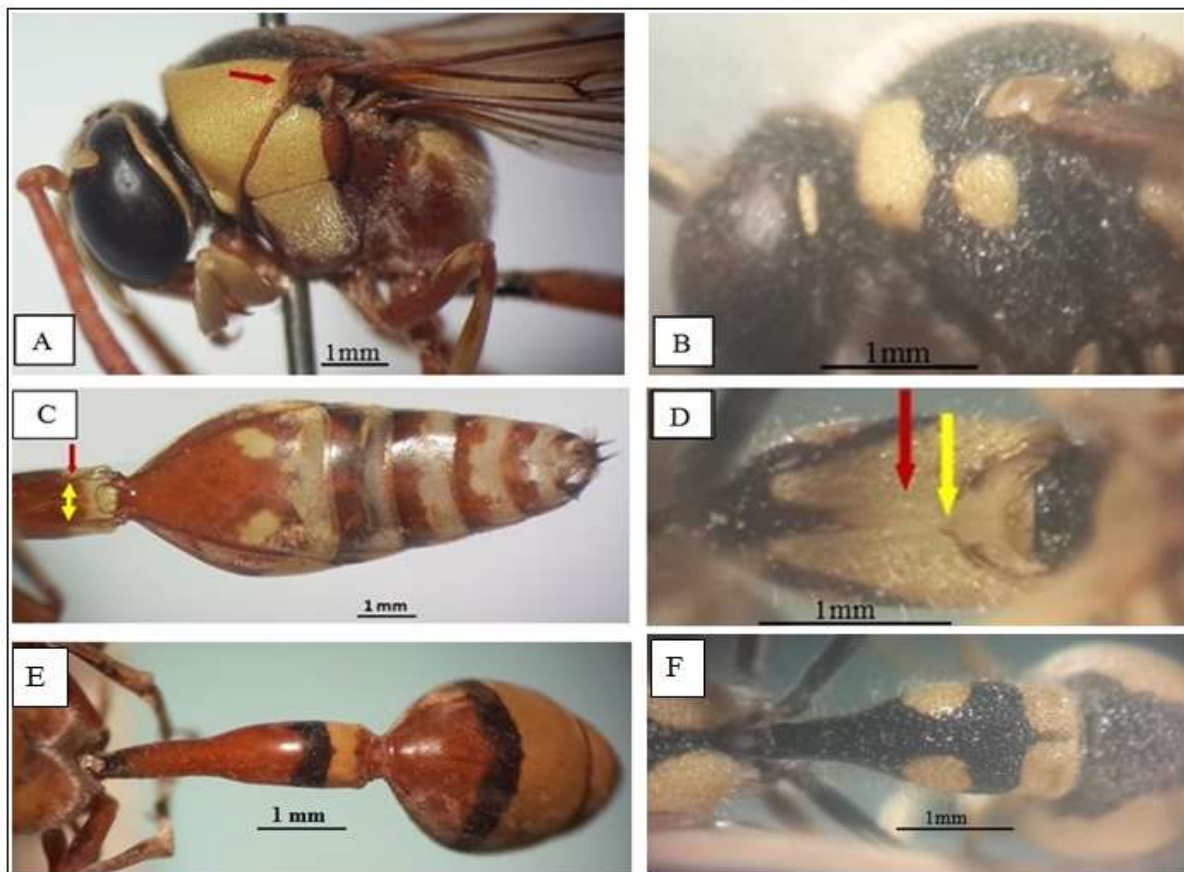
In our investigations, there four species that

belonging to three genera belonging to this subfamily, these species are:

*Stenodynerus* sp. (Figure 5).

#### Material

(3♀♀): Wasit, Shahabi (1♀) 10.VI.2015; Al-Zubaidiya (1♀) 25.VII.2016. Maysan, Hawizeh Marshes, Umm An-Ni'aaj (1♀) 9.VI.2015.



**Fig. 6.** *Delta esuriens* A: lateral view of thorax, C & E: ventral and dorsal metasoma that shown petiole; *Eumenes pomiformis* B, lateral view of thorax, D & F ventral and dorsal of petiole (yellow pointer: sternite1, red pointer: tergite1).

*Eumenes pomiformis* (Fabricius, 1781) (Plate 8 A, B)

#### Material

(5♂♂, 2♀♀): Baghdad, Bab Al-Mudham: (2♂♂) 18.VIII.2016. Dohuk, Sersenk (1♂, 2♀♀). Wasit, Shahabi: 27.X.2016 (1♂). Maysan, Hawizeh Marshes, Umm An-Ni'aaj, (1♂) 28.X.2016.

