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THE EUROPEAN DRAGONFLIES: NOTES ON THE CHECKLIST AND ON SPECIES DIVERSITY*

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Casing natural geographical boundaries, 130 spp. can be considered as European, though when broader political borders are followed this number rises to 136. In addition 20 exotic spp. have been recorded as a result of accidental importation. The highest diversity, defined by the number of spp. per standard area of 250x250 km^2, is found in the Alps, while the lowest diversity occurs in the northern parts of mainland Europe and on some islands. Surprisingly, the Mediterranean region is not as rich in spp. as the central part of Europe. When compared with other continents, it is clear that Europe has the lowest number of spp. However, when compared specifically with areas at the same latitude, the Odon. diversity in Europe is relatively average: somewhat higher than expected in the northern regions, somewhat lower than expected in southern regions.

INTRODUCTION

In this article we discuss the number of species in Europe, look at the distribution of the diversity of dragonflies within this area, and compare this with other regions of the world.

Although conventionally referred to as one of the seven continents of the world, Europe is actually just the western fifth of the Eurasian landmass. The climate is strongly dependent on latitude. Around the Mediterranean Sea a mild climate dominates. The warm Atlantic Gulf Stream influences a major part of Europe, primarily the coastal regions of western Europe, which generally have mild winters and somewhat rainy mild summers. In the central and eastern parts of Europe, a harsher continental climate dominates with higher summer temperatures and colder winters.

* Dedicated to our friend and colleague, Professor Dr Gerhard JURZITZA; his kind and enthusiastic advice in recent years has been an important stimulus for us.

METHODS

It is not easy to define the frontiers of the continent of Europe. In six publications on European dragonflies, minor differences are found in this definition (Tab. I). Here we prefer to follow natural borders such as rivers, highest mountain-ridges and the lowest rift valleys in the sea, in preference to political frontiers. Therefore, in this article we define Europe as the western side of the Ural Mountains, along the Ural River to the northern side of the Caucasus. From there, the boundary passes through the Black Sea and the Aegean (excluding the islands near the Turkish coast, such as Rhodes), through the Mediterranean Sea (including Crete) towards the Azores, and so excluding the Canary Islands and Madeira. From the Azores, the boundary goes to Iceland and back to the Ural Mountains. For completeness, at the end of the checklist we also note those species that occur within the broader political frontiers of Europe, i.e. the species of Rhodes and other Greek islands near the Turkish coast, Madeira, the Canary Islands and including the species of the southern side of the Caucasus.

In addition to simply listing species, the normalized species density for areas in Europe and on the world has been calculated. As standard area size we took 250×250 km^2: 62500 km^2 (or 37000 square miles). The choice for this standard size can influence the maps of species diversity. Often a smaller standard size of area is applied to correlate species diversity with area, e.g. 100×100 km^2 in BARTHLOTT et al. (1999). Such a smaller standard size will give more advantage to countries or areas with a high diversity of landscapes in that region. For many organisms, Slovenia, for example, is considered as a region with a very high biological diversity (MRŠIČ, 1997). If such a smaller standard size had been applied in our study, this country would have been seen to be of more importance for dragonflies.

The species densities for areas smaller or larger than the standard size have been calculated by applying a rough bench mark formula. Initially we took the formula from Island Theory into consideration; however, the factor 'z' is unknown for Odonata in general and may be highly dependent upon the precise situation, therefore we decided to use another approach. Which formula would be best, it

Table I

Different recent publications on the European dragonfly fauna with their implied European boundaries and number of European species

Region	SCHMIDT (1978)	TSUDA (1991)	ASKEW (1988)	WENDLER et al. (1995)	BOS & WASSCHER (1997)	BOS & WASSCHER (1998)
Southern slopes of the Caucasian mountains	+	-	-	-	-	-
Greek islands near the Turkish coast (e.g. Rhodes)	+	+	-	+	-	-
Canary Islands	-	+	-	+	-	-
Number of European species (boundaries as defined in the present article)	?	121	114	126	124	130
Total number of species listed in the publication	127	128	114	132	124	130

+ area included in that publication, - area excluded in that publication, ? hard to give an exact number of species

is very difficult to decide. We decided to follow BARTHLOTT et al. (1999), using the formula from EVANS et al. (1955):

$$S = s \log (N)/\log (n)$$

where 'S' is an estimate of the number of species expected in an area consisting of 'N' km^2 (in our case 62500 km^2) and 's' is the number of species known from an area with a size of 'n' km^2. The original formula by Evans was: $S = s \log (N+1)/\log (n+1)$. We omitted the '+1' in the formula because we used it only for huge numbers.

