

Help-notes towards the determination and the classification of the European Myrmeleonidae.

By

P. Esben-Petersen, Silkeborg.

I trust that the following notes, and especially the photos may be of some value for the future study of the European Myrmeleonid-Fauna.

My best thanks are due to H. Stitz, Berlin Museum, and Dr. Zerny, Vienna Museum, for their great readiness to help me. I am especially much indebted to Dr. Zerny for the opportunity of examining and photographing some of Navas's type-specimens.

In the wings of the Myrmeleonidae *Sc* and *R* unite at the pterostigma, and from the pterostigma to the tip of the wing they continue as a single nervure. The area beyond the pterostigma and between *C* and *Sc + R* is named the apical area. The branches from *Sc + R* in that area are often connected by crossveins. *Rs* arises from *R* more or less close to the base of the wing; it runs almost parallel to *R*, and between *R* and *Rs* is found a series of crossveins. *Rs* emits a series of branches connected with each other by crossveins, some of which, especially towards the apex of the wing, form more or less regular series; one or more of these apical series are often shaded. In a number of Myrmeleonidae the bran-

ches from *Rs* are bent in such a manner that an apparently continuous or nearly continuous, straight line is formed, running through the middle of the apical third of the wing; this line is named the anterior Banksian line*). In the forewing *M* is forked about one third from its base; its upper branch, *M*₁, or only *M*, continues in an almost straight direction of the median stem towards the margin of the wing; its lower branch has the shape and the direction like an oblique crossvein, and it disappears apparently when it reaches *Cu*₁. In the hindwing *M* forks close to the base of the wing. *M*₁ runs like an unforked nervure towards the margin of the wing; the anterior branch, *M*_{2a}, has almost the same direction as *M*₁; the posterior branch, *M*_{2p}, runs as a rule in an oblique direction into the hind margin of the wing. *M*_{2a} emits a series of branches towards the hind margin, and the branches have almost the same direction as *M*_{2p}. In several of the broad-winged forms the branches from *M*_{2a} together with a longitudinal series of crossveins form a more or less distinct longitudinal line, which I name the posterior Banksian line. This line is f. inst. very distinct in species of the *Acanthaclisini*. In the Palparid-group *M*_{2p} fuses with *Cu*₁, and from that point a "recurrent" nervure arises. The apical part of this recurrent nervure runs parallel to *M*_{2a}. In the forewing *Cu* forks close to the base of the wing. *Cu*₁ has almost the shape like *M*₂ in the hindwing; it forks at some distance from the base of the wings, and the anterior branch, *Cu*_{1a}, runs parallel to *M*₁. The posterior branch, *Cu*_{1a}⁸, runs in a more or less oblique direction to the hind margin. *Cu*_{1a} emits a series of branches, running in an oblique direction to the hind margin. In many forms these branches together with a series of crossveins form a more or less distinct longitudinal line, the posterior Banksian line**).

*) Tillyard: Proceedings of the Linnean Society of New South Wales, p. 747, 1915.

**) In some of my previous works I have named this line the intercubital line.

The area between *Cu 1a*, *Cu 1p* and the hind margin of the wing is named the cubital area. In the Palparid-group *Cu 2* runs as a free and not coalescing nervure to the margin of the wing; but in all the other forms of the Myrmeleonidae — as far as I know — *Cu 2* coalesces with *1A* for some distance. In *Dendroleon* the basal part of *Cu 2* is easily observable; in the *Macronemurini* the

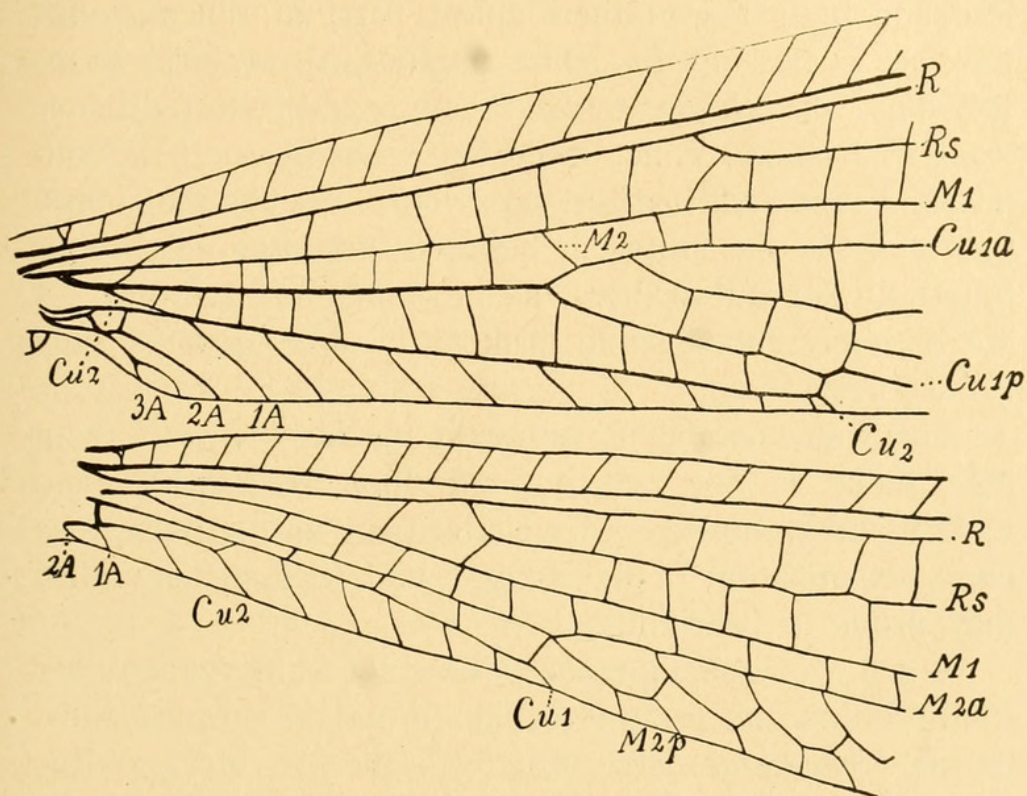


Fig. 1. Basal half part of fore and hindwing of *Neuroleon arenarius*.

basal part has only the form of an oblique crossvein between *Cu 1* and *1A*. Close to the base of the wing and almost at that point where *Cu* forks an oblique, forwardly directed crossvein is emitted from *Cu*. This vein crosses *M* and continues in a still more oblique direction until it coalesces with *R*. In the hindwing *Cu* also forks close to the base of the wing. *Cu 1* is free and runs into the hind margin a little before the point where *M 2p* ends. *Cu 2* only touches *1A* close to its base, or it coalesces with *1A* for some distance. In the forewing of the Pal-

palparid-group *1A* is free; in the other groups of the Myrmeleonidae — as far as I know — *1A* coalesces with *Cu 2* for some distance and runs into the hind margin in the same direction as an oblique crossvein from *Cu 2*. In the hindwing of the Palparid-group *1A* is rather long, but in the hindwing of the other groups it is short and curved. In the forewing of several groups *2A* and *3A* are free and branched in their apical part; in other groups they are coalescing for some distance. In several forms *2A* runs very closely to *1A* basally. In a short distance from its base *2A* either coalesces with *3A*, or it is connected to *3A* with a short crossvein. Besides that crossvein at least one crossvein between these two nervures is found further outwardly. In the hindwing *2A* and *3A* are both present in some groups; in other groups only *2A* is present.

