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Atlas of the Italian Leuctridae (Insecta, Plecoptera) with an appendix including Central European species

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With 72 figures

Schlagwörter: Leuctridae, Plecoptera, Insecta, Italien, Mitteleuropa, Morphologie, Bestimmung, Imago, Verbreitung, Faunistik

Keywords: Leuctridae, Plecoptera, Insecta, Italy, Central Europe, morphology, identification, adult, distribution, faunistics

The main abdominal characters of both adult male and female of each of the 59 species of Leuctridae inhabiting the Italian Region and of each taxon is illustrated by a series of drawings. Synthetic data concerning body length, emergence time, altitudinal distribution, ecological and chorological class, distribution in Italy, are also provided. Six additional species recorded on the external slopes of the Alps are illustrated in an appendix. The total of 65 species includes also all Leuctridae of Central Europe.

1 Introduction

This paper has been conceived as an illustrated guide for the identification of the adult species of Leuctridae. It is neither a monograph, nor a revision of this stonefly family, consequently no keys to the species determination have been provided. Identification is in general easier if referred to a draw, than to a key. Keys are frequently difficult to understand, and also meticulous descriptions should always be used in conjunction with figures. Nevertheless I think it is useful to give, as a minimum, a few explanations in order to show at first how to separate *Leuctra* and *Tyrrhenoleuctra* genera, then how to spot the group and/or sub-group of the *Leuctra* species.

Leuctridae emerge in all seasons and may be collected in the stream shores and on vegetation alongside unpolluted running waters, from the more exiguous trickles to the main rivers. Their altitudinal distribution is between the sea level and the snow line, i.e. up to 2.780 m a.s.l. in the Alps. Leuctridae may be collected as other Stoneflies; specimens have to be stored in alcohol 80-85 % with a 2 % of glycerine. For identification a stereomicroscope is suggested; 50x magnification is enough to see the minuscule structures of male and female genitalia.

2 The Leuctridae Klapálek in Italy and their taxonomic groupment

The family Leuctridae comprises two subfamilies, the Megaleuctrinae, that does not belong to the Palaearctic fauna and the Leuctrinae represented in Europe by three genera, *Leuctra* STEPHENS (1836), *Tyrrhenoleuctra* CONSIGLIO (1957) and *Pachyleuctra* DESPAX (1929), the first two of them occurring in the Italian region. Leuctrinae are from small to medium sized Plecoptera, the body length is between 4 and 13 mm; the body colour is from brown to dark brown. These insects are generally macropterous, and their wings are uniformly dark-coloured and folded around the abdomen at repose. The second tarsal segment is shorter than the first and the third. The cerci are one-segmented with sometimes a tiny vestigial second segment at the tip.

The genus *Leuctra* is represented in Italy by 58 taxa (species and subspecies), many of them are endemic to the Italian Region and a few are restricted to small areas. This genus is very homogeneous, so in spite of the high number of species, it has not been fragmented in sub-genera. *Leuctra* species have an extremely similar appearance; in consequence it is impossible to separate them without studying the last abdominal segments. The only Italian species of the genus *Tyrrhenoleuctra* is *T. zavattarii* Consiglio, endemic to Corsica and Sardinia.

The Italian Stonefly-fauna includes all the species ascertained into the geographical boundaries of the Italian Region, that embraces not only Italy, but also Corsica, and a few drainage basins of the internal slopes of the Alps; they are the Roja basin in France, the high Ticino in Switzerland and the high Isonzo basin in Slovenia.

The most important morphological characters essential for the identification of male *Leuctra* species are the sclerotized tergal processes, membranous areas and pigmented spots present in some abdominal male segments, and external genitalia in both sexes. The species without sclerotized processes, as well those closely related, may be identified examining also the epiproct, paraprocts (styli, specilla, lateral lobes) and the IX sternum vesicle outline. The female most important taxonomic characters are on the 8th sternum, chiefly the shape of the subgenital plate and its hind lobes. All Italian species are illustrated; each figure shows characters that are easily spotted, essential for identification. No previous knowledge is requested, but of course a minimal experience will be useful. The author has drawn all the figures from Italian and Alpine specimens.

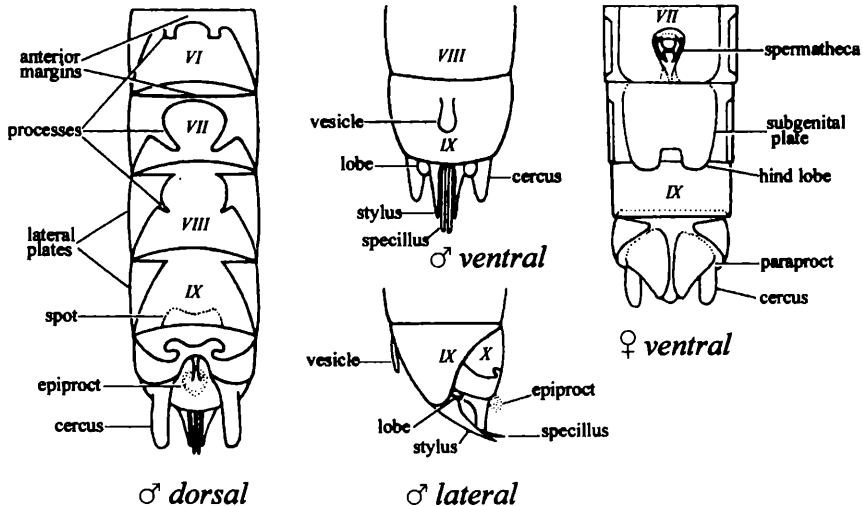
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- 1 Male epiproct tubular, open centrally, sub-triangular in ventral-hind view, pear-shaped in lateral view. Base of paraprocts constituted by a sclerotized transversal strip, from the centre of its hind margin, project, side by side, two paired long and slender styli and specilla, sheathed into the distal third of the epiproct (see species No. 59). *Tyrrhenoleuctra*
 Male epiproct in form of a vesicle placed at the top of a stalk projecting from the centre of the hind margin hollow of the X tergum. Paraprocts are sclerotized and composed by two paired styli, two specilla and two lateral lobes (notice the following figure). *Leuctra*

According to the morphological characters of the male, the European *Leuctra* species have been divided into different *groups of species*. Some mixed groups have been divided into *sub-groups*. The characters of both *groups*, and *sub-groups* should be a help to individuate the figures that must be evaluated for species separation. Besides the 58 Italian *Leuctra* species, six additional species recorded on the external slopes of the Alps, outside the Italian Region border, are dealt with in the Appendix. These additional species appear in square brackets in the following species group and sub-group list. The number of species in the paragraph Atlas is in round brackets. The Atlas allows the identification of the adult of all Italian and Central European Leuctridae

- A. Antennae with a whorl of hairs around the apex of each antennal segment.
1. **geniculata group** (1). Male with a single sclerotized process on the VI tergum: *L. geniculata*.
 2. **braueri group** (2). Male with two conical processes on the VI tergum: *L. braueri*.
- B. Antennae without a whorl of hairs around the apex of each antennal segment.
3. **schmidi group** (3). Male with two paired big sub-conical processes on the VI tergum and two paired smaller processes at the centre of both the VII and VIII tergum. The VIII tergum anterior margin is continuous: *L. schmidi*.
 4. **boreoni group** (4). Male with two paired big sub-conical processes on the VI tergum and two paired lateral processes on the VII and VIII tergum. The VIII tergum anterior margin is interrupted in the median third: *L. boreoni*.
 5. **nigra group** (5). Male with two paired small sub-triangular processes on the VI tergum and two bigger processes on the VIII tergum: *L. nigra*.

6. ***fusca* group.** Male provided with two plate-shaped processes on the VI tergum. This group is divided into the following sub-groups:
- fusca* sub-group** (from 6 to 14 and 60, 61). Male paraprocts styles tapered, sometimes reduced, or lacking completely. Females: armature of the spermatheca with two longitudinal arms joined at their tips (shaped like a V): [*L. digitata*] *L. fusca*, *L. mortoni*, *L. moselyi*, *L. albida*, *L. meridionalis*, *L. pasquinii*, *L. zwicki*, [*L. malickyi*] *L. archimedis* and *L. hexacantha*.
- aurita* sub-group** (from 15 to 24 and 62). Male paraprocts styles shaped like a thin and curved blade. Females: armature of the spermatheca with thin arms, converging towards their tip (shape sub-oval): *L. major*, *L. leptogaster*, *L. concii*, *L. cingulata*, [*L. pseudocingulata*], *L. dolasilla*, *L. marinettae*, *L. hexacantha*, *L. budtzi*, *L. costai*, *L. annae* and *L. aurita*.
7. ***hippopus* group.** Male provided with processes on the VIII tergum only, or sometimes lacking any process. In Italy, this group comprises the following four sub-groups:
- brevipennis* sub-group** (from 25 to 29). Male with an unpaired single process Y-shaped on the VIII tergum: Wings shortened in both sexes, chiefly in the male: *L. brevipennis*, *L. canavensis*, *L. vesulensis*, *L. vinconi* and *L. vinconi aubertorum*.
- prima* sub-group** (from 30 to 41 and 63 to 65). Male with a single plate-shaped process on the VIII tergum: *L. prima*, *L. helvetica*, *L. niveola*, *L. armata*, *L. auberti*, *L. rosinae*, *L. pseudorosinae*, [*L. signifera*], [*L. pseudosignifera*], *L. ravizzai*, *L. ligurica*, [*L. istenicae*], *L. caprai*, *L. autumnalis* and *L. queyrassiana*.
- hippopus* sub-group** (from 42 to 49). Male with two processes on the VIII tergum, either completely separated, or joined at their apices by a thin sclerotized crossbar (reduced to two comma-shaped sclerotization in *L. sesvenna*): *L. hippopus*, *L. elisabethae*, *L. fraterna*, *L. cyrnea cyrnea*, *L. cyrnea incudensis*, *L. alpina*, *L. subalpina* and *L. sesvenna*.
- occitana* sub-group** (50). Male either with two paired processes (the Pyrenean *L. occitana*), or lacking any process; paraprocts plough shaped in lateral view: *L. festai*.
8. ***inermis* group** (from 51 to 58). Male lacking any process on all the abdominal terga, the lateral lobes of the paraprocts are well protruding and project outwards the base of the styles: *L. inermis*, *L. handlirschi*, *L. rauscheri*, *L. teriolensis*, *L. ameliae*, *L. silana*, *L. insubrica* and *L. apenninicola*.