With the information on normalized species density, diversity zones within Europe were mapped (Fig 1). For this map we used ca 50 sources, mostly regional atlases (e.g. DOMMANGET, 1994; LOPAU & WENDLER, 1995; MAIBACH & MEYER, 1987; MERRITT et al., 1996) and other regional publications (e.g. JÖDICKE, 1996). An additional provisional map of species diversity on a global scale was prepared (Fig. 2) as published by BARTHLOTT et al. (1999) for plant diversity. For this map we used ca 250 sources: information available in the literature (e.g. ROWE, 1992; WATSON et al., 1991), Odonatological Abstracts (through the years 1997-1999) and on the Internet (e.g. PAULSON, 1999).

On the European map five zones are used: four of these covering a range of less than 25 species to more than 76 species, with one extra category added. On the global map five zones, covering a range of less than 25 species to more than 250 species per standard area, were plotted.

THE EUROPEAN SPECIES LIST

Over the past 25 years, several publications on the European dragonflies have included species lists. A number do not include the European part of Russia, or include areas outside Europe: D'AGUILAR et al. (1986), ASKEW (1988) and VAN TOL & VERDONK (1988). The species lists in these publications are not taken into account in Table I. Besides these, there is also one recent publication (RUDDEK, 1996) which lists the species of the complete Western Palearctic, an area much bigger than Europe.

Table I presents the species lists in the publications of SCHMIDT (1978), ASKEW (1988), TSUDA (1991), WENDLER et al. (1995) and BOS & WASSCHER (1997, 1998). There are only minor differences in these lists. If the natural geographical frontiers are followed, 130 species are regarded as European (see Appendix). If, instead, the political boundaries are followed (see chapter Methods for definition), 6 further species can be added. The European list then contains 136 species.

The European dragonfly fauna is probably among the best studied in the world. Despite this, new species are still described from within European territory. In the last 25 years four new species have been described: *Cordulegaster trinacriae* Waterston, 1976, *C. heros* Theischinger, 1979, *C. helladica* (Lohmann, 1993) and *Boyeria cretensis* Peters, 1991. Moreover, in this period twelve species, whose strongholds are in other continents, have also been discovered within Europe, and so have been added to the European list.

Besides the indigenous species, twenty exotic species have been recorded (Tab. II). CALVERT (1912) gave the first record of an exotic dragonfly in Europe. He described the capture of a giant damselfly *Mecistogaster* sp. in the village of

Driese (which lies in what was then Germany, but now Poland). The larvae of this species had probably been imported in water held in the central leaves of a *Bromelia* plant. Nowadays these exotic species are generally recorded in places with imported waterplants, such as greenhouses or aquarium centres.

SPECIES DIVERSITY

In Figure 1, the diversity of Odonata within different regions of Europe is mapped. In most parts of central Europe 60 to 75 species occur within the standard 250x250 km^2 plots. Northern Scandinavia has a very low odonate diversity, but dragonflies can be found to the very north, close to Hammerfest at 70°40' N. Compared to the mainland, islands such as the United Kingdom and Ireland, are relatively poor in species (with 40 and 22 species, respectively; MERRITT et al. 1996). On Iceland only the vagrant *Hemianax ephippiger* (Burm.) has