This view on the nervature of the Myrmeleonid-wing here stated is not the common one. N. Banks*) and L. Krüger**), however, have given me the impulse to a closer examination of the wing, and I trust that my view may prove to be right.

When we look upon the whole lot of Myrmeleonidae we find that the Palparid-like forms are nearest allied to the *Nymphidae* with regard to the nervature of the wings. They differ especially in the absence of the crossveins in the subcostal area, in the fusion of *M 2* with *Cu 1a* in the forewing and in the more distal origin of *Rs*. They agree with regard to the fact that *1A* does not coalesce with *Cu 2* and in having *1A*, *2A* and *3A* present in both pairs of the wings. These forms may be considered as the oldest or the most archaic of the Myrmeleonidae, and they form the division *Archæmyrmeleonidae*. The second division, which I name the *Neomyrme-*

*) N. Banks: Proceedings of the Academy of Natural Sciences of Philadelphia, pag. 608—632, 1914.

**) L. Krüger: Stett. Entom. Zeitung, pag. 158—162, 1916.

leonidae, may be divided into two subfamilies, the *Dendroleoninae* and the *Myrmeleoninae**).

In the hindwing of the *Dendroleoninae* *Rs* arises close to the base of the wing, and only one (very seldom two) crossvein is found in the radial area before the origin of *Rs*. This subfamily is the oldest.

In the hindwing of the *Myrmeleoninae* *Rs* arises further out, and at least two crossveins are found in the radial area before the origin of *Rs*.

When we turn to the *Dendroleoninae* we find that in the European genus, *Dendroleon*, and in the extra-European genera, *Episalus*, *Froggattisca*, *Periclystus*, *Glenoleon*, *Chrysoleon*, *Cymothales* etc., *Rs* in the forewing arises before the level of the fork of *Cu1*. In their forewing *Cu2* is rather long and easily recognizable; between it and *Cu1* two or more crossveins are present before it coalesces with *1A*. In the forewing *2A* and *3A* are well separated (in a few cases the two nervures touch each other at a point). Body, legs and antennae are rather slender. This group may be looked upon as a tribe, *Dendroleonini*, and it seems to me to be very distinct, and to be the most archaic one within the *Dendroleoninae*.

Amongst the rest of the *Dendroleoninae* we shall look upon all those in which *Cu2* in the forewing is easily recognizable. This nervure coalesces with *1A* at the point where it emits its first crossvein to *Cu1* or a little further out. Sometimes this basal part of *Cu2* is quite hyaline, like the membrane of the wing, and a good magnifying-glass or better a microscope is then necessary. In this group the *Rs* in the forewing arises further out than the level of the cubital fork. In the forewing *2A* and *3A* touch each other at a point, or they coalesce for a short distance.

One of the most distinct groups is the *Creagrini*, a tribe characterized by the peculiar shape of *Cu1p* and

*) N. Banks: The Canadian Entomologist, pag. 67–71, 1899,

*Cu*2 in the forewing. These two nervures are for a rather long distance running parallel to each other and with *Cu*1a and the hind border of the wing. 2A and 3A in the forewing coalesce for a very short distance.

In the *Megistopini* and the *Gymnocnemini*, two tribes only represented in the European fauna by one genus each, the 2A and 3A in the forewing coalesce for a rather long distance. 2A forked, 3A unforked. In the *Megistopini* 2A in the hindwing runs into the hind margin of the wing in the usual manner; in the *Gymnocnemini*, however, 2A runs parallel with the hind margin of the wing, and it coalesces with 1A before this nervure reaches the margin. In the *Megistopini* 2A and 3A in the forewing coalesce before 2A emits the second crossvein to 1A; in the *Gymnocnemini* this crossvein is emitted before 2A coalesces with 3A.

In the *Formicaleonini*, which are well-represented in the European fauna, *Cu*1p and *Cu*2 in the forewing are running obliquely to the hind margin of the wing. In the forewing 2A and 3A touch each other in a point; 2A unforked, 3A forked. 2A emits its second crossvein to 1A at that point where it touches 3A, or a little further out. In the hindwing 2A is hardly visible. Wings rather long and lanceolate.

Now we want to deal with those, in which the basal and free part of the *Cu*2 in the forewing only has the shape of a somewhat oblique crossvein, which touches 1A rather long before that point where the first true crossvein is emitted to *Cu*1. In that tribe, *Macronemurini*, 2A and 3A in the forewing coalesce for a longer or shorter distance. 2A unforked; 3A forked.

When we turn to the *Myrmeleoninae*, we firstly look upon the *Lopezini*, a tribe only represented in the European fauna by one genus, *Lopezus*. This tribe may be considered as an old one, in the forewing of which *Rs* arises a little before, or at the level of the fork of *Cu*1.

The basal part of *Cu2* in the forewing is free, but *Cu2* coalesces with *1A* close to its base, and at the point where it coalesces it emits a curved and forward-directed crossvein to *Cu1*. *2A* runs wide apart *1A* basally, and it coalesces with *3A* in a point, or for a very short distance; before it coalesces, it is connected with *1A* by a very conspicuous crossvein, it is forked, but occasionally unforked. *3A* forked. In the hindwing *Rs* arises rather close to the base of the wing, or a little further out than the level of the fork of *M2*. *1A* long and forked. *2A* rudimentary. The shape of the wings is rather exceptional. The breadth of the wings is almost the same from the base to the tip, which is regularly pointed.

The *Myrmecaelurini* form a well-defined tribe. The free and basal part of *Cu2* in the forewing is rather short, and from the point where it coalesces with *1A*, a crossvein is emitted to *Cu1*. *2A* and *3A* are coalescing in a point, or for a short distance. *2A* unforked. *3A* forked. In the forewing *Rs* arises further outwards than the level of the fork of *Cu1*, and in the hindwing the same takes place. In the hindwing *1A* is forked; *2A* rudimentary.