#### Distribution

Iraq (Khalaf, 1958); Europe, Malta, Turkey, Lebanon, Crimea, Tunisia (Yıldırım and Kojima, 1999).

Male: Clypeus yellow, mandibles black. Scape yellow ventrally, black dorsally.

The last flagellomere mat yellow recurved hook-shaped to the eleventh flagellomere. Sixth and seventh gastral tergites black, the rest with yellow bands.

Female: Clypeus yellow, longer than wide and free margin is toothed. Mandibles black. Scape yellow ventrally, black dorsally; pedicel and flagellum black. Gasteral tergites 3-5 with yellow bands, 6th tergum black.

*Odynerus spinipes* (Linnaeus, 1758) (Figure 4 A, B)

#### Material

(6♂♂): Wasit, Shahabi: 28.VII.2016 (2♂♂).

Maysan, Hawizeh Marshes, Umm An-Ni'aaj: (4♂♂) 28.X.2016.

#### Distribution

Europe, Turkey (Yıldırım and Kojima, 1999); in Iraq, this species is registered under name *Hoplomerus spinipes* (Linnaeus, 1758) by Khalaf (1958).

The males of this species characterized by markings of all body with yellow; mid femurs diagnosed by have toothed-like projections.



**Fig. 7.** Vertex and Occiput A: *Vespa orientalis*, B: *Vespula vulgaris*.

*Delta dimidiatipenne* (de Saussure, 1852) (Figure 4, 6, 8C).

#### Materials

(3♀♀): Diyala, Adhim: 26.VII.2016 (3♀♀).

#### Distribution

Iraq (Derwesh, 1965); North-West Africa, Egypt, Somalia, Turkey, Yemen, and Afghanistan to Nepal and western India (Vecht and Fischer, 1972); Iran, Oman, Palestine, Saudi Arabia (Yıldırım and Kojima, 1999); Pakistan (Bodlah *et al.*, 2011); Canary Islands (Vardy and Vardy, 1988).

This species can be diagnosed from *Delta esuriens* by the posterior part of second gasteral tergite black, there no yellow color in other parts, while in the *D. esuriens*, the posterior part of second gasteral tergite and other different parts of body with yellow color.

#### Delta esuriens

(Fabricius, 1787) (Plate 4 C, D; 6 A, C, E; 8D, E)

#### Materials

(8♂♂, 13♀♀): Baghdad: Jaddria, 30.IX.2016 (2♀♀); Wasit: Al-Zubaidiya 9.IX.2016 (2♂♂, 4♀♀); Dohuk, Sersenk, 27.VII.2016 (1♂, 3♀♀); Erbil: Rawanduz, 1.VIII.2016 (2♂♂); Maysan: Hawizeh Marshes, Umm An-Ni'aaj, 28. X.2016 (3♂♂, 4♀♀).

#### Distribution

This species was registered for Iraq by Morice (1921) as *Eumenes esuriens* (Fabricius), then Vecht and Fischer (1972) were referred to this species in Iraqi fauna as *Delta esuriens* (Fabricius); in the world it distributed in India, Saudi Arabia, Indonesia, Iran, Myanmar, Pakistan, Philippines, Sri Lanka; Thailand, Vietnam (Nguyen *et al.*, 2007); Thailand (Srinivasan

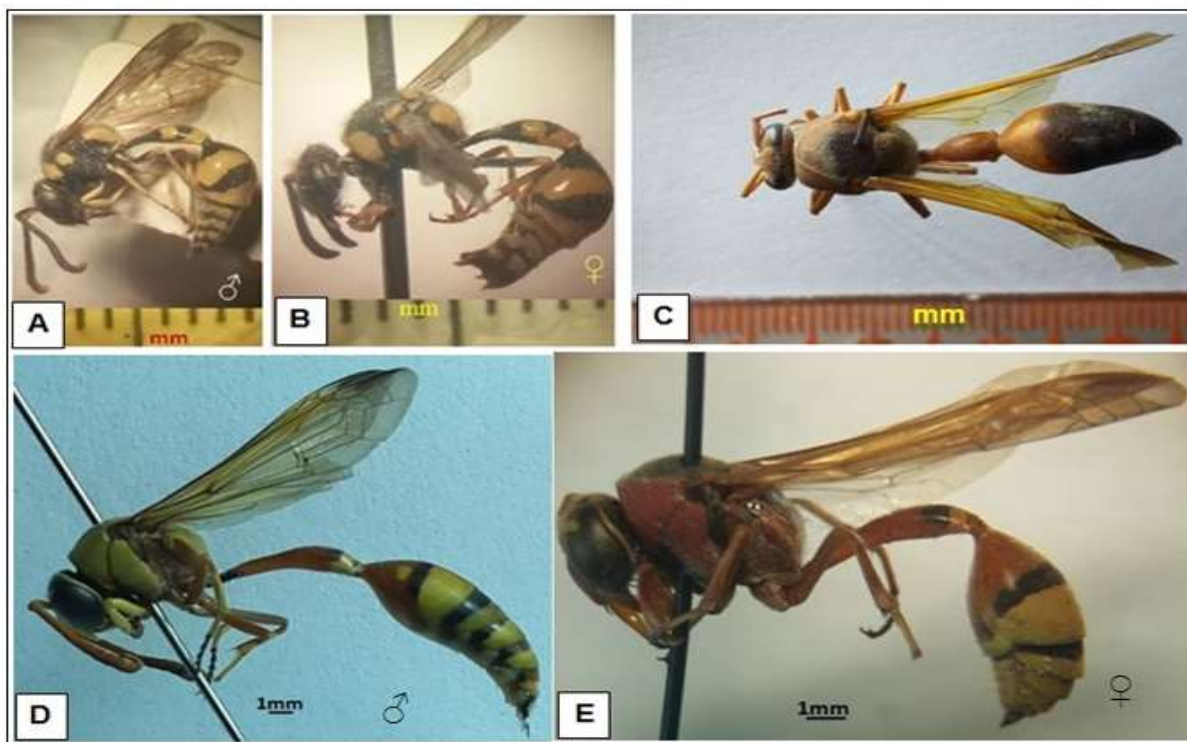
and Kumar 2010); Australia, Laos, Mauritius, Timor (Kumar, 2012; Kumar and Sharma, 2014).

*D. esuriens* characterizes by the mesoscutum with red and black markings; apical part of petiole with yellow band.

#### Subfamily

#### Polistinae

According to previous checklists the genus of *Polistes* Latreille, 1802 was registered in Iraq only.



**Fig. 8.** A, B: *Eumenes pomiformis*; C: Female of *Delta dimidiatipenne*; D, E: *Delta esuriens*.

*Polistes gallicus* (Linnaeus, 1767) (Figure 9 A, B, C, D)

#### Materials

(9♂♂, 11♀♀): Maysan; Amara, (1♂, 3♀♀) 27.X.2016; Wasit: Al-Zubaidiya, (6♂♂, 3♀♀) 29.VI.2016; Dohuk, Sersenk, (2♂♂, 5♀♀) 27.VII.2016.

#### Distribution

Iraq (1965); South and Central of Europe, North Africa, Ukraine, Russia, Caucasus, Mongolia, China, Israel, Turkey (Carpenter, 1996); Jordan (Haddad *et al.*, 2007).

*P. gallicus* characterize from *P. nimpha* (Christ, 1791) that recorded to Iraqi fauna previously (Derwesh, 1965) by having many features: generally, body color less black; female: mandibles black with yellow spot, genae and temples black;

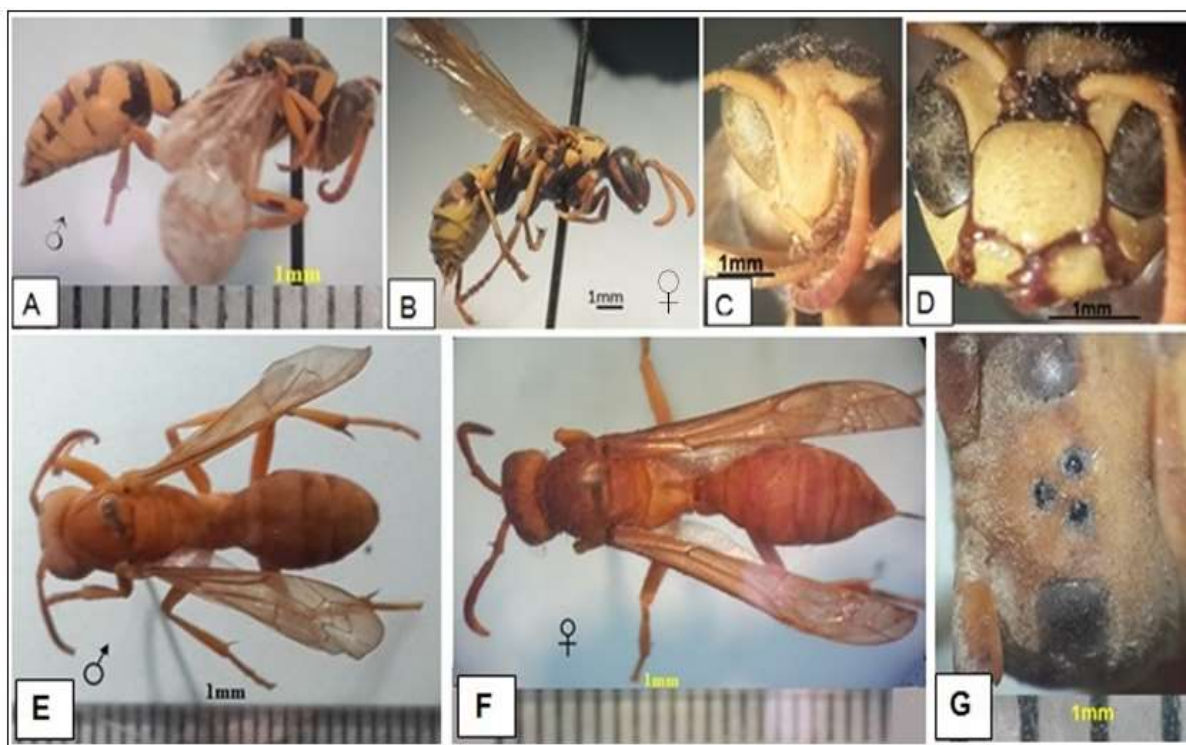
last sternum yellow with black marking. Male: lateral sides of clypeus convergent below keel between antennae without groove; clypeus without ridges at lateral margins; antennae with orange-yellow color above beyond third antennomere.

#### *Polistes wattii*

Cameron, 1900 (Figure 1; 9 E, F, G)

#### Materials

(17♂♂, 21♀♀): Baghdad, Bab- Al Mudham: (4♂♂, 2♀♀) 16.VI.2016, (3♀♀) 11.X.2016. Maysan, Amara, (2♂♂, 1♀) 27. X.2016. DhiQar, Al Refai, (4♂♂, 4♀♀) 17. III. 2016. Wasit, Shahabi: (1♀) 27.X.2016; Al-Zubaidiya 29.VI.2016 (3♂♂, 3♀♀), 6.VII.2016 (1♀), 14.VII.2016 (4♂♂, 5♀♀). Maysan, Hawizeh Marshes, Umm An-Ni'aaj, (1♀) 28.X.2016.



**Fig. 9.** *Polistes gallicus* A, B: male and female, C, D: face male and female; E, F, G: male, female and ocelli of *P. wattii*.

#### Distribution

Iraq (El- Haidari *et al.*, 1971); Mauritius, China, Afghanistan, Iran, Saudi Arabia, United Arab Emirates, Tajikistan, Oman, Pakistan and India (Kumar and Sharma, 2014 and 2015).

The species of *P. wattii* differ from *P. olivaceus* (De Geer, 1773) that registered in Iraq by Khalaf and Al – Omar (1974) in different features: the first one is larger form wasps (usually exceed 16 mm), occipital carina in female complete; ocellus enclosed with black mark. Mesoscutum brownish without distinct yellow stripes; metasoma brown, mixed with yellow color; coxae without black markings.

#### Subfamily: Vespinae

*Vespa orientalis* Linnaeus, 1771 (Figure 3, 10 C).

#### Materials

(28♀♀): Baghdad, Bab- Al Mudham: (2♀♀) 16.VI.2016; Shurta Al Khamisa, (2♀♀) 11.X.2016. Maysan, Amara (3♀♀) 27. X.2016. Dhi Qar,

Al Refai (2♀♀) 17. III. 2016. Wasit, Shahabi (2♀♀) 27.X.2016; Al-Zubaidiya 29.VI.2016 (1♀), 6.VII.2016 (2♀♀), 14.VII.2016 (2♀♀). Babil, Musayyib (9 ♀♀) 25.X.2016. Maysan, Hawizeh Marshes, Umm An-Ni'aaj, (3♀♀) 28.X.2016.