Table II
Exotic odonates recorded in Europe

Species	Continent where from	Country in which recorded
Coenagrionidae		
Agriocnemis femina (Brauer, 1868)	Asia	NL
Argia fumipennis (Burmeister, 1839)	America	GB
Ceriagrion cerinorubellum (Brauer, 1865)	Asia	GB
Enallagma signatum (Hagen, 1861)	America	GB
Ischnura posita (Hagen, 1861)	America	GB
Ischnura senegalensis (Rambur, 1842)	Asia/Africa	GB/SF
Mecistogaster sp.	America	PL
Pseudagrion microcephalum (Rambur, 1842)	Asia	SF
Aeshnidae		
Anax gibbosulus Rambur, 1842	Asia/Australia	GB
Anax guttatus (Burmeister, 1839)	Asia	GB/SF
Gomphidae		
Ictinogomphus decoratus melaenops (Selys, 1858)	Asia	NL
Libellulidae		
Crocothemis servilia (Drury, 1770)	Asia	GB
Erythemis simplicicollis (Say, 1839)	America	GB
Neurothemis fluctuans (Fabricius, 1793)	Asia	NL/SF
Orthetrum japonicum internum McLachlan, 1894	Asia	SF
Rhodothemis rufa (Rambur, 1842)	Asia	GB
Sympetrum eroticum (Selys, 1883)	Asia	LT
Tramea transmarina euryale Selys, 1878	Asia	GB
Urothemis bisignata Brauer, 1868	Asia/Australia	GB

Countries: GB = Great Britain (BROOKS, 1988), LT = Lithuania (STANIONYTE, 1989); NL = The Netherlands (WASSCHER & GOUTBEEK, 1998); PL = Poland (CALVERT, 1912); SF = Finland (VALTONEN, 1985).

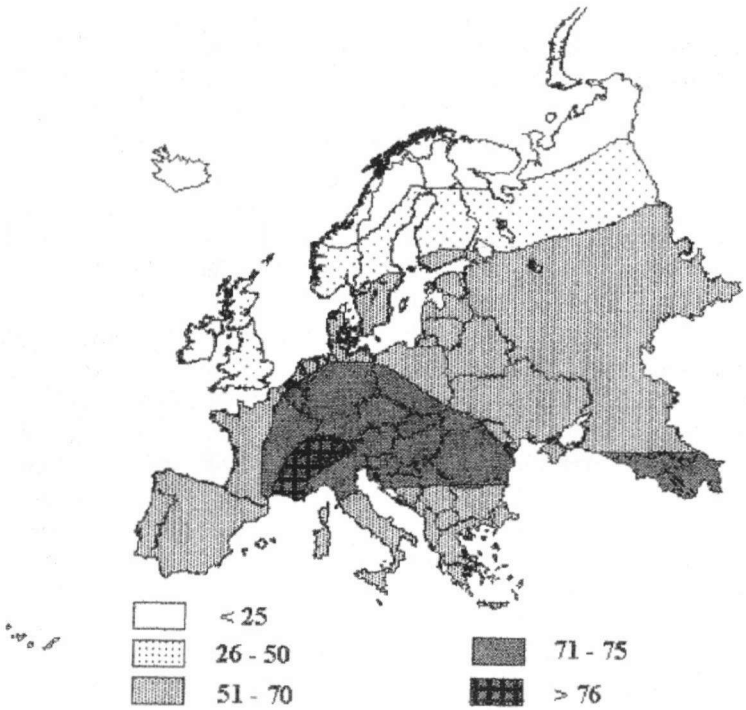

Fig. 1. Diversity of odonate species in Europe, showing the number of species per standard area of 250×250 km². Class intervals have been deliberately made unequal, to show just how close a large part of central Europe comes towards a value of 76 species per standard area.

been observed.

Further south, the diversity generally increases, though it is not true that the very southern part is the richest area of Europe. The highest diversity rate, with over 75 species per unit area, is in the Alps and the very south of France. The region with the highest diversity per unit area in western Europe is Switzerland, with 80 species (MAIBACH & MEIER, 1987). In eastern Europe, the Caucasus is also rather rich, with 75 species in the northern half (regarded by us as the European part) and 82 species in the entire Caucasus (POPOVA, 1997; KETENCHIEV & HARITONOV, 1998). Both Switzerland (41290 km²) and the northern half of the Caucasus (approx. 70000 km²) are about the size of the unit area.

Species that are regarded as endemic to Europe are listed in Table III. Most of these are found in the southern, Mediterranean, region. Besides the ten true endemics, an additional four species occur only very occasionally outside Europe. These are *Calopteryx xanthostoma* (Charp.) and *Oxygastra curtisii* (Dale), both of

which also occur in Morocco, *Orthetrum coerulescens* (Fabr.), which is found also in Turkey, and *Brachytron pratense* (Müller), which is found in Turkey and Kazakhstan.

DISCUSSION

In Europe 130 species of dragonflies are known to occur. In the entire world there have been about 5500 species described so far (SCHORR et al., 1998). This makes Europe, having seven percent of the world landmass and only two percent of the world species, relatively species-poor.

The European odonate fauna can be compared in several different ways with that of other regions. The number of species can be compared directly with two other parts of the world which have about the same size, namely Canada and Australia. For both of these countries the number of species listed is much higher than for Europe, the total being 198 for Canada (DANKS, 1988) and 308 for Australia (WATSON et al., 1991). This is true even though the very south of Canada (at 42°N) lies 750 km further to the north than the very south of Europe (at 35°N). Generally speaking, the higher the latitude the fewer dragonfly species that occur. The relative proximity to the equator in the case of Australia is one of the main reasons for its richness in species. The fact that the North-American continent accommodates more species than Europe and that eastern and western Canada have partially distinct assemblages, explains a part of the Canadian diversity.

In preference to the simple number of species, the normalized species diversity (as defined by the number of species in a standard area of 62500 km^2) may be a better standard for comparison. When the species diversity in Europe is compared with the species diversity in other parts of the world (Fig. 2), the relative poorness

Table III

Endemic odonates in Europe, with the latitude of their occurrence

Species	Distribution	Occurring north of degrees of latitude						
		30	35	40	45	50	55	60
Ischnura genei (Rambur, 1842)	Sicily, Sardinia, Corsica		x	x				
Platycnemis acutipennis Selys, 1841	SW Europe		x	x	x			
Platycnemis latipes Rambur, 1842	SW Europe		x	x	x			
Boyeria cretensis Peters, 1991	Crete		x					
Gomphus graslinii Rambur, 1842	SW Europe		x	x	x			
Gomphus pulchellus Selys, 1840	W Europe		x	x	x	x		
Cordulegaster helladica (Lohmann, 1993)	Greece		x					
Cordulegaster heros Theischinger, 1979	Balkans		x	x	x			
Cordulegaster trinacriae Waterston, 1976	S. Italy, Sicily		x					
Macromia splendens (Pictet, 1834)	SW Europe		x	x				

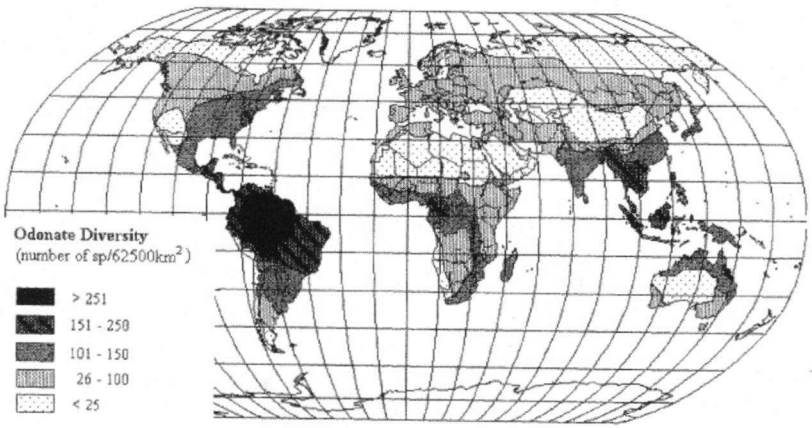

Fig. 2. Preliminary map of diversity of Odonate species on a world scale, showing the number of species per standard area of 250´250 km².

of the European dragonfly fauna is again initially apparent. Except for Antarctica, where no dragonflies occur, Europe is the only continent without a zone in which a species diversity of over 100 species per standard area occurs. This is in strong contrast to the diversity shown in the richest regions for dragonflies, i.e. the tropical rainforests of Central and South America. Here numbers can rise to over 250 species per standard area. In even a small country such as Costa Rica (which has a size of approximately the 62500 km² standard area) at least 252 species are found (PAULSON, 1999), almost double the number of species occurring in the whole of Europe.

