

# **IDENTIFICATION OF INSECTS**

**Identification key of orders and main families**

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## PREFACE

In memory of prof Ezio Sgrò,  
my dear friend  
and teacher

These pages were written seven years after the publication in my web site<sup>1</sup> of the entomological section and aim to summarize its main subject: the identification.

Macro photography makes us think about the nature of the photographed creatures and insects are usually one of the most interesting subject. Therefore the goal is to give a compact and useful tool, in short words a vademecum helping in recognizing the family of the insect; indeed this is the lowest identification level allowed by macro photographs with living insects in their natural environment.

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<sup>1</sup> Identification of insects, <http://astrangesite.altervista.org>

## INTRODUCTION

Insects represent about 80% of all of the animal kingdom; we know more than a million of species and this number increases day by day with the progress of the entomological research. But it is also true that we often use the word "insect" speaking of animals that are not properly insects.

Insects can be distinguished from other animals because they are invertebrate and adults have 3 pairs of legs. Spiders and Millepede for example, are not insects because they are invertebrate too but have more than 6 legs, on the contrary they respectively belong to the class of Aracnida and of Diplopoda.

The body of adult insects is divided in three sections:

- head;
- thorax (divided in 3 segments) with three pairs of legs and in case the wings, two pairs at most;
- abdomen (usually divided in 11 segments, but are not more than 6 in collembola).

On the head there are the antennae (sensorial organs) variable in form and length, two compound eyes (formed by many eyes called ommatidia) and/or the ocelli (simple eyes), and the mouth parts which can be fitted for chewing, lapping or for sucking. The respiratory system is "tracheal", a system of small tubes communicating with outside assures the oxygenation of the internal tissues. They have the circulation of the blood and a heart.

Most of insects are oviparous, they lay eggs, but there are also viviparous insects procreating living insects and ovoviviparous insects, the incubation of eggs is internal and therefore the eggs open when they are laid. Most of insects are subject to metamorphosis process. Generally we individualize the following phases: egg, larva, pupa (or chrysalid) and adult.

which according to the species can be complete or not, in fact the pupa phase (in the meaning of phase preceding adult phase in which insect doesn't eat; notice that some authors use the word nymph to indicate the phase in object instead of the larva of insects with incomplete metamorphosis) might be missing. Generally we individualize the following phases: egg, larva, pupa (or chrysalid) and adult. For example, in species of caelifera and ensifera the metamorphosis is not complete; the larva, which is very similar to the adult, is subject to many moults before it become an adult.

The metamorphosis process is called incomplete if the pupa stage (in the meaning of phase preceding adult phase in which insect doesn't eat; notice that some authors use the word nymph to indicate the phase in object instead of the larva of insects with incomplete metamorphosis) is missing. In the phase of pupa the internal tissues are usually dissolved (histolysis). When metamorphosis is incomplete, "hemimetabolous" insects <sup>2</sup>, the larva (usually called as nymph) looks roughly like the adult arthropods, but only the last is sexually mature and, in the case of winged insects, has also completely developed wings. When metamorphosis is complete, "holometabolous" insects <sup>3</sup>, instead the larva has a very different look. At any case, generally the larva goes through 4-5 moults, in which it abandon its old cuticle (the new cuticle requires a bit of time to become hard so the insect just moulted has a pale soft body); the stage between a molt and the next one is called

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<sup>2</sup> Anoplura, Blattaria, Dermaptera, Embioptera, Ephemeroptera, Heteroptera, Homoptera, Isoptera, Mallophaga, Mantodea, Odonata, Orthoptera, Phasmida, Plecoptera, Psocoptera, Thysanoptera. Some authors use the term "hemimetabolous" speaking only of those insects with aquatic larvae and terrestrial adults (Odonata, Plecoptera, Ephemeroptera) and the term "paurometabolous" for the other ones; for these they use also the term "gradual metamorphosis"

<sup>3</sup> Coleoptera, Diptera, Hymenoptera, Lepidoptera, Mecoptera, Neuroptera, Siphonaptera, Strepsiptera, Trichoptera.

"instar". There are also insects with more than one intermediate stages, in that case the metamorphosis is called complex as there are more intermediate stages<sup>4</sup> and finally there are also insects that are not subject to metamorphosis, but during their life they molt many times ("ametabolous" insects<sup>5</sup>).

## CLASSIFICATION

For study reasons, all living organisms are divided into homogenous groups by using hierarchical categories; the upper category includes all the lower ones. This system was stated for the first time in the book "Systema Naturae" (1758) by Carl von Linné (Carlo Linneo, generally cited with the Latin name Linnaeus). The main categories are: "kingdom" (regnum), phylum, "class" (classis), "order" (ordo), "family" (familia), "genus" and "species".

Generally, we use also intermediate categories such as the "superfamily" which includes two or more families, or the "subfamily" grouping two or more genera. Really, each category is an "abstraction" built on the basis of "characters" shared by more living organisms.

In praxis each living organism is identified by using a couple of names ("binomial nomenclature"), that is by the genus and by the species in its "properly meaning", sometimes a third name is used to identify the "subspecies" (or geographical race).

Up today, there is not a definition of "species" having an universal validity: we can go from a "typological" definition, in this meaning the species is "a group of organisms having a minimal and sufficient range of common morphological characters", to the "biological" definition in which the species is "a group of inter-fertile organisms". The first definition clashes with the existence of "organisms" that, even though had the same morphology or with only insignificant differences, are not "inter-fertile"; the second one, of course, cannot be used for agamic organisms and for extinct organisms.

## IDENTIFICATION OF INSECTS

Generally, it is not easy to identify, that is to individuate the species of the insect we are looking at. Sometimes, such as for the butterflies, it is enough to compare our insect with photos found in books; but this is not always valid. Usually we have to look at certain morphological characters that are not always easily visible such as, the veins in the wings or the number of the segments in the antenna. For example, in Sicily there are four coleopter species of the genus *Scaurus*, the *Scaurus striatus* can be distinguished by its ribs on elytra. Furthermore, if we consider that only the class Insecta, the most numerous class of arthropods, includes more than 1.000.000 of species, than it is very clear how difficult it is to identify each arthropod. At any rate a good rule is to make more photos, from different angle-shots, from above and from lateral sides. We could try to proceed in this way:

1) at first, we can try to recognize the class (see the guide) and the order (for the insects see the specific section).

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<sup>4</sup> Anoplura, Blattaria, Dermaptera, Embioptera, Ephemeroptera, Heteroptera, Homoptera, Isoptera, Mallophaga, Mantodea, Odonata, Orthoptera, Phasmida, Plecoptera, Psocoptera, Thysanoptera. Some authors use the term "hemimetabolous" speaking only of those insects with aquatic larvae and terrestrial adults (Odonata, Plecoptera, Ephemeroptera) and the term "paurometabolous" for the other ones; for these they use also the term "gradual metamorphosis".

<sup>5</sup> Collembola, Protura, Diplura, Thysanura.

2) at second, we can compare our photo with those found in the web or in books; this step could help us to identify the species or could help us to get an idea about the family or the genus.

3) finally, we can use a list of morphological characters, obviously considering the characters well visible, in order to identify the family (or the genus, or the species); we can also use this list to test the result of the previous step (see the specific section).

A good aid comes from the "check lists" (lists of insects living in a specific geographical area) because they help us to narrow the search range. For example, if we took a photo of a coleopter in Sicily, we can reduce the search to the keys and photos of the families (or genus, or species) living in Sicily. In conclusion it is difficult, but not impossible: it requires time and patience. Of course, the best satisfaction is when we made it without catching and maltreating insects.

## ORDERS OF ITALIAN INSECTS

### **Anoplura (Sucking lice)<sup>6</sup>**

**Morphological distinctive characters:** flat body, small head, without wings, short antennae, mouth parts are suited for piercing. They are parasite of mammals and of man too.

### **Blattaria (Cockroaches)**

**Morphological distinctive characters:** body is flat, antennae are long, abdomen ends with two appendages (cerci) and males have other two smaller appendages. Generally they have 2 pairs of wings and front ones are thick. Mouth parts are suited for chewing.

### **Caelifera (Short-Horned Grasshoppers)<sup>7</sup>**

**Morphological distinctive characters:** hind femora are long and strong fitted for leaping, antennae are short, females have a very short ovopositor. Generally they are winged but hind wings are membranous while front wings (tegmina) are coriaceous and unfitted for flying.

### **Coleoptera (Beetles)**

**Morphological distinctive characters:** front wings are coriaceous (elytra), mouth parts are suited for chewing.

### **Collembola (Springtails)<sup>8</sup>**

**Morphological distinctive characters:** small insects without wings, usually they have a springing organ (furcula) kept under the abdomen when at rest. Springtails have always a ventral tube located under the first abdominal segment.

### **Dermaptera (Earwigs)**

**Morphological distinctive characters:** abdomen ends with appendage like forceps.

### **Diplura (Diplurans)<sup>8</sup>**

**Morphological distinctive characters:** without wings, without eyes, they live in the ground, the abdomen ends with two appendages (cerci) sometimes like forceps (but in this case you can distinguish them from Dermaptera because their tarsi have only 1 segment).

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<sup>6</sup> Anoplura and Mallophaga are considered by some authors as suborders of the order Phthiraptera.

<sup>7</sup> Caelifera and Ensifera are considered by some authors as suborders of the order Orthoptera.

<sup>8</sup> Collembola, Diplura and Protura are considered by some authors as belonging to a different class, that of Entognatha (subphylum Hexapoda).

### **Diptera (True Flies, Mosquitos)**

**Morphological distinctive characters:** generally they are winged, but only the front wings are suited for flying while hind ones are small and function as a balancing system (halteres), antennae usually are short. The biggest species wingless belong to the families Hippoboscidae and Nycteribiidae and are parasite of mammals, those of family of Braulidae are very small and parasite of bees.

### **Embioptera (Webspinners)**

**Morphological distinctive characters:** they are small insects with an elonged body and the first segment of front tarsi enlarged y modified for silk production; the silk is used in nest construction. Mouth parts are suited for chewing. Males can be winged.

### **Ensifera (Crickets, Long-Horned Grasshoppers, Locusts, Katydid<sup>9</sup>)**

**Morphological distinctive characters:** hind femora are long and strong, fitted for leaping. Antennae, except in species of family Grylotalpidae, are long as the body or more; females have a very long ovipositor. Generally they are winged but hind wings are membranous while front wings (tegmina) are coriaceous and unfitted for flying.

### **Ephemeroptera (Mayflies, Fishflies)**

**Morphological distinctive characters:** generally they are winged with four membranous wings, abdomen ends with two or three long appendages (cerci).

### **Heteroptera (True Bugs)**

**Morphological distinctive characters:** mouth parts are suited for piercing, generally they are phytophagous. Scutellum (triangular plate between bases of wings) is well developed. Usually they are winged but most of the front wings (hemelytra) is coriaceous. In species belonging to the family of Scutelleridae the scutellum covers all of the abdomen and it could be confused with elytra of Coleopter but we must consider that between the two elytron at rest, in the species of Coleoptera where they are not welded together, we can see a longitudinal line and this can help us.

### **Homoptera (Cicadas, Aphids, Whiteflies, Leafhoppers, Treehoppers)**

**Morphological distinctive characters:** mouth parts are suited for piercing (are phytophagous), generally they are winged and wings are membranous with a similar structure.

### **Hymenoptera (Ants, Wasps, Bees)**

**Morphological distinctive characters:** generally they are winged with two pairs of membranous wings (hind ones are smaller) transparent or with purple or brown reflections. Mouth parts are suited for chewing or sucking and lapping. Females of Mutillidae, Tiphidae and of some species of the superfamily Chrysidoidea are generally wingless. Formicidae are wingless too, but males and queens have wings up to the nuptial fly.

Belong to this order many species with social costume: bees, wasps, ants. In social structure there is the queen that is the only fertile female, males and female-workers; sometimes in the structure of ants there are also soldiers. Some species of ants bring up small aphides to get their sweet effluvia.

### **Isoptera (Termites)**

**Morphological distinctive characters:** elongated soft body, light colour; compound eyes are very small or absent but are well developed in males and females (females have a big abdomen); males and females are darker and have also two pairs of similar wings up to the nuptial flight. Are insects

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<sup>9</sup> Caelifera and Ensifera are considered by some authors as suborders of the order Orthoptera.

with social costume: there is a queen and a king too. Mouth parts are suited for chewing and most of them feed on wood.

### **Lepidoptera (Butterflies, Moth)**

**Morphological distinctive characters:** generally they are winged with 2 pairs of wings covered by colored scales (species of Sesiidae have wings with few scales and for their look might be confused with hymenoptera), mouth parts are fitted for lapping like a spiral (species of Micropterygidae have mouth parts fitted for chewing). Females of some species of Limntriidae and mainly of Geometridae have only vestigial wings (body is hairy and/or covered by scales).

Lepidoptera, usually called butterflies, for their colour and form are one of the most beautiful manifestation of nature. But not all of the lepidoptera have an elegant look, some species (for example those of Pterophoridae) are not so graceful.

### **Mallophaga (Biting lice)<sup>6</sup>**

**Morphological distinctive characters:** flat body, big head, without wings, short antennae, mouth parts are suited for chewing. They are parasite of birds and mammals too.