Schematic drawings of a *Leuctra* abdomen tip: ♂ in dorsal, ventral and lateral views; ♀ in ventral view

Abbreviations and symbols

Al = Alps, W-Al = Western Alps, C-Al = Central Alps, E-Al = Eastern Alps
 Ap = Apennines, N-Ap = Northern Apennines, C-Ap = Central Apennines,
 S-Ap = Southern Apennines

Si = Sicily, Sa = Sardinia, Co = Corsica

F = France, CH = Switzerland

⊙ = micro endemic species (the restricted area of distribution is specified)

↔ = length of the body in mm

➤ = flight period in months

E = ecological class (i.e. rheophilic, orophilic, rheocrenic, fluvial, etc.)

↑↓ = altitudinal distribution in m a.s.l.

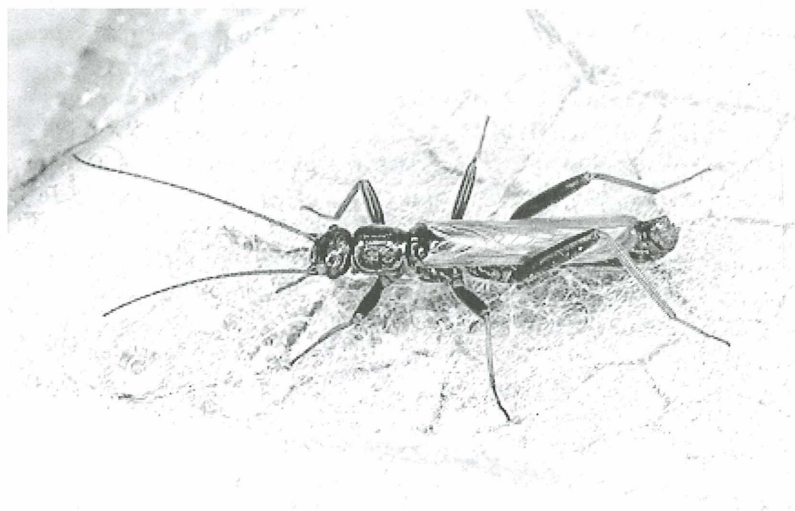
□ = chorological class

I = distribution in Italy

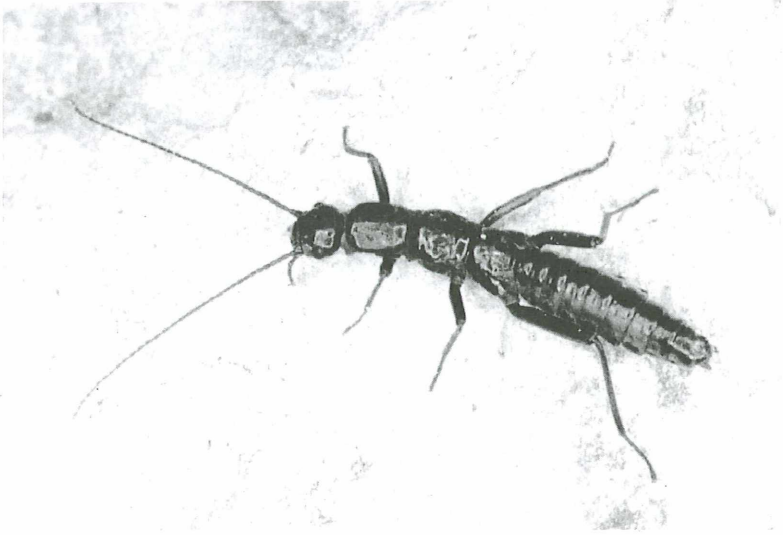
! = remarks



Leuctra schmidi AUBERT, a full-winged species endemic to the Western Alps



Leuctra brevipennis RAVIZZA, a short-winged micro-endemic species restricted to Biellese (southern edge of the Pennine Alps)

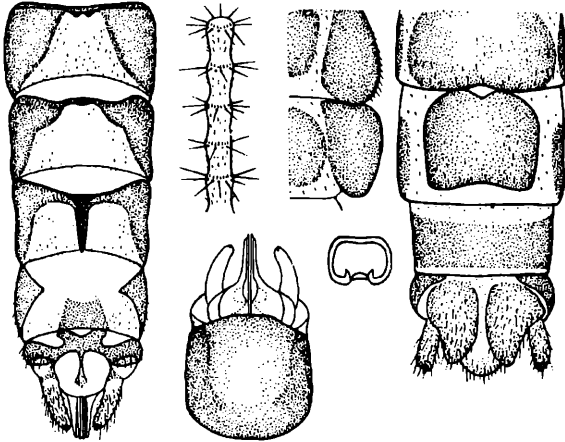


***Leuctra ligurica* AUBERT, an apterous micro-endemic species restricted to eastern Liguria, between the western edge of the Ligurian Apennines and the eastern edge of the Ligurian Alps**

***Leuctra*
geniculata group**

1. *Leuctra geniculata* (STEPHENS) 1836

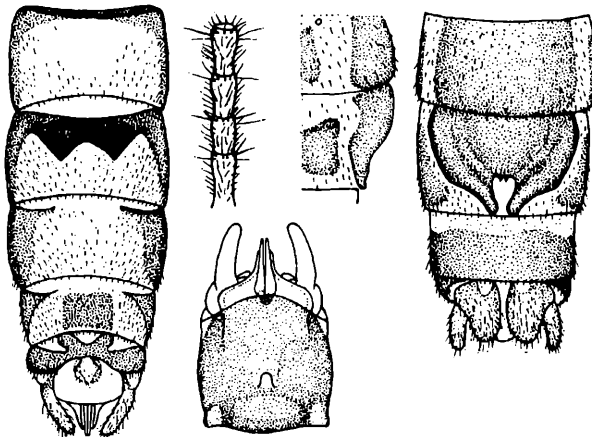
↔ 8.0-12.0; > IX; E fluvial; ↑ 0-900; □ European; I Co



***braueri* group**

2. *Leuctra braueri* KEMPNY 1898

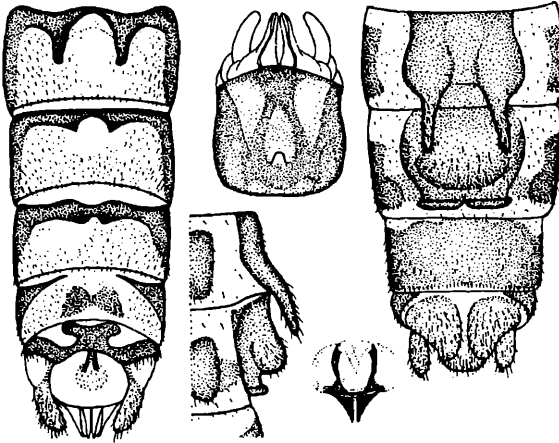
↔ 7.0-10.0; > VIII-XI; E rheophilic; ↑ = 200-1500; □ Alpine-Carpathian; I Al



***schmidi* group**

3. *Leuctra schmidi* AUBERT 1946

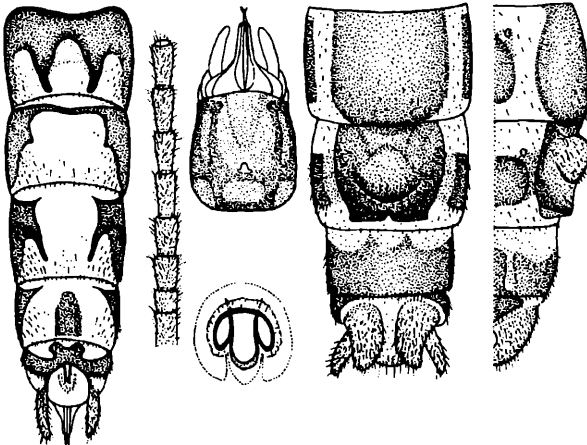
↔ 8.0-12.0; > IX-XII; E rheophilic, orophilic; ↓ 600-2000; □ Alpine; I W-Al



***boreoni* group**

4. *Leuctra boreoni* AUBERT 1962

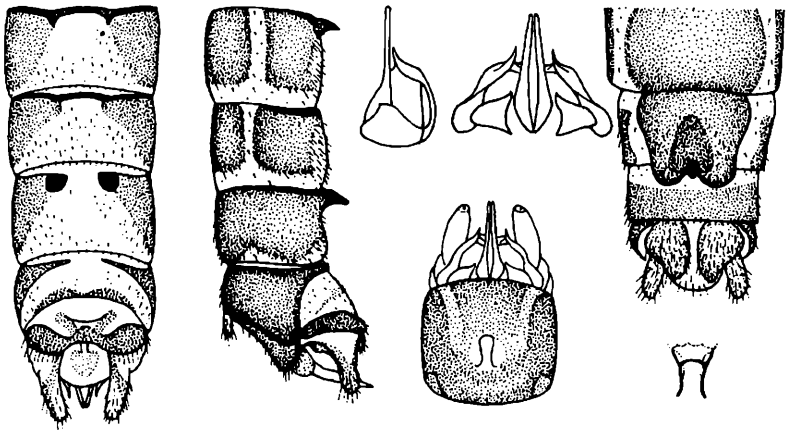
↔ 7.0-11.0; > IX-XI; E rheophilic; ↓ 500-1500; □ W-Alpine, N-Apennine; I W-Al, N-Ap



