

Lestes parvidens and *L. viridis* in southeastern Europe: a chorological analysis (Odonata: Lestidae)

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Abstract

In order to clarify the actual distribution and the overlap of ranges of *Lestes parvidens* and *L. viridis* in Europe, all available and credible information from records of the two species in southern and southeastern Europe was compiled. This compilation includes all literature references that clearly distinguish between the two species, which usually was not the case prior to the mid-1990s, records taken personally by the authors, and the checking of museum speci-mens. The hitherto researched distributional range of *L. parvidens* in Europe extends from Asia minor to Corsica and Sicily in the west, and to Austria, Slovakia and the Ukraine in the north. On the other hand, the range of *L. viridis* extends from western, central and southern Europe, where it is common, to the southeast as far as the southern Greek mainland and the Black Sea coast. The first records of *L. viridis* from Turkey are documented from Turkish Thrace. In the area of overlapping ranges, which from north to south extends over more than 1,000 km in Italy as well as the Pannonian lowlands and the Balkans, numerous cases of syntopic occurrences were recorded. Although in these hybridization is not uncommon, the reproductive isolation between *L. parvidens* and *L. viridis* has reached an extent that does not allow a complete amalgamation of the two taxa any more. In conclusion, the results of our chorological analysis substantiate the status of *L. parvidens* and *L. viridis* as clearly separated, good species.

Zusammenfassung

Lestes parvidens und *L. viridis* in Südost-Europa: eine chorologische Analyse (Odonata: Lestidae)
In der Arbeit werden alle verlässlichen Informationen zur aktuellen Verbreitung von *L. parvidens* und zur Arealüberlappung mit *L. viridis* aus Süd- und Südost-Europa zusammengestellt.

Die Daten umfassen sowohl unveröffentlichte Funde und die Ergebnisse der Auswertung von Museumsmaterial sowie alle zugänglichen Literaturangaben, in denen eine klare Arttrennung vorgenommen wurde. Bis zur Mitte der 1990er-Jahre hatten die meisten Autoren noch nicht zwischen den zwei Arten unterschieden, so dass unbelegte Literaturquellen kritisch betrachtet werden müssen. Das bislang bekannte europäische Areal von *L. parvidens* erstreckt sich von Kleinasien nach Westen bis Korsika und Sizilien, im Norden erreicht es Österreich, die Slowakei und die Ukraine. Dagegen besitzt *L. viridis* in West- und Mitteleuropa eine weite Verbreitung, die sich nach Südosteuropa bis in den Süden des griechischen Festlands erstreckt und in Bulgarien und der Türkei an die Schwarzmeerküste heranreicht. In der Arbeit werden die ersten sicheren Feststellungen von *L. viridis* aus dem europäischen Teil der Türkei dokumentiert. Die Areale beider Arten überlappen sich in einer mehr als 1.000 km breiten Zone in Italien, der Pannonischen Tiefebene und auf der Balkanhalbinsel. Aus dieser Überlappungszone sind mehrere Fälle syntoper Populationen bekannt. Obwohl in diesen regelmäßig Hybridisierung festgestellt wurde, hat die reproduktive Eigenständigkeit von *L. parvidens* und *L. viridis* einen Grad erreicht, der keine völlige Vermischung der Taxa mehr zulässt. Die Ergebnisse der chorologischen Analyse belegen den Status von *L. parvidens* und *L. viridis* als deutlich separierte, gute Arten.