### **Mantodea (Mantids)**

**Morphological distinctive characters:** front legs are stronger than hind ones and fitted to catch preys (tibiae and femora have many thorns), mouth parts are suited for chewing

### **Mecoptera (Scorpion flies)**

**Morphological distinctive characters:** head with a long appendage in which there are mouth parts suited for chewing.

### **Neuroptera (Net-winged insects)**

**Morphological distinctive characters:** they have four membranous wings; wings held roof like when at rest. Most of all are carnivorous. The three Neuroptera suborders (Megaloptera, Raphidioptera and Planipennia) are generally considered just as insect orders.

### **Odonata (Dragonflies, Damselflies)**

**Morphological distinctive characters:** they have four membranous wings, mouth parts are suited for chewing, antennae are short, abdomen ends with appendages called cerci.

### **Phasmatodea (Walkingsticks)**

**Morphological distinctive characters:** big insects with elongated cylindrical body (just like a branch) or very flat (just like a leaf). Mouth parts are suited for chewing; are phytophagous.

### **Plecoptera (Stoneflies)**

**Morphological distinctive characters:** they have four membranous wings, hind wings have a caudal lobe, antennae are long and filiform, abdomen ends with appendages called cerci.

### **Protura (Proturans)<sup>10</sup>**

**Morphological distinctive characters:** very small insects living in the ground, the body is elongate and slender, without antennae, without eyes, without wings, fore legs stretched forward.

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<sup>10</sup> Collembola, Diplura and Protura are considered by some authors as belonging to a different class, that of Entognatha (subphylum Hexapoda).

### **Psocoptera (Psocids, Barklice, Booklice)**

**Morphological distinctive characters:** they are very small insects with long and filiform antennae, mouth parts are suited for chewing. They live in building too, usually inside books. Some species are winged.

### **Siphonaptera (Fleas)**

**Morphological distinctive characters:** body laterally compressed, without wings, short antennae, mouth part are suited for piercing. They are parasites of birds, mammals and of man too.

### **Strepsiptera (Stylopids, Twisted-winged insects)**

**Morphological distinctive characters:** very small insects: females look like worms and live inside insects (they are parasite) while males have broad antennae and are winged but fore wings are a bit like halteres of Diptera.

### **Thysanura (Silverfishes, Firebrats)**

**Morphological distinctive characters:** they have not wings and abdomen ends with three long appendages. Species without ocelli are sometimes considered as part of the distinct order of Zygentoma and those with ocelli as part of the order of Microcoryphia.

### **Thysanoptera (Thrips)**

**Morphological distinctive characters:** very small insects with elongate body, mouth parts are suited for rasping and sucking, they usually live on vegetables, winged species have two pairs of narrow wings fringed with hair, the body is narrow and flat in wingless species.

### **Trichoptera (Caddisflies)**

**Morphological distinctive characters:** they might be confused with lepidoptera, but generally wings are covered with hair and their antennae are long as wings or more.



## IDENTIFICATION KEY OF MAIN FAMILIES

Here it is a list of some morphological features of some Italian insect families; the family name is the Latin one. As the aim is to carry out the identification without capturing and maltreating insects, here are mainly shown those characters easily visible in macro pictures. To use this guide you must know the insect order, for this purpose please see the main section. Numbers near order (or suborder) name show the number of families here listed and the total number of families existing in Italy (check list dated 2003).

### **Blattaria [4/4]**

For a rigorous identification we should look at morphological features that are not easy to see in photos so here are only given general indications.

#### **Blattellidae**

- Body is elongate, they are from 0,7 to 1,6 cm long. Two of the three species living in Italy are common pests in buildings

#### **Blattidae**

- From 1,8 to 3,4 cm long. The two species living in Italy are common pests in buildings.

#### **Ectobiidae**

- From 0,6 to 1,5 cm long. They live in forests and grasslands.

#### **Polyphagidae [sp Polyphaga aegyptiaca (Linnaeus, 1758)]**

- Only one species lives in Italy (females have a rounded body).

### **Caelifera [6/6]**

#### **Acrididae**

- Antennae longer than front femora.  
- Pronotum not prolonged over abdomen.  
- Tarsi with 3 segments.

#### **Catantopidae**

- Prosternum with a conical tubercle.

#### **Pamphagidae**

- Prosternum with a tubercle without carina.

#### **Pyrgomorphidae [sp. Pyrgomorpha conica (Olivier, 1791)]**

- Conical head, vertex elongate.  
- Prosternum with a tubercle widening in its anterior side.

#### **Tetrigidae**

- Pronotum prolonged over abdomen.  
- Fore and middle tarsi with 2 segments, hind tarsi with 3 segments.

### **Tridactylidae**

- Hind femora very big.
- Fore and middle tarsi with 2 segments, hind tarsi with 1 segment or absent.

## **Coleoptera [87/140]**

### **Aderidae**

- Front and middle tarsi with 4 visible segments, hind tarsi with 4 or 3 visible segments.
- Small.

### **Anthicidae**

- Small (up to 0,4 cm long), the head is rounded and well separated from the thorax.
- Fore and median tarsi with 5 segments, hind tarsi with 4 segments.

a) Similar species are those in family **Pyrochroidae** (bigger, with toothed antennae).

### **Attelabidae** (included family **Brenthidae**)

- With a slender snout.
- Antennae not elbowed, clubbed, scape is short.

a) Similar species are those in families **Anthribidae** (snout is short, with groovy elytra), **Apionidae** (body with a pear shape, trochanters are long, antennae could be elbowed too), **Brachyceridae** (with a wrinkled body).

### **Bostrichidae**

- Head covered by the prothorax in part at least.
- Tarsi with 5 segments.
- With clubbed antennae, asymmetrical club with 3 segments.

a) Similar species are those in families **Anobiidae** (hind tarsi with 5 or 4 segments, without snout, head covered by prothorax, antennae generally without a distinct club), **Lyctidae** (tarsi with 5 or 4 segments, club with 2 segments), **Ptinidae** (hind tarsi with 5 or 4 segments, antennae are filiform).

### **Bruchidae**

- The apex of the abdomen is not covered by elytra.
- Tarsi with 4 visible segments.
- Hind femora thickened.

### **Buprestidae**

- Antennae not elbowed and not lamellate.
- Tarsi with 5 segments.
- The elytra cover entirely the abdomen.
- The prosternum has a spine extending into mesosternum.
- Prothorax closely attached to the abdomen, angles not prolonged.
- The first two abdominal segments are ventrally fused.

### **Byrrhidae**

- Oval body.
- They can retract the legs and antennae into cavities in the ventral body surface.

### **Cantharidae**

- With filiform antennae.
- Tarsi with 5 segments, the fourth segment with two lobes.
- Elytra cover most of the abdomen.

a) Similar species are those in family: **Lycidae** (with groovy elytra), **Drilidae** (elongated prosternum, antennae pectinate)

### **Carabidae** (included families: **Cicindelidae**<sup>11</sup>, **Rhysodidae**<sup>12</sup>)

- Filiform antennae inserted in the sides of the head between the eyes and the base of the mandible.
- All tarsi with 5 segments.
- Head narrower than the thorax.

### **Cerambycidae**

- Filiform antennae at least as long as the head and the thorax.
- Elongate body.
- Tarsi with 4 visible segments.
- Tibiae with spurs.

### **Chrysomelidae**

- Antennae shorter than the head and the thorax, not clubbed
- Tarsi with 4 visible segments.
- Tibiae without spurs.

### **Ciidae**

- Clubbed antennae.
- Tarsi with 4 or 3 segments.
- Head covered by the prothorax in part at least.

a) Similar species are those in families: **Colydiidae**, **Mycetophagidae**.

### **Cleridae**

- Antennae not elbowed and not filiform.
- Tarsi with 5 or 4 segments, one or more with two lobes.
- Thorax narrower than the elytra.
- Head as wide as the thorax.

### **Coccinellidae**

- Body with a round shape, with clubbed antennae.
- Tarsi with 3 visible segments.

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<sup>11</sup> Clypeus broader than distance between sockets of antennae.

<sup>12</sup> Antennae are moniliform, head and pronotum deeply grooved.

### **Cucujidae**

- Tarsi 5-5-5 or 5-5-4.
- The body is flat and elongate.
- Usually sides of thorax are toothed.
- Antennas are almost filiform.

a) Similar species are those in families: **Cryptophagidae** (antennae with a 2-segmented club), **Phalacridae** (oval body not flattened, antennae with a club), **Silvanidae** (antennae with a 3-segmented club).

### **Curculionidae** (included family **Rhynchophoridae**)

- With a slender snout.
- Antennae usually elbowed.
- With clubbed antennae, scape is long.

a) Similar species are those in families: **Scolytidae** (without snout, head covered by prothorax), **Platypodidae** (look like Scolytidae but body is cylindrical)

### **Dermestidae** (included families **Derodontidae, Nosodendridae, Thorictidae**)

- With clubbed antennae.
- Tarsi with 5 segments.
- Front coxae are conical and prominent.
- Body covered with scales or hair.
- Without a slender snout.
- Elytra cover entirely the abdomen.

### **Dytiscidae**

- Antennae filiform.
- Tarsi with 5 segments.
- Legs fitted for swimming, flattened and with a fringe of hairs.
- Two compound eyes.

### **Elateridae** (included families **Cerophytidae, Eucnemidae, Throscidae**)

- Antennae not elbowed.
- Tarsi with 5 segments.
- Pronotum with hind angles well developed.
- Prothorax movable upwards and downwards.

a) Similar species, but mandibles are more developed, are those in family **Cebrionidae**

### **Endomychidae** (included family **Alexiidae**)

- Tarsi with 4 or 3 segments.
- With clubbed antennae.

a) Similar species are those in families: **Cerylonidae, Corylophiidae** (small, head is small and covered by the prothorax in part at least, oval body, tarsi with 4 segments), **Latridiidae** (small, tarsi with 3 segments, elytra generally with furrows or tubercles), **Merophysiidae**.

### **Erotylidae**

- Tarsi with 5 segments.
- With clubbed antennae.

### **Gyrinidae**

- Antennae filiform.
- Tarsi with 5 segments.
- Legs fitted for swimming, flattened and with a fringe of hairs.
- Four compound eyes.

### **Haliplidae**

- Hind coxae like big plates.

### **Heteroceridae**

- Small, aquatic insect.
- Front tibiae with many spines.
- Antennae are hardy and short.

a) Similar species are those in families: **Dryopidae** (hairy, tibiae without spines), **Elmididae** (tibiae without spines, antennae are filiform).

### **Histeridae**

- Antennae elbowed and clubbed.
- Tarsi with 4 or 3 segments.
- Elytra does not cover the last abdominal segments.

### **Hydrophilidae**

- Palpi elongate.
- Legs fitted for swimming.

### **Lampyridae**

- Head covered by the prothorax in part at least.
- Tarsi with 5 segments.
- Abdomen of one or both sexes with organs emitting light.

### **Lucanidae**

- Antennae lamellate and elbowed.
- Tarsi with 5 segments.
- Without a slender snout.

### **Meloidae**

- Front and middle tarsi with 5 segments, hind tarsi with 4 segments.
- Head as wide as the thorax.

### **Melyridae**

- Antennae not lamellate.
- Tarsi with 5 or 4 segments without lobes.

### **Mordellidae**

- Front and median tarsi with 5 segments, hind tarsi with 4 segments.
- Head narrower than the thorax.
- Abdomen ending with a pointed shape.

a) Similar species, but the abdomen is not prolonged, are those in families: **Melandryidae**, **Scraptiidae**.

**Nitidulidae** (included families **Cybocephalidae**<sup>13</sup>, **Kateretidae**<sup>14</sup>)

- Small.
- All tarsi with 5 or 4 segments.
- Generally with clubbed antennae, club with 3 segments.
- Usually elytra does not cover the last abdominal segments.

a) Similar species are those in family: **Rhizophagidae** (club with 1-2 segments).

**Oedemeridae**

- Antennae not lamellate.
- Front and middle tarsi with 5 segments, hind tarsi with 4 segments.
- Middle coxae very prominent.

**Ripiphoridae**

- Antennae are pectinate at least in males.
- Generally with reduced elytra.
- Front and middle tarsi with 5 segments, hind tarsi with 4 segments.

**Scarabaeidae** (included families **Aphodiidae**<sup>15</sup>, **Cetoniidae**<sup>16</sup>, **Dynastidae**<sup>17</sup>, **Geotrupidae**<sup>18</sup>, **Melolonthidae**<sup>19</sup>, **Rutelidae**<sup>20</sup>, **Trogidae**<sup>21</sup>)

- Antennae lamellate but not elbowed.
- Front tibiae dilated and toothed or scalloped.
- Tarsi with 5 segments, in some species the fore tarsi are missed.

**Scirtidae**

- Small, aquatic larvae.
- Tarsi with 5 segments, the fourth is bilobed.

a) Similar species, but with terrestrial larvae, are those in families: **Clambidae** (head is big, with clubbed antennae), **Dascillidae** (bigger, segments 2, 3 and 4 of tarsi are bilobed), **Eucinetidae** (hind coxae very enlarged in triangular form).

**Staphylinidae**

- Antennae not lamellate.
- Elytra cover only the first segments of the abdomen.
- The abdomen is flexible.

a) Similar species are those in families: **Silphidae** (tarsi with 5 segments, Antennae are clubbed and elytra longer), **Pselaphidae** (very small, with clubbed antennae and long palpi).

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<sup>13</sup> Tarsi di 4 segmenti.

<sup>14</sup> Clava antennale poco distinta.

<sup>15</sup> Hind tibiae with two spurs, clypeus very wide.