nigra group

5. *Leuctra nigra* (OLIVIER) 1811

↔ 5.0-7.0; > IV-VIII; E rheophilic; ↓ 400-2000; □ European; I Al, N-Ap

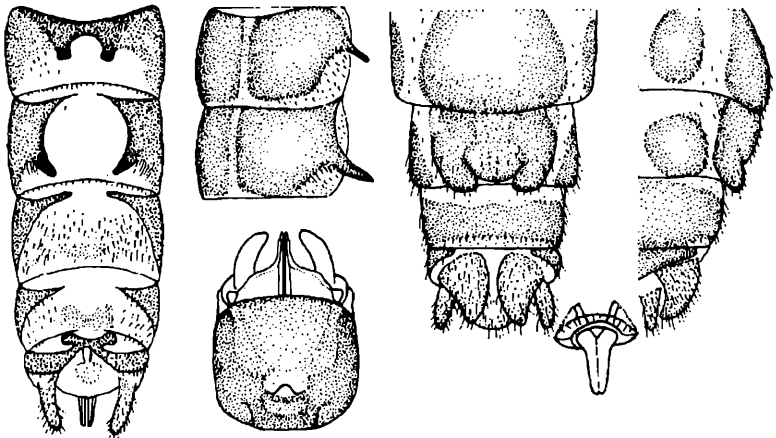


fusca group

fusca group, fusca sub-group

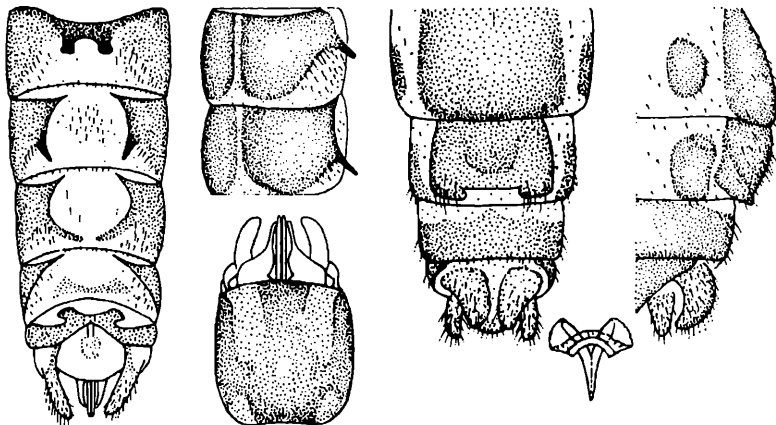
6. *Leuctra fusca* (LINNAEUS) 1758

↔ 6.0-9.0; > IX-XII; E rheophilic; ↓ 50-900; □ Eurosiberian; I Al, Ap



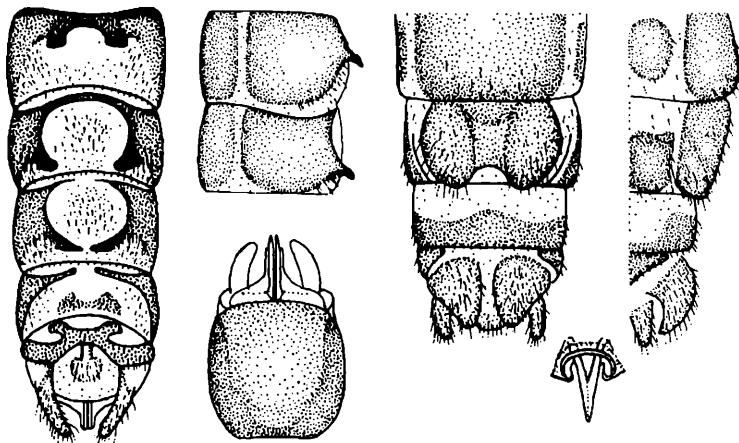
7. *Leuctra mortoni* KEMPNY 1899

↔ 5.0-8.0; > VIII-X; E rheophilic; ↑ 200-1500; □ Alpine-Carpathian-Pyrenean;
I Al, C-Ap



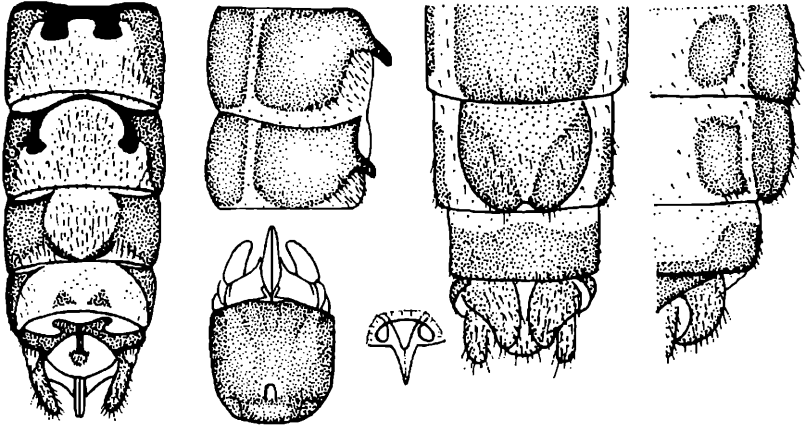
8. *Leuctra moselyi* MORTON 1929

↔ 5.0-8.0; > VIII-XI; E rheophilic; ↑ 300-2300; Middle European; I Al



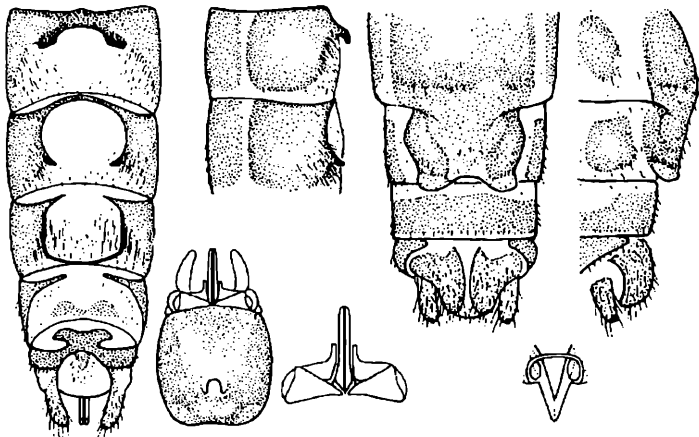
9. *Leuctra albida* KEMPNY 1899

↔ 5.0-8.0; > VI-VII; E rheophilic; ↓ 400-1300; □ Middle European; I W-Al, C-Al



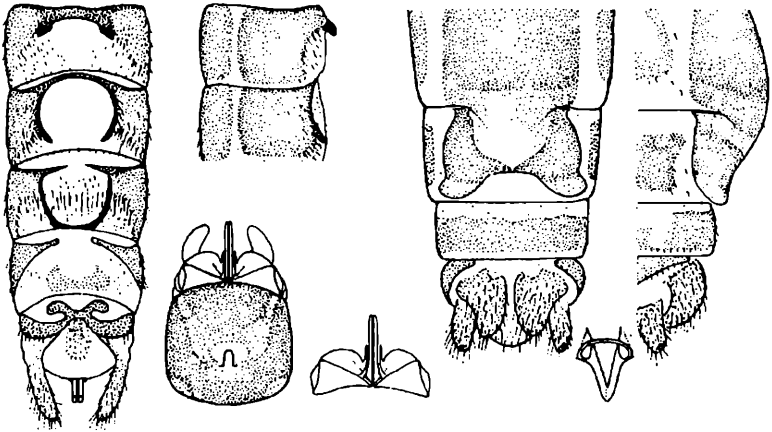
10. *Leuctra pasquinii* CONSIGLIO 1958

↔ 6.0-9.0; > VII-X; E rheophilic; ↓ 900-1300; □ Apennine; I C-Ap, N-Ap



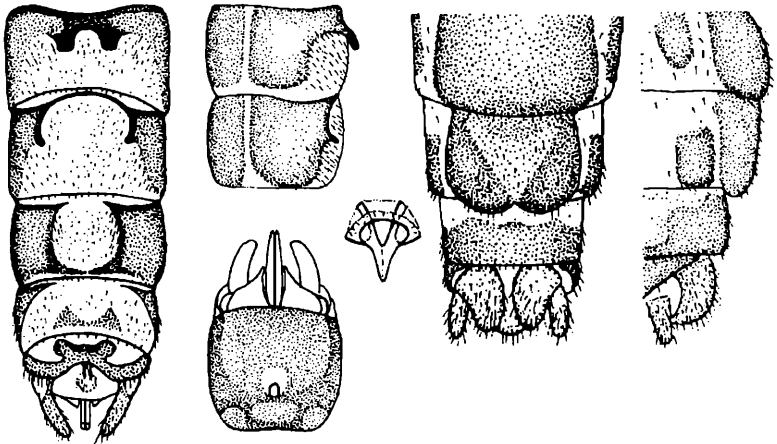
11. *Leuctra zwicki* RAVIZZA & VINÇON 1991

↔ 5.5-9.0; > IX-XII; E rheophilic; ↓ 700-1700; □ W-Alpine; I W-Al



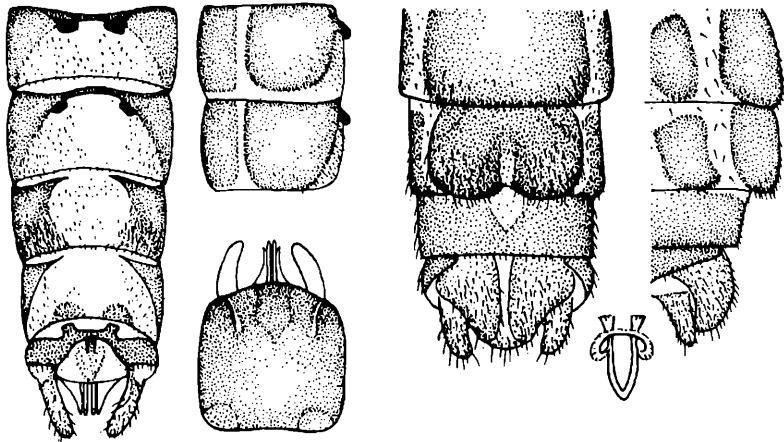
12. *Leuctra meridionalis* AUBERT 1951

↔ 6.0-10.0; > VIII-XII; E rheophilic; ↓ 200-1700; □ Alpine, N-Apennine;
I N-Ap, C-Al, W-Al