Still we have to deal with the *Myrmeleonini* and the *Acanthaclisini*, the rest of the subfamily. A common character for both tribes is the apparent irregularity in the nervature of the anal part of the forewing. In the *Myrmeleonini* the *Rs* of both pairs of wings arises further out than the level of respectively the cubital and the median fork. In the forewing *Cu2* is rather short and coalesces with *1A* where it reaches the first crossvein emitted from *Cu1*, or a little further outwards. Basal part of *2A* runs parallel with and very close to *1A*, and just at the point where it diverges from *1A*, it coalesces with this nervure in a point. *2A* and *3A* coalesce for a distance. *2A* forked; *3A* unforked(?). In the hindwing *1A* is well-separated from *Cu2* basally, but connected with that nervure by a short crossvein. *1A* forked. *2A* rudimentary.

In the *Acanthaclisini* *Rs* in both pairs of the wings arises further out than the level of the cubital and of the median fork. In the forewing *Cu* 2 is rather short, and it coalesces with *1A* where it reaches the first crossvein from *Cu* 1, or a little further out. Basal part of *2A* well-separated from *1A*. A distinct crossvein between *1A* and *2A* is present at that point where *2A* begins to diverge from *1A*. *2A* and *3A* forked. In the hindwing *1A* is unforked. *2A* is present and running forward at some distance from the hind margin of the wing, until it coalesces with *1A* a little before this nervure runs into the hind margin*). The area circumscribed by these two nervures has the likeness of a circular cell. The wings rather long; their apex more or less pointed. The nervature very conspicuous. Body and legs stout, and strongly haired.

Analytic table of subfamilies and tribes.

1. *1A* of forewing does not coalesce with *Cu* 2. *1A*, *2A* and *3A* present in both pairs of the wings

I ***Archæmyrmeleonidae***.

- 1A* of forewing coalesces with *Cu* 2 for some distance. *2A* in hindwing rarely present; *3A* absent

II ***Neomyrmeleonidae*** 2.

2. In the radial area of the hindwing only one crossvein present before the origin of *Rs*. *Dendroleoninae*.. 3.
In the radial area of the hindwing two or more crossveins present before the origin of *Rs*. *Myrmeleoninae*..... 8.

3. In the forewing *Rs* arises before the level of the fork of *Cu* 1. The free and basal part of *Cu* 2 in the forewing long; two or three crossveins present between this part and *Cu* 1. *2A* and *3A* in the forewing well separated..... *Dendroleonini*.
In the forewing *Rs* arises further out than the level of the fork of *Cu* 1. The free and basal part of *Cu* 2 in the forewing is short; at most one crossvein between this part and *Cu* 1 present. *2A* and *3A* coalesce in a point, or for some distance 4.

*) In some American species the two nervures separate just before they reach the margin,

4. *Cu1p* and *Cu2* in the forewing are running parallel to each other, to *Cu1a* and to the hind margin of the wing *Creagrini*.
Cu1p and *Cu2* do not run parallel to *Cu1a* or to the hind margin 5.
5. The free and basal part of *Cu2* in the forewing is so long that it at least reaches the first crossvein, emitted from *Cu1*..... 6.
 The free and basal part of *Cu2* in the forewing has the shape of an oblique crossvein, and it does not reach the first crossvein, emitted from *Cu1*.....
Macronemurini.
6. In the forewing *2A* is forked, *3A* unforked7.
 In the forewing *2A* is unforked, *3A* forked. In the hindwing *2A* is hardly visible. Wings rather long and lanceolate *Formicaleonini*.
7. In the forewing *2A* emits its second crossvein to *1A* before it coalesces with *3A*. In the hindwing *2A* is present, running at some distance from the hind margin until it coalesces with *1A* before this nervure runs into the hind margin *Gymnocnemini*.
 In the forewing *2A* coalesces with *3A* before it emits its second crossvein to *1A*. In the hindwing *2A* is hardly visible *Megistopini*.
8. In the forewing *Rs* arises at the level of the fork of *Cu1*, or a little before. *2A* runs widely apart from *1A* basally. The first crossvein between *1A* and *2A* long and conspicuous. In the hindwing *1A* is long and forked..... *Lopezini*.
 In the forewing *Rs* arises further out than the level of the fork of *Cu1*..... 9.
9. In the hindwing *2A* is present, and with a single exception it forms together with *1A* a circular conspicuous cell. Body and legs stout and very hairy.....
Acanthaclisini.
 In the hindwing *2A* is absent or rudimentary. Body and legs not very stout and only shortly haired ...10.
10. In the forewing *2A* is unforked *Myrmecaelurini*.
 In the forewing *2A* is forked..... *Myrmeleonini*.

ARCHÆMYRMELEONIDAE

Palpares.

Rambur, Histoire nat. Insectes, Névroptères, pag. 365, 1842.

Of the *Archæmyrmeleonidae* this genus only is known from Europe.

Table of species.

Abdomen yellowish above and with three more or less distinct blackish or blackish brown streaks, one along the dorsum and one along each side. Venter black or blackish brown.....*libelluloides*.

Abdomen yellowish above with a more or less complete blackish dorsal streak, no lateral streaks, but each segment blackish at its base laterally. Venter blackish..

hispanus.

Palpares libelluloides (Pl. II, fig. 2).

Myrmeleon libelluloides Linné, Syst. Nat., Ed. XII, p. 913.

The species is known from all the countries on the northern shores of the Mediterranean. I have also seen it from Caucasus, Abyssinia and Asia minor.

Palpares hispanus.

Hagen, Stett. Ent. Zeitg., p. 40, 1860.

This species resembles the former very much; but it is of smaller size, and its wings are broader and shorter. The dark markings on the wings are more pronounced, and the irrorations on the anterior ones more numerous.

The species is known from the Iberian peninsula and from the opposite coast of Africa.

I possess it from Spain and Oran.

NEOMYRMELEONIDAE

DENDROLEONINAE

Dendroleonini.

Dendroleon.

Brauer, Novarra-Expedition, Neuroptera, p. 42, 1866.

Of the *Dendroleonini* this genus only (containing one European species) is known from Europe.

Dendroleon pantherinus (Pl. I, fig. 3).

Myrmeleon pantherinum Fabricius, Mant. Ins., p. 249.

Dendroleon pantherinus Brauer, Verh. zool.—bot. Gesellschaft. Wien, p. 963—966, 1867.

The species seems to be very scarce wherever it is found. It is known from Austria, Hungary, Hesse, Silesia, Italy and Malta.

*Formicaleonini**).

In the European genera of this tribe the anterior Bankian line is only slightly indicated, the posterior one, however, is rather distinct in some genera.

Table of genera.

1. Wings very long and slender, more than five times as long as broad. The angle between *Cu1a* and *Cu1p* very acute. The second branch from *Cu1a* arises much further out than the extreme point of *Cu1p*. *Nemoleon*. Wings moderately long, about four times as long as broad. *Cu1a* and *Cu1p* rather diverging, and the angle between them not so acute as in *Nemoleon*. The second branch from *Cu1a* arises almost at the level of the extreme point of *Cu1p* 2.

*) I cannot by any means follow Navas in dividing this tribe into two, the *Formicaleonini* and the *Neuroleonini*, owing to the difference in the length of the spurs. Firstly this character is so slight, especially when also extra-European genera be taken into consideration, and secondly such a division will bring closely allied genera into separate tribes.

2. First tarsal joint long, and as long as fifth. Spurs almost straight and as long as first tarsal joint. One row of cells between *Cu1a* and the posterior Banksian line in the forewing..... *Nicarinus*.
First tarsal joint much shorter than fifth. Spurs at least as long as first tarsal joint..... 3.
3. Legs rather short and stout, strongly haired. Spurs about as long as first, second and third joint united. More than three cells between the branches from *M2a* in the hindwing..... *Formicaleo*.
Legs not so stout or so strongly haired. Spurs not so long as first, second and third joint united. Two or three cells between the branches from *M2a* in the hindwing..... 4.
4. The apical area in both pairs of wings (as a rule) without crossveins..... *Neuroleon*.
The apical area in the forewing (at least) contains a row of crossveins..... *Nelees*.

Nemoleon.

Navas, Mem. I Congr. Natur. Esp., p. 147, 1909.

This genus is very distinct on account of the peculiar shape of the fork of *Cu1* in the forewing. Two rows of cells between *Cu1a* and *Cu1p*. Between *Cu1a* and the posterior Banksian line one row of cells in the basal half part; two irregular rows in the apical half part. In the hindwing two rows of cells between *M2a* and the hind margin in basal half part, one row in the apical half part. Tarsi long; basal joint as long as fifth. Spurs only a little longer than basal tarsal joint. The abdomen of the male longer than the wings and with short appendages.

One European species.

Nemoleon notatus (Pl. I, fig. 4).

Myrmeleon notatus Rambur, Hist. nat. Insectes, Névroptères, p. 402, 1842.

Nemoleon notatus Navas, Revista Real Acad. Madrid, p. 631, 1915.

The species is known from Malaga, Orihuela and other places in Spain. Rambur mentions „les environs

de Malaga", but he states also that he has got the species from Senegal. Rambur is undoubtedly right as to the last mentioned locality, and I believe to have seen several specimens from Congo and Abyssinia, but described under other names. Later on I hope to come back to this subject.

Nicarinus.

Navas, Ann. Soc. scient. Bruxelles. p. 243, 1914.

Nisteus Navas, Revista Real Acad. Madrid. p. 634, 1915.

This genus agrees very well with the foregoing as to the shape and length of tarsal joints and the spurs; but with regard to the nervature of the wings it is nearer allied to the genus *Formicaleo*. Both have a number of short cells between the branches of *Rs*, especially between first, second, third and fourth. Between the branches from *M2a* in the hindwing more than three cells. Legs with long hairs.

Nicarinus poecilopterus (Pl. II, fig. 5).

Myrmeleon poecilopterus Stein, Berliner Entom. Zeitschr. p. 421, 1863.

Nicarinus basilicus Navas, Ann. Soc. scient. Bruxelles. p. 244, 1914.

The species was described on specimens collected by Krüper, probably in Peloponnesus. I possess the species from Brussa in Asia minor and from Caucasus. Navas mentions Akbés in Syria. Brauer (Festschrift k. k. zool.-bot. Gesellsch. Wien, p. 289, 1876) places the species in *Formicaleo*, but he remarks that it ought to be placed in a new genus.

Formicaleo.

Leach, Edinb. Encycl. IX, p. 138, 1815.

Legs short and stout, strongly haired. Body rather robust. Strong and robust species.

Table of species.

1. Abdomen dark, without yellowish spots. Margins of the wings black. *Sc* and *R* blackish banded. All the other nervures yellowish. A more or less distinct brownish dot or oblong spot in the apical third part of the hindwing *lineatus*.
Abdomen dark with pale markings. Nervature of wings dark, yellowish banded..... 2.
2. Abdomen with two yellowish spots on the dorsum of several segments. Wings more or less marked with brown spots or streaks..... *tetragrammicus*.
Abdomen with a broad transverse yellowish band at the apex of each segment. Wings without markings. *annulatus*.

Formicaleo tetragrammicus (Pl. II, fig. 6).

Myrmeleon tetragrammicus Fabricius, Ent. Syst. Suppl. p. 205, 1798.

This species is a widely spread one; it is known from Spain, France, Italy, Austria, Hungary, Saxony, Dalmatia, South Russia, Turkey, Turkestan and Japan.

I have seen specimens from Central Europe, Caucasus and Japan. I consider *Formicaleo nigricans* Okamoto (Wiener Entom. Zeitung, p. 288, 1910), of which species I possess a specimen from Japan, to be identical with *tetragrammicus*. In a great number of specimens the dark spots along the *R* in the forewing are wanting.

Formicaleo lineatus.

Myrmeleon lineatus Fabricius, Ent. Syst. Suppl., p. 205, 1798.

„ *ornatum* Olivier, Encycl. Meth. VIII, p. 123.

„ *sibiricum* Fischerv. Waldheim, Entomogr. IV, p. 45, tab. 1, fig. 2; tab. 2, fig. 7.

The species is known from South Russia, Roumania, Sibiria, Turkestan and China. I have seen it from Moldavia (Montandon leg.), South Russia (coll. mea) and Tsingtau (Entom. Mus. Berlin).

Formicaleo annulatus.

Myrmeleon annulatus Klug, Symb. Phys. IV, tab. 36, fig. 7.

The species is known from Spain. Navas remarks that it is also known from Asia occident. Mac Lachlan (Entom. Monthly Mag., Vol. 25, p. 347) mentions it from Benzus Bay, Morocco, but he remarks that his determination is doubtful. I know the species only from the description and the figure, given by Klug.

Neuroleon.

Navas, Mem. Primer Congr. Naturalistas Esp., p. 148, 1909.—
Revista Real Acad. Cienc. Madrid,
p. 625, 1915.

Tiny species. Legs and body slender. In the forewing the angle between *Cu1a* and *Cu1p* very acute, enclosing two rows of cells; the second branch from *Cu1a* arises a little before the point where *Cu1p* runs into the hind margin. No anterior Banksian line; the posterior one slightly indicated. The apical area in both pairs of wings without crossveins*). Wings slender; their tip acute; the posterior ones slightly falcate at apex.

Neuroleon arenarius (Pl. II, fig. 7).

Myrmeleon arenarius nom. nov. Navas, Butll. Inst. Cat. Hist. Nat., p. 24, 1904.