Introduction

Early in the 20th century, BARTENEF (1911) was the first to recognize that a male specimen of *Lestes viridis* collected in the Russian Kuban district, situated between northwestern Caucasus, Sea of Azov and the Black Sea, differed noticeably from Selys' description of that species: «*Lestes viridis* Lind. – 1 male, 21-VII-1906: This male differs from the description by Selys-Longchamps ... the small mound on the inner margin of the upper appendages is almost not noticeable ...» (BARTENEF 1911: 35 f.). However, Bartenef did not draw any taxonomic conclusions from that observation. More than a decade later, MORTON (1922) encountered a similar problem when he compared specimens of *L. viridis* in the British Museum of southeastern European origin with central European material. He already considered the presence of a southeastern taxon distinct to central and western European *L. viridis*, but at the same time recognized 'southeastern' characters in specimens from Lazio, Italy: «... males from Belgium, Germany and Sicily agree with one another in having the distal tubercle well developed in the superior appendages, while in one from Cyprus it is barely, if at all, discernible, three males from Ostia, Italy, resembling the last-mentioned ... I had been disposed to consider ... an eastern race or sub-species, but the Ostia examples are a disturbing factor, and I leave the matter as it is until more abundant material is forthcoming, especially from Italy and the Balkan countries.» (MORTON 1922: 81). This quotation demonstrates that Morton early in the 20th century had already understood the situation of two taxa that present a confusing distributional picture – a puzzle that we have tried to solve by this study more than 80 years later.

The next important step was to give this recognised taxon a name, which was performed by ARTOBOLEVSKII (1929) who formally described the subspecies «*Lestes viridis parvidens*» from the type locality Kikjenjeiz in the Crimea peninsula, Ukraine. From then on, the status of *L. parvidens* for more than half a century was that of a sleeping beauty. European odonatologists probably regarded it as a rather unimportant eastern vicariant of *L. viridis*, with a distribution that ranged approximately from southeastern Europe via the Crimea and the Caucasus into western Asia. However, nobody cared much about the actual distributional limits of this taxon as well as of those of the nominotypic subspecies; both were regarded as meeting somewhere across the Balkans (cf. JÖDICKE 1997: 99). The shape of male appendices superiores was regarded as the main character for the separation of the two taxa (MORTON 1922, ARTOBOLEVSKII 1929), and ST. QUENTIN (1965) assumed a smooth transition in this feature between eastern and western form, as it would have been typical for subspecies. Only in the mid-1980s, the Austrian Gerhard Lehmann detected in some lestid specimens he had collected north of Ravenna, Italy, most surprisingly the typical characters of *parvidens* (cf. SCHNEIDER 1986: 52). Hence, although he never published his records personally, Lehmann brought this taxon back to the attention of European scientists, subsequently activating LOHMANN (1993) to report on the occurrence of «*Chalcolestes viridis parvidens*» in Campania, Italy, and in the Greek Cyclades islands.

After Lehmann's discovery, Carlo Utzeri and co-workers systematically investigated the distribution of both «*Chalcolestes parvidens*» and «*C. viridis*» in Italy, and detected wide areas with syntopic occurrences but without amalgamation, which should not be expected for subspecies (DELL'ANNA et al. 1994, UTZERI et al. 1994b). Although hybrids were detected in one syntopic occurrence near Castel Porziano, Central Italy, both taxa continuously also existed at the same site without alteration. They showed differences in phenology, daily activity and body size that obviously intensified sexual isolation (DELL'ANNA et al. 1996). Besides, electrophoretic analyses revealed a high genetic distance (UTZERI et al. 1994a). From these facts, COBOLLI et al. (1994) concluded that the evolutionary separation between *parvidens* and *viridis* had already advanced to a level that made it possible to regard both as good species. However, contrary to the Italian view, JÖDICKE (1997: 88 ff.) in his monograph on European Lestidae retained the more conservative approach and regarded both taxa as subspecies, but admitted that this was a borderline case. On the other hand, JÖDICKE (1997: 101) already recommended further research on the actual distribution of *parvidens* and *viridis* especially in the Balkans, in order to shed light on the taxonomic situation.

This discussion on the species rank of *parvidens* drew the attention of odonatologists to the probable contact zones in southeastern Europe (e.g. WEIHRACH et al. 2005). In the past few years, a vast number of *L. parvidens* records were taken in the Balkans, as well as in southeastern regions of central Europe, which in part are still unpublished, and are compiled and annotated in this study.

It is demonstrated that, as in Italy and southeastern Europe, there exist wide areas of overlapping ranges. The analysis of the actual distributional situation will furnish further criteria to regard *L. parvidens* and *L. viridis* in future as distinctly separated, good species.