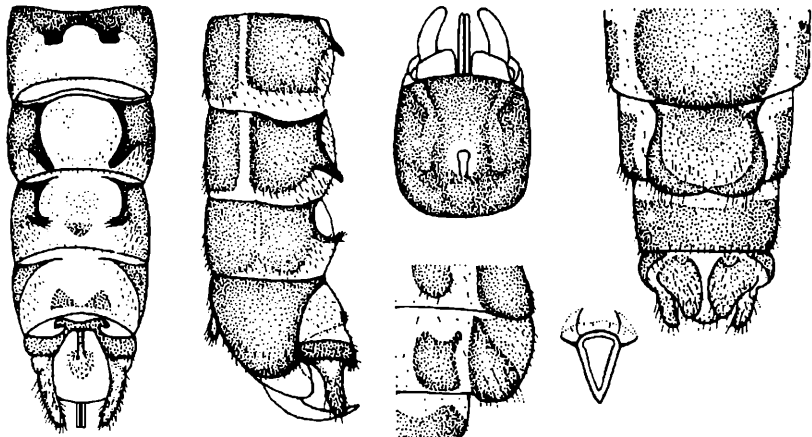
13. *Leuctra archimedis* CONSIGLIO 1968

↔ 4.5-8.0; > IX-II, VI; E rheophilic; ↑ 180-1450; □ Sicilian; I Si



14. *Leuctra hexacantha* DESPAX 1940

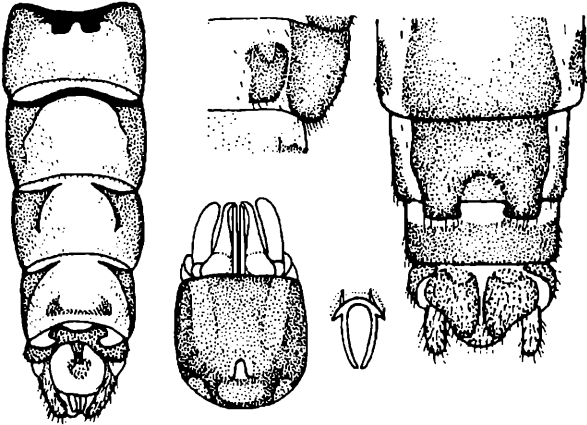
↔ 5.0-8.0; > VIII-XII; E rheophilic; ↑ 100-1200; □ Alpine, N-Apennine; I C-Al, W-Al, Ap



fusca group, aurita sub-group

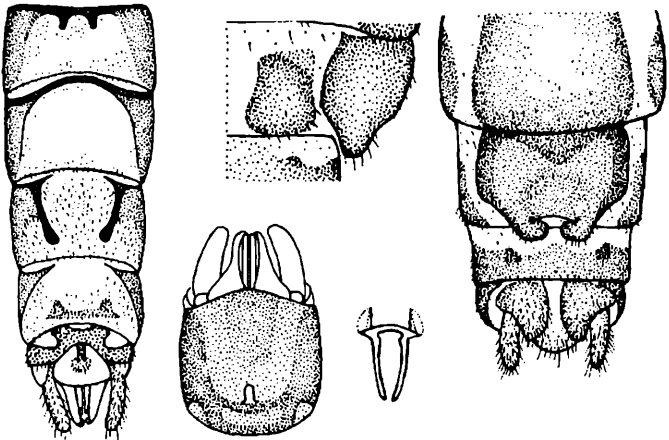
15. *Leuctra cingulata* KEMPNY 1899

↔ 6.0-9.0; ➤ IX-X; E rheophilic; ⚡ 1200-2000; □ Alpine; I E-Al, C-Al



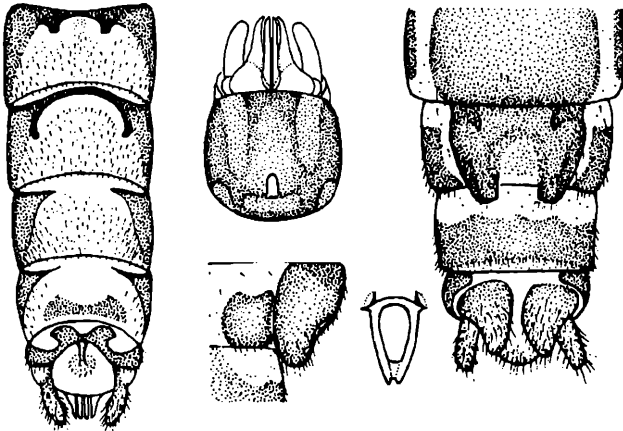
16. *Leuctra dolasilla* CONSIGLIO 1955

↔ 5.0-8.0; ➤ VIII-X; E rheophilic; ⚡ 600-2000; □ Alpine; I Al



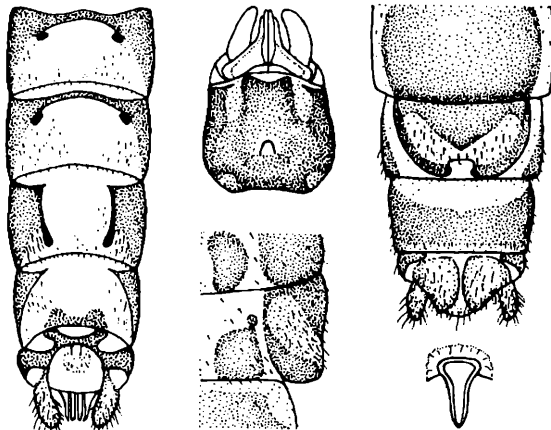
17. *Leuctra concii* CONSIGLIO 1958

↔ 5.5-7.5; > VI-XI; E rheophilic; ↓ 750-1500; □ Alpine-Apennine; I C-Ap, N-Ap, W-Al



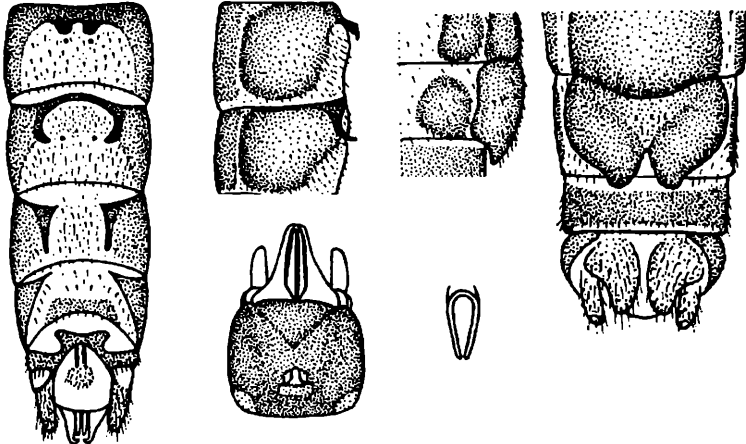
18. *Leuctra budtzi* EBBEN-PETERSEN 1912

↔ 5.0-8.0; > IX-X; E rheophilic; ↓ 800-1000; □ Sardinian-Corsican; I Co, Sa



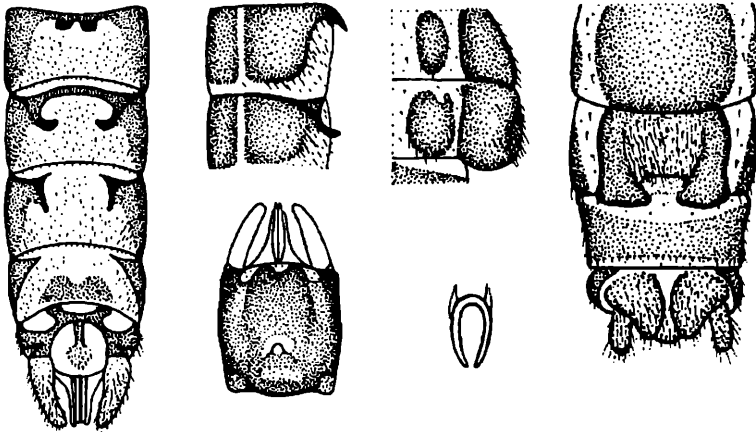
19. *Leuctra marinettae* RAVIZZA & VINÇON 1989

↔ 7.0-8.0; > IX-X; E rheophilic; ↓ 1900; □ Alpine; I unknown; ! F, close to the Italian border



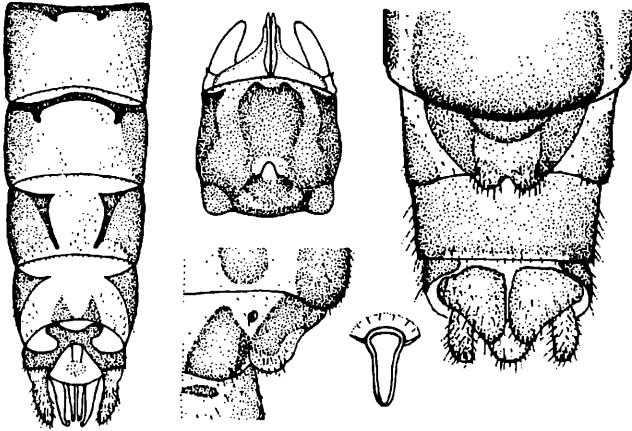
20. *Leuctra annae* CONSIGLIO 1975

↔ 4.5-8.5 > IX-XII. E rheophilic. ↓ 800-1700 □ Sardinian. I: Sa.



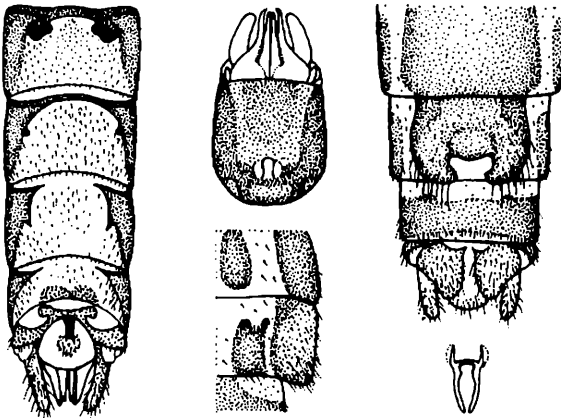
21. *Leuctra costai* AUBERT 1953

↔ 7.5-10.5; > X-XII; E rheophilic; ↓ 500-1650; □ Apennine Sicilian; I C-Ap, S-Ap, Si



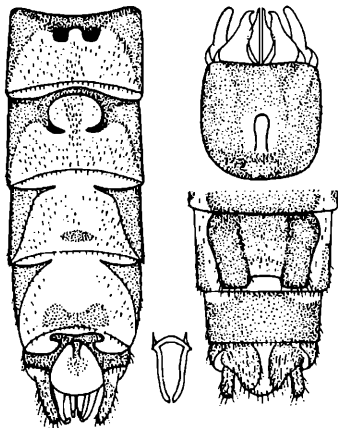
22. *Leuctra aurita* NAVAS 1919

↔ 4.0-8.0; > VIII-XI; E rheophilic; ↓ 600-2000; □ Middle European; I It might be found in the E-Al



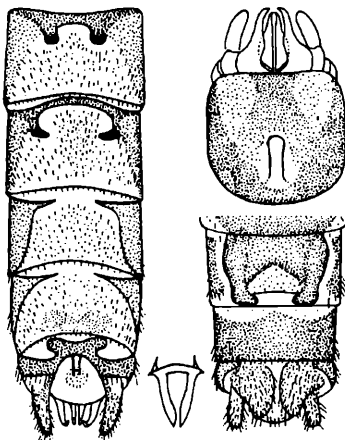
23. *Leuctra leptogaster* AUBERT 1949

↔ 8.0-11.0; > VIII-XII; E rheophilic; ↓ 300-2000; □ Middle S-European; I Al,
Ap, Si



24. *Leuctra major* BRINCK 1949

↔ 8.0-13.0; > VIII-XI; E rheophilic; ↓ 400-2300; □ Middle S-European; I Al,
Ap

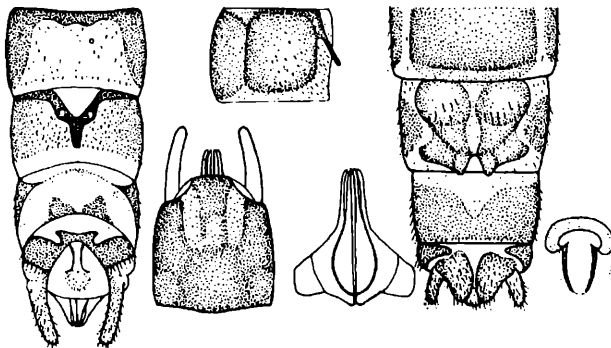


hippopus group

hippopus group, brevipennis sub-group

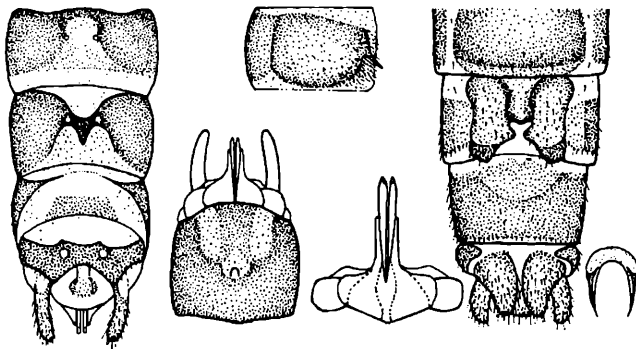
25. *Leuctra brevipennis* RAVIZZA 1978

↔ 7.8-9.6; > IX-XI; E rheophilic, crenophilic; ↓ 1200-2000; □ Alpine; I W-Al
◎ (Pennine Alps)



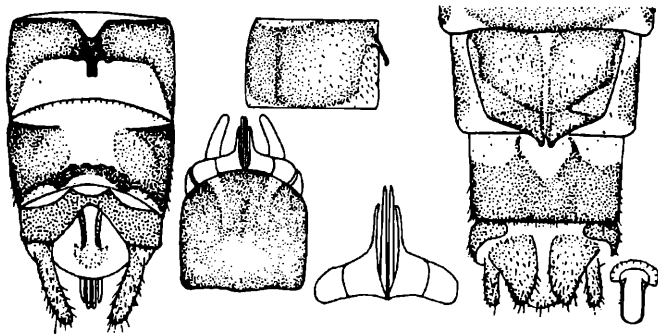
26. *Leuctra vesulensis* RAVIZZA & RAVIZZA DEMATTEIS 1984

↔ 5.2-8.5; > VIII-XI; E rheophilic, crenophilic; ↓ 1350-1400; □ Alpine; I W-Al
◎ (Cottian Alps, Viso Mt.)



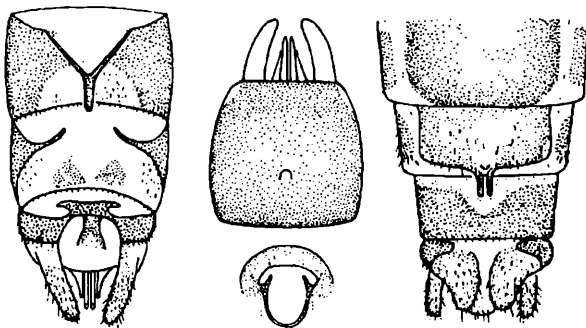
27. *Leuctra canavensis* RAVIZZA & RAVIZZA DEMATTEIS 1992

↔ 7.0-9.5; > IX-XI; E rheophilic, crenophilic; ↓ 850-900; □ Alpine; I W-Al;
◎ (Graian Alps, Soana valley)



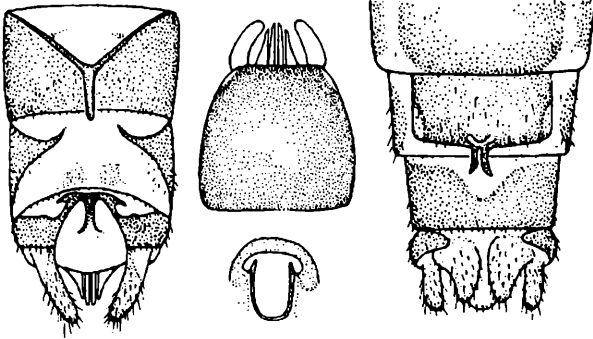
28. *Leuctra vinconi vinconi* RAVIZZA & RAVIZZA DEMATTEIS 1993

↔ 6.0-9.0; > IX-XI; E rheophilic, crenophilic; ↓ 600-900; □ Alpine; I W-Al;
◎ (Pennine Alps, Sesia valley)



29. *Leuctra vinconi aubertorum* RAVIZZA & RAVIZZA DEMATTEIS 1994

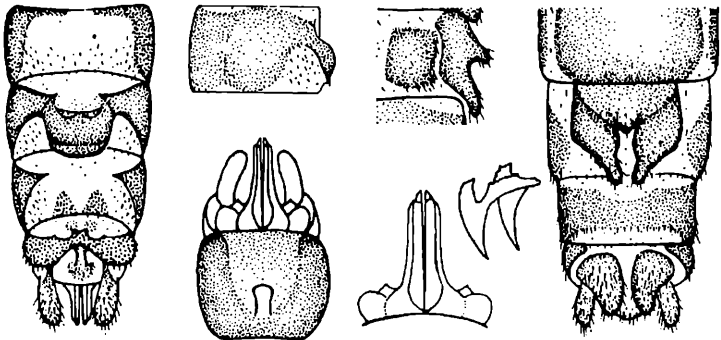
↔ 6.0-9.0; ➤ IX-X; E crenophilic; ↓ 700-950; □ Alpine; I C-Al;
© (CH, Lepontine Alps, Tamaro Mt.)



hippopus group, *prima* sub-group

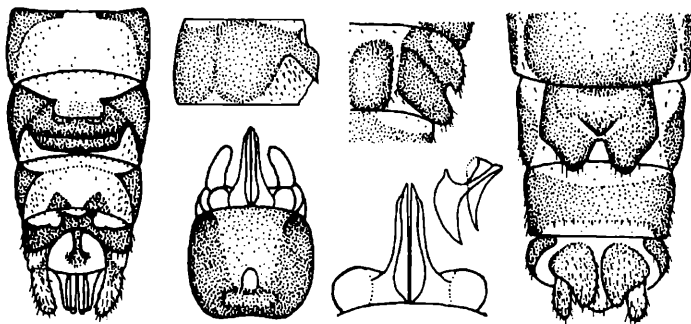
30. *Leuctra armata* KEMPNY 1899

↔ 4.0-7.0; ➤ V-VIII; E rheophilic; ↓ 600-2300; □ Alpine-Carpathian; I Al



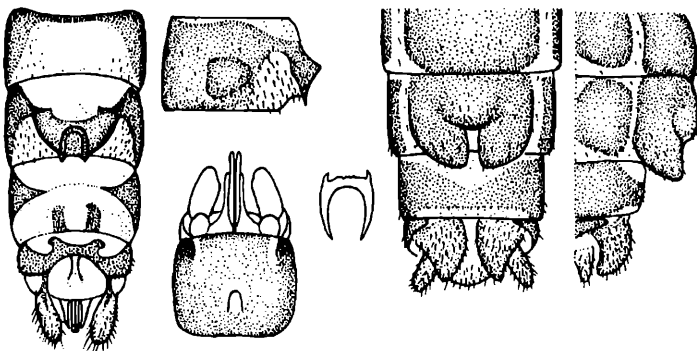
31. *Leuctra auberti* RAVIZZA & RAVIZZA DEMATTEIS 1985

↔ 5.0-7.0; > IV-VIII; E rheophilic; ↓ 700-2000; □ Alpine; I C-Al, W-Al



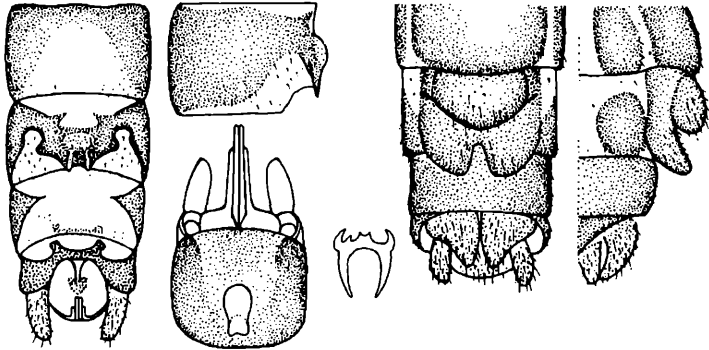
32. *Leuctra rosinae* KEMPNY 1900

↔ 5.0-8.0; > V-XI; E rheophilic, orophilic; ↓ 1200-2780; □ Alpine-Carpathian; I Al



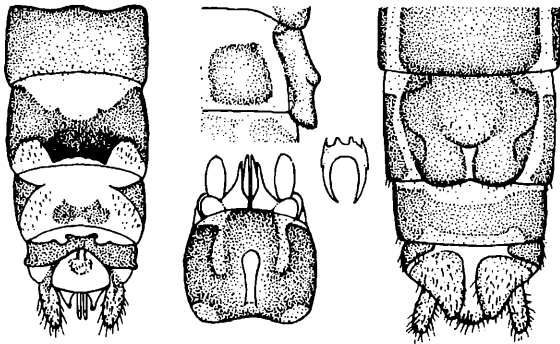
33. *Leuctra pseudorosinae* AUBERT 1954

↔ 6.0-8.0; > IV-VI; E rheophilic, orophilic; ↓ 1700-2400; □ Alpine; I E-Al



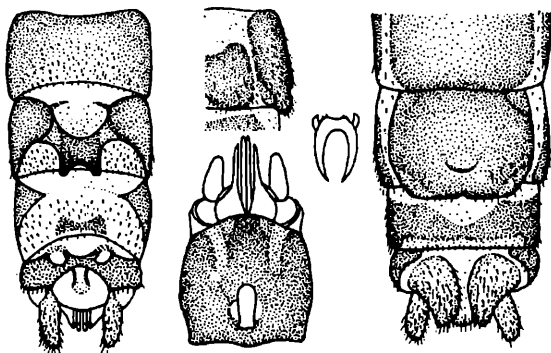
34. *Leuctra niveola* SCHMID 1947

↔ 6.0-8.0; > II-IV; E rheophilic; ↓ 900-1300; □ Alpine N-Apennine; I Al, N-Ap



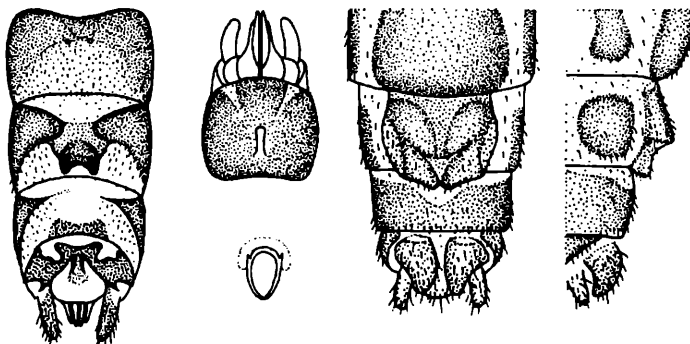
35. *Leuctra helvetica* AUBERT 1956

↔ 5.0-8.0; > II-V; E rheophilic, orophilic; ↓ 600-2400; □ Alpine; I Al



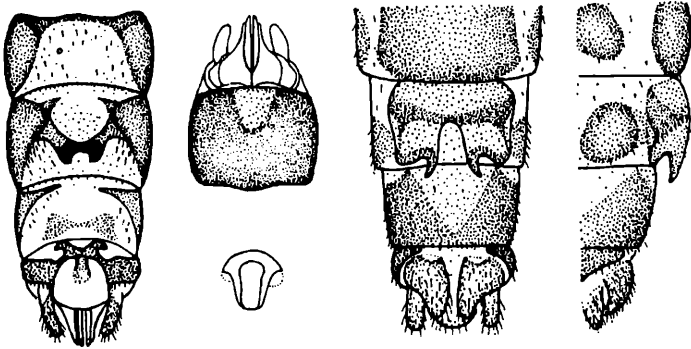
36. *Leuctra autumnalis* AUBERT 1948

↔ 5.0-8.0; > VIII-XI; E rheophilic; ↓ 1000-2000; □ Alpine-Carpathian; I E-Al, C-Al



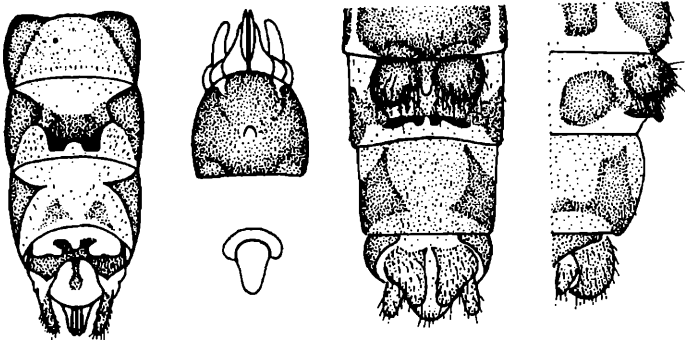
37. *Leuctra caprai* FESTA 1939

↔ 4.5-8.0; > VIII -IX; E rheophilic; ↑ 1200-2000; □ Alpine; I W-Al



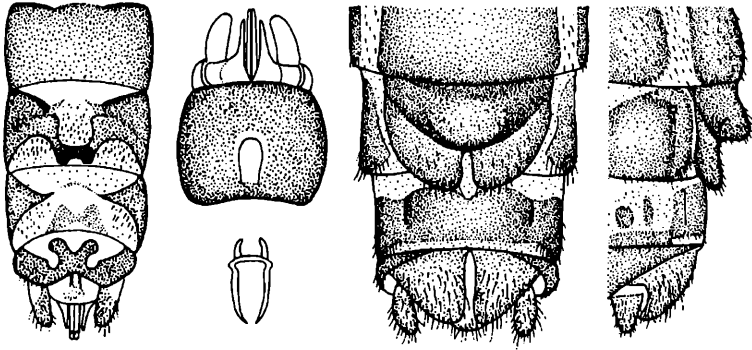
38. *Leuctra queyrassiana* RAVIZZA & VINÇON 1991

↔ 6.0-9.0; > X-XI; E rheophilic, orophilic; ↑ 1700-2400; □ Alpine; I W-Al;
© (Cottian Alps)



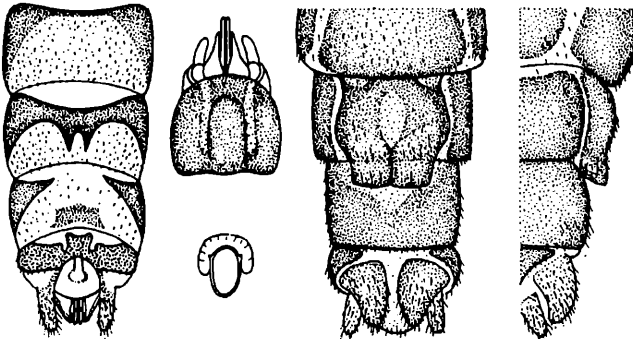
39. *Leuctra ravizai* RAVIZZA DEMATTEIS & VINÇON 1991

↔ 7.0-11.0; > V-VII; E rheophilic; ↓ 1000-2000; □ Alpine; I W-Al



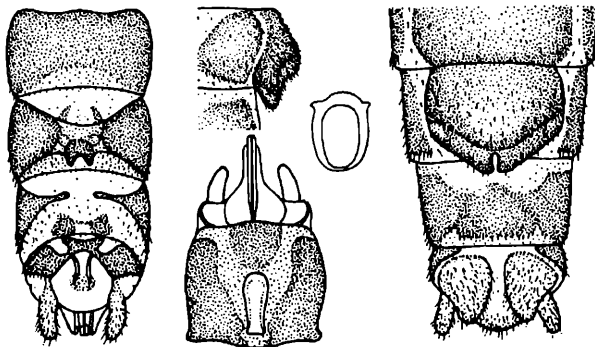
40. *Leuctra ligurica* AUBERT 1962

↔ 4.5-8.5; > XII-IV; E rheophilic; ↓ 300-1200; □ W-Alpine, N-Apennine; I W-Al, N-Ap; ◎ (from the western edge of the Ligurian Apennines to the eastern edge of the Ligurian Alps); ! apterous species



41. *Leuctra prima* KEMPNY 1899

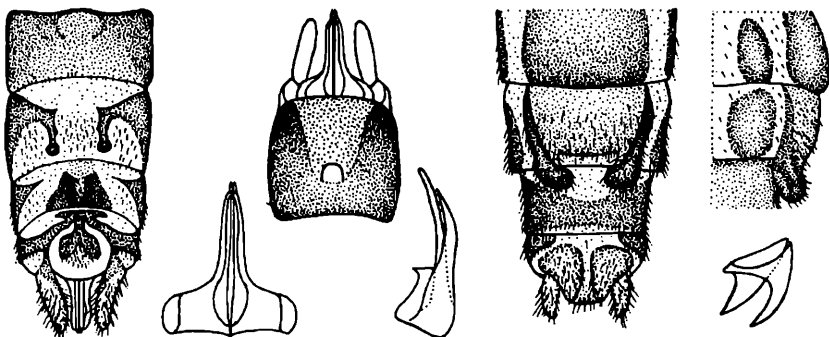
↔ 6.0-9.0; > XII-II; E rheophilic; ↓ 1500; □ Middle European; I E-A1