Myrmeleon variegatus Rambur (nec Klug), Hist. nat. Ins., Névroptères, p. 400, 1842.

Neuroleon naxensis Navas, Revista Real Acad. Cienc. Madrid, p. 626, fig. 10, 1915.

The species is found in Spain, South France, Italy, Greece and Asia minor. I have examined the type specimen of *N. naxensis* and compared it with specimens from Spain, Sicily and Asia minor.

*) This character is not constant. In some specimens before me (ex coll. Navas) one or two crossveins are present in the apical area of the forewing.

Neuroleon ocreatus (Pl. III, fig. 8).

Myrmeleon ocreatus Navas, Butll. Inst. Cat. Hist. Nat., p. 23, 1904.

Neuroleon ocreatus Navas, Revista Real Acad. Cienc. Madrid, p. 627, 1915.

A larger and more broad-winged species than the foregoing. It is a good and distinct species, and it is only known from Spain.

In „Revista Real Acad. Cienc. Madrid“, p. 374, 1909, Navas has described a species *Myrmeleon* (*Neuroleon*) *Laufferi* from Spain. I do not know the species.

Nelees.

Navas, Broteria, p. 31, 1912.

This genus differs only from the before named in having a row of crossveins in the apical area of at least the forewing. I have already mentioned that such crossveins sometimes also are present in *Neuroleon*, and therefore it seems to me that *Nelees* only may be looked upon as a subgenus of *Neuroleon*.

Nelees nemausiensis (Pl. III, fig. 9).

Myrmeleon nemausiensis Borkhausen, Scriba Beiträge, II, p. 162, pl. XI, fig. 6.

Myrmeleon canariensis Navas, Real Acad. Cienc. Madrid, p. 12 (sep.), figs. 1 and 2, 1906.

This species is known from Spain, South France and the Canary Islands.

I possess the species from Spain and the Canary Islands.

Nelees imbecillus*) (Pl. III, fig. 10).

Myrmeleon imbecillus Stein, Berl. Ent. Zeitschr., p. 421, 1863.

Maracanda amoena Hagen (nec Mac Lachlan), Canadian Entomologist, p. 210, 1887.

*) Owing to the kindness of Dr. Zerny, Vienna Museum, I have had at hand two specimens from Morea sept. of *Myrmeleon imbecillus* Stein. Moreover Dr. Zerny communicated to me that the specimens were

Nelees propinquus Navas, Ann. Mus. Zool. Acad. Imp. St. Petersburg., p. 529, 1911.

Nelees noxius Navas, Broteria, p. 48, 1915.

Nelees hellenicus Navas, ibid, p. 93, 1915.

The species has very much likeness to *nemausiensis*, and the differences between them are very small. In *imbecillus* the abdomen of the male is probably a little longer than in the male of *nemausiensis*. The markings of head, thorax and abdomen are the same in both species, with the exception that the pale lateral streaks on the prothorax as a rule are somewhat broader in *imbecillus*. The median streak on prothorax is sometimes entire, sometimes interrupted and sometimes only present on the front part. I may say that there is much variation in the markings of the thorax, partly due to the degree of maturity of the specimen, I think. The most valuable character is found in the shape of the wings. In *imbecillus* the wings, especially the forewings, are more broadened towards the tip, and the tip itself is more obtuse than in *nemausiensis*. In the forewing of *imbecillus* the third branch from *Cu*₁*a* arises as a rule within the angular space of the cubital fork; in *nemausiensis* the third branch arises further out. In the forewing of *imbecillus* often three rows of cells between *Cu*₁*a* and the posterior Banksian line; in *nemausiensis* as a rule one row at the base of the Banksian line and two rows further out.

In „Mitteil. Kaukas. Museum“, p. 291, 1913, I mentioned a broad-winged form of *nemausiensis* from the eastern part of the Mediterranean Region, but at that time I did not know *Myrm. imbecillus* Stein. I am, however, still much inclined to consider *imbecillus* only as a geo-

presented to Brauer from Krüper himself. H. Stitz, Assistant of the Berlin Museum, has kindly compared my photo of the wings with Stein's type, and he writes to me: „Ich teile Ihnen mit, dass 1, das Flügelgeäder unseres Stein'schen Exemplars von *Myrmeleon imbecillus* mit Ihrer eingesandten Photographie genau übereinstimmt. 2, dass das Stein'sche Exemplar Sporne besitzt“.

graphical form of *nemausiensis*; it seems to me that the differences are very small to give *imbecillus* specific rank.

With regard to the species names which I have put amongst those of the synonyms I shall firstly deal with *N. noxius*. I possess the type-specimen of that species, and the specimen agrees entirely with specimens of *imbecillus*. Concerning *propinquus* and *hellenicus* I am quite sure that both are only specimens of *imbecillus*.

N. imbecillus seems to be rather common in the eastern part of the Mediterranean Region. I have seen long series of specimens, especially from Caucasus.

Nelees sticticus.

Myrmeleon sticticus Navas, Bol. Soc. Arag. Cienc. Naturales, p. 107, 1903.

Nelees distichus.

Myrmeleon distichus Navas, *ibid.*, p. 106, 1903.

I do not know these two species, which are only known from Spain.

Megistopini.

Only one genus is found in Europe.

Megistopus.

Rambur, Hist. nat. Insectes, Névroptères, p. 410, 1842.

The angle between *Cu1* and *Cu1p* rather acute. *Cu1a* emits three branches within the angular space. The areas between *Cu1a* and the hind border of the forewing and between *M2a* and the hind border of the hindwing very broad. No Banksian line.

Megistopus flavicornis (Pl. IV, fig. 11).

Myrmeleon flavicornis Rossi, Fauna Etr. II, 16, p. 693, t. 9, fig. 2.

Megistopus bisignatus Rambur, Hist. nat. Insectes, Névroptères, p. 411, 1842.

The species is known from Spain, France, Italy, Hungary, Dalmatia, Greece, Turkey, Asia minor and Caucasus. I possess specimens from Hungary and Caucasus.

Gymnocnemini.

Only one genus is found in Europe.

Gymnocnemia.

Schneider, Stett. Ent. Zeitung, p. 343, 1845.

Aplectrocnemus Costa, Fauna Napol. Myrm., p. 18, 1855.

The angle between *Cu1a* and *Cu1p* in the forewing rather obtuse. *Cu1a* emits only two branches within the angular space. The area between *Cu1a* and the hind border of the forewing very broad. Between *M2a* and the hind margin of the hindwing three rows of cells. No Banksian line.

***Gymnocnemia variegata* (Pl. IV, fig. 12).**

Megistopus variegatus Schneider, Stett. Ent. Zeitung, p. 342, 1845.

Aplectrocnemus multipunctatus Costa, Faun. Nap. Myrm., p. 18, t. 9, fig. 6.

