

Chapter 2

Morphology and Anatomy

2.1 Morphology and Anatomy of the Adults

Hover wasps are the most beautiful of all social wasps. Most of them are not really colourful, but their elegance, especially when flying, competes against that of better known and more loved insects.

They can be considered medium-size wasps and their length varies between 10 mm (some species of *Parischnogaster*) and 25 mm (some *Eustenogaster*).

The colour in most genera is dark brown with brilliant shades of black mixed with yellow, white or yellowish spots, but in *Liostenogaster* both sexes are brown with more or less extended yellow areas. Some species present distinct black markings on the face that could be important for individual recognition (Fig. 2.2). The wings, transparent, have iridescent reflections in some species.

The body (Fig. 2.1) is distinctly divided into three parts: the head, with the antennae and mouthparts, the thorax (with the legs and wings) plus the first abdominal segment (the propodeum), and the gaster the first segment of which is a long petiole, truncate posteriorly. For a general description I shall refer to the scheme elaborated by Spradbery (1973) for vespine wasps, stressing the differences when necessary, and taking examples from species in the various genera. To summarise the main characteristics of some body parts in the various genera, I shall also use the technique known as TPS (thin-plate spline graphical analysis, Rohlf 2006, 2007), which compares landmark points of the exoskeleton obtained through specific algorithms, resulting in schematisation of the variability in a given sample population.

The matrix in Table 2.1, developed by Carpenter (2001) for the phylogenetic analysis of the genera summarises the principal characteristics of the group.

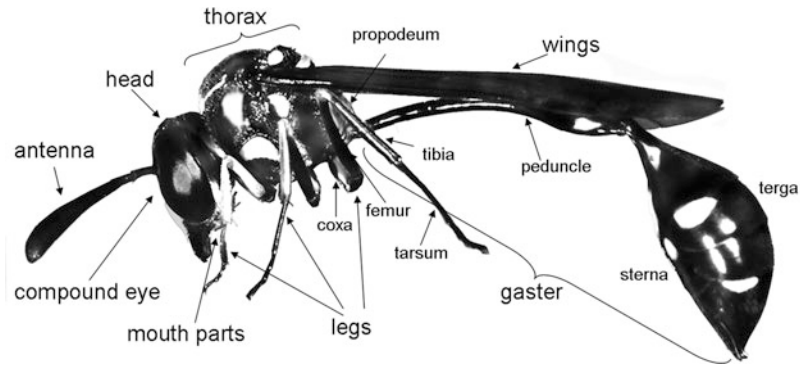


Fig. 2.1 Schematic picture of a female hover wasp (*Parischnogaster* sp.), indicating the main morphological parts

Table 2.1 Data on genera of Stenogastrinae (from Carpenter 2001)

Genera	Lio	Par	Met	Ani	Ste	Eus	Coc
Occip. carina	0	1	1	1	1	1	1
Male clypeus	0	0	0	0	2	1	1
Male teeth	\$	0	1	0	2	2	1
Maxillary palp	0	0	0	0	1	1	*
Male antennae	0	0	1	0	2	0	3
Notauli	0	0	1	0	0	0	1
Scutellum	0	0	0	0	0	1	*
Prop. valvula	0	1	2	0	0	0	1
Prop. sculpture	\$	\$	0	1	0	2	2
II metasomal	0	1	1	1	0	0	0
Parameral spine	0	1	0	0	0	0	2
Aedeagus	0	1	1	0	0	0	1
Aedeagal Processes	0	0	1	0	0	0	1

- 1. Occipital carina: gap (0); fused to hypostomal carina (1)
- 2. Male clypeus: pointed apically (0); round (1); depressed (2); emarginate (3)
- 3. Male mandibular teeth: three (0); two (1); one (2); four or five (3)
- 4. Maxillary palpi: palpomeres 2 and 3 equal in length (0); 2 longer than 3 (1)
- 5. Male antennae: conical (0); flat (1); tipped (2); spatulate (3)
- 6. Notauli: weak (0); strong (1)
- 7. Scutellum: ecarinate (0); carinate in female (1)
- 8. Propodeal valvula: round (0); posteriorly attenuate (1); narrow (2)
- 9. Propodeal sculpture: striate (0); punctate (1); smooth (2)
- 10. Metasomal segment II: not petiolate (0); petiolate (1)
- 11. Parameral spine: spinose (0); flat (1); elbowed (2)
- 12. Aedeagus: normal (0); dilated (1)
- 13. Aedeagal processes: absent (0); present laterobasally (1)