Methods

This study is based on the evaluation of all available information allowing a plausible separation of *Lestes parvidens* and *L. viridis*. With the help of a number of records taken personally and inquiries regarding other hitherto unpublished information from the past 10 years we were able to compile a list of securely documented and verifiable records (see Appendices 1, 2). This list includes the checking of museum specimens from the following collections:

- BMNH Natural History Museum, London, United Kingdom
- DEI Deutsches Entomologisches Institut, Eberswalde, Germany
- NMW Naturhistorisches Museum Wien, Austria
- RMNH Nationaal Natuurhistorisch Museum Naturalis, Leiden, The Netherlands
- ZMHB Zoologisches Museum der Humboldt-Universität Berlin, Germany
- ZSM Zoologische Staatssammlung München, Germany

The separation of *Lestes parvidens* from *L. viridis* and hybrids of the two was based on morphological characters as presented by JÖDICKE (1997: 96) and OLIAS & SERBEDIJA (1998). In males, these features comprised the shape and colour of the appendices superiores in dorsal view, especially the size and situation of the distal tubercle, and the angle and the shape of tips of the appendices inferiores in lateral view (Fig. 1). In females, the discrimination was based on the number of large carinal teeth on the ovipositor in lateral view six to nine in *L. parvidens*, and eight to 14 in *L. viridis* (Fig. 2).

Concerning unpublished observations of the authors or checks of museum specimens, in the text or in the appendices the initials of the authors are given, as follows: MO, FW, MB, NH, MM, AŠ.

All records taken from the literature were checked for their authenticity, and were only considered to be reliable when they contained a distinct note on the differentiation of the two taxa, which usually was not the case prior to the mid-1990s. Even in a fair number of current studies obviously wrong information is given, because some authors inferred the identity of a taxon only by the geographic origin of a specimen, without checking its true identity by examining its morphology. This even includes explicit records of *L. parvidens* or *L. viridis* based only on larval records, although no information on the separation of the two taxa in the larval stadium has hitherto been available.

The area we took into consideration can be regarded as southeastern Europe *sensu lato* and includes the following 18 countries: Albania, Austria, Bosnia-Herzegovina, Bulgaria, Croatia, France (Corsica only), Greece, Hungary, Italy, Macedonia, Moldova, Montenegro, Romania, Serbia, Slovakia, Slovenia, Turkey, and Ukraine.

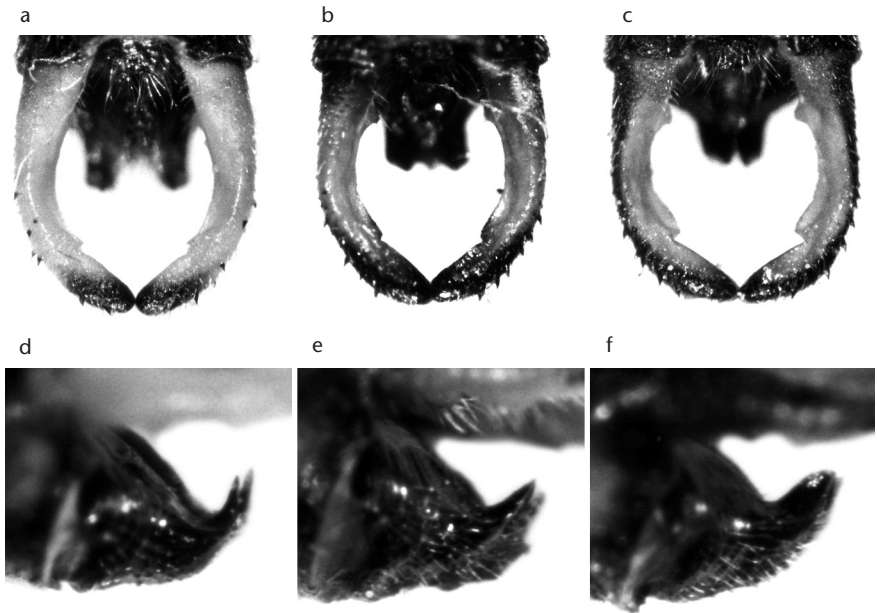


Figure 1: Male appendages of *Lestes parvidens* (a, d), *L. viridis* (c, f) