



Revision of the Charipinae species present in India with some taxonomic changes (Hymenoptera: Cynipoidea, Figitidae, Charipinae)

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Abstract. Charipinae species present in India are revised and taxonomic changes are proposed for some species recently described from this country. In total seven species are nowadays valid from India: *Alloxysta brevis* (Thomson, 1862), *A. consobrina* (Zetterstedt, 1838), *A. nottoni* Ferrer-Suay & Pujade-Villar, 2015, *A. pleuralis* (Cameron, 1879), *Phaenoglyphis indica* Ferrer-Suay & Pujade-Villar, 2013, *P. longicornis* (Hartig, 1840) and *P. villosa* (Hartig, 1841). *Alloxysta ochracea* Bijoy & Rajmohana, 2013, is a new synonymy of *A. brevis* (Thomson, 1862). *Alloxysta bhagyae* Bijoy & Rajmohana, 2013, *A. indica* Bijoy & Rajmohana, 2013, and *A. sholicola* Bijoy & Rajmohana, 2013 are new synonymies of *A. consobrina* (Zetterstedt, 1838). Comments and figures are included here to support these taxonomic changes. Diagnosis for these species and a key to identify the Charipinae from India is also incorporated.

Keywords: Charipinae, India, revision, *Alloxysta*, *Phaenoglyphis*

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Introduction

The Charipinae (Hymenoptera: Cynipoidea, Figitidae) are very small wasps (0.8-2.0 mm). They are mainly characterized by their smooth and shiny body. Members of the subfamily Charipinae are widely distributed around the world (Ferrer-Suay *et al.*, 2012). They are biologically characterized being hyperparasitoids of aphids via Aphidiinae (Hymenoptera: Ichneumonidae: Braconidae) and Aphelininae (Hymenoptera: Chalcidoidea: Aphelinidae) and hyperparasitoids of psyllids via Encyrtidae (Hymenoptera: Chalcidoidea) (Menke & Evenhuis, 1991). *Alloxysta* Förster, 1869 and *Phaenoglyphis* Förster, 1869 are the most numerous and widely distributed genera within this subfamily.

Eight genera are distinguished in this subfamily: *Alloxysta* Förster, 1869 (cosmopolitan), *Apocharips* Fergussou, 1986 (Eastern Palearctic and Neotropics), *Dilapothor* Paretas-Martínez & Pujade-Villar, 2006 (Australia), *Dilyta* Förster, 1869 (cosmopolitan except Australia), *Lobopterocharips* Paretas-Martínez & Pujade-Villar, 2007 (Nepal), *Lytoxysta* Kieffer, 1909 (North America), *Phaenoglyphis* Förster, 1869 (cosmopolitan), and *Thoreauana* Girault, 1930 (Australia). The Charipinae have been diversified along with their host primary parasitoids and secondary hosts. To consult the characters to recognize Charipinae species, hosts, and distribution we can use www.charipinaedatabase.com (Ferrer-Suay and Garrido-Salas, 2014).

Considering that the material deposited in India cannot be loaned we have performed this revision based on the work published by Bijoy & Rajmohana (2013); fortunately, this work has nice pictures of the species described and some diagnostic characters are mentioned in the descriptions. Bijoy and Rajmohana described four new *Alloxysta* species (*A. ochracea*, *A. bhagyae*, *A. indica* and *A. sholicola*). After comparing the images presented in this

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paper with other well-known and widely distributed *Alloxysta* species we conclude that *A. bhagyae*, *A. indica* and *A. sbolica* are a junior synonym with *A. consobrina* (Zetterstedt, 1838) and *A. ochracea* is a junior synonymy with *A. brevis* (Thomson, 1862).

According with the data available (Ferrer-Suay *et al.*, 2012, 2013, 2015, 2018, 2019) now seven Charipinae species are present in India. We have included here a diagnosis for each species, references of distribution and hosts records and a key to identify them.