An asterisk (*) denotes a polymorphism showing all applicable states; a dollar sign (\$) denotes a subset polymorphism (for *Liostenogaster*: Male mandibular teeth [0,1] and Propodeal structure [1,2]; for *Parischnogaster*: Propodeal structure [0,1]). Multistate characters are treated as non-additive

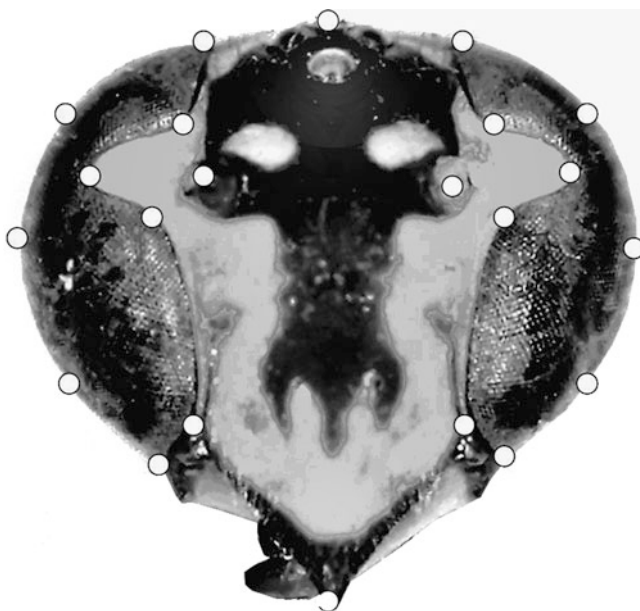


Fig. 2.2 Head of female *Liostenogaster flavolineata*, indicating the landmark points used for the TPS analysis

2.1.1 The Head

The shape of the head, viewed from the front, is sub-triangular owing to the very long mandibles (Fig. 2.2). This is particularly evident in *Stenogaster* (with average head length/width ratio of over 1).

According to TPS analysis performed on 26 landmark points on the head of females of 27 species from 6 genera, the largest variation in species occurs in head width rather than head length (Fig. 2.3). On the right side of the graph we find *Eustenogaster* and *Stenogaster* with heads longer than wide, while *Parischnogaster* presents the widest and shortest shape and *Liostenogaster* and *Metischnogaster* something in between (Fig. 2.3).

The clypeus is usually quite pointed in females and slightly less in the males, with the exception of males of *Eustenogaster* and *Metischnogaster*, which have a rounded clypeus, and *Stenogaster* where it is rounded apically and slightly depressed.

A particular carina surrounding the occipital foramen (the occipital carina) fuses with the hypostomal carina in all the genera except *Liostenogaster*. This represents a distinction for this genus (Fig. 2.4).

The female antennae are generally somewhat clavate. In males they are generally conical but in *Metischnogaster* they are flattened, in *Stenogaster* truncate and in