<sup>16</sup> Hind tibiae with two spurs, claws of hind tarsi are equal.

<sup>17</sup> Hind tibiae with two spurs, claws of hind tarsi are equal, claws of median tarsi not toothed, antennal insertion not visible from above.

<sup>18</sup> Antennae with 11 segments, mouth parts are visible from above.

<sup>19</sup> Hind tibiae with two spurs, claws of hind tarsi are equal, claws of median tarsi are toothed.

<sup>20</sup> Hind tibiae with two spurs, claws of hind tarsi are different.

<sup>21</sup> With wrinkled elytra.

**Tenebrionidae** (included families **Alleculidae, Lagriidae**)

- Front and middle tarsi with 5 segments, hind tarsi with 4 segments.
- Head narrower than the thorax.
- Abdomen not ending with a pointed shape.

**Collembola [18/18]**

For a rigorous identification we should look at morphological features that are not easy to see in photos so here are only given general indications.

**Suborder Arthropleona [11/11]**

- Body is elongate.

**Entomobryoidea** (superfamily grouping: **Cyphoderidae, Entomobryidae, Isotomidae, Oncopoduridae, Tomoceridae**)

- Legs and antennae are long.

**Poduroidea** (superfamily grouping: **Hypogastruridae, Odontellidae, Onychiuridae, Neanuridae, Poduridae, Tullbergiidae**)

- Legs and antennae are short.

**Suborder Symphypleona [7/7]**

- Body is globular.

**Neelidae**

- Antennas shorter than head.

**Sminthuridae**

- Antennas at least as long as head.

a) similar species are those in families: **Arrhopalitidae, Bourletiellidae, Dicyrtomidae, Katiannidae, Sminthurididae.**

**Dermaptera [4/4]**

**Anisolabididae**

- Tegmina very small or absent.
- Forceps of males usually are not symmetrical.

**Forficulidae**

- Antennae with 11-16 segments.
- The second segment of tarsi has two lobes.

**Labiduridae**

- Antennae with 20-30 segments.
- Forceps of males not strongly curved.

**Labiidae**

- Antennae with 10-16 segments.
- Forceps of males are symmetrical.
- Less than 2 cm long.
- Tegmina generally well developed and meeting entire length.

## **Diplura [5/5]**

### **Suborder Dicellurata [2/2]**

- Cerci are like pliers.

#### **Japygidae**

- Cerci are like pliers.

- a) similar species are those in family **Parajapygidae**.

### **Suborder Rhabdura [3/3]**

- Cerci filiform.

#### **Campodeidae**

- Cerci are filiform and long.

- a) cerci are short in families: **Anayapigidae, Procampodeidae**.

## **Diptera [68/107]**

### **Sottordine Brachycera [12/18]**

- Antennae are shorter than thorax and usually with 3 segments.
- Anal cell is closed or much narrowed at wing borders.

#### **Acroceridae**

- With swollen body and a small head.
- The last segment of tarsi with 3 pads.

#### **Asilidae**

- Radial vein four branched.
- Top of the head hollowed out between the eyes.

#### **Bombyliidae**

- Radial vein with three-four branches.
  - First anal cell narrowly open, or closed close to the border of the wing.
  - Top of the head not hollowed out between the eyes.
  - They are usually hairy and have pictured wings.

#### **Dolichopodidae**

- Body is small; legs are long.
- Only one clear cross vein.
- Metallic colour, generally green.
- The last segment of tarsi with 3 or less than 3 pads.

#### **Empididae**

- Radial vein four branched.
- Top of the head not hollowed out between the eyes.
- Anal cell is closed far from wing margin.
- The last segment of tarsi with 3 or less than 3 pads.



a) in some species the radial vein is two branched.

b) Similar families: Hybotidae (radial vein two or three branched).

### **Rhagionidae**

- Body is elongate, with long legs.
- Generally, wings with stigma. Generalmente, alas con estigma.
- Medial and hind tibiae with spurs at apex.
- The last segment of tarsi with 3 pads.

a) Similar families: **Vermileonidae** (spurs on fore tibiae too), **Athericidae** (anal cell is closed).

### **Scenopinidae**

- Discal cell is large, anal cell is long and pointed.
- The last segment of tarsi with less than 3 pads.
- Small species without bristles.

### **Stratiomyidae**

- The first medial cell two (or discal cell) is small.
- Medial tibiae without spurs at apex.
- The last segment of tarsi with 3 pads.

### **Tabanidae**

- The first medial cell two (or discal cell) is much longer than wide.
- Medial tibiae with two spurs at apex.
- Triangular head.
- The last segment of tarsi with 3 pads.

### **Therevidae**

- Body is hairy and elongate, legs are thin.
- Top of the head not hollowed out between the eyes.
- Anal cell is close.

### **Cyclorrhapha [33/59]**

- Antennae very short with 3 segments.
- Anal cell is very small, closed and basal.

### **Agromyzidae**

- Lower orbital bristles curved inward.
- Costal vein with one interruption..

### **Anthomyiidae**

- Vein 6 reaches wing margin.
- Vein 4 not curved [fifth radial (or first posterior) cell not narrowed in the border of the wing].

### **Asteiidae**

- Small flies.
- Anal cell is missing.
- Posterior transversal vein absent or located much before the middle of the wing.

### **Calliphoridae**

- Arista plumose.
- Generally with a metallic blue or green colour.
- Vein 4 much curved [fifth radial (or first posterior) cell narrowed in the border of the wing].
- Post-humeral bristle is located more down than pre-sutural bristle.
- With hypopleural bristles.

### **Chloropidae**

- Ocellar triangle is large.
- Costal vein with one interruption.
- Wings without discoidal cell

### **Conopidae**

- Thoracic squamae small or absent.
- Subcostal (or auxiliary) vein absent or incomplete.
- Vein 4 much curved [fifth radial (or first posterior) cell narrowed in the border of the wing].
- They often resemble bees or wasps because colours.

### **Drosophilidae**

- Arista plumose.
- Costal vein with two interruptions.

### **Ephydriidae**

- Small flies.
- Costal vein with two interruptions, without anal cell.

### **Fanniidae**

- Vein 7 longer than vein 6; the two vein are convergent.
- Vein 4 not curved [fifth radial (or first posterior) cell not narrowed in the border of the wing].

### **Heleomyzidae**

- The costal margin has many spines.
- Hind tibiae with spur.

### **Hippoboscidae**

- The body usually is flat.
- Abdomen without a clear segmentation.
- Wings with strong veins only in the anterior section.

### **Lonchaeidae**

- Small flies usually with a dark metallic colour.
- Costal vein clear interrupted near the subcostal..

### **Lonchopteridae**

- Wings are pointed and without evident cross veins.
- The last antennal segment is rounded..

**Lauxaniidae**

- Hind tibiae with spur.
- Basal, discoidal and anal cell are present and closed.

**Micropezidae**

- Body is elongate, with long legs and wings, femora without spines.

**Muscidae**

- Arista plumose to the apex.
- Base of abdomen without large bristles.
- Veins 6 and 7 don't reach wing margin.
- Vein 4 generally much curved [fifth radial (or first posterior) cell generally narrowed in the border of the wing].

**Oestridae**

- With small mouth parts.
- Thoracic squamae are large.

**Opomyzidae**

- Small flies with spotted wings.
- Veins 2 and 3 are convergent.

**Phoridae**

- Small flies in which only the anterior veins are well marked, but short.
- Generally the costal margin has many spines at its base.

**Psychodidae**

- Wings are hairy and without transversal veins.

**Rhinophoridae**

- Antennae with arista. With hypopleural bristles.
- Thoracic squamae divergent from scutellum.
- Vein 4 generally much curved [fifth radial (or first posterior) cell generally narrowed in the border of the wing]

**Sarcophagidae**

- Generally base of arista plumose; apex bare.
- Base of abdomen without large bristles.
- Vein 4 much curved [fifth radial (or first posterior) cell narrowed in the border of the wing].
- Many species are grey with tessellated abdomen.
- With hypopleural bristles.

**Scathophagidae**

- Thoracic squamae small and generally with a ribbon shape.
- Thoracic suture is complete.

**Sciomyzidae**

- Anal cell and second basal cell are short, anal cell is not closed by a curved vein.

### **Sepsidae**

- Small flies not hairy, abdomen with a constriction near the base, usually wings have a dark mark near the apex.

### **Sphaeroceridae**

- The first segment of hind tarsi is short and enlarged.
- Vein 5 usually interrupted near the posterior cross-vein.

### **Syrphidae**

- Generally there is a false vein between radial vein and medial vein intersecting the radio-medial cross-vein.
- They often resemble bees or wasps because colours.

### **Tachinidae**

- Arista bare or short plumose.
- Vein 4 much curved [fifth radial (or first posterior) cell narrowed in the border of the wing].
- With hypopleural bristles.
- Post-scutellum well developed (this detail cannot be viewed on free specimen).

### **Tephritidae**

- The subcostal vein is bent about at a 90° angle at tip.
- Wings usually pictured.
- Costal vein with two interruptions.

a) Similar families: **Ulidiidae** (included family **Otitidae**) (deep furrows in face, subcostal vein not so curved, costal vein without interruptions), **Platystomatidae** (very similar to Otitidae, costal vein with one interruption), **Pallopteridae** (very similar to Otitidae but without furrows)..

### **Nematocera [22/30]**

- Antennae are long with 3 or more segments, antennae generally are longer than thorax.
- Without arista.
- Anal cell (cubital) very much open or it is not present.

### **Anisopodidae**

- Tibiae with spurs.
- Generally wings have a discoidal cell; thorax without suture.

### **Bibionidae**

- Antennae inserted below the eyes.
- With ocelli.
- Antennae shorter than the thorax.
- Veins without scales.

### **Cecidomyiidae**

- Antennae are moniliform.
- Wings with few veins.

### **Ceratopogonidae**

- Very small insects.
- Thorax is gibbous.

a) Similar but with long front legs are the species of the family **Chironomidae**

#### **Culicidae**

- Wing veins with scales or hairs.
- Wings are long, narrow and have cross veins.
- Antenne in genere lunghe. Generally antennae are long. Antenas generalmente largas.

**Mycetophilidae** (included families **Bolitophilidae**, **Ditomyiidae**, **Keroplastidae**, **Diadocidiidae**, **Macroceridae**, **Mycetobiidae**)

- Tibiae with spurs.
- Wings without discoidal cell; thorax without suture.

#### **Ptychopteridae**

- Thorax with a clear dorsal suture like a U.

#### **Sciaridae**

- Tibiae with spurs.
- Eyes are in contact above antennae socket.

#### **Simuliidae**

- Without ocelli.
- Antennae shorter than the thorax.
- Veins without scales.

#### **Scatopsidae**

- Small flies with strong antennae.
- Generally eyes are in contact above antennae socket.

#### **Tipulidae**

- Thorax with a clear dorsal suture like a V. La vena subcostale termina sulla vena radiale.

a) Similar families (but the subcostal vein usually ends in costal vein): **Cylindrotromidae** (vein Rs with two branches), **Limoniidae** (vein Rs with 3 branches or tibiae without spur), **Pediciidae** (eyes are pubescent), **Trichoceridae** (vein A2 short and curved).

### **Embioptera [2/2]**

There are only two families in Italy but morphological features are not easy to see in photos.

#### **Embiidae**

- The first segment of hind tarsi has one protuberance.

#### **Oligotomidae**

- The first segment of hind tarsi has two protuberances.

### **Ensifera [5/5]**

#### **Gryllidae**

- Tarsi with 3 segments.
- Cerci are long.
- Ovipositor is cylindrical or needle-shaped.

### **Gryllotalpidae**

- Tarsi with 3 segments.
- Front legs fitted for digging.

### **Oecanthidae**

- Head and hind femora are slender.

### **Raphidophoridae**

- Palpi are very long.

### **Tettigonidae**

- Tarsi with 4 segments.
- Palpi are normal.
- Ovipositor is long and laterally flattened.

## **Ephemeroptera [7/10]**

### **Baetidae**

- Vein R5 detached from R4 near the base of fore wings.
- Two cerci.
- Some species are without hind wings.

### **Caenidae**

- Without hind wings.
- Usually with three cerci.

### **Ephemerellidae**

- Vein R5 is not detached from R4 near the base of fore wings.
- Vein Cu2 is nearer R4 than A1 toward the base of hind wings.
- Vein R4 is fused with R5 in hind wings.
- Usually with three cerci.

### **Ephemeridae**

- Medial vein and Cu1 are abruptly divergent in fore wings.
- With three cerci.

### **Heptageniidae**

- Hind tarsi with 5 free segments.
- With two cerci.

### **Leptophlebiidae**

- Vein R5 is not detached from R4 near the base of fore wings.
- Vein Cu2 is nearer A1 than Cu1 or in the middle between A1 and Cu1 toward the base of hind wings.
- Vein R4 is fused with R5 in hind wings.
- With three cerci.

### **Siphonuridae**

- Vein R5 is not detached from R4 near the base of fore wings.
- Vein R4 is separated from R5 at margin of hind wings.
- With two cerci.

## Heteroptera [40/40]

### Alydidae

- Antennae with 4 segments.
- The fourth segment of the antennae is long and curved.
- Hind femora with strong subapical spines.
- Tarsi with 3 segments.