When one looks not just at the intermediate or large scale, but also at a local level, differences in species diversity remain substantial. The region with the highest diversity in Europe is probably the canton of Zürich in Switzerland, in which 70 species have been observed (in an area of 1729 km²) (MAIBACH & MEIER, 1987). The localities in the world with the greatest species diversity are found in South America, where tropical rainforest meets mountain ranges. One such case is at Cerro de la Neblina (00°49'50"N, 66°09'40"W) in the very south of Venezuela, next to the Brazilian border. Here, during a few months of 1984, 152 species were collected in an area of approximately 625 km² (DE MARMELS, 1989). Similarly, the Tambopata-Candamo Reserved Zone near the Andes in southern Peru (12°50'18"S, 69°17'59"W) has a very high number of species despite of its size of only 5.5 km². Prior to 1977, a total of 152 species were known from this locality (PAULSON, 1985), but this number was increased to 169 during fieldwork carried out in 1992 (BUTT, 1995).

If sites in Europe are compared directly with sites in other areas in the world which are at the same latitude (Fig. 3), then the relative poverty of species diversity in Europe becomes less conspicuous. The richest area at moderately high latitude

is the eastern part of North America, at about 45°N, though central Europe itself is a little richer than some other areas. Generally we see that species diversity decreases towards the poles, and above about 50° latitude the diversity seen in Europe is very comparable, or even a little better, to that seen in North America as well as Asia. What is, however, apparent from the figures is that the diversity seen in southern Europe is rather poor in comparison to that of equivalent latitudes in other continents, or even to that of central Europe. This is possibly a reflection of the area's relatively isolated situation; due to the Sahara desert lying to the south there are only a very limited number of subtropical species able to migrate from Africa into Europe. The Sahara and the northern part of Africa are rather poor in species. In northern Morocco for example, only 49 species occur (JACQUEMIN, 1994). It is generally thought that the relative paucity of all animal and plant groups in Europe is caused by the East-West orientation of the major mountain ranges, which acts as a barrier to the movement of species. During the ice-ages, many species were thus unable to migrate further south and became extinct. The fact that the Sahara to the south is an even more impassible boundary for many southern species attempting to move northwards is perhaps as plausible as the "mountain theory" is for an explanation of the relatively poor species diversity especially in the Mediterranean part of Europe.

The only previous publication that names some European endemics is that of VAN TOL & VERDONK (1988). The list given in the present article is more ex-

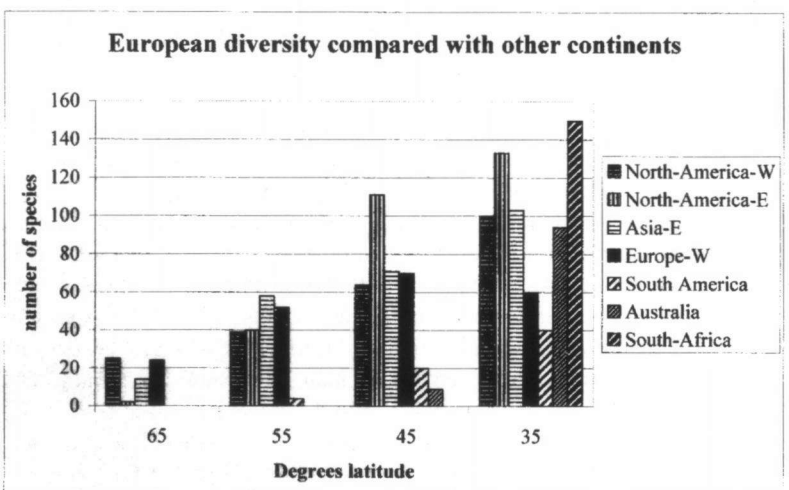

Fig.3. Comparison of the diversity of species throughout the world at different latitudes from 35 to 65 degrees, based on the number of species per standard area of 250x250 km². The central column in each data set refers to Europe, columns to the left are from other regions in the Northern Hemisphere, and columns to the right are from the Southern Hemisphere.

tensive (Tab. III). Some eight percent of the European dragonflies can be regarded as endemic, with a further three percent of the species being almost, but not quite, confined to Europe. In the Temperate Zone, New Zealand has probably the highest percentage of endemic dragonflies, at 59% (10 out of 17 species; ROWE, 1992). This, no doubt, reflects to some extent its island nature and isolated position. Values for island regions in the tropics can be lower, e.g. for Sulawesi the value is 40% (VAN TOL, 1987) and for Sri Lanka it is 47% (39 out of 115 species; BEDJANIČ, 1998). But higher values can also be encountered, as for example on the isolated small island of Hawaii, where some 67% of species are endemic (23 out 35 species; NISHIDA, 1992). Endemism is particularly prevalent in the ancient continent of Australia, where no fewer than 75% of species are endemic (233 out of 308 species; WATSON, et al., 1991).

All ten true European endemics have their optimum in the Mediterranean region, at 35 degrees of latitude (Tab. III). This can be explained on the basis that the Mediterranean, unlike more northerly latitudes, has been ice-free throughout the Pleistocene (ST. QUENTIN, 1960; DEVAI, 1976). The only Russian endemic in the western half of Russia is probably *Ischnura aralensis* Haritonov, occurring at 45°N (HARITONOV, 1984).

Interestingly, although lying at roughly the same latitude as Europe, the Canadian/Alaska region has had much ice-free land in more northerly regions during the ice-ages, notably the region termed Beringia at a latitude of 67°N (CANNINGS et al., 1991). The result of this is that in contrast to the European situation, the four northern endemics from Canada and Alaska, i.e. *Somatochlora brevicincta* Robert, *Somatochlora septentrionalis* (Hagen), *Somatochlora whitehousi* Walker and *Leucorrhinia patricia* Walker (viz. CANNINGS et al., 1991; TSUDA, 1991), all have a boreal distribution.

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APPENDIX

List of the 130 species regarded as European (BOS & WASSCHER, 1998); the generally accepted subspecies are included.

CALOPTERYGIDAE
Calopteryx haemorrhoidalis (Vander Linden, 1825)
C. s. splendens (Harris, 1782)
C. splendens balcanica Fudakowski, 1930
C. splendens caprai Conci, 1956
C. splendens intermedia Selys, 1887
C. splendens taurica Selys, 1853
C. v. virgo (Linnaeus, 1758)
C. virgo festiva (Brullé, 1832)
C. virgo meridionalis Selys, 1853
C. xanthostoma (Charpentier, 1825)
EUPHAEIDAE
Epallage fatime (Charpentier, 1840)
LESTIDAE
Chalcolestes viridis (Vander Linden, 1825)
C. parvidens Artobolevski, 1929
Lestes barbarus (Fabricius, 1798)
L. dryas Kirby, 1890
L. macrostigma (Eversmann, 1836)
L. sponsa (Hansemann, 1823)
L. v. virens (Charpentier, 1825)
L. virens vestalis Rambur, 1842
Sympecma gobica (Förster, 1900)
S. paedisca (Brauer, 1882)
S. fusca (Vander Linden, 1820)
COENAGRIONIDAE
Cercion lindenii (Selys, 1840)
C. tenellum tenellum (Villers, 1789)
C. tenellum nielseni Schmidt, 1953
Coenagrion armatum (Charpentier, 1840)
C. hylas freyi Bilek, 1954
C. c. caerulescens (Fonscolombe, 1838)
C. caerulescens caesarum Schmidt, 1959

C. hastulatum (Charpentier, 1825)
C. johanssoni (Wallengren, 1894)
C. lunulatum (Charpentier, 1840)
C. m. mercuriale (Charpentier, 1840)
C. mercuriale castellani Roberts, 1948
C. ornatum (Selys, 1850)
C. p. ponticum (Bartenev, 1929)
C. ponticum intermedium Lohmann, 1990
C. puella (Linnaeus, 1758)
C. pulchellum (Vander Linden, 1825)
C. scitulum (Rambur, 1842)
Enallagma cyathigerum (Charpentier, 1840)
Erythromma najas (Hansemann, 1823)
E. viridulum (Charpentier, 1840)
I. e. elegans (Vander Linden, 1820)
Ischnura elegans ebneri Schmidt, 1939
I. elegans pontica Schmidt, 1939
I. fountaineae Morton, 1905
I. genei (Rambur, 1842)
I. graellsii (Rambur, 1842)
I. hastata (Say, 1839)
I. pumilio (Charpentier, 1825)
Nehalennia speciosa (Charpentier, 1840)
P. n. nymphula (Sulzer, 1776)
P. nymphula elisabethae Schmidt 1948
PLATYCNEMIDIDAE
Platycnemis acutipennis Selys, 1841
P. dealbata Selys, 1863
P. latipes Rambur, 1842
P. p. pennipes (Pallas, 1771)
P. pennipes nitidula (Brullé, 1832)
AESHNIDAE
Aeshna affinis Vander Linden, 1820
A. caerulea (Ström, 1783)
A. crenata Hagen, 1856
A. cyanea (Müller, 1764)
A. grandis (Linnaeus, 1758)
A. i. isosceles (Müller, 1767)
A. isosceles antehumeralis Schmidt, 1950
A. j. juncea (Linnaeus, 1758)
A. juncea atshischgho Bartenev, 1929
A. mixta Latreille, 1805
A. serrata osiliensis Mierzejewski, 1913
A. subarctica elisabethae Djakonov, 1922
A. viridis Eversman, 1836
Anax immaculifrons Rambur, 1842
A. imperator Leach, 1815
A. junius (Drury, 1770)
A. parthenope (Selys, 1839)
Brachytron pratense (Müller, 1764)
Boyeria cretensis Peters, 1991
B. irene (Fonscolombe, 1838)
Caliaeschna microstigma (Schneider, 1845)
Hemianax ephippiger (Burmeister, 1839)
GOMPHIDAE
Gomphus f. flavipes (Charpentier, 1825)
G. flavipes lineatus Bartenev, 1929
G. graslinii Rambur, 1842
G. pulchellus Selys, 1840
G. schneiderii Selys, 1840
G. simillimus Selys, 1850
G. vulgatissimus (Linnaeus, 1758)
Lindenia tetraphylla (Vander Linden, 1825)
Onychogomphus assimilis (Schneider, 1845)
O. costae (Selys, 1885)
O. flexuosus (Schneider, 1845)
O. f. forcipatus (Linnaeus, 1758)
O. forcipatus unguiculatus (Vander Linden, 1820)
O. uncatus (Charpentier, 1840)
Ophiogomphus cecilia (Fourcroy, 1785)
Paragomphus genei (Selys, 1841)
CORDULEGASTRIDAE
Cordulegaster b. bidentata Selys, 1843
C. bidentata sicilica Fraser, 1929
C. b. boltonii (Donovan, 1807)
C. boltonii iberica Boudot & Jacquemin, 1995
C. boltonii immaculifrons Selys, 1858
C. h. helladica (Lohmann, 1993)
C. helladica bucholzi (Lohmann, 1993)
C. helladica kastalia (Lohmann, 1993)
C. h. heros Theischinger, 1979
C. heros pelionensis Theischinger, 1979
C. insignis Schneider, 1854
C. picta Selys, 1854
C. trinacriae Waterston, 1976
CORDULIIDAE
Cordulia aenea (Linnaeus, 1758)
Epitheca bimaculata (Charpentier, 1825)
Oxygastra curtisii (Dale, 1834)
Somatochlora alpestris (Selys, 1840)
S. arctica (Zetterstedt, 1840)
S. flavomaculata (Vander Linden, 1825)
S. meridionalis Nielsen, 1935
S. m. metallica (Vander Linden, 1825)
S. metallica abocanica Beleshev, 1955
S. sahlbergi Trybom, 1889
MACROMIIDAE
Macromia splendens (Pictet, 1834)
LIBELLULIDAE
Brachythemis leucosticta (Burmeister, 1839)
Crocothemis erythraea (Brullé, 1832)
Diplacodes levebvrei (Rambur, 1842)