***hippopus* group, *hippopus* sub-group**

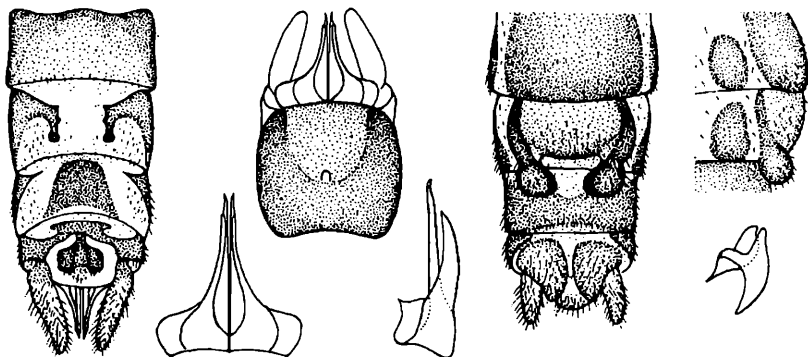
42. *Leuctra hippopus* KEMPNY 1899

↔ 5.0-8.0; > IV-VI; E rheophilic; ↓ 60-1000; □ Euro Asiatic; I A1, Ap



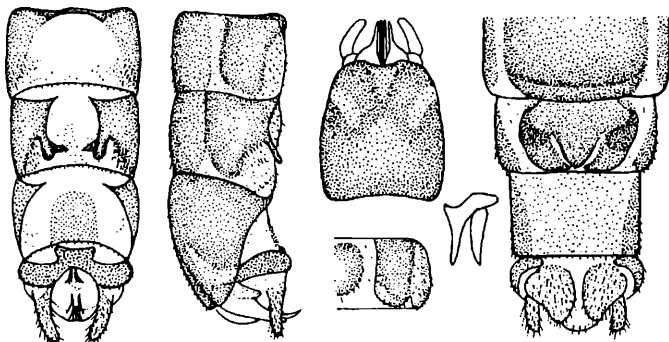
43. *Leuctra elisabethae* RAVIZZA 1985

↔ 4.8-7.0; > XII-V; E rheophilic; ↓ 500-1500; □ Alpine Apennine; I C-Al, W-Al, Ap



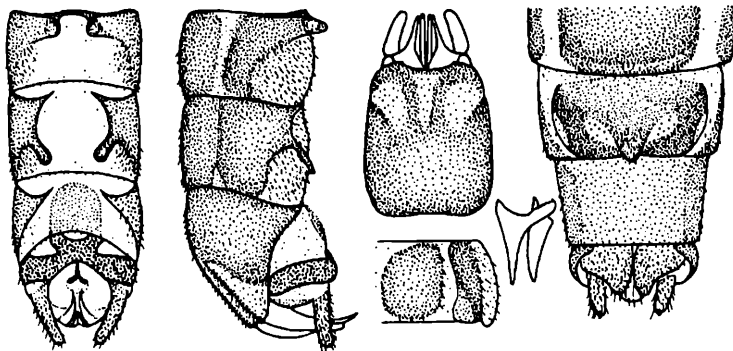
44. *Leuctra cyrnea cyrnea* CONSIGLIO & GIUDICELLI 1965

↔ 6.6-9.0; > IX-X; E rheophilic, orophilic; ↓ 1100-2000; □ Corsican; I Co
◎ (North Corsica)



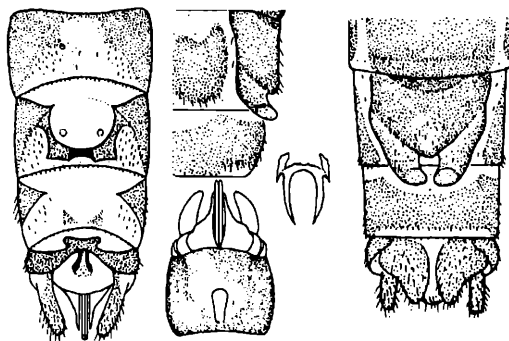
45. *Leuctra cyrnea incidensis* VINÇON & RAVIZZA 2000

↔ 6.0-9.5; > X; E rheophilic, orophilic; ↓ 750-1800; □ Corsican; I Co;
● (South Corsica)



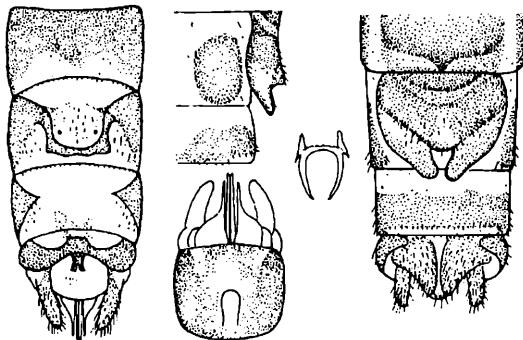
46. *Leuctra alpina* KÜHTREIBER 1934

↔ 5.0-9.0; > IV-V; E rheophilic, orophilic; ↓ 500-2300; □ Middle S-European;
I Al, N-Ap



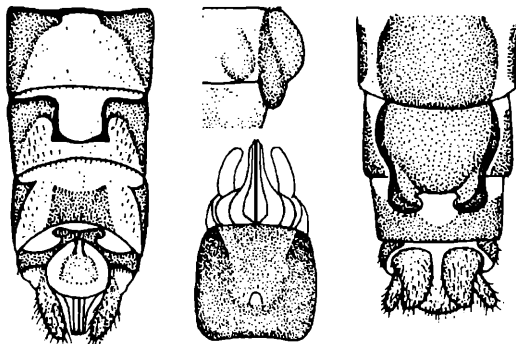
47. *Leuctra subalpina* VINÇON, RAVIZZA & AUBERT 1995

↔ 6.0-12.0; > IV-VI; E rheophilic; ↓ 500-1800; □ Apennine-Alpine; I Ap, W-Al



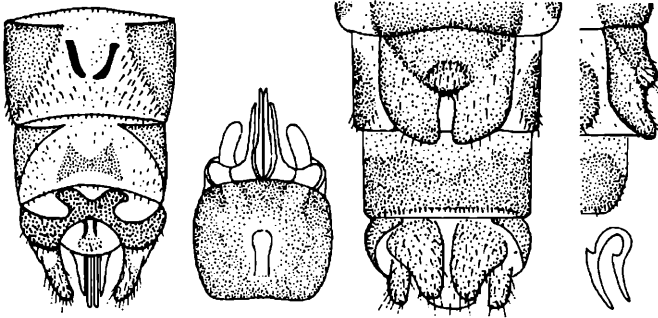
48. *Leuctra fraterna* MORTON 1930

↔ 7.0-8.0; > V; E rheophilic, orophilic; ↓ 1000-1300; □ Corsican; I Co
◎ (Corsican)



49. *Leuctra sesvenna* AUBERT 1953

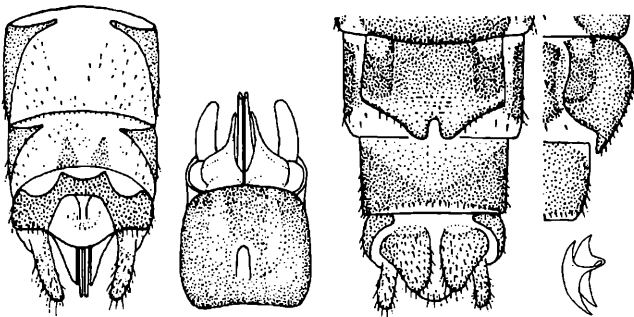
↔ 6.0-8.0; > VI-VII; E rheophilic, orophilic; ↑ 1900-2600; □ Alpine; I C-Al
◎ (Rhaetian Alps)



hippopus group, *occitana* sub-group

50. *Leuctra festai* AUBERT 1954

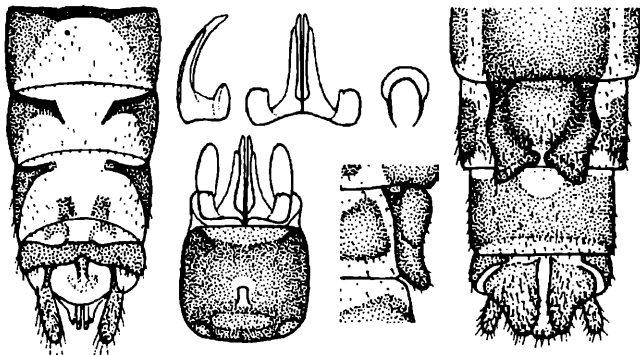
↔ 6.0-8.0; > IV-IX; E rheophilic, orophilic; ↑ 1850-2400; □ Alpine; I W-Al
◎ (Pennine Alps, Sesia valley)



***inermis* group**

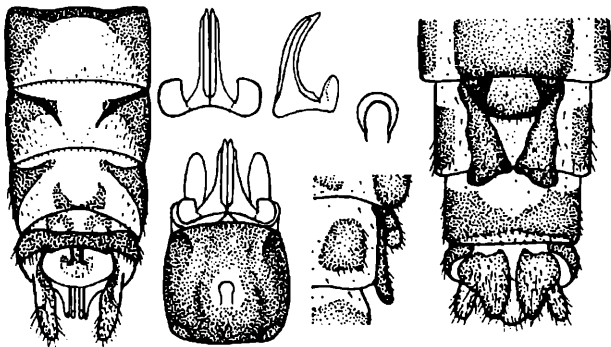
51. *Leuctra insubrica* AUBERT 1949

↔ 4.0-8.0; > V-IX; E rheophilic; ↑ 500-1900; □ Alpine; I C-Al, W-Al



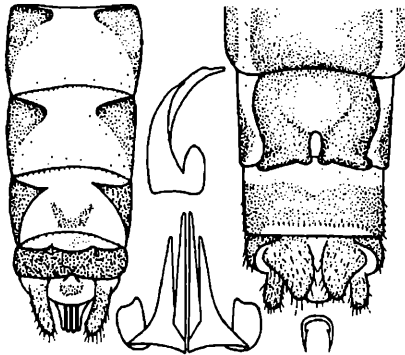
52. *Leuctra apenninicola* RAVIZZA 1988

↔ 4.5-7.0; > IV-VII; E rheophilic; ↑ 500-1500; □ Apennine; I Ap



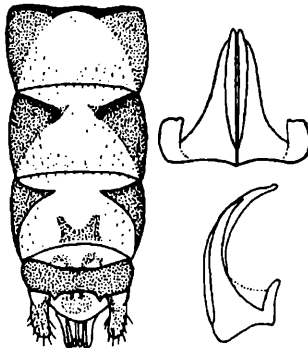
53. *Leuctra inermis* KEMPNY 1899

↔ 4.0-9.0; ➤ IV-VI; E rheophilic; ⚡ 60-1500; □ European; I Al, Ap, Si



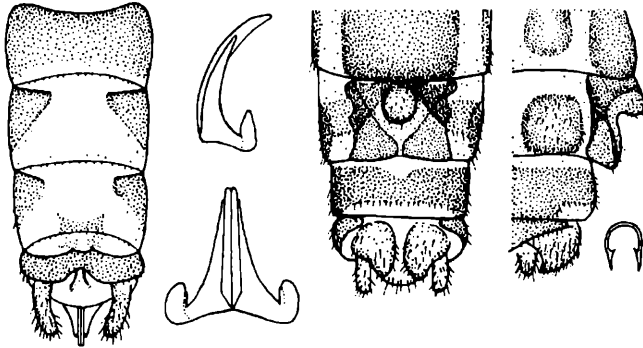
54. *Leuctra silana* AUBERT 1953

↔ 6.5; ♀ unknown; ➤ IV; E rheophilic, orophilic; ⚡ 1300-1700; □ S-Apennine; I S-Ap; ◎ (Sila)