The species is known from Spain, Italy, Dalmatia, Greece and Algeria. Mac Lachlan (Trans. Ent. Soc. Lond., p. 153, 1898) remarks about the species: „A wide-spread insect over the Mediterranean Region and extending to Turkestan“. I have seen the species only from Dalmatia.

In „Rovartani Lapok“, XVII, p. 187, fig. 7, 1910, Pongracz has described a species, *G. Moscaryi*, from Hungary. I do not know the species or the periodical in which it is described.

Creagrini.

Only one genus is known from Europe.

Creagris.

Hagen, Stett. Ent. Zeitung, p. 364, 1860.

Several species are described and stated to belong to the European Fauna, but much confusion exists in the literature concerning the synonymy. At present I am not able to clear up the questions, but I hope that the photos, here given, may contribute somewhat to the solution of the problem.

Creagris plumbea.

Myrmeleon plumbeus Olivier, Encycl. Meth. VIII, p. 126.

This species has a long row of synonymic names. It is spread over the whole of the Mediterranean Region, and I have seen the insect from several localities.

Creagris V-nigrum (Pl. IV, fig. 13).

Myrmeleon V-nigrum Rambur, Hist. nat. Insectes, Névroptères, p. 394, 1842.

Rambur remarks: „Je l'ai découvert en Andalousie, dans les environs de Malaga“. I do not know the species, but I give here a photo of the wings of the type-specimen.

Creagris submaculosa (Pl. V, fig. 14).

Myrmeleon submaculosus Rambur, Hist. nat. Insectes, Névroptères, p. 396, 1842.

Creagris corsica (Brauer), Hagen.

Rambur remarks that he has taken the species „dans les environs de Malaga“. In my collection I have two specimens from Spain, received from Navas under the name of *C. V-nigrum*; these two specimens I suppose to be what Rambur names *submaculosa*. I follow Brauer (Festschr. zool.—bot. Gesellsch., Wien, p. 289, 1872) in regarding *Creagris corsica* as a synonym of *submaculosa*. In „Stett. entom. Zeitung“, p. 43, 1860, Hagen remarks that he has received from Brauer specimens, taken in Corsica, under the name *Myrmeleon corsicus* (no description is given by Brauer); in ibid. p. 364 he also gives a note about the Corsican specimens, but in „Ann. Soc. Ent. Fr.“, p. 42, 1864 he yet gives a few supplementary notes.

He remarks also that the species has much likeness to *C. submaculosa*. The photo, here given (Pl. V, fig. 15), is from a specimen, determined and named by Hagen himself.

Macronemurini.

The free and basal part of *Cu*2 in the forewing has the shape of an oblique crossvein; it does not reach the first true crossvein, emitted from *Cu*1 to *Cu*2. 2A and 3A coalesce for a shorter or longer distance. 2A unforked; 3A forked.

Table of the European genera.

Anterior and posterior Banksian line in the forewing present, although not very distinct. Fifth tarsal joint the longest. Spurs longer than basal tarsal joint

Macronemurus.

Only posterior Banksian line in the forewing present, but rather indistinct. First tarsal joint as long as fifth.

Spurs much shorter than first tarsal joint

Pignatellus.

Macronemurus.

Costa, Fauna Napol. Myrm. 2, p. 8, 1855.

Two species are known from Europe.

Macronemurus appendiculatus (Pl. V, fig. 16).

Myrmeleon appendiculatus Latreille, Gen. Crust. et Insect. III, p. 193.

Myrmeleon linearis Klug, Symb. Phys. IV, tab. 36, fig. 1.

It is a wide-spread species, known from the Mediterranean Region and from South Russia.

Macronemurus bilineatus (Pl. VI, fig. 17).

Brauer, Verh. zool.—bot. Gesellsch. Wien, p. 189, 1868.

The species is easily separated from the foregoing by the two longitudinal dark streaks on the basal part of the prothorax; sometimes also two small dark spots are pre-

sent on the anterior part of the prothorax. In *appendiculatus* a rather broad dark median longitudinal streaks is present together with two small dark spots at each side.

The species is known from Dalmatia, Greece, Turkey, Caucasus and Crimea.

Pignatellus.

Navas, Asoc. esp. para Progr. Cienc., Congr. Madrid 1913, Cienc. Nat. p. 43. — Revista Real Acad. Madrid, p. 623, 1915.

Rotandon Navas, Ann. Soc. scient. Brux., p. 242, 1914.

Only a single species is known.

Pignatellus extorris (Pl. VI, fig. 18).

Navas, Asoc. esp. para Progr. Cienc., Congr. Madrid 1913, Cienc. Nat., p. 44, figs. *a*, *b*. — Rev. Real Acad. Madrid, p. 623, fig. 9, 1915.

Rotandon sobrius Navas, Bull. Mus. Paris, p. 116, fig. 1, 1914.

Rotandon clarus Navas, Ann. Soc. scient. Brux., p. 242, 1914.

The species is known from Crete, from several localities in Asia minor, from Syria and Caucasus. I possess the species from Amasia (Asia minor) and Caucasus.

MYRMELEONINAE.

Lopezini.

Only one genus, containing a single species, is known from Europe.

Lopezus.

Navas, Novit. Zool., p. 449, 1913.

Lopezus fedtschenkoi (Pl. VI, fig. 19).

Myrmecaelurus Fedtschenkoi MacLachlan, Fedtschenko's Voyage in Turkestan, pag. 4 (sep.), tab. 1, figs. 3 and 4, 1875.

The species is described on specimens from Kiselkum in Turkestan.

I possess it from the river Kuma, Ciscaucasia, and Mac Lachlan (Trans. Ent. Soc. Lond., p. 157, 1898) records it from Oran.

Myrmecaelurini.

In the radial area of the hindwing two or more crossveins before the origin of *Rs*. In the forewing *Rs* arises further out than the level of the fork of *Cu1*. *Cu2* in the forewing distinct, and it reaches the first crossvein, emitted from *Cu1*, before it coalesces with *1A*. *2A* unforked; *3A* forked. *2A* and *3A* free, or they coalesce for a shorter or longer distance. In the hindwing *1A* is forked.

Table of European genera*).

1. Banksian lines absent in both pairs of wings. Spurs almost microscopic.....*Maracanda*.
Banksian lines present and distinct in both pairs of wings. Spurs distinct.....2.
2. In the forewing *2A* and *3A* coalesce for a rather long distance. Basal tarsal joint almost as long as the apical one. Spurs much shorter than first tarsal joint. *Cueta*.

In the forewing *2A* and *3A* coalesce for a short distance. Basal tarsal joint shorter than fifth. Spurs at least as long as basal joint.....*Myrmecaelurus*.