### Anthocoridae

- Antennae with 4 segments.
- With ocelli.
- Beak with 3 segments.
- Membranous area of the fore wings without longitudinal veins or closed cells.
- Tarsi with 3 segments.

a) Similar species (there are also wingless and short winged forms), but tarsi are with 2 segments are those in family: **Microphysidae** ( $\leq 2\text{mm}$ )

### Aradidae

- Antennae with 4 segments.
- Tarsi with 2 segments.
- Flat Body.
- Fore wings shorter than abdomen.

a) Similari sono le specie della famiglia **Aneuridae** (ali anteriori sono in gran parte membranose).

### Berytidae

- Antennae with 4 segments.
- Antennae are long, the last segment is short and enlarged.
- Body is slender and legs are long.
- Front legs are not raptorial.
- Tarsi with 3 segments.

### Ceratocombidae

- Small species (about 2mm).
- The thorax covers part of the head.
- Tarsi with 2-3 segments.

### Cimicidae

- Antennae with 4 segments.
- The body is flat and dark brown.
- Hemelytra are very small, hind wings not present.
- Tarsi with 3 segments.
- Without ocelli.

### Coreidae

- Antennae with 4 segments.
- Membranous area of the fore wings with many branched veins.
- Tarsi with 2-3 segments.

a) similar species, but with conspicuous dark and pale banding on the antennae and legs are those in family **Stenocephalidae**

### **Cydnidae**

- Antennae with 5 segments.
- Basal part of fore wings narrow and rounded.
- Tibiae with strong spines.
- Tarsi with 3 segments.

a) The scutellum covers entirely the abdomen of the similar species of family **Thyreocoridae**

### **Dipsocoridae**

- Small species (2-3mm).
- Fore wings without a membrana.
- Tarsi with 2-3 segments.

### **Hebridae**

- Small species (1-3mm).
- Body with hair.
- Tarsi with 2 segments.

### **Leptopodidae**

- Pronotum with spines.
- Small species (about 3mm).
- Eyes are big and prominent.
- Tarsi with 3 segments.

### **Lygaeidae**

- Antennae with 4 segments.
- Beak of 4 segments.
- Membranous area of the fore wings with only 4-5 longitudinal veins not branched.
- With ocelli.
- Tarsi with 3 segments.

### **Miridae**

- Antennae with 4 segments.
- Wings with a cuneus.
- Beak with 4 segments.
- Membranous area of the fore wings with 1-2 wide closed cells and without longitudinal veins.
- Without ocelli.
- Tarsi with 3 segments.

### **Nabidae**

- Antennae with 4-5 segments.
- Front legs are raptorial.
- Membranous area of the fore wings with many branched veins.
- With ocelli.
- Tarsi with 3 segments.



### **Nepidae**

- Antennae not visible from above.
- Slender body with long abdominal appendage.

Other common aquatic families are:

#### **Belostomatidae**

- Antennae not visible from above.
- Front legs are raptorial.
- At least 3 cm long.

#### **Corixidae**

- Antennae not visible from above.
- Beak short and rounded.

#### **Gerridae**

- Antennae visible from above.
- Antennae with 4 segments.
- Median legs are nearer to hind ones.

#### **Hydrometridae**

- Antennae visible from above.
- Antennae with 4-5 segments.
- Head very elongate.

#### **Naucoridae**

- Antennae not visible from above.
- Front femora are very flat.

a) Similar but usually wingless or with very small wings are the species in family **Aphlelocheiridae**.

#### **Notonectidae**

- Antennae not visible from above.
- Median legs are shorter than hind ones.
- At least 1 cm long.

a) Similar but very small is in Italy the only species of the family **Pleidae** [*Plea minutissima* minutissima (Leach, 1817)]

#### **Veliidae**

- Antennae visible from above.
- Antennae with 4 segments.
- Legs more or less at the same distance.

a) Similar but usually green are the species in the family **Mesoveliidae**.

### **Pentatomidae**

- Antennae with 5 segments.
- Tarsi have 3 segments.
- Basal portion of fore wings wide and obtuse at tip.

a) Tarsi have 2 segments in similar species in the families **Acanthosomatidae** (tarsi di 2 segmenti), **Platyspadidae** (hemispherical body)

b) Scutellum is very large and the pronotum has not any pointed projection near the eyes in similar species of the family **Scutelleridae**.

### **Pyrrhocoridae**

- Antennae with 3-4 segments.
- Beak of 4 segments.
- Veins of the membranous area of the fore wings do not form a net.
- Without ocelli.
- Tarsi with 3 segments.

### **Reduvidae**

- Wings without a cuneus.
- Beak with 3 segments.
- Membranous area of the fore wings with 1-2 wide closed cells and without longitudinal veins.

a) Similar but with very big front legs is in Italy the only species of the family **Phymatidae** [*Phymata crassipes* (Fabricius, 1775)].

### **Rhopalidae**

- Antennae with 4 segments.
- Tarsi with 3 segments.
- Membranous area of the fore wings with many longitudinal veins not forming a net.

### **Saldidae**

- Beak with 3 segments.
- Legs covered with bristle.

### **Thaumastocoridae** [This family is not native of Italy]

- Eyes more or less pedunculate.
- Membranous area of the fore wings without veins.
- Antennae with 4 segments. Beak of 4 segments. Tarsi with 2 segments.

### **Tingidae**

- Fore wings like a net.

a) Similar, but the pronotum does not cover the scutellum, are the species in family **Piesmidae**.

## **Homoptera [38/38]**

### **Aleyrodidae**

- Zampe non adattate al salto.
- Ali opache di colore bianco.
- Tarsi di 1-2 segmenti.

### **Aphididae**

- Legs not fitted for jumping.
- Wings, if present, are transparent.
- With two abdominal appendages well visible.
- Tarsi with 2 segments.

a) There are other similar families (with very small appendages or without them) belonging to the superfamily Aphidoidea (**Adelgidae, Aphididae, Phylloxeridae**)

### **Cercopidae**

- Tarsi with 3 segments.
- Apex of hind tibiae with a row of strong spines.
- Antennae inserted below the eyes at the side of the head.
- With 3 ocelli.

### **Cicadellidae**

- Tarsi with 3 segments.
- With less than 3 ocelli.
- Hind tibiae with one or more rows of spines.

### **Cicadidae**

- Tarsi with 3 segments.
- With 3 ocelli.

**Coccoidea** (superfamily grouping **Acleridae, Asterolecaniidae, Cerococcidae, Coccidae, Cryptococcidae, Diaspididae, Eriococcidae, Kermesidae, Lecanodiaspididae, Margarodidae, Micrococcidae, Ortheziidae, Phoenicococcidae, Pseudococcidae**)

- Females usually covered with wax and often without legs.
- Males usually with long abdominal filaments and winged, with forewings (only two veins are distinct and share a common stalk) and halteres or only with forewings, or wingless.
- Tarsi with 1 segment.

**Fulgoridae** (included families **Achilidae, Cixiidae, Delphacidae, Derbidae, Dictyopharidae, Flatidae, Issidae, Tettigometridae, Tropiduchidae**)

- Antennae inserted below the eyes at the side of the head.
- With less than 3 ocelli.
- Tarsi with 3 segments.

### **Membracidae**

- Prothorax enlarged upwards and backwards covering the abdomen.
- Tarsi with 3 segments.

**Psylloidea** (superfamily grouping **Aphalaridae, Calophyidae, Homotomidae, Psyllidae, Spondiliaspidae, Triozidae**)

- Very small, in fore wings veins R, M and Cu1 are fused at base and there are not cross veins.
- Tarsi with 2 segments.

## Hymenoptera [62/72]

### Suborder Apocrita [51/61]

- Abdomen jointed to the thorax by a peduncle (petiole).

#### Andrenidae

- Eyes near the base of mandibles.
- Fore wings usually with 3 submarginal cells.
- The first segment of the hind tarsi is elongate, enlarged but not always much compressed.
- Labrum very short.

a) The longer tongue distinguishes these species from species of the family **Colletidae**.

b) Basal veins are straight and not so curved as in species of the family **Halictidae**.

#### Anthophoridae

- Eyes near the base of mandibles.
- Head and thorax densely covered with hairs.
- Fore wings usually with 3 submarginal cells, these cells are almost equal in size.
- The first segment of the hind tarsi is elongate, enlarged but not always much compressed.

#### Apidae

- Eyes are distant from the base of mandibles.
- The first segment of the hind tarsi is elongate, enlarged and compressed so to help in collecting pollen.

#### Braconidae

- Fore wings with a stigma.
- Fore wings without the second median cell.
- With a slender petiole.
- Generally they are small insects.

**Chalcidoidea** [superfamily grouping **Agaonidae, Aphelinidae, Chalcididae, Elasmidae, Encyrtidae, Eucharitidae, Eulophidae, Eupelmidae, Eurytomidae, Leucospidae** (bigger insects), **Mymaridae, Ormyridae, Perilampidae, Pteromalidae, Signiphoridae, Tetracampidae, Torymidae** (hind coxae are big, abdomen usually triangular), **Trichogrammatidae**]

- Small insects, wings without cells.
- Pronotum doesn't touch the tegulae.

#### Chrysididae

- Hind wings without closed cells.
- Colours are metallic, generally green, blue or red.

**Cynipoidea** (superfamily grouping **Cynipidae, Eucoilidae, Figitidae, Ibaliidae**)

- Small insects with a triangular radial cell.
- Antennae not elbowed.

#### Eumenidae

- Hind tibiae bare or with short hairs.
- Medial tibiae with only one spur.
- Pronotum touches the tegulae.

- With a slender petiole.
- Eyes with a conspicuous notch in their border.

### **Formicidae**

- Petiole with an erect scale or one or two nodes.
- Antennae are elbowed.

Let's see the morphological characteristic of some subfamilies and genus of ants (key refers to workers). For these I wish to thank Ezio Sgrò.

#### **subfamily Dolichoderinae**

- Petiole with a very small node, cloaca opening with a transversal line shape.

##### **genus Bothriomyrmex**

- Clypeus without a fissure, small eyes.

##### **genus Dolichoderus**

- Head with big spots.

##### **genus Linepithema**

- Clypeus without a fissure, yellowish body.

##### **genus Liometopum**

- With ocelli.

##### **genus Tapinoma**

- Clypeus with a fissure on its anterior margin.

#### **subfamily Formicinae**

- Petiole with one node.

##### **genus Camponotus**

- Antennae with 12 segments, insertion of antennae far from clypeus.

##### **genus Formica**

- Antennae with 12 segments, insertion of antennae near the clypeus, with well developed ocelli, the last segments of the funiculus are longer than the first ones.

##### **genus Lasius**

- Antennae with 12 segments, insertion of antennae near the clypeus, without ocelli or with rudimental ocelli.

##### **genus Lepisiota**

- Antennae with 11 segments, with ocelli.
- Scale is bifid.

##### **genus Plagiolepis**

- Antennae with 11 segments, without ocelli, scale is not bifid.

### **subfamily Myrmicinae**

- Petiole with two nodes.

#### **genus Aphaenogaster**

- With long legs, elongate petiole, propodeum with spines, elongate head with its posterior border rounded, antennae with 12 segments without a distinct club.

#### **genus Cardiocondyla**

- Antennae with 12 segments and a club with 3 segments, the postpetiole, in dorsal view, is wider than long, wider than petiole.

#### **genus Crematogaster**

- Antennae with 11 segments, abdomen can be moved over thorax (postpetiole inserted at the dorsal surface of the gaster).

#### **genus Messor**

- From 0,3 to 1,3 cm long, polymorphism, propodeum without spines, antennae with 12 segments without a distinct club.

#### **genus Leptothorax sensu lato**

- Median tibiae without spur, propodeum with spines, antennae with 11-12 segments and a club with 3 segments.

#### **genus Monomorium**

- From 0,26 to 0,36 cm long, head longer than wider, abdomen darker than thorax, propodeum without spines.

#### **genus Myrmica**

- Antennae with 12 segments and a club with 3-4 segments, propodeum with long spines.

#### **genus Pheidole**

- Antennae with 11-12 segments and a club with 3 segments, there are soldiers with an enormous head concave in its posterior border.

#### **genus Pyramica** (included genera *Epitritus*, *Smithistruma*, *Trichoscapa*)

- With a triangular head.

#### **genus Solenopsis**

- Clypeus with two teeth.

- Worker antennae with 10 segments and a club with 2 segments.

#### **genus Tetramorium**

- Antennae with 11-12 segments and a club with 3 segments, head is quadrate, propodeum with spines, median tibiae with spur.

- The clypeus forms a ridge in front of of each antennal insertion.

### **subfamily Ponerinae**

- Sting clearly visible, clear constriction between the first and the second segment of the gaster.

**genus Amblyopone**

- The petiole is broadly attached at the gaster.

**genus Cryptopone**

- Middle and hind tibiae with two spurs.

**genus Hypoponera**

- Middle and hind tibiae with only one spur.
- Inferior side of the petiole without a spine.

**genus Ponera**

- Inferior side of the petiole with a spine.

**Gasteruptionidae**

- Gaster elongate and narrow, inserted near to the up side of the propodeum.

a) similar species are those in families: **Aulacidae** (gaster is like a pear) **Evaniidae** (gaster is small).

**Ichneumonidae**

- Fore wings with a stigma.
- Antennae very long.
- Fore wings with a second median cell.
- With a slender petiole.

**Megachilidae**

- Eyes near the base of mandibles.
- Fore wings with 2 submarginal cells.
- Labrum not large.
- Males with a hairy face, females with a dense layer of hairs on the ventral side of the abdomen fitted for collecting pollen.
- The first segment of the hind tarsi is elongate, enlarged but not always much compressed.

**Mutillidae** (included family **Myrmosidae**)

- Females are wingless, hairy and look a bit like Formicidae, the thorax is almost squadrate.

a) Similar but less hairy species are those in families: **Bethylidae** (abdomen with a constriction), **Sapygidae** (wings with a small lobe), **Tiphidae** (included family **Methocidae**) (abdomen with a constriction, wings of males with a big lobe, abdomen ends with an upward thorn in males, thorax is elongate and with 3 furrows well marked).

**Pompilidae**

- Pronotum touches the tegulae.
- With two spurs at the apex of the middle tibiae.
- Generally eyes without a notch in their border.
- With a slender petiole.

**Proctotrupoidea** (superfamily grouping **Diapriidae**, **Heloridae**, **Platygasteridae**, **Proctotrupidae**, **Scelionidae**)

- Small insects with very few veins, many species are wingless.

a) Similar species are those in superfamily **Ceraphronoidea** (front tibiae with two spurs, grouping families **Ceraphronidae**, **Megaspilidae**).

**Scoliidae**

- Pronotum touches the tegulae.
- With one spur at the apex of the middle tibiae.
- Hind tibiae have spines and long hairs.

**Sphecidae**

- Pronotum doesn't touch the tegulae.
- Petiole slender (very long in some species).

**Vespidae**

- Pronotum touches the tegulae.
- With two spurs at the apex of the middle tibiae.
- Eyes with a conspicuous notch in their border.
- With a slender petiole.

a) Similar species are those in family **Masaridae** (fore wings with only 2 submarginal cells).

**Symphyta [11/11]**

- Abdomen and thorax are broadly jointed.

**Argidae**

- Antennae with 3 segments, the third one is very long, generally hairy and sometimes biforked too.

**Cepidae**

- With one spur at the apex of the front tibiae.
- Usually with a slender body.

**Cimbicidae**

- With two spurs at the apex of the front tibiae.
- Ovipositor with a saw shape.
- Antennae strongly capitate.

**Diprionidae**

- Antennae are toothed or comb-like.

**Megalodontidae**

- Antennae are toothed or comb-like.
- The abdomen is very flat.

**Orussidae**

- Antennae inserted below the eyes.
- Fore wings without a closed anal cell.



### **Pamphilidae**

- The abdomen is very flat.

### **Siricidae**

- With one spur at the apex of the front tibiae.

### **Tenthredinidae**

- With two spurs at the apex of the front tibiae.
- Ovipositor with a saw shape.

### **Xiphydriidae**

- With a long neck.

### **Xyelidae**

- The third antennal segment is very long and the following ones are very slender.

## **Isoptera [2/2]**

### **Kalotermitidae**

- Soldiers with a normal labrum. In Italy there is only the species *Kalotermes flavicollis* (Fabricius, 1793) and winged specimens have a yellow band on their pronotum.

### **Rhinotermitidae**

- Soldiers with labrum modified in a brush shape. In Italy there is only the species *Reticulitermes lucifugus* (Rossi, 1792) and winged specimens have the pronotum entirely dark.

## **Lepidoptera [62/89]**

Identification is based on wing veins but veins are usually covered by scales; here are only considered those families having characters easily visible in the field.

### **Adelinae**

- Antennae are very long in males.

### **Geometridae**

- Antennae are not clubbed.
- Usually wings are not held roof like when at rest.

### **Hesperiidae** (subfamily Hesperinae)

- At rest fore wings are held vertically, while hind ones are held horizontally.

### **Lasiocampidae**

- Species generally very hairy with a conspicuous tuft of hair on the pronotum.

a) un conspicuo ciuffo di peli sul pronoto è presente anche in specie di altre famiglie in particolare / a conspicuous tuft of hair on the pronotum is presente also in species of other families particularly / un conspicuo mechón de pelo en el pronoto es presente también en especies de otras familias en particular: **Cossidae**, **Hepialidae**, **Lemoniidae**, **Lymantriidae**, **Noctuidae**, **Notodontidae**, **Thaumetopoeidae**.

### **Lycaenidae**

- Antennae are clubbed.
- Usually wings are blue or brown.

### **Noctuidae**

- E' la famiglia più numerosa, le ali anteriori sono in genere di colore marrone o grigio.

### **Notodontidae (in part)**

- With a group of long hair on the posterior margin of fore wings forming a kind of crest when at rest.

### **Nymphalidae**

- Antennae are clubbed.
- Front legs are smaller than other ones.

a) front legs are short in other species such as in those of family **Satyridae**.

### **Papilionidae (in part)**

- Hind wings with a tile.

### **Pieridae**

- Antennae are clubbed.
- Usually wings are white or yellow with black spots.

### **Pterophoridae**

- Wings are very narrow and borders are hairy.

### **Pyralidae (included family Crambidae) (in part)**

- Wings are held roof like when at rest.
- Palpi are strong and long.

### **Saturniidae**

- With mark like an eye on each wing.

### **Sesiidae**

- Wings with few coloured scales and therefore partially transparent.

### **Sphingidae**

- Body large with long and narrow fore wings.

### **Tortricidae**

- Usually they are small insects with fringed wings, fore wings are rectangular in many species.

a) some similar species are those in superfamily **Tineoidea** (usually wings are very narrow, fore wings are not rectangular, grouping families Acrolepiidae, Agonoxenidae, Argyresthiidae, Batrachedridae, Bedelliidae, Blastobasidae, Bucculatricidae, Chimabachidae, Coleophoridae, Cosmopterigidae, Depressariidae, Douglasiidae, Elachistidae, Eriocottidae, Ethmiidae, Gelechiidae, Glyphipterygidae, Gracillariidae, Heliodinidae, Holcopogonidae, Lecithoceridae, Lyonetiidae, Momphidae, Ochsenheimiidae, Oecophoridae, Plutellidae, Psychidae, Pterolonchidae, Tineidae,

Roeslerstammiidae, Phyllocnistidae, Scythrididae, Stathmopodidae, Symmocidae, Yponomeutidae, Ypsolophidae).

b) there are similar species in other families: **Choreutidae**, **Micropterigidae**.

### **Zygaenidae**

- Antennae are clubbed.
- Metallic colours.

## **Mantodea [2/2]**

### **Mantidae**

- Top of the head without a protuberance.

### **Empusidae**

- The top of the head with a protuberance divided at apex.

## **Mecoptera [3/3]**

### **Bittacidae**

- Front legs very long and raptorial.

### **Boreidae**

- Very small insects, usually found on the snow.

### **Panorpidae**

- In males abdomen ends with big pliers.

## **Neuroptera [10/14]**

I wish to thank Agostino Letardi for his "Hypotheses about European Neuroptera (sensu lato) identification".

### **Megaloptera [1/1]**

- Prothorax not elonged.
- Mouthparts are turned forward.

#### **Sialidae**

- The fourth segment of tarsi is swelled.

### **Planipennia [7/11]**

- Mouth parts are turned downward.

#### **Ascalaphidae**

- Antennae clavate and about as long as fore wings.

#### **Chrysopidae**

- Without ocelli.
- Fore wings with cross veins in the costal area not bifurcate.
- Adult usually green/blue.

**Coniopterygidae**

- Costal area with not more than two veins.
- Without stigma.
- Body covered with a wax secretion.
- Very small insects, front wings less than 0,5 cm long.

**Hemerobiidae**

- Without ocelli.
- Fore wings with bifurcate cross veins in the costal area.
- Adult usually brown.

**Mantispidae**

- Front legs are raptorial.

**Myrmeleontidae**

- Antennae clavate and short, about as long as head and prothorax.

**Nemopteridae**

- Hind wings filiform or with a ribbon shape.

**Raphidioptera [2/2]**

- Prothorax very elonged.
- Mouth parts are turned forward.

**Inocelliidae**

- The third tarsal segment is swelled.
- Stigma not crossed by veins.
- Without ocelli.

**Raphidiidae**

- The third tarsal segment is swelled.
- Stigma crossed by one or more veins.
- With 3 ocelli.

**Odonata [9/9]****Zygoptera [4/4]**

- Front and hind wings similar in shape and narrowed at base.
- Head wider than long.
- Wings vertically held when at rest.

**Calopterygidae**

- Wings gradually narrowed at base.
- With 10 or more antenodal cross veins.

**Coenagrionidae**

- Wings abruptly narrowed at base.
- With 2-3 antenodal cross veins.

### **Lestidae**

- Wings abruptly narrowed at base.
- With 2-3 antenodal cross veins.
- The longitudinal vein between medial and radial vein arises from a point that is nearer nodus than arculus.

### **Platycnemididae** [Platycnemis pennipes (Pallas, 1771)]

- Only one species, blue and green with white enlarged middle and hind tibiae.

### **Anisoptera [5/5]**

- Fore wings wider at base than hind wings.
- Wings horizontally held when at rest.

### **Aeshnidae**

- Antenodal veins of the first and second row do not touch each other.
- Eyes are in contact dorsally for a long portion.

### **Gomphidae**

- Eyes are not in contact or touching at a single point.
- Abdomen is swollen.

a) Similar species are those in family **Cordulegasteridae** (abdomen is not swollen).

### **Libellulidae**

- Triangles in fore and hind wing are not similar in shape.

a) Similar species are those in family **Corduliidae** (the triangle in front wing has the front side about as long as the base).

### **Phasmatodea [1/1]**

There is only one family in Italy

### **Bacillidae**

- Lower carina of middle and hind tibiae is biforked.
- Tarsi clearly with 5 segments.
- First abdominal segments shorter than metanotum.

### **Plecoptera [7/7]**

For a rigorous identification we should look at morphological features that are not easy to see in photos so here are only given general indications.

### **Capniidae**

- Second anal vein not branched.

### **Chloroperlidae**

- Hind wings with reduced anal lobe.
- Hind wings usually with not more than 4 anal veins.

### **Leuctridae**

- Abdominal appendages are very short.
- Fore wings without an apical cross vein.

### **Nemouridae**

- Abdominal appendages are very short.
- Fore wings with an apical cross vein.

### **Perlidae**

- Hind wings with well developed anal lobe.
- Usually the cross vein running between cubital and anal vein reaches the anal cell or it is as far from it as its own length.

### **Perlodidae**

- Hind wings with well developed anal lobe.
- Hind wings usually with 5-10 anal veins.

### **Taeniopterygidae**

- Abdominal appendages are very short.
- The second segment of tarsi is very short.

## **Psocoptera [17/18]**

For a rigorous identification we should look at morphological features that are not easy to see in photos so here are only given general indications for the most common families.

### **Amphipsocidae**

- Winged.
- Forewing margin with long hair.
- The stigma (not always coloured) is not connected to the radial branch.
- The areola postica is not joined to the medial vein.
- Distal branches of veins in forewings with more than one row of setae.
- Tarsi with 2 segments.

a) Similar species are those in families **Caeciliidae** (branches of veins in forewings with one row of setae, forewing margin with more than one row of setae), **Elipsocidae** (with short setae, tarsi with 2-3 segments), **Epipsocidae** (winged or wingless, dark coloured, in winged specimen vein R of forewings is joined to M by a cross vein), **Lachesillidae** (wings without setae, stigma with a wedge shape), **Mesopsocidae** (winged or with vestigial wings, wings without setae, tarsi with 3 segments), **Philotarsidae** (setae of forewing margin crossing each other, tarsi with 3 segments), **Pseudocaeciliidae** (setae of forewing margin crossing each other, tarsi with 2-3 segments), **Trichopsocidae** (setae of hind wing margin alternatively long and short).

### **Liposcelididae**

- All of Italian species are wingless.
- Hind femora are dilated.
- Tarsi with 3 segments.
- Common in buildings.

### **Myopsocidae**

- Wings with dark and pale patches.
- Tarsi with 3 segments.
- The areola postica is joined to the medial vein.

### **Peripsocidae**

- Winged.
- Without areola postica.
- Tarsi with 2 segments.

a) Similar species are those in family **Ectopsocidae** (stigma rectangular)

### **Psocidae**

- Winged.
- The stigma (not always coloured) is not joined to the radial branch.
- The areola postica is joined to the medial vein by a cross vein.
- In fore wings the vein M has 3 branches.
- Tarsi with 2 segments.

### **Psyllipsocidae**

- With very long hind legs.
- With well developed wings or with vestigial wings.
- Vein Sc incomplete.
- Tarsi with 3 segments.

### **Stenopsocidae**

- Winged.
- The stigma (not always coloured) is connected to the radial branch by a cross vein.
- The areola postica is joined to the medial vein by a cross vein.
- Tarsi with 2 segments.

### **Trogiidae**

- Wingless or with vestigial wings.
- Hind femora are not dilated.
- Tarsi with 3 segments.
- Common in buildings.

## **Siphonaptera [6/6]**

### **Ceratophyllidae**

- Without genal comb, with pronotal comb.<sup>22</sup>

### **Hystrichopsyllidae**

- Genal comb with many bristles, with pronotal comb, posterior margin of metanotum without spines.

### **Ischnopsyllidae**

- Genal comb with two bristles, with pronotal comb.

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<sup>22</sup> For the genal comb and the pronotal comb see picture 5.

### **Leptopsyllidae**

- Genal comb with many bristles, with pronotal comb, posterior margin of metanotum with some spines.

### **Pulicidae**

- Hind coxae with small spines at inner side.

### **Vermipsyllidae**

- Without genal comb, hind coxae with small spines at inner side.

## **Thysanoptera [5/5]**

### **Suborder Terebrantia [3/3]**

- The last abdominal segment is rounded.

#### **Adiheterothripidae** [sp. *Holarthrotrips tenuicornis* (Bagnall, 1927)]

- There is only one species in Italy.

#### **Aelothripidae**

- Front wing tips are rounded.

#### **Thripidae**

- Front wing tips are pointed.

### **Suborder Tubulifera [2/2]**

- The last abdominal segment is tubular.

#### **Phlaeothripidae**

- a) Similar species are the few in family **Urothripidae**.

## **Thysanura [5/5]**

### **Suborder Microcoryphia [2/2]**

- With ocelli.

#### **Machilidae**

- With big compound eyes.

- a) Very similar species are those in family **Meinertellidae** (antenna base without scales).

### **Suborder Zygentoma [3/3]**

- Without ocelli.

#### **Ateluridae**

- Without compound eyes.
- Body with golden scales.

#### **Lepismatidae**

- With compound eyes.
- Body covered with scale.



### **Nicoletiidae**

- Without compound eyes.
- White body without scales.

## **Trichoptera [17/19]**

For a rigorous identification we should look at morphological features that are not easy to see in photos so here are only given general indications.

### **Beraeidae**

- Without ocelli.
- With 2 spurs in front and middle tibiae, 4 spurs in hind tibiae.
- With 2 spurs in front and middle tibiae, 4 spurs in hind tibiae.

a) others species with the same spur numbers in front and middle tibiae and from 2 up to 4 spurs in hind tibiae are those in family **Sericostomatidae** (fore wings with discoidal cell).

### **Brachycentridae**

- With 2 spurs in fore tibiae, 3-4 spurs in middle and 2-3 in hind tibiae.

### **Hydropsychidae**

- Without ocelli.
- With 2 spurs in front tibiae and 4 spurs in middle and hind tibiae.
- Hind wings are as wide as fore ones at least.
- The last segment of palpi is longer than half a palp.

a) other species with the same spur number and without ocelli are those in families **Psychomyidae** (hind wings narrower than fore ones)

### **Hydroptilidae**

- Fore tibiae with not more than a spur.
- Wings very narrow.
- Usually longer not more than 0,5 cm and very hairy.

### **Leptoceridae**

- Without ocelli.
- Antennae are thin and much longer than body.
- Hind tibiae with 2 spurs.

### **Limnephilidae**

- Without ocelli.
- Generally they have not more than one spur in front tibiae, 2-3 spurs in middle tibiae and 4 spurs in hind ones.

### **Odontoceridae**

- Without ocelli.
- Antennae are toothed.
- With 2 spurs in front tibiae and 4 spurs in middle and hind tibiae.

### **Phryganeidae**

- With ocelli.
- Generally they have 2 spurs in front tibiae and 4 spurs in middle and hind tibiae.

a) other species with ocelli and the same number of spurs are those in families **Glossosomatidae** (second segment of palpi not long than the first), **Philopotamidae** (the last segment of palpi is longer than half a palp).

b) other species without ocelli, but with the same spur number are those in families **Goeridae**, **Lepidostomatidae**.

### **Rhyacophilidae**

- With ocelli.
- Generally they have 3 spurs in front tibiae, 4 spurs in middle and in hind tibiae.

a) other species with the same spur number are those in families **Polycentropidae** (without ocelli), **Ecnomidae** (the last segment of palpi is longer than half a palp).

## GLOSSARY

**Basal** - Near to the body.

**Carina** - Keel.

**Distal** - - Far from the body.

**Medium (Size)** - Generally 10-20 mm. - Length is from the head to the abdomen apex, antennae and abdominal appendages are not included.

**Spiracle** - External opening of the respiratory system.

### ANTENNAE

**Arista** - Antennal bristle (Picture 4).

**Capitate** - Terminal segments of antennae abruptly enlarged and forming a club.

**Clavate** - Terminal segments of antennae abruptly enlarged and forming a club.

**Clubbed** - Diameter of antenna segments increases at apex.

**Elbowed** - Antennae are curved at angle..

**Filiform** - Like a thread.

**Funiculus** - The group of the antennal segments located after the scape; the first segment of the funiculus is called **pedicel** while the other ones are the **flagellum**. (Picture 1).

**Lamellate** - Antennae have flattened and enlarged segments at their apex.

**Moniliform** - Like a necklace.

**Plumose** - Like feathers.

**Scape** - The first antennal segment, that near the head. (Picture 1).

### HEAD

**Clypeus** - Section of the face above mouth parts (Picture 1).

**Compound Eye** - Eye formed by many eyes called ommatidia.

**Gena** - Section of the head below and behind the eyes (cheek).

**Gula** - Inferior side of head.

**Occipute** - Back of head (Picture 2).

**Ocelli** - Simple eyes (Picture 3).

**Vertex** - Top of the head.

### MOUTH PARTS

**Labrum** - Upper lip, the underlip is called **labium** (Picture 6).

**Palpus (Palpi)** - Appendages of mouth parts. (Picture 6).

### THORAX

**Prothorax** - The first segment of the thorax, that near the head; front legs are inserted in this segment.

**Pronotum** - Dorsal section of the first segment of the thorax (Picture 1).

**Prosternum** - Ventral section of the first segment of the thorax.

**Mesothorax** - The second segment of the thorax; middle legs and fore wings are inserted in this segment.

**Mesosternum** - Ventral section of the second segment of the thorax, the dorsal one is called **mesonotum**.

**Metathorax** - The third segment of the thorax; hind legs and hind wings are inserted in this segment.

**Metasternum** - - Ventral section of the third segment of the thorax, the dorsal one is called **metanotum**.

**Scutellum** - Triangular plate between bases of wings; please note that really the scutellum is the third section of the dorsal surface of each thoracic segment, but

in many insects only the third part of the mesothorax is visible and generally it has a triangular shape (Picture 6).

### LEGS (Picture 2)

**Coxa (Coxae)** - Basal segment of leg (hip, ilium).

**Trochanter** - The second segment of the leg.

**Femur (Femora)** - The third segment of the leg.

**Raptorial** - Legs fitted for catching: tibia capable to close against femur, tibiae and femora with spines.

**Tibia (Tibiae)** - The fourth segment of the leg.

**Tarsus (Tarsi)** - Distal portion of leg.

### WINGS (Picture 3)

**Anale [vein]** - Longitudinal vein, not branched, extending from the base to the hind border below the cubital vein.

**Antenodal [vein]** - Cross vein along the portion of the fore border of the wing extending from the base to the nodus, between the costal vein and the radial vein.

**Arculus** - Basal cross vein between radial and cubital vein.

**Cell (Cells)** - Wing area delimited by veins. A cell is closed if it is entirely delimited by veins, if instead it is delimited partly by wing margin the cell is said to be open. Each cell is usually named according to the longitudinal vein on its anterior side.

**Costal [vein]** - The first longitudinal vein.

**Cubital [vein]** - The fifth longitudinal vein, generally it is divided in two branches before reaching the border of the wing.

**Cuneus** - A closed cell located at the end of the thickened area of the fore wings (hemelytra). The thickened part of hemelytra is called **corium** while parts along the posterior and the anterior edge of fore wings, when distinguished, are respectively called as **clavus** and **embolium**. (Picture 6).

**Discal [or discoidal cell]** - Cell between the anterior basal cross vein and the posterior one.

**Medial [vein]** - The fourth longitudinal vein.

**Nodus** - A strong cross vein about in the middle of the costal edge of the wing.

**Radial [vena]** - The third longitudinal vein.

**Squama** - Lobe of fore wings attached to the thorax (Picture 4).

**Stigma** - Coloured portion of the costal margin of wing.

**Subcostal [vein]** - The second longitudinal vein.

**Sub-marginal [cells]** - Cells below those at the fore margin of the wings.

**Tegmina** - Coriaceous front wings.

**Tegulae** - Scales overlapping the base of fore wings.

**Triangle** - A cell or a group of triangular cells near the base of wings.

**Vein** - Section of the wing support structure. Longitudinal veins are usually shown using the following abbreviations.

### Comstock-Needham System (Picture 3)

In the Comstock-Needham system are usually used the following abbreviations: **C** = costal, **Sc** = subcostal, **R** = radial, **M** = medial, **Cu** = cubital, **A** = anal, **1A (2A, 3A)** = first (second, third) anal vein.

The branches of longitudinal veins are numbered in a progressive way from the anterior to the posterior position, for example  $R_1$  ( $M_1$ ) is the anterior branch of the radial (medial) vein but  $Cu_{1a}$  and  $Cu_{1b}$  are the anterior and the posterior branch of  $Cu_1$  while the posterior branch of  $Cu$  is called  $Cu_2$ .

Cross veins are usually named according to the longitudinal veins they connect, please see the following example:

**c-sc** = cross vein between costal and subcostal vein.

**r** = cross vein between two adjacent radial branches.

**r-m** = cross vein between radial and medial vein.

**m-cu** = cross vein between medial and cubital vein.

#### **Another System (Picture 4)**

Another system is to enumerate the longitudinal veins according to the order they reach the margin, starting from the radial that, therefore, is the vein number 1 (branches have the same number, veins 3 and 4 are connected by the anterior cross vein, blue arrow, while veins 4 and 5 by the posterior cross vein, red arrow) (Picture 4).

#### **ABDOMEN**

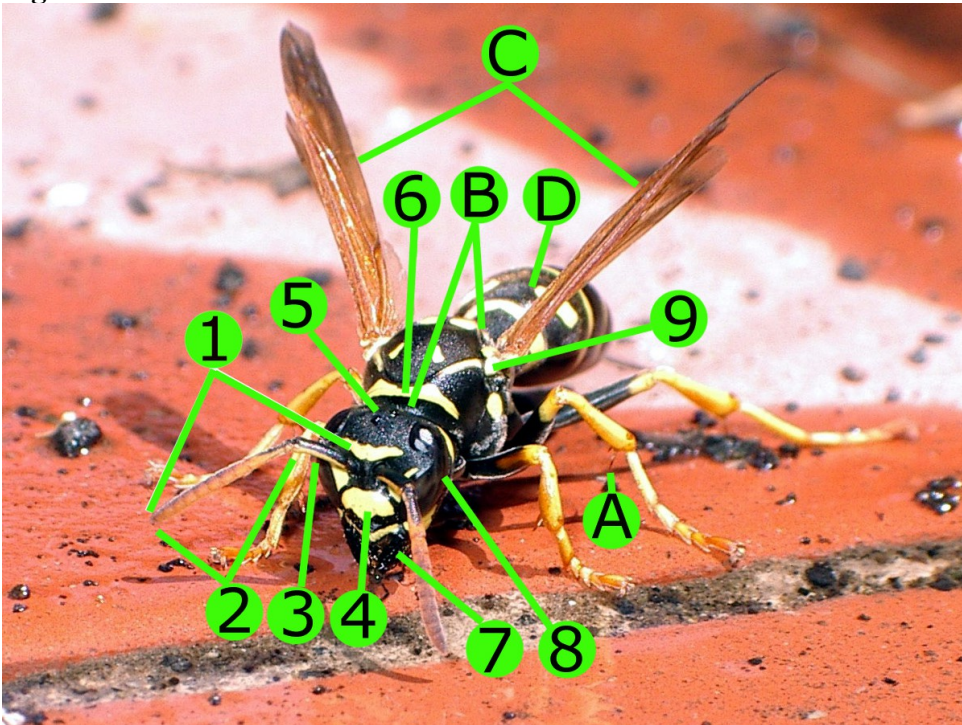
**Cerci** - Abdominal appendages.

**Petiole** - Constriction of the abdomen forming the insertion to the thorax (properly to the popodeum); if there are two segments the first is called properly as petiole while the second is called as **postpetiole** (Picture 2).

**Propodeum** - The first abdominal segment of Apocrita (hymenoptera), that jointed to the thorax; thorax and propodeum together are called as **alitrunk**, while the section of abdomen following the petiole is called as **gaster** (Picture 2).

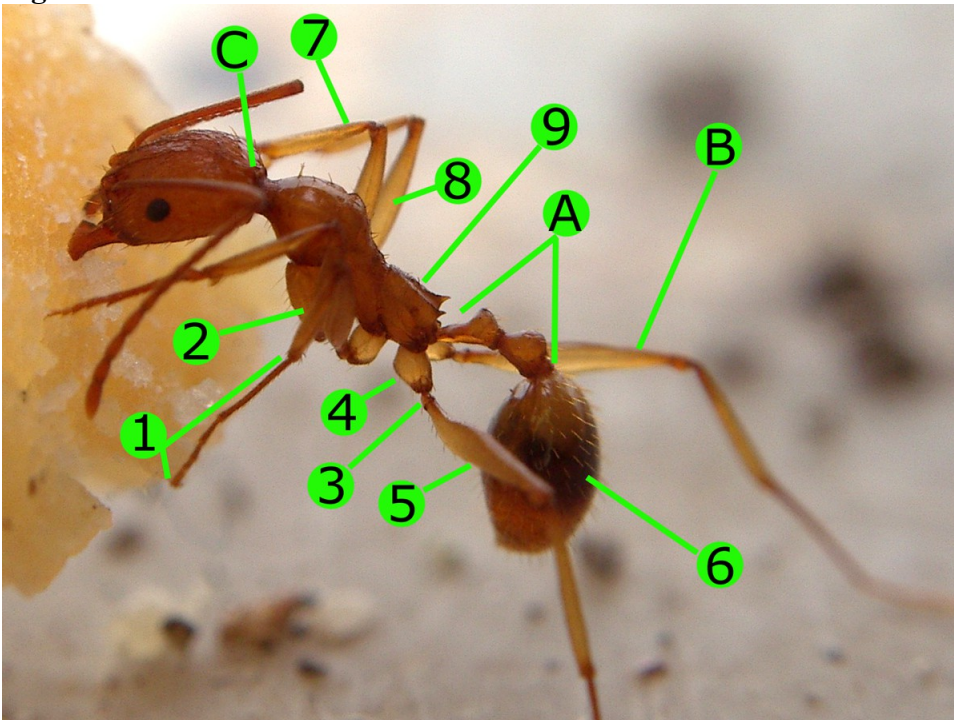
**Sternum** - Ventral section of a segment (also called as sternite), the dorsal section is called **tergum** (or tergite); generally used for abdomen.

Fig.1 <sup>23</sup>



- 1 - Antenna
- 2 - Funiculus
- 3 - Scape
- 4 - Clipeus
- 5 - Ocelli
- 6 - Pronotum
- 7 - Mandible
- 8 - Compound eye
- 9 - Tegula
- A - Spur
- B - Thorax
- C - Wings
- D - Abdomen

Fig.2 <sup>24</sup>

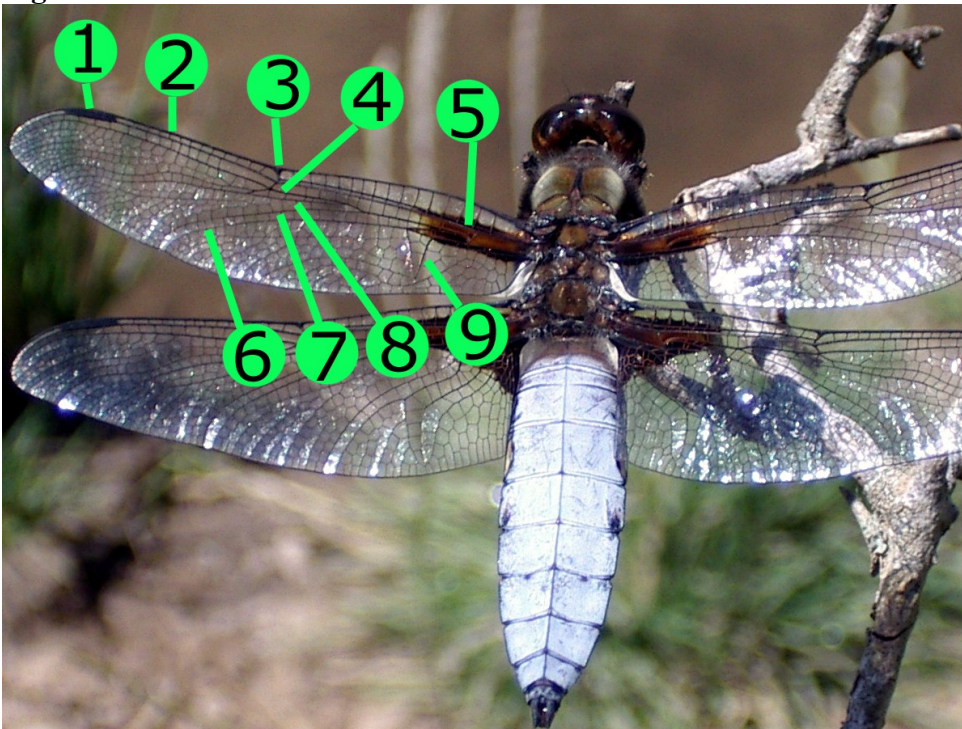


- 1 - Tarsus
- 2 - Tibia
- 3 - Tronchater
- 4 - Coxa
- 5 - Femur
- 6 - Gaster
- 7 - Fore leg
- 8 - Median Leg
- 9 - Propodeum
- A - Petiole
- B - Hind leg
- C - Occiput

<sup>23</sup> Hymenoptera – Vespidae, *Polistes gallicus non Linneaus*.

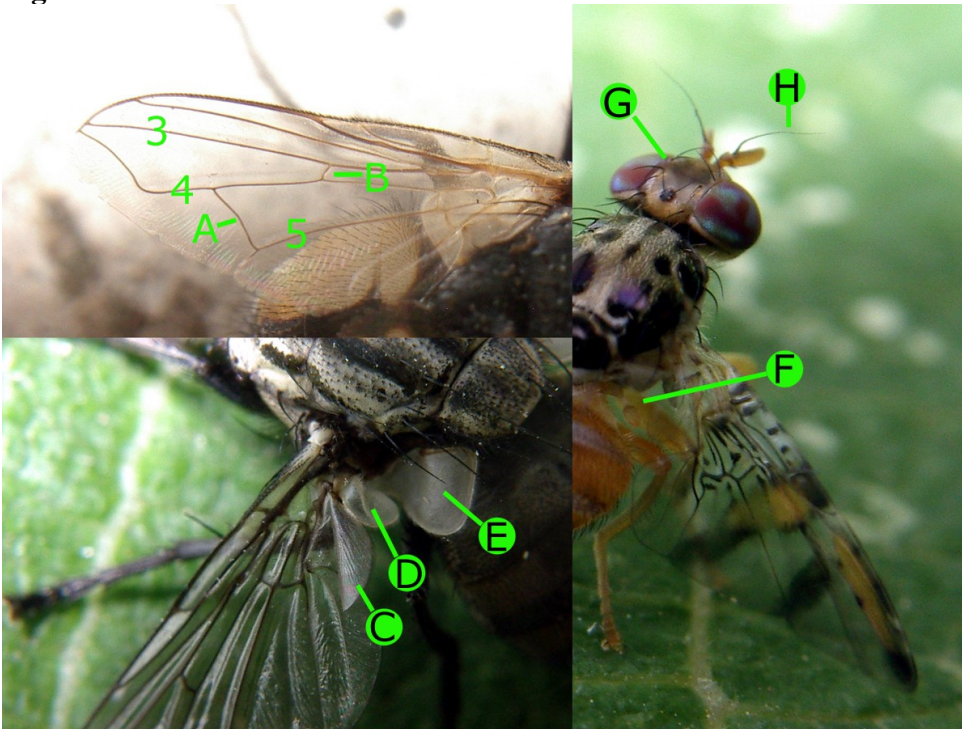
<sup>24</sup> Hymenoptera – Formicidae, worker of *Aphaenogaster splendida* (Roger, 1859). Identification by prof. Ezio Sgrò.

Fig.3 <sup>25</sup>



- 1 - Stigma
- 2 - Costal
- 3 - Nodus
- 4 - Radial
- 5 - Subcostal
- 6 - Anal
- 7 - Cubital
- 8 - Medial
- 9 - Triangle

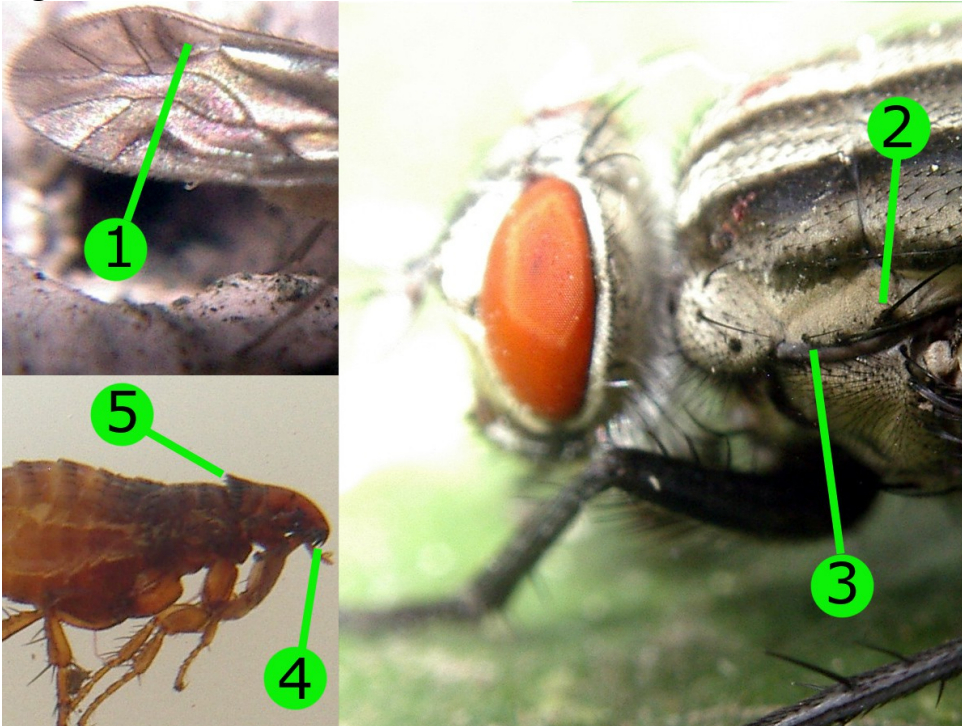
Fig.4



- C - Alula
- D - Squamula
- E - Squama
- F - Halteres
- G - Orbital bristles
- H - Arista

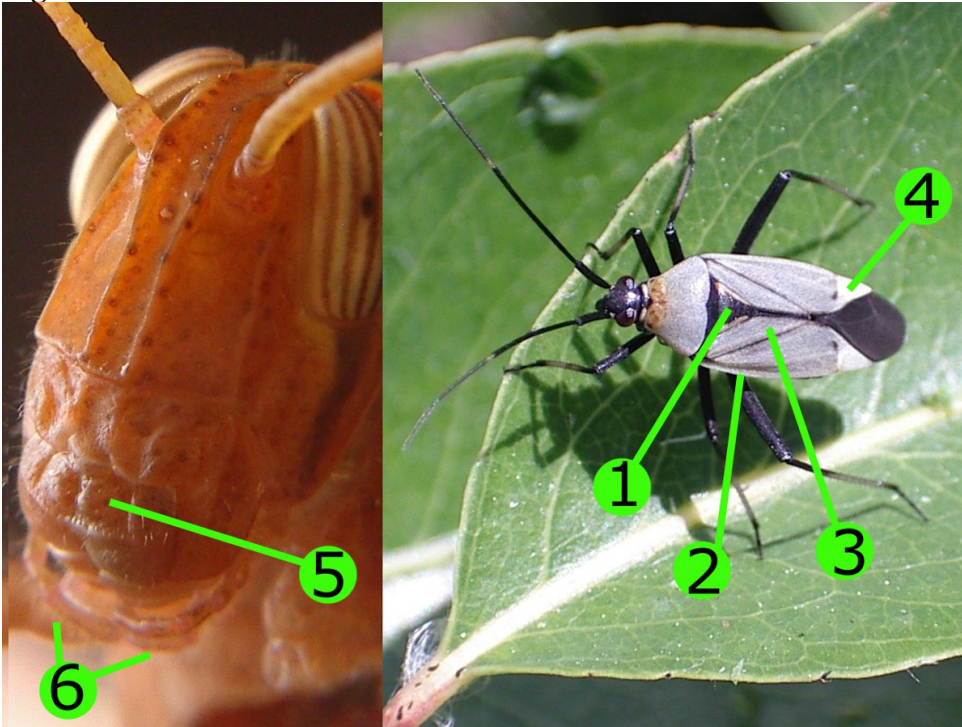
<sup>25</sup> Odonata, Libellulidae, male of *Libellula depressa* (Linnaeus, 1758).

Fig.5



- 1 - Areola postica
- 2 - Pre-sutural bristle
- 3 - Post-humeral bristle
- 4 - Pronotal comb
- 5 - Genal comb

Fig.6



- 1 - Scutellum
- 2 - Embolium
- 3 - Clavus
- 4 - Cuneus
- 5 - Labrum
- 6 - Palps



## MACRO PHOTOGRAPHY

Almost all of the digital cameras, even the cheaper ones, have a macro functions; in that mode it's possible to take beautiful macro photographs, but using some tricks it's also possible to get more interesting results.

Indeed, using a biconvex lens in front of the camera, it's possible to increase the magnification ratio; it's enough to use the manual focus and to use a white paper to reflect the light emitted by the camera flash in order to get a better lighting.



Hymenoptera - Formicidae: *Aphaenogaster splendida* (Roger, 1859)<sup>26</sup>

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<sup>26</sup> Male, identification by prof. Ezio Sgrò.



Neuroptera – Raphiididae: *Xanthostigma corsica* (Hagen, 1867)<sup>27</sup>

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<sup>27</sup> Female, identification by dr. Agostino Letardi

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IDENTIFICATION OF INSECTS.....	1
PREFACE.....	2
INTRODUCTION.....	3
CLASSIFICATION.....	4
IDENTIFICATION OF INSECTS.....	4
ORDERS OF ITALIAN INSECTS.....	5
<i>Anoplura</i> (Sucking lice) .....	5
<i>Blattaria</i> (Cockroaches).....	5
<i>Caelifera</i> (Short-Horned Grasshoppers).....	5
<i>Coleoptera</i> (Beetles).....	5
<i>Collembola</i> (Springtails).....	5
<i>Dermaptera</i> (Earwigs).....	5
<i>Diplura</i> (Diplurans)8 .....	5
<i>Diptera</i> (True Flies, Mosquitos).....	6
<i>Embioptera</i> (Webspinners).....	6
<i>Ensifera</i> (Crickets, Long-Horned Grasshoppers, Locusts, Katydid).....	6
<i>Ephemeroptera</i> (Mayflies, Fishflies).....	6
<i>Heteroptera</i> (True Bugs).....	6
<i>Homoptera</i> (Cicadas, Aphids, Whiteflies, Leafhoppers, Treehoppers).....	6
<i>Hymenoptera</i> (Ants, Wasps, Bees).....	6
<i>Isoptera</i> (Termites).....	6
<i>Lepidoptera</i> (Butterflies, Moth).....	7
<i>Mallophaga</i> (Biting lice)6.....	7
<i>Mantodea</i> (Mantids).....	7
<i>Mecoptera</i> (Scorpion flies).....	7
<i>Neuroptera</i> (Net-winged insects).....	7
<i>Odonata</i> (Dragonflies, Damselflies).....	7
<i>Phasmatodea</i> (Walkingsticks).....	7
<i>Plecoptera</i> (Stoneflies).....	7
<i>Protura</i> (Proturans).....	7
<i>Psocoptera</i> (Psocids, Barklice, Booklice).....	8
<i>Siphonaptera</i> (Fleas).....	8
<i>Strepsiptera</i> (Stylopids, Twisted-winged insects).....	8
<i>Thysanura</i> (Silverfishes, Firebrats).....	8
<i>Thysanoptera</i> (Thrips).....	8
<i>Trichoptera</i> (Caddisflies).....	8
IDENTIFICATION KEY OF MAIN FAMILIES.....	9
<i>Blattaria</i> [4/4].....	9
Blattellidae.....	9
Blattidae .....	9
Ectobiidae.....	9
Polyphagidae [sp <i>Polyphaga aegyptiaca</i> (Linnaeus, 1758)].....	9
<i>Caelifera</i> [6/6].....	9
Acrididae.....	9
Catantopidae.....	9
Pamphagidae.....	9
Pyrgomorphidae [sp. <i>Pyrgomorpha conica</i> (Olivier, 1791)].....	9
Tetrigidae.....	9
Tridactylidae.....	10
<i>Coleoptera</i> [87/140].....	10
Aderidae.....	10

Anthicidae.....	10
Attelabidae (included family Brentidae).....	10
Bostrichidae.....	10
Bruchidae.....	10
Buprestidae.....	10
Byrrhidae.....	10
Cantharidae.....	11
Carabidae (included families: Cicindelidae, Rhysodidae).....	11
Cerambycidae.....	11
Chrysomelidae.....	11
Ciidae.....	11
Cleridae.....	11
Coccinellidae.....	11
Cucujidae.....	12
Dermestidae (included families Derodontidae, Nosodendridae, Thorictidae).....	12
Dytiscidae.....	12
Elateridae (included families Cerophytidae, Eucnemidae, Throscidae).....	12
Endomychidae (included family Alexiidae).....	12
Erotylidae.....	12
Haliplidae.....	13
Heteroceridae.....	13
Histeridae.....	13
Hydrophilidae.....	13
Lampyridae.....	13
Lucanidae.....	13
Meloidae.....	13
Melyridae.....	13
Mordellidae.....	13
Oedemeridae.....	14
Rhipiphoridae.....	14
Scarabaeidae (included families Aphodiidae, Cetoniidae, Dynastidae, Geotrupidae, Melolonthidae, Rutelidae, Trogidae).....	14
Scirtidae.....	14
Staphylinidae.....	14
Tenebrionidae (included families Alleculidae, Lagriidae).....	15
Collembola [18/18].....	15
Suborder Arthropleona [11/11].....	15
Entomobryoidea (superfamily grouping: Cyphoderidae, Entomobryidae, Isotomidae, Oncopoduridae, Tomoceridae).....	15
Poduroidea (superfamily grouping: Hypogastruridae, Odontellidae, Onychiuridae, Neanuridae, Poduridae, Tullbergiidae).....	15
Suborder Symphypleona [7/7].....	15
Neelidae.....	15
Sminthuridae.....	15
<i>Dermaptera</i> [4/4].....	15
Anisolabididae.....	15
Forficulidae.....	15
Labiduridae.....	15
Labiidae.....	15
<i>Diplura</i> [5/5].....	16
Suborder Dicellurata [2/2].....	16

Japygidae.....	16
Suborder Rhabdura [3/3].....	16
Campodeidae.....	16
<i>Diptera</i> [68/107].....	16
Sottordine Brachycera [12/18].....	16
Acroceridae.....	16
Asilidae.....	16
Bombyliidae.....	16
Dolichopodidae.....	16
Empididae.....	16
Rhagionidae.....	17
Scenopinidae.....	17
Stratiomyidae.....	17
Tabanidae.....	17
Therevidae.....	17
Cyclorrhapha [33/59].....	17
Agromyzidae.....	17
Anthomyiidae.....	17
Asteiidae.....	17
Calliphoridae.....	18
Chloropidae.....	18
Conopidae.....	18
Drosophilidae.....	18
Ephydriidae.....	18
Fanniidae.....	18
Heleomyzidae.....	18
Hippoboscidae.....	18
Lonchaeidae.....	18
Lonchopteridae.....	18
Lauxaniidae.....	19
Micropezidae.....	19
Muscidae.....	19
Oestridae.....	19
Opomyzidae.....	19
Phoridae.....	19
Psychodidae.....	19
Rhinophoridae.....	19
Sarcophagidae.....	19
Scathophagidae.....	19
Sciomyzidae.....	19
Sepsidae.....	20
Sphaeroceridae.....	20
Syrphidae.....	20
Tachinidae.....	20
Tephritidae.....	20
Nematocera [22/30].....	20
Anisopodidae.....	20
Bibionidae.....	20
Cecidomyiidae.....	20
Ceratopogonidae.....	20

Mycetophilidae (included families Bolitophilidae, Ditomyiidae, Keroplatidae, Diadocidiidae, Macroceridae, Mycetobiidae).....	21
Ptychopteridae.....	21
Sciaridae.....	21
Simuliidae.....	21
Scatopsidae.....	21
Tipulidae.....	21
<i>Embioptera</i> [2/2].....	21
Embiidae.....	21
Oligotomidae.....	21
<i>Ensifera</i> [5/5].....	21
Gryllidae.....	21
Gryllotalpidae.....	22
Oecanthidae.....	22
Raphidophoridae.....	22
Tettigonidae.....	22
<i>Ephemeroptera</i> [7/10].....	22
Baetidae.....	22
Caenidae.....	22
Ephemerellidae.....	22
Ephemeridae.....	22
Heptageniidae.....	22
Leptophlebiidae.....	22
Siphonuridae.....	22
<i>Heteroptera</i> [40/40].....	23
Alydidae.....	23
Anthocoridae.....	23
Aradidae.....	23
Berytidae.....	23
Ceratocombidae.....	23
Cimicidae.....	23
Coreidae.....	23
Cydnidae.....	24
Dipsocoridae.....	24
Hebridae.....	24
Leptopodidae.....	24
Lygaeidae.....	24
Miridae.....	24
Nabidae.....	24
Nepidae.....	25
Belostomatidae.....	25
Corixidae.....	25
Gerridae.....	25
Hydrometridae.....	25
Naucoridae.....	25
Notonectidae.....	25
Veliidae.....	25
Pentatomidae.....	26
Pyrrhocoridae.....	26
Reduvidae.....	26
Rhopalidae.....	26

Saldidae.....	26
Thaumastocoridae [This family is not native of Italy].....	26
Tingidae.....	26
<i>Homoptera</i> [38/38].....	26
Aleyrodidae.....	26
Aphididae.....	27
Cercopidae.....	27
Cicadellidae.....	27
Cicadidae.....	27
Coccoidea (superfamily grouping Acleridae, Asterolecaniidae, Cerococcidae, Coccidae, Cryptococcidae, Diaspididae, Eriococcidae, Kermesidae, Lecanodiaspididae, Margarodidae, Micrococcidae, Ortheziidae, Phoenicococcidae, Pseudococcidae).....	27
Fulgoridae (included families Achilidae, Cixiidae, Delphacidae, Derbidae, Dictyopharidae, Flatidae, Issidae, Tettigometridae, Tropiduchidae).....	27
Membracidae.....	27
Psylloidea (superfamily grouping Aphalaridae, Calophyidae, Homotomidae, Psyllidae, Spondiliaspidae, Triozidae).....	27
<i>Hymenoptera</i> [62/72].....	28
Suborder Apocrita [51/61].....	28
Andrenidae.....	28
Anthophoridae.....	28
Apidae.....	28
Braconidae.....	28
Chalcidoidea [superfamily grouping Agaonidae, Aphelinidae, Chalcididae, Elasmidae, Encyrtidae, Eucharitidae, Eulophidae, Eupelmidae, Eurytomidae, Leucospididae (bigger insects), Mymaridae, Ormyridae, Perilampidae, Pteromalidae, Signiphoridae, Tetracampidae, Torymidae (hind coxae are big, abdomen usually triangular), Trichogrammatidae].....	28
Chrysididae.....	28
Cynipoidea (superfamily grouping Cynipidae, Eucoilidae, Figitidae, Ibalidae).....	28
Eumenidae.....	28
Formicidae.....	29
Gasteruptionidae.....	31
Ichneumonidae.....	31
Megachilidae.....	31
Mutillidae (included family Myrmosidae).....	31
Pompilidae.....	31
Proctotrupoidea (superfamily grouping Diapriidae, Heloridae, Platygasteridae, Proctotrupidae, Scelionidae).....	32
Scoliidae.....	32
Sphecidae.....	32
Vespidae.....	32
Symphyta [11/11].....	32
Argidae.....	32
Cepidae.....	32
Cimbicidae.....	32
Diprionidae.....	32
Megalodontidae.....	32
Orussidae.....	32
Pamphilidae.....	33
Siricidae.....	33



Tenthredinidae.....	33
Xiphydriidae.....	33
Xyelidae.....	33
<i>Isoptera</i> [2/2].....	33
Kalotermitidae.....	33
Rhinotermitidae .....	33
<i>Lepidoptera</i> [62/89].....	33
Adelinae.....	33
Geometridae.....	33
Hesperiidae (subfamily Hesperinae).....	33
Lasiocampidae.....	33
Lycaenidae.....	34
Noctuidae.....	34
Notodontidae (in part).....	34
Nymphalidae.....	34
Papilionidae (in part).....	34
Pieridae.....	34
Pterophoridae.....	34
Pyralidae (included family Crambidae) (in part).....	34
Saturniidae.....	34
Sesiidae.....	34
Sphingidae.....	34
Tortricidae .....	34
Zygaenidae.....	35
<i>Mantodea</i> [2/2].....	35
Mantidae.....	35
Empusidae.....	35
<i>Mecoptera</i> [3/3].....	35
Bittacidae.....	35
Boreidae.....	35
Panorpidae.....	35
<i>Neuroptera</i> [10/14].....	35
Megaloptera [1/1].....	35
Sialidae.....	35
Planipennia [7/11] .....	35
Ascalaphidae.....	35
Chrysopidae.....	35
Coniopterygidae.....	36
Hemerobiidae.....	36
Mantispidae.....	36
Myrmeleontidae.....	36
Nemopteridae.....	36
Raphidioptera [2/2] .....	36
Inocelliidae.....	36
Raphidiidae.....	36
<i>Odonata</i> [9/9].....	36
Zygoptera [4/4] .....	36
Calopterygidae.....	36
Coenagrionidae.....	36
Lestidae.....	37
Platycnemididae [Platycnemis pennipes (Pallas, 1771)].....	37

Anisoptera [5/5].....	37
Aeshnidae.....	37
Gomphidae.....	37
Libellulidae.....	37
<i>Phasmatodea</i> [1/1].....	37
Bacillidae.....	37
<i>Plecoptera</i> [7/7].....	37
Capniidae.....	37
Chloroperlidae.....	37
Leuctridae.....	38
Nemouridae.....	38
Perlidae.....	38
Perlodidae.....	38
Taeniopterygidae.....	38
<i>Psocoptera</i> [17/18].....	38
Amphipsocidae.....	38
Liposcelididae.....	38
Myopsocidae.....	39
Peripsocidae.....	39
Psocidae.....	39
Psyllipsocidae.....	39
Stenopsocidae.....	39
Trogiiidae.....	39
<i>Siphonaptera</i> [6/6].....	39
Ceratophyllidae.....	39
Hystrihopsyllidae.....	39
Ischnopsyllidae.....	39
Pulicidae.....	40
Vermipsyllidae.....	40
<i>Thysanoptera</i> [5/5].....	40
Suborder Terebrantia [3/3].....	40
Adiheterothripidae [sp. <i>Holarthrothrips tenuicornis</i> (Bagnall, 1927)].....	40
Aelothripidae.....	40
Thripidae.....	40
Suborder Tubulifera [2/2].....	40
Phlaeothripidae.....	40
<i>Thysanura</i> [5/5].....	40
Suborder Microcoryphia [2/2] .....	40
Machilidae.....	40
Ateluridae.....	40
Lepismatidae.....	40
Nicoletiidae.....	41
<i>Trichoptera</i> [17/19].....	41
Beraeidae.....	41
Brachycentridae.....	41
Hydropsychidae.....	41
Hydroptilidae.....	41
Leptoceridae.....	41
Limnephilidae.....	41
Odontoceridae .....	41
Phryganeidae.....	42

Rhyacophilidae .....	42
GLOSSARY.....	43
MACRO PHOTOGRAPHY.....	49
BIBLIOGRAPHY.....	51