Materials and methods

Morphological terms used are taken from Paretas-Martínez *et al.* (2007). Measurements and abbreviations include F1–F12, first and subsequent flagellomeres. The width of the forewing radial cell is measured from the margin of the wing to the beginning Rs vein. The transfacial line is measured as the distance between the inner margins of compound eyes, measured across the face through the antennal sockets divided by the height of the eye. The malar space is measured by the distance from the lower part of the gena from the mouthparts to the ventral margin of the compound eye, divided by the height of the eye. Females and males of the species shortly described have the same characters except where indicated.

The following institutions abbreviations are used:

- BMNH (British Museum Natural History, London, England; D. Notton)
- MZLU (Lund Museum of Zoology, Lund, Sweden; R. Danielsson)
- ZSM (Zoologische Staatssammlung Museum, München, Germany; S. Schmidt)

Results

Alloxysta brevis (Thomson, 1862)

Alloxysta brevis Thomson, 1862: 408. Type: deposited in MZLU (examined).

Alloxysta ochracea Bijoy & Rajmohana, 2013 **syn.nov.**

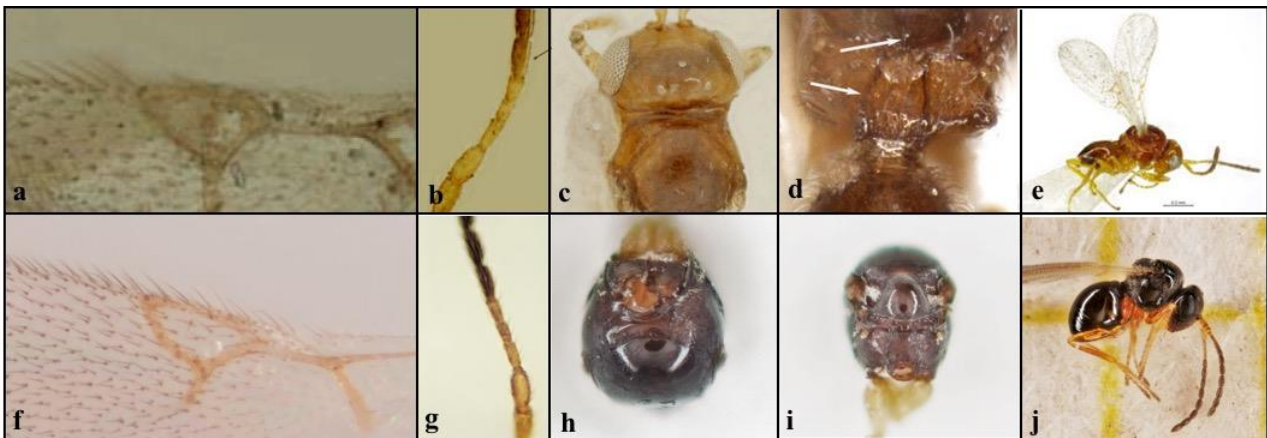


Fig. 1. Comparison between *A. brevis* female (a- Radial cell, b- Antennae, c- Pronotum, d- Propodeum, e- Lateral habitus) and *A. ochracea* (f- Radial cell, g- Antennae, h- Pronotum, i- Propodeum, j- Lateral habitus).

Comments. We established this synonymy based on the following shared features: closed radial cell (being 2.1 times as long as wide), F1 shorter than pedicel, F1–F3 subequal in length, pronotal carinae absent, propodeal carinae present forming a plate.

Diagnosis. It is mainly characterized by a small closed radial cell that is 2.1 times as long as wide (Fig. 1f & Bijoy & Rajmohana, 2013: Fig. 14); the absence of pronotal carina (Fig. 1h & Bijoy & Rajmohana, 2013: Fig. 18); the presence of propodeal carinae that forms a plate (Fig. 1i & Bijoy & Rajmohana, 2013: Fig. 17); and female and male antennae with rhinaria beginning in F4, F1 shorter than pedicel, and F1–F3 subequal in length (Fig. 1g & Bijoy & Rajmohana, 2013: Fig. 10). It is similar to *A. darvi* (Girault, 1933) but they can be differentiated by the length of antennae (shorter than the body in *A. brevis* but longer in *A. darvi*) and the marginal setae in the fore wing (shorter in *A. brevis* than *A. darvi*).

Distribution. Easter Paearctic and Holartic (Ferrer-Suay *et al.* 2018).

Alloxysta brevis has a cosmopolitan distribution with variable coloration (brown to black) (Figs 1 a-e). From India was previously mentioned by Ferrer-Suay *et al.* (2013) in Aligarh (Uttar Prades). Bijoy & Rajmohana (2013) mention it from Kalpetta (Kerala).

Host. Consult Ferrer-Suay *et al.* (2012)

Alloxysta consobrina (Zetterstedt, 1838)

Cynips consobrina Zetterstedt, 1838: 410. Type: deposited in MZLU (examined).

Xystus fuscicornis Hartig, 1841: 352. Type: deposited in ZSM (examined), junior synonymy.

Alloxysta bhagyae Bijoy & Rajmohana, 2013 **syn.nov.**

Alloxysta indica Bijoy & Rajmohana, 2013 **syn.nov.**

Alloxysta sholicola Bijoy & Rajmohana, 2013 **syn.nov.**

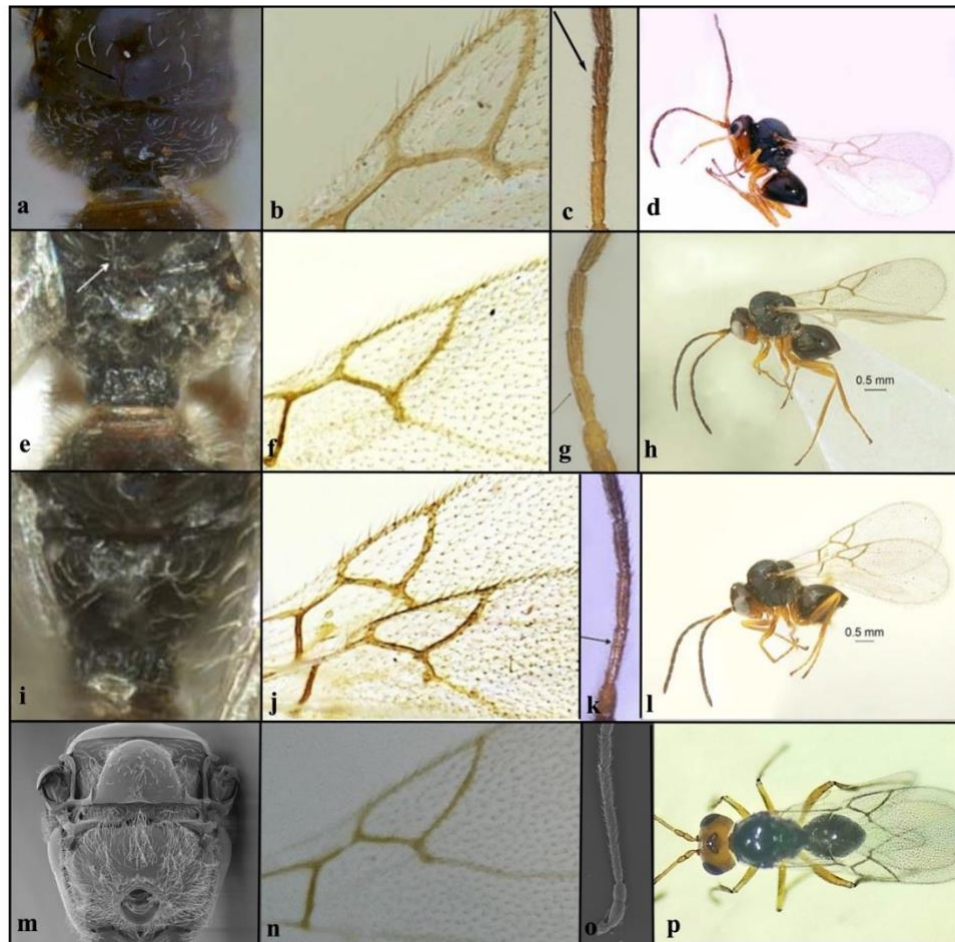


Fig. 2. Comparison between *A. consobrina*, *A. bhagyae*, *A. indica*, *A. sholicola* and *A. ochracea* female: a) propodeum of *A. bhagyae*; b) radial cell of *A. bhagyae*; c) antennae of *A. bhagyae*; d) habitus of *A. bhagyae*; e) propodeum of *A. indica*; f) radial cell of *A. indica*; g) antennae of *A. indica*; h) habitus of *A. indica*; i) propodeum of *A. sholicola*; j) radial cell of *A. sholicola*; k) antennae of *A. sholicola*; l) habitus of *A. sholicola*; m) propodeum of *A. victrix*; n) radial cell of *A. victrix*; o) antennae of *A. victrix*; p) habitus of *A. victrix*.

Comments. We established this synonymy based on the following shared features: closed radial cell (being 2.4 or 2.5 times as long as wide), F1 longer than pedicel, F1 longer than F2, F2 subequal to F3 and F4, pronotal carinae present, propodeal carinae absent, carinae present on the apex of mesoscutellum. Male with F2 and F3 curved. However, there are a few other features that are variable and do not match exactly with *A. consobrina* features. In *A. indica*, rhinaria begins in F1 in female antennae and F2 is slightly shorter than F3 (but according with the images F2 and F3 are very similar in length, the position of the antennae in the image could disturb the appreciation).

Diagnosis. It is mainly characterized by a closed radial cell that is 2.7 times as long as wide (Fig. 2n & Bijoy & Rajmohana, 2013: Figs 11-13); the presence of pronotal carinae (Bijoy & Rajmohana, 2013: Fig. 5); the absence of propodeal carinae (Fig. 2m & Bijoy and Rajmohana, 2013: Figs 6, 15-16); and male and female antennae with rhinaria beginning in F4, F2 longer than F3, F3 shorter than F4 (Fig. 20 & Bijoy & Rajmohana, 2013: Fig. 7-9), and bowed F1–F3 in males. It is similar to *A. circumscripta* (Hartig, 1841), but they can be differentiated by

flagellomere proportions F1 is longer than F2 and F2 is subequal to F3 in *A. consobrina*, while F1 is subequal to F2 and F2 is shorter than or subequal to F3 in *A. circumscripta* and the size of the radial cell (2.7 times as long as wide in *A. consobrina* but 2.5 times in *A. circumscripta*).

Distribution. Cosmopolitan (Ferrer-Suay *et al.* 2018).

From India was previously mentioned by Ferrer-Suay *et al.* (2013) in Rajouri. Bijoy & Rajmohana (2013) mention it from Idukki (Kerala).

Host. Consult Ferrer-Suay *et al.* (2012).

Alloxysta nottoni Ferrer-Suay & Pujade-Villar, 2015

Alloxysta nottoni Ferrer-Suay & Pujade-Villar, 2015 in Ferrer-Suay *et al.* 2015: 846. Type: deposited in BMNH.

Diagnosis. *Alloxysta nottoni* is characterized by the presence of pronotal carinae and propodeal plate, radial cell completely open, rhinaria and club shaped begin in F3 and F1 subequal to pedicel. It is similar to *Alloxysta xanthopa* (Thomson, 1862) distributed in the Palaearctic region. They could be differentiated by the relation between pedicel/F1: F1 subequal to pedicel in *A. nottoni* but F1 longer than pedicel in *A. xanthopa*; size of radial cell: 2.2 times as long as wide in *A. nottoni* while it is 2.4 times in *A. xanthopa*.

Distribution. India (Manali) (Ferrer-Suay *et al.* 2015).

Host. Unknown.

Alloxysta pleuralis (Cameron, 1879)

Allotria pleuralis Cameron, 1879: 113. Type: deposited in BMNH (examined).

Diagnosis. This species is easily differentiated from other *Alloxysta* species by the following combination of features: partially open radial cell; pronotal carinae present; two propodeal carinae well defined reaching the base independently; female antennae: F1 longer than F2, F2 shorter than F3 and F3 shorter than F4; male antennae: F1-F3 subequal in length and slightly curved.

Distribution. Palaearctic and Oriental (Ferrer-Suay *et al.* 2018).

Host. Consult Ferrer-Suay *et al.* (2012)

Phaenoglyphis indica Ferrer-Suay & Pujade-Villar, 2013

Phaenoglyphis indica Ferrer-Suay & Pujade-Villar, 2013 in Ferrer-Suay *et al.* 2013: 20. Type: deposited in BMNH.

Diagnosis. *Phaenoglyphis indica* is easily differentiated from other *Phaenoglyphis* species present in Asia because it is the only species with a completely open radial cell.

Distribution

Oriental region (India, Kashmir, Srinagar) (Ferrer-Suay *et al.* 2013).

Host. Consult Ferrer-Suay *et al.* (2012).

Phaenoglyphis longicornis (Hartig, 1840)

Xystus longicornis Hartig, 1840: 199. Type: deposited in ZSM (examined).

Diagnosis. *Phaenoglyphis longicornis* is mainly characterized having closed radial cell being 2.7 times as long as wide, pronotal and propodeal carinae, notauli present, oval scutellar foveae with straight margins, separated by a carina and not delimited at the bottom, female antennae with the beginning of rhinaria in F1, F1 longer than pedicel and F2, F2 subequal to F3 and F3 shorter than F4. It is similar to *P. stricta* but they can be differentiated by the beginning of rhinaria: in all the surface of F1 in *P. longicornis* while the rhinaria begin in the last three quarters of F1 in *P. stricta*; shape of scutellar foveae: scutellar foveae not delimited on the bottom in *P. longicornis* while they are not delimited on top and on the bottom in *P. stricta*; size of radial cell: 2.7 times as long as wide in *P. longicornis* but 2.4 times in *P. stricta*.

Distribution. Palaearctic and Oriental (Ferrer-Suay *et al.* 2018).

Host. Consult Ferrer-Suay *et al.* (2012)

Phaenoglyphis villosa (Hartig, 1841)

Xystus villosus Hartig, 1841: 353. Type: deposited in ZSM (examined).

Diagnosis. *Phaenoglyphis villosa* is characterized having partially open radial cell being 2.1-2.7 times as long as wide, pronotal and propodeal carinae present, notauli absent, scutellum with two deep oval foveae more or less separated by a carina or completely fused, female antennae with the beginning of rhinaria in F3, F1 as long as pedicel or slightly longer, F1 subequal to F2, F2 shorter than F3, F3 shorter than F4, male antennae with the beginning of rhinaria in F3, F1 subequal to F2, F2 shorter than F3. At the moment *P. villosa* is easily differentiated from the other *Phaenoglyphis* species because it is the only *Phaenoglyphis* species with partially open radial cell.

Distribution. Cosmopolitan (Ferrer-Suay *et al.* 2018).

Host. Consult Ferrer-Suay *et al.* (2012).

Below is presented a key to identify the Charipinae species present in India:

- 1. Lower part of mesopleuron with horizontal sulcus..... *Phaenoglyphis* Förster, 1869 2
 - Mesopleuron lacks horizontal sulcus. *Alloxysta* Förster, 1869 4

- 2. Radial cell closed, rhinaria begin in F1. *P. longicornis*
 - Radial cell open or partially open, rhinaria begin in other flagellomeres. 3

- 3. Radial cell partially open along anterior margin, scutellar foveae present..... *P. villosa*
 - Radial cell completely open, scutellar foveae absent. *P. indica*

- 4. Radial cell closed. 5
 - Radial cell open or partially open. 6

- 5. Pronotal carinae absent, propodeal plate present. *A. brevis*
 - Pronotal carinae present, propodeal plate absent. *A. consobrina*

- 6. Radial cell partially open, two propodeal carinae well defined reaching the base independently. *A. pleuralis*
 - Radial cell completely open, propodeal carinae fused forming a plate..... *A. nottoni*

Discussion

According to the results mentioned here, from India have been registered only seven Charipinae species: *Alloxysta brevis* (= *Alloxysta ochracea* Bijoy & Rajmohana, 2013 **syn.nov.**), *A. consobrina* (= *Alloxysta bhagyae* Bijoy & Rajmohana, 2013 **syn.nov.**, = *Alloxysta indica* Bijoy & Rajmohana, 2013 **syn.nov.** and = *Alloxysta sholicola* Bijoy & Rajmohana, 2013 **syn.nov.**), *A. nottoni* Ferrer-Suay & Pujade-Villar, 2015, *A. pleuralis* (Cameron, 1879), *Phaenoglyphis indica* Ferrer-Suay & Pujade-Villar, 2013, *P. longicornis* (Hartig, 1840) and *P. villosa* (Hartig, 1841). The distribution of the Charipinae species present in this country can be consulted in Figure 3 and details in Table 1.

All these species have previously been reported by Ahmad & Singh (1996) and Ferrer-Suay *et al.* (2013, 2015). It is true that new collects will increase the number of Charipinae species known from India.

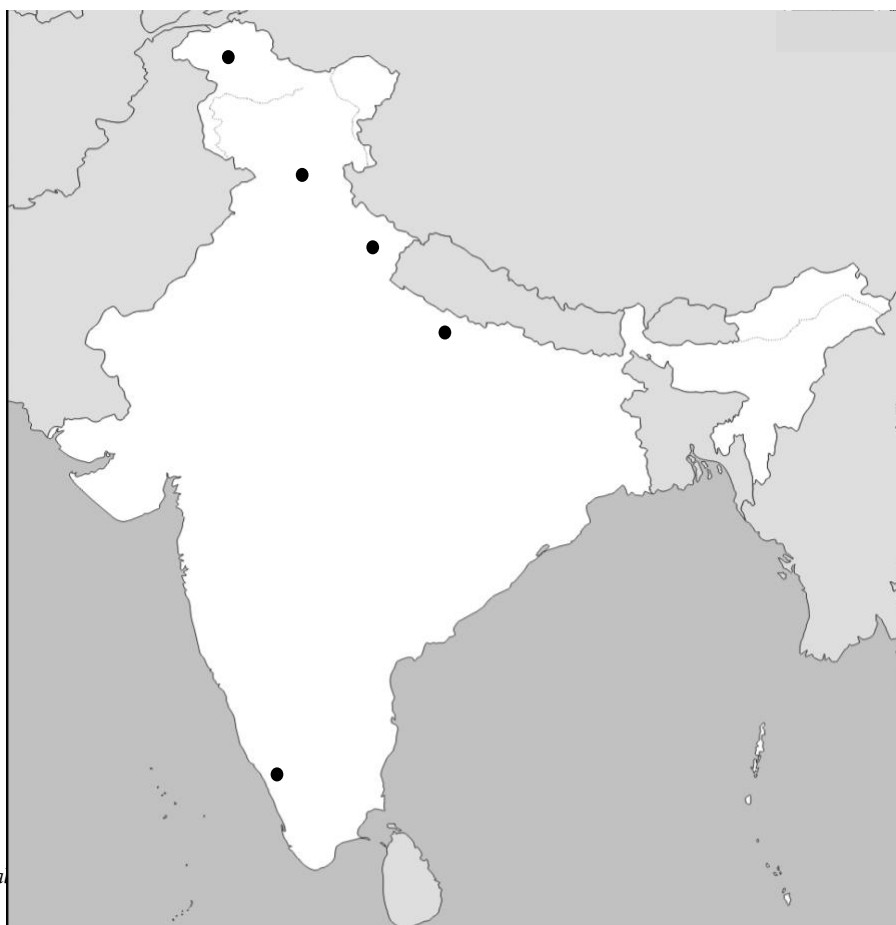





Fig. 3. Charipinae distribution in India (map extracted from d-maps.com).**Table 1.** Localities where Charipinae species have been collected.

Charipinae species	Locality
<i>Alloxysta brevis</i>	Aligarh (Uttar Pradesh) Kalpetta (Kerala)
<i>Alloxysta consobrina</i>	Rajouri Idukki (Kerala)
<i>Alloxysta nottoni</i>	Manali
<i>Alloxysta pleuralis</i>	India
<i>Phaenoglyptis indica</i>	Kashmir (Srinagar)
<i>Phaenoglyptis longicornis</i>	Rajouri
<i>Phaenoglyptis villosa</i>	India

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