Myrmecaelurus.

Costa, Fauna Napol. Myrm., p. 10, 1855.

In the species which I know, the *Cu1p* in the forewing is more or less curved towards the base of the wing.

*) I do not know the Navasian genus *Solter* (Navas, Broteria, p. 32, 1912) or the single species placed therein (*Solter liber* Navas, Broteria, p. 33, 1912); but his figure of the basal part of the forewing shows that the genus is closely allied to *Myrmecaelurus*. We have the curved *Cu1p*. Spurs longer than the two basal tarsal joints united. The species is known from Spain,

The wings evenly broadened towards their tip for a distance of two third from their base; their tip rather obtuse. Apical half part of the hind border of the wings strongly rounded.

Table of European species.

1. The nervation yellowish (sometimes the *Sc* is faintly dark banded) *trigrammus*.
The nervation partly blackish and partly yellowish 2.
2. All the longitudinal nervures quite black or dark brown with the exception of *R* in both wings, *2A* and *3A* in the forewing, *M1*, *Cu1*, *Cu2* and *1A* in the hindwing, which nervures all are yellowish *major*.
All the longitudinal nervures yellowish with dark bands. Smaller species 3.
3. No crossveins margined or shaded with black. *atrox*.
Most of the costal crossveins blackish shaded where they touch *Sc*. Some crossveins blackish shaded where they touch *R* or the stem of *Cu1* in the forewing ... *punctulatus*.

Myrmecaelurus trigrammus (Pl. VII, fig. 20).

Myrmeleon trigrammus Pallas, Iter I, p. 469.

„ *pictum* Fabricius, Ent. Syst. Suppl., p. 206.

„ *flavus* Rambur, Hist. Nat. Ins., Névroptères, p. 398.

„ *laetus* Klug, Symb. Phys. IV, tab. 36, fig. 4.

The species is known from the Mediterranean Region, from South Russia, Caucasus etc.

Myrmecaelurus major.

Mac Lachlan, Fedtschenko's Voyage in Turkestan, p. 4 (sep.), tab. 1, fig. 2, 1875.

The species is described on specimens from Kisilkum in Turkestan. I possess it from Berlad (Roumania) and from Van (Armenia). The species has much likeness to *M. acerbus* Walker (Cat. Neur. Ins. Brit. Mus., p. 366, 1853) from India; but as far as I can see the two species are certainly distinct.

Myrmecaelurus atrox (Pl. VII, fig. 21).

Myrmeleon atrox Walker, Cat. Neur. Ins. Brit. Mus., p. 390, 1853.

„ *iners* Walker, loc. cit. p. 390.

Myrmecaelurus atrox Mac Lachlan, Trans. Ent. Soc. Lond., p. 154, 1898.

Walker described the species on specimens from Turkey. Mac Lachlan records it from Biskra, and I possess it from Ciscaucasia.

Myrmecaelurus punctulatus (Pl. VII, fig. 22).

Myrmeleon punctulatus (Steven) Hagen, Stett. entom. Zeit., p. 126, 1858.

The species is known from Hungary, Caucasus and South Russia, and I possess it from these countries.

Cueta.

Navas, Insecta, Rennes, p. 242, 1911. — Ann. Soc. scient. Brux., p. 236, 1914.

In the male the abdomen is somewhat longer than the wings, and at the apex it is furnished with a pair of short cylindrical appendages.

Cueta lineosa (Pl. VIII, fig. 23).

Myrmeleon lineosus Rambur, Hist. nat. Ins., Névroptères, p. 389, 1842 (Egypt.).

Myrmeleon Ulianini Mac Lachlan, Fedtschenko's Voyage in Turkestan, pag. 8 (sep.), tab. 1, fig. 7, 1875 (Marakand).

Cueta trilineata Navas, Insecta, Rennes, p. 243, fig. 1, 1911 (photos of ♂ and ♀ on p. 266) (Djibouti).

Myrmeleon grammaticus Navas, Broteria, p. 49, fig. 6, 1912 (Asia minor).

Cueta syriaca Navas, Ann. Soc. scient. Brux., p. 236, fig. 4, 1914 (Syria).

Although this species has not yet been found in Europe proper, there is some probability that it may be found f. inst. in Ciscaucasia or on the isles in the Archipelago.

The type-specimen in Coll. Selys has not been seen or examined by Mac Lachlan (vide Ann. Soc. Ent. Belg., p. 134, 1875). It has been seen by Hagen and myself. There is some variation in the species with regard to the markings on the wings; very often the dark markings are not so conspicuous as in the type-specimen. The species has some likeness to *Cueta* (Myrmeleon) *variegata* Klug (Symb. Phys., IV, pl. 36, fig. 4, 1829), from which species it is easily separated by the obtuse and strongly rounded tip of the wings.

I possess *Cueta variegata* Klug from Abyssinia, and I possess *Cueta lineosa* Rambur from Asia minor, Caucasus, Egypt and Djemmorak (Algeria). I have examined long series of the species from different localities in Caucasus. Mac Lachlan (Trans. Ent. Soc. Lond., p. 156, 1898) records it from Algeria.

Maracanda.

Mac Lachlan, Fedtschenko's Voyage in Turkestan, p. 1 (sep.), 1875.

Hagen, Canadian Entomologist, p. 210, 1887.

Navas, Novitates Zool., Vol. XX, p. 455, 1913.

In the forewing *Rs* arises further out than the level of the fork of *Cu1*. The angle between *Cu1a* and *Cu1p* very acute. Second branch from *Cu1a* arises before the end of *Cu1p*. *2A* and *3A* do not coalesce. In the apical area very few crossveins present. In the radial area of the hindwing two (or more) crossveins before the origin of *Rs*. The angle between *M2a* and *M2p* very acute. In the apical area no crossveins present. Spurs very short and only visible by great enlargement. Male with two short, cylindrical and downwardly directed appendages.

The specimens before me are from Northern Sahara, from almost the same locality as Navas mentions.

I have no doubt as to the correctness of my determination, although both Mac Lachlan, Hagen and Navas state that no spurs are present. I think they have used only a usual magnifying-glass.

Maracanda amoena (Pl. VIII, fig. 24).

Mac Lachlan, loc. cit., p. 2 (sep.), pl. 1, fig. 1.

Maracanda saharica Navas, loc. cit., p. 457, fig. 9.

My specimens agree in every respect with the description, given by Navas, and on the other hand they agree also very well with that, given by Mac Lachlan, as well as with the figure on the plate. The only thing I have to add is that my specimens are somewhat paler, but I think it is due to the fact that they have been kept in alcohol. I think there is some possibility that the two other species (*lineata* and *stigmalis*) described by Navas from the same locality may also prove to be the same species; but at present my materiel is not sufficient to decide the question.