#### Distribution

Iraq (Morice, 1921); Afghanistan, Pakistan, India, Mexico, Italy, Malta, Bulgaria, Albania, Romania, Russia, Uzbekistan, Tajikistan, Turkmenistan, Turkey, Nepal, China, Madagascar, Greece, Cyprus, Ethiopia, Somalia, Algeria, Libya, Egypt, Israel, Iran, Bahrain, Oman, Saudi Arabia, U.A.E., Yemen, Palestine, Lebanon, Syria and Jordan (Carpenter and Kojima, 1997; Dvořák, 2006; Gusenleitner, 2013; Kumar and Sharma, 2014).

This species can be diagnostic by: pretegular carina complete; second, fifth and sixth gastral tergites dark brown color; third and fourth gastral tergites yellow.

*Vespula germanica* (Fabricius, 1793).

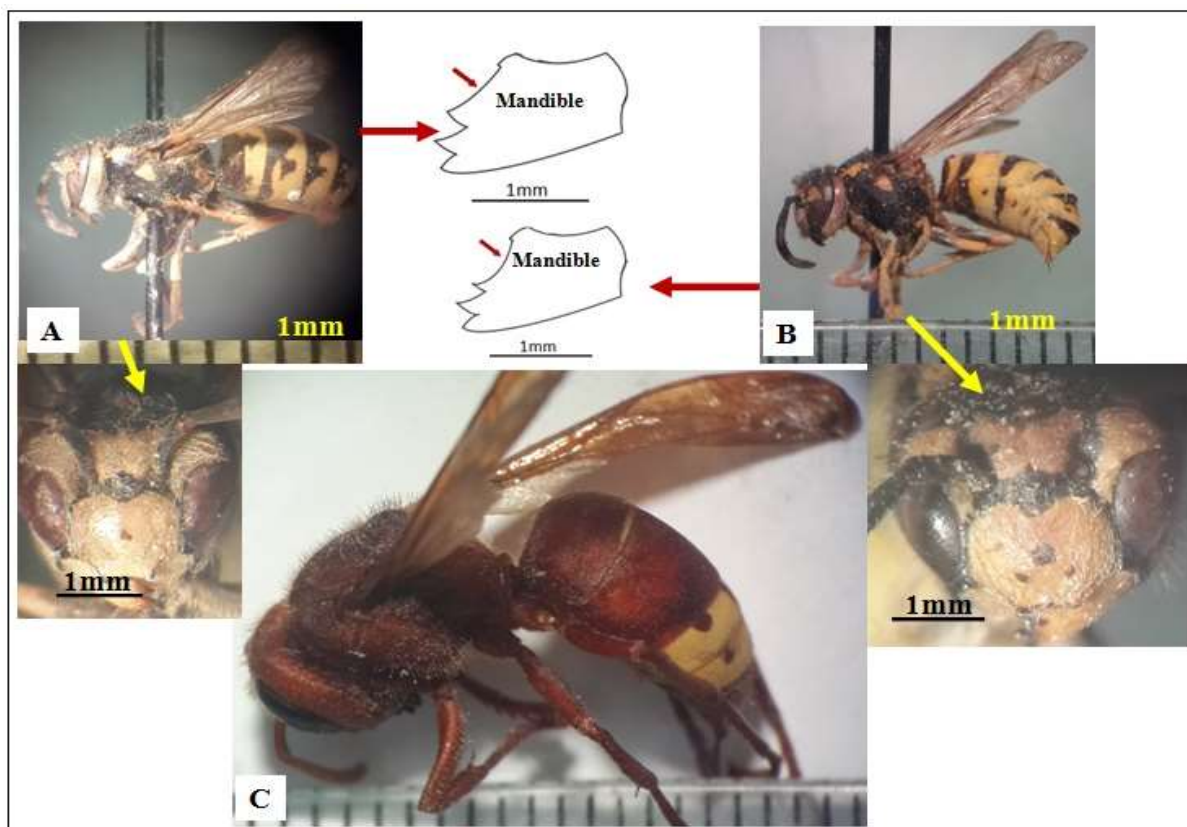
#### Materials

(3♀♀): Dohuk, Sersenk, 27.VII.2016.

#### Distribution

Iraq (Khalaf, 1958); South Africa (Whitehead and Prins, 1975); North Africa, South and Central Europe,

Scandinavia (Pekkarinen and Huldén, 1995), Asia Minor, Iran, Afghanistan, Pakistan, India, Central Asia, Kazakhstan, Mongolia, China, Korea. Iceland, Canada, USA, Chile, Argentina, Australia, New Zealand, Russia, N. Caucasus, Southern Siberia (Tobias, 1978; Dubatolov, 1998).



**Fig. 9.** *Polistes gallicus* A, B: male and female, C, D: face male and female; E, F, G: male, female and ocelli of *P. wattii*.

*Vespula vulgaris* (Linnaeus, 1758).

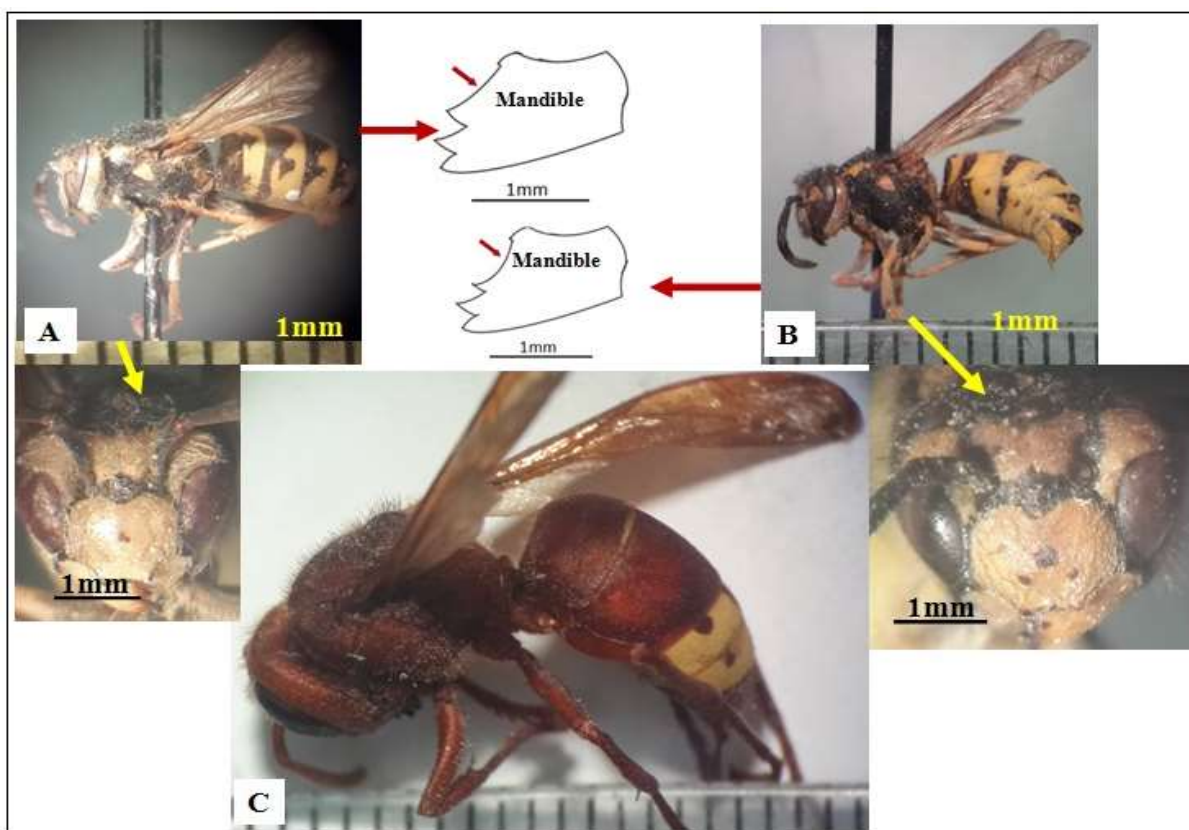
#### Materials

(2♀♀): Dohuk, Solaf 28.VII.2016.

#### Distribution

Iraq (Khalaf, 1961); Most of North America, from Alaska to northern Mexico; widespread in Europe; across the Palearctic part of Asia to Japan; introduced to Iceland, New Zealand, Australia and Hawaii (Carpenter and Kojima, 1997).

The two species above that belonging to *Vespula* are very closely that having body with black and yellow colored, but we can isolate *V. germanica* from *V. vulgaris* by: margin behind third mandibular tooth distinctly concave, usually with three black dots on clypeus while in last species the margin behind third mandibular tooth straight and clypeus usually with one black mark (Figure 10 A, B).