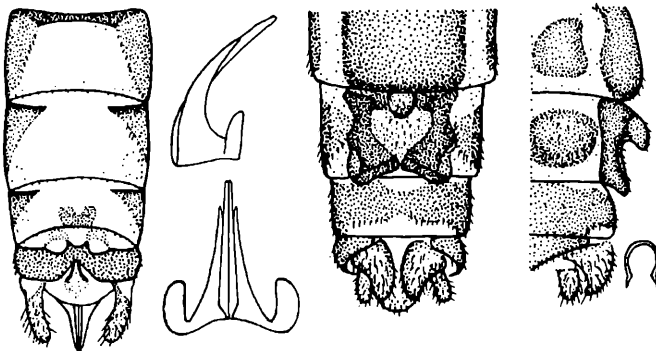
55. *Leuctra rauscheri* AUBERT 1957

↔ 4.0-7.0; > IV-VII; E rheophilic; ↓ 1000-2500; □ Middle-S-European; I Al,
N-Ap, C-Ap



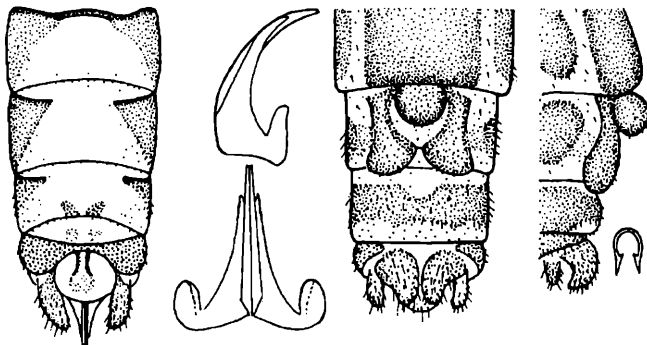
56. *Leuctra teriolensis* KEMPNY 1900

↔ 4.0-7.0; > VI-IX; E rheophilic, orophilic; ↓ 1000-2300; □ Alpine-Carpathian;
I Al



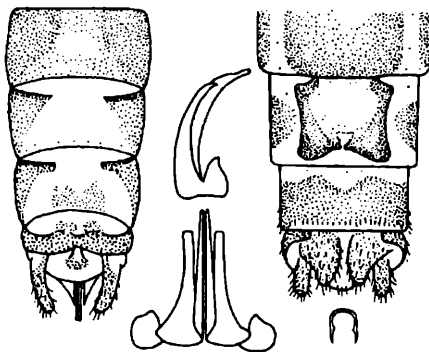
57. *Leuctra ameliae* VINÇON & RAVIZZA 1996

↔ 4.5-7.0; > V-VII; E rheophilic, orophilic; ↓ 900-2000; □ Alpine; I C-Al, W-Al



58. *Leuctra handlirschi* KEMPNY 1898

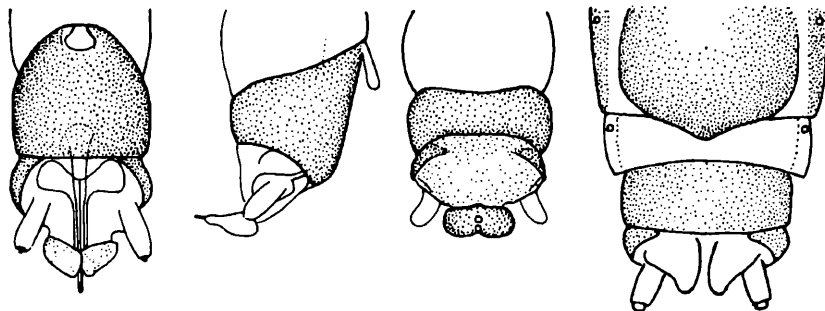
↔ 3.5-7.0; > IV-VIII; E rheophilic; ↓ 60-1500; □ Middle S-European; I Al, Ap



Tyrhenoleuctra

59. *Tyrhenoleuctra zavattarii* CONSIGLIO 1956

↔ 4.5-7.5; ➤ IV-V; E rheophilic; ↓ 0-900; □ Sardinian-Corsican; I Sa, Co



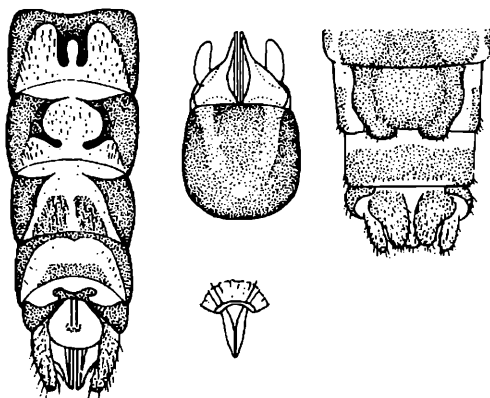
4 Appendix

The six following species have been recorded on the external slopes of the Alps. They do not belong to the Italian Stonefly-fauna, but most of them live in sites not to far from the Italian northeastern Region borders.

fusca group, *fusca* sub-group

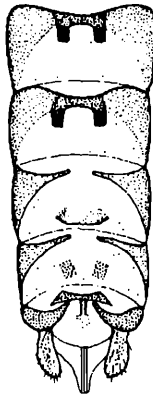
60. *Leuctra digitata* KEMPNY 1899

↔ 6-9; ➤ VIII-X; E rheophilic; ↓ 300-1000; □ Middle N-European, Alps: Germany and Austria



61. *Leuctra malickyi* BRAASCH & JOOST 1951

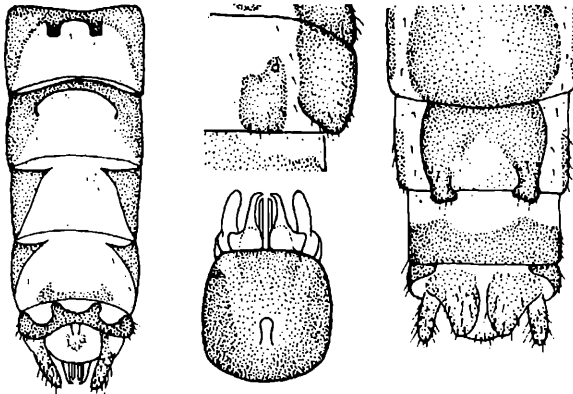
↔ 6.5; ➤ X; E rheophilic; ↓ 1000; □ E-Alpine; Alps: Austria Tirol; ! female unknown



fusca group, *aurita* sub-group

62. *Leuctra pseudocingulata* MENDEL 1968

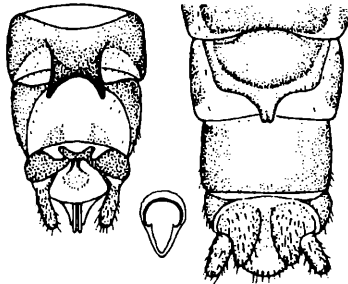
↔ 6.0- 8.5; ➤ VII-X; E rheophilic; ↓ 800-1500; □ Middle European; Alps: Austria and Slovenia



hippopus group, prima sub-group

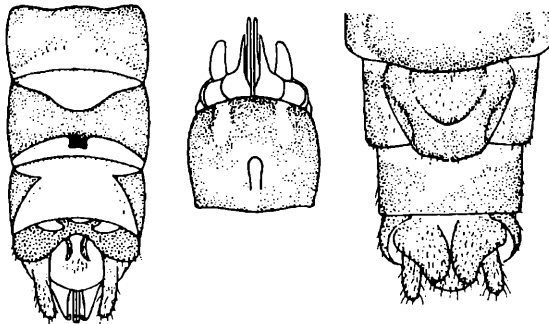
63. *Leuctra istenicae* SIVĚC 1982

↔ 5-7; > X; E rheophilic, crenophilic; ↓ 1300; □ E-Alpine; Alps: Austria (Koralpe) and Slovenian Pre-Alps; ! apterous species



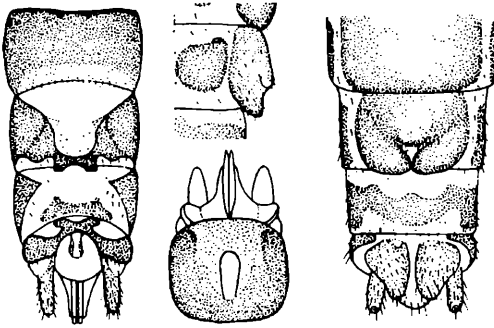
64. *Leuctra signifera* KEMPNY 1899

↔ 7-8; > IX-XI; E rheophilic; ↓ 800-1500; □ E-Alpine; Alps: Austria and Slovenia



65. *Leuctra pseudosignifera* AUBERT 1954

↔ 5-8; ➤ III-VII; E rheophilic, crenophilic; ↓ 300-1800; □ Middle European;
Alps: France, Switzerland, Germany, Austria and Slovenia



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