It seems to me that it is not remarkable that we find the same species in North Africa and in West Asia; it is the case in several insects within the *Neuroptera*. Here we have already dealt with *Lopezus fedtschenkoi* and *Cueta lineosa*.

When I record the species as belonging to the European Fauna it is due to the fact, that Hagen (Canadian Entomologist, p. 210, 1887) writes: „I possess a couple of *M. imbecillus* Stein from Montenegro, Europe, which agree entirely with *M. amoena*, and can not be identified with any other described species.“.

Myrmeleonini.

In the radial area of the hindwing more than two cross-

veins before the origin of *Rs*. In the forewing *Rs* arises further out than the level of the fork of *Cu1*. *Cu2* in the forewing reaches the first crossveins between *Cu1* and *Cu2*, before it coalesces with *1A*. *2A* is forked in the forewing, rudimentary in the hindwing. Body and legs not very stout, but shortly haired.

Table of European genera.

1. In the forewing *Cu1p* and *Cu2*, and in the hindwing *M2p* and *Cu1* are running parallel. The angle between *Cu1a* and *Cu1p* in the forewing, and the angle between *M2a* and *M2p* in the hindwing very acute..... *Euroleon*.
The above named nervures are all diverging, and the above named angles are very obtuse.....2.
2. No crossveins present in the apical area of the hindwing..... *Mortier*.
Crossveins present in the apical area of the hindwing
Myrmeleon.

Myrmeleon.

Linné, Syst. Nat. XII, p. 913.

Cu1a and *Cu1p* in the forewing much diverging and the angle between them very obtuse. The same takes place in the hindwing as to *M2a* and *M2p*. Posterior Bankian line present, but not always very distinct. Crossveins present in the apical area of both wings.

Myrmeleon formicarius (Pl. VIII, fig. 25).

Linné, Syst. Nat. Ed. XII, p. 914.

The species is known from the whole of the Europe with the exception of England, and from Caucasus.

Myrmeleon inconspicuus (Pl. IX, fig. 26).

Rambur, Hist. nat. Ins., Névroptères, p. 406, 1842.

Myrmeleon Erberi Brauer, Verh. zool.-bot. Gesellsch. Wien, p. 190, 1868.

The species which as a rule is smaller than the fore-

going, differs from it by the pale spots at the base of the abdominal segments. It is known from Spain, France, Belgium, Austria, Hungary, Italy, Corfu, Asia minor etc. I possess the species from Spain, Hungary and Asia minor.

Morter.

Navas, Mem. Real Acad. Cienc. Barcelona, p. 466, 1915.

This genus is nearly related to the foregoing. The main difference is found in the absence of crossveins in the apical area of the hindwings.

Morter hyalinus (Pl. IX, fig. 27).

Myrmeleon hyalinum Olivier, Encycl. VIII, p. 126.

Myrmeleon cinereus Klug, Symb. Phys. IV, tab. 36, fig. 3.

Myrmeleon distinguendus Rambur, Hist. nat. Ins., Névroptères, p. 407, 1842.

This insect is known from the Mediterranean Region, and from Caucasus and Arabia. I possess the species from Spain, Poros and Caucasus.

Navas (Revista Real Acad. Cienc. Madrid, p. 613, 1915) is undoubtedly right in placing *Myrmeleon cinereus* Klug as a synonym. *M. hyalinus* agrees very well with the description and the figure, given by Klug.

Euroleon n. g.

In the forewing *Rs* arises further out than the level of the fork of *Cu1*. The angle between *Cu1a* and *Cu1p* very acute and enclosing two rows of cells; the second branch from *Cu1a* arises a little before the end of *Cu1p*. *Cu1p* almost parallel with *Cu2*; its apical part strongly curved just before emitting the last crossvein to *Cu2*. Posterior Banksian line present. The angle between *M2a* and *M2p* in the hindwing very acute and enclosing two rows of cells. The second branch from *M2a* arises approximately at the level of the end of *M2p*. *M2p* almost

parallel with *Cu1*; its apical part strongly curved before emitting the last crossvein to *Cu1*. Posterior Banksian line present. Crossveins present in the apical area of both pairs of wings. Basal tarsal joint somewhat shorter than the apical one. Spurs straight and about as long as the first tarsal joint.

Genotype the below named species.

Euroleon europaeus (Pl. IX, fig. 28).

Myrmeleon europaeus Mac Lachlan, Ann. Soc. Ent. Belg., p. 137, 1873.

This species is found in the greater part of Europe and in Caucasus. The insect is easily known by its spotted wings.

***Acanthaclisini*.**

Body and legs as a rule very stout and with long and dense pilosity. In the hindwing 2A is unforked (in a few genera, f. inst. *Syngenes* and *Epacanthaclisis* 2A is forked). 3A forked. In the hindwing the apical part of *Cu1* fuses totally or for a rather long distance with *M2p* (in *Paranthaclisis* these two nervures seem to be independent). 1A and 2A always present. 1A forms together with 2A a conspicuous circular cell. In *Epacanthaclisis* 2A is rather long, and before it runs into the hind margin, it is connected with 1A by a crossvein.

Only one genus is present i Europe.

***Acanthaclisis*.**

Rambur, Hist. nat. Insectes, Névroptères, p. 378, 1842.

In „Entom. Monthly Mag.“, Vol. XX, p. 181—189, 1883—84, Mac Lachlan gives a series of characters to differentiate the two European species. The most distinctive character amongst those is found in the different shape of the two rows of cells in the costal area of the forewing.

Acanthaclisis occitanica (Pl. X, fig. 29).

Myrmeleon occitanicum Villers, Linn. Ent., p. 63, pl. 7.
fig. 10, 1789.

The insect is found in South and Central Europe, Russia and Central Asia.

Acanthaclisis baetica (Pl. X, fig. 30).

Rambur, Hist. nat. Insectes, Névroptères, p. 379, 1842.

The species is found on the Iberian Peninsula, in South France and Oran (Algeria). I possess a specimen from the last named locality.

In „Horæ Soc. Entom. Ross.“, p. 453, 1886, Mac Lachlan describes a species, *Acanthaclisis pallida*, from Central Asia. Navas (Revista Real. Acad. Cienc. Madrid, p. 609, 1915) records it from South Russia. I do not know the species.



Esben-Petersen, Peter. 1919. "Help-notes towards the determination and classification of the European Myrmeleonidae." *Entomologiske meddelelser* 12, 97-127.

View This Item Online: <https://www.biodiversitylibrary.org/item/44884>

Permalink: <https://www.biodiversitylibrary.org/partpdf/192719>

Holding Institution

Smithsonian Libraries and Archives

Sponsored by

Smithsonian

Copyright & Reuse

Copyright Status: NOT_IN_COPYRIGHT

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.