Leucorrhinia albifrons (Burmeister, 1839)
L. caudalis (Charpentier, 1840)
L. d. dubia (Vander Linden, 1825)
L. dubia circassica Bartenev, 1929
L. pectoralis (Charpentier, 1825)
L. rubicunda (Linnaeus, 1758)
Libellula d. depressa Linnaeus, 1758
L. depressa taurica Beutler, 1984
L. fulva Müller, 1764
L. quadrimaculata Linnaeus, 1758
Orthetrum albistylum (Selys, 1848)
O. b. brunneum (Fonscolombe, 1837)
O. brunneum cycnos (Selys, 1848)
O. cancellatum (Linnaeus, 1758)
O. chrysostigma (Burmeister, 1839)
O. c. coerulescens (Fabricius, 1798)
O. coerulescens anceps (Schneider, 1845)
O. nitidinerve (Selys, 1841)
O. sabina (Drury, 1770)
O. trinacria (Selys, 1841)
Pantala flavescens (Fabricius, 1798)
Sympetrum danae (Sulzer, 1776)
S. depressiusculum (Selys, 1841)
S. flaveolum (Linnaeus, 1758)
S. fonscolombii (Selys, 1840)
S. meridionale (Selys, 1841)
S. pedemontanum (Müller, 1766)
S. sanguineum (Müller, 1764)
S. sinaiticum tarraconense Jödicke, 1994
S. s. striolatum (Charpentier, 1840)
S. striolatum nigrescens Lucas, 1912
S. tibiale (Ris, 1897)
S. vulgatum ibericum Ocharan, 1985
S. v. vulgatum (Linnaeus, 1758)
S. vulgatum flavum Bartenev, 1915
Selysiothemis nigra (Vander Linden, 1825)
Trithemis annulata (Palisot de Beauvois, 1807)
Zygonyx torrida (Kirby, 1889)

When the expanded frontiers are applied the following (sub-)species are additionally regarded as European:

On Rhodes and neighbouring Greek islands:
Onychogomphus forcipatus albotibialis Schmidt, 1954
Orthetrum taeniolatum (Schneider, 1845)
Trithemis festiva (Rambur, 1842).

On the Canary Islands and Madeira:
Ischnura saharensis Aguesse, 1958
Sympetrum nigrifemur (Selys, 1884)
Trithemis arteriosa (Burmeister, 1839)

In the southern Caucasus (see KETENCHIEV & HARITONOV, 1998; names as in TSUDA, 1991):
Calopteryx intermedia Selys, 1887
Calopteryx splendens erevanensis Akramovski, 1948
Calopteryx splendens mingrelica Selys, 1868
Calopteryx splendens tschaldirica Bartenev, 1912
Coenagrion puella syriacum Morton, 1924
Onychogomphus assimilus fulvipennis Bartenev, 1912
Cordulegaster insignis nobilis Morton, 1915
Cordulegaster insignis charpentieri Kolenati, 1846
Sympetrum flaveolum austrinum Akramovski, 1948

Some species are recorded from just to the east of Europe, and may conceivably occur within European boundaries. Those expected in the European part of the Ural are (BELYSHEV & HARITONOV, 1980):
Coenagrion h. hylas (Trybom, 1889)
Aeshna undulata Bartenev, 1930
Somatochlora graeseri Selys, 1887
Leucorrhinia dubia orientalis Selys, 1887