**Fig. 10.** A: *Vespula vulgaris*, female; B: *Vespula germanica*, female; C: *Vespa orientalis*, female.

### Acknowledgments

The author is thankful to the professor of insect taxonomy, Dr. M. S. Abdul-Rassoul, Iraq Natural History Research Center and Museum, Baghdad University for providing facilities.

### References

- Archer ME.** 1989a. A Key to the world species of the Vespinae (Hymenoptera). Research Monograph of the College of Ripon and St. John **2(1)**, 1-41.
- Archer ME.** 1989b. A key to the world species of the Vespinae (Hymenoptera). Research Monograph of the College of Ripon & York St. John **2(2)**, 1-34.
- Akre RD, Greene A, MacDonald JF, Landolt PJ, Davis HG.** 1980. Yellow jackets of America North of Mexico. Agriculture Handbook, NO.552, U.S. Department of Agriculture, Washington, USA. 102 p.
- Barthélémey C.** 2008. Provisional Guide to the Social Vespids of Hong Kong (Hymenoptera: Vespidae). On line: [http://insectahk.com/book\\_page.Html](http://insectahk.com/book_page.Html).
- Bodlah I, Bodlah M A, Akhter T, Naeem M, Khan MR.** 2011. Record of *Delta dimidiatipenne* (de Saussure, 1852) (Hymenoptera: Eumeninae, Vespidae) from Barani areas of Punjab Province of Pakistan. Pakistan Journal Zoology **43(5)**, 1019-1020.
- Buck M, Marshall SA, Cheung DKB.** 2008. Identification Atlas of the Vespidae (Hymenoptera, Aculeata) of the northeastern Nearctic region. Canadian Journal of Arthropod Identification **5**, 1-492.
- Carpenter JM.** 1982. The phylogenetic relationship and natural classification of the Vespoidea (Hymenoptera). Systematic Entomology **7**, 11-38.

- Carpenter JM.** 1996. Distributional checklist of species of the genus *Polistes* (Hymenoptera, Vespidae, Polistinae, Polistini). American Museum Novitates **3188**, 1-39.
- Carpenter JM.** 2008. Review of Hawaiian Vespidae (Hymenoptera). Bishop Museum Occasional Papers **99**, 18.
- Carpenter JM, Kojima J.** 1997. Checklist of the species in the subfamily Vespinae (Insecta: Hymenoptera: Vespidae). Natural History Bulletin of Ibaraki University **1**, 51-92.
- Carpenter JM, Nguyen LPT.** 2003. Keys to the genera of social wasps of South-East Asia (Hymenoptera: Vespidae). Entomological Science **6**, 183-192.
- Chang V.** 1988. Toxic baiting of the western yellow jacket (Hymenoptera: Vespidae) in Hawaii. Journal of Economic Entomology **81** (1), 228-235.
- Derwesh AI.** 1965. A preliminary list of identified insects and arachnids of Iraq. *Director General Agriculture Research Projections Baghdad*, Bulletin **121**, 123 p.
- Dubatolov VV.** 1998. Social wasps (Hymenoptera, Vespidae: Polistinae, Vespinae) of Siberia in the collection of Siberian Zoological Museum. Far Eastern Entomologist **57**, 1-11.
- Dvořák L.** 2006. Oriental Hornet *Vespa orientalis* Linnaeus, 1771 found in Mexico (Hymenoptera, Vespidae, Vespinae). Entomological Problems **36**(1), 80.
- Dvořák L, Roberts SPM.** 2006. Key to the paper and social wasps of Central Europe (Hymenoptera: Vespidae). Acta Entomologica Musei Nationalis Pragae **46**, 221-244.
- Dvořák L, Ghahari H, Carpenter JM, Abbasi R.** 2012. On the distribution and taxonomy of vespine wasps of Iran (Hymenoptera: Vespidae: Vespinae). Acta Musei Moraviae, Scientiae Biologicae **97**(2), 69-86.
- Ebrahimi E, Carpenter JM.** 2008. Catalog of the vespid wasps of Iran (Hymenoptera, Vespidae). Zootaxa **1785**, 1-42.
- Gusenleitner J.** 1998. Über Faltenwespen aus dem asiatischen Raum (Hymenoptera, Eumenidae, Masaridae). Linzer Biologische Beiträge **30** (2), 503-513.
- Gusenleitner J.** 2013. Die Gattungen der Vespidae im Nahen Osten, in Nordafrika und in Arabien (Hymenoptera: Vespidae). Linzer biologische Beiträge **45**(2), 1025-1046.
- Goulet H, Huber JT.** 1993. Hymenoptera of the World: An Identification Guide to Families. Ottawa: Agriculture Canada, 668 p.
- Haddad NJ, Dvořák L, Adwan O, Mdanat H, Bataynah A.** 2007. New data of Vespidae wasp fauna of Jordan (Hymenoptera: Vespidae). Linzer Biologische Beiträge **39**(1), 137-142.
- Khalaf KT.** 1958. Some Hymenoptera and Coleoptera from Iraq. Iraq Natural History Museum Publication **14**, 1-3.
- Khalaf KT.** 1961. Miscellaneous insects from Iraq. Bulletin of the Iraq Natural History Museum **1**(7), 1-7.
- Khalaf AN, Al-Omar MA.** 1974. A second list of insects from Iraq. Biological Research Centre, Publication **2**, 41 p.
- Kumar PG.** 2012. Redescription and new distribution records of *Delta esuriens* (Fabricius) (Hymenoptera: Vespidae: Eumeninae) from Indian states. Records of the Zoological Survey of India **112**(part-4), 55-60.
- Kumar PG, Sharma G.** 2014. Taxonomic Studies on vespid wasps (Vespidae: Vespoidea: Hymenoptera: Insecta) of Rajasthan, India with Six New Records from the State. Journal on New Biological Reports **3**(3), 240 – 258.

- Kumar PG, Sharma G.** 2015. Taxonomic Studies on vespid wasps (Hymenoptera: Vespoidea: Vespidae) of Chhattisgarh, India. *Journal of Threatened Taxa* **7(14)**, 8096–8127.
- Morice FD.** 1921. Annotated lists of aculeate Hymenoptera (except Heterogyna) and chrysidids recently collected in Mesopotamia and north-west Persia. *Journal of the Bombay Natural History Society* **28**, 192–203.
- Nguyen LTP.** 2015. Taxonomic Notes on the Genus *Delta* de Saussure (Hymenoptera: Vespidae: Eumeninae) from Vietnam. *Animal Systematics, Evolution and Diversity* **31 (2)**, 95-100.
- Pekkarinen A, Huldén L.** 1995. Distribution and phenology of the Vespinae and Polistinae species in eastern Fennoscandia (Hymenoptera: Vespidae). *Sahlbergia* **2**, 99-111.
- Pickett KM, Wenzel JW.** 2004. Phylogenetic Analysis of the New World Polistes (Hymenoptera: Vespidae: Polistinae) Using Morphology and Molecules. *Journal of the Kansas Entomological Society* **77(4)**, 742-60.
- Raveret Richter M.** 2000. Social wasp (Hymenoptera: Vespidae) foraging behavior. *Annual Review of Entomology* **45**, 121-150.
- Seath CJ.** 1999. Wasp (Hymenoptera: Vespidae) trapping with carbohydrates, pp. 275-280. In: *Proceedings of the 3rd international conference on urban pests* (Robinson, W. H.; Rettich, F.; Rambo, G. W., Eds), 19-22 July 1999, Prague, Czech Republic.
- Srinivasan G, Kumar PG.** 2010. New records of potter wasps (Hymenoptera: Vespidae: Eumeninae) from Arunachal Pradesh, India: five genera and ten species. *Journal of Threatened Taxa* **2(12)**, 1313–1322.  
<http://dx.doi.org/10.11609/JoTT.02468.1313-22>
- Tobias VI.** 1978. Superfamily Vespoidea - hornets.1. Family Vespidae. In: *A key to insects from the European part of the USSR. T. III. [Hymenoptera]*. P. 1. Nauka, Leningrad: 147-152. (In Russian).
- Tüzün A, Bagriacik N, Gulmez Y, Kirpik MA.** 2000. Studies on Eumenidae of Aegean Region (Insecta: Hymenoptera). *Entomofauna* **21(16)**, 197-212.
- Vecht J, Van der, Fischer FCJ.** 1972. Palaearctic Eumenidae. *Hymenopterorum Catalogus (Novo Editio)* **8**, 1–197.
- Whitehead VB, Prins AJ.** 1975. The European wasp, *Vespula germanica* (F.), in the Cape Peninsula. *Journal of the Entomological Society of Southern Africa* **38**, 39–42.
- Yıldırım E, Kojima J.** 1999. Distributional checklist of the species of the family Vespidae (Insecta: Hymenoptera; Aculeata) of Turkey. *Natural History Bulletin of Ibaraki University* **3**, 19-50.