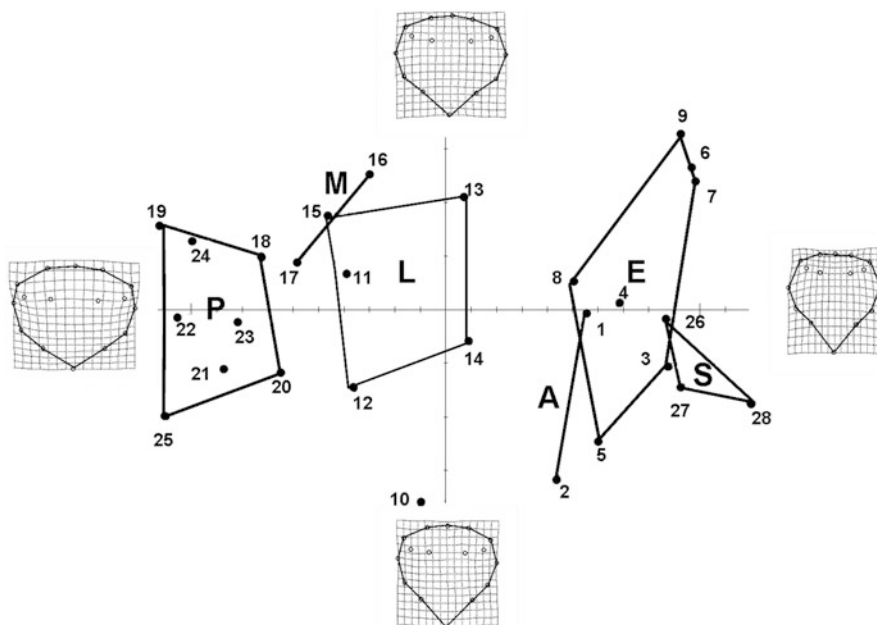


Fig. 2.3 General graph of head shape in 28 species belonging to 6 genera. obtained by TPS analysis of the landmark points indicated in Fig. 2.2. A = *Anischnogaster* (1 = *A. iridipennis*, 2 = *A. spilaspis*). E = *Eustenogaster* (3 = *E. latebricola*, 4 = *E. calyptodoma*, 5 = *E. fumipennis*, 6 = *E. hauxwellii*, 7 = *E. luzonensis*, 8 = *E. micans*, 9 = *E. palavanica*). L = *Liostenogaster* (11 = *L. flavolineata*, 12 = *L. nitidipennis*, 13 = *L. topographica*, 14 = *L. varipicta*, 15 = *L. vechti*). M = *Metischnogaster* (16 = *M. cilipennis*, 17 = *M. drewseni*). P = *Parischnogaster* (18 = *P. alternata*, 19 = *P. depressigaster*, 20 = *P. jacobsoni*, 21 = *P. mellyi*, 22 = *P. nigricans*, 23 = *P. striatula*, 24 = *P. timida*, 25 = *P. unicuspata*). S = *Stenogaster* (26 = *S. canaliculata*, 27 = *S. concinna*, 28 = *S. latebricola*). 10 = *Holischnogaster* (= *Parischnogaster*) *gracilipes*

the males of the genus *Cochlischnogaster* there is a final spatulate segment with a peculiar spoon shape (Fig. 2.5).

Regarding the mouthparts, the mandibles are much thinner than those in polistine or vespine wasps: in the females they can bear up to three teeth, which also occur in the males of *Parischnogaster* and *Anischnogaster*. The mandibles of the males of *Metischnogaster* and *Cochlischnogaster* have two teeth, but in *Eustenogaster* and *Stenogaster* there is only one with the internal margin almost straight. The second tooth of the female mandible can be blunt or sharply edged depending on the material the species uses for nest construction (see Chap. 6, Fig. 6.72).

Eustenogaster and *Stenogaster* have a second maxillary palp which is three times longer than the third; the palpomeres are almost the same length as in the other genera.

The compound eyes are large; in male *Cochlischnogaster*, for example, Carpenter and Starr (2000) calculate that they are about 85 % as long as the entire head,

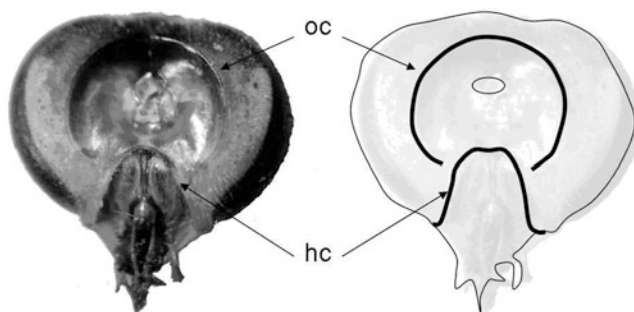


Fig. 2.4 Occipital view of the head of a *Liostenogaster* showing the occipital carina (oc) not reaching the hypostomal carina (hc)



Fig. 2.5 Antennae of a male of *Cochlishnogaster* with the peculiar final segment (courtesy of James Carpenter)

occupying almost all the side view of the head itself. The ocelli are also large if compared with those of most polistine and vespine wasps (personal observations), this could be related to the rather dark environments where the hover wasps live.

The colouration of the “face” is particularly evident in females and males of some species (*Liostenogaster*, *Eustenogaster*, *Metischnogaster* and some species of *Parischnogaster*) with widely varying intraspecific (and even intracolony) patterning, while in other species (such as *P. mellyi* and *P. nigricans serrei*) facial colouration is quite uniform. Males usually have less evident facial markings than females (Fig. 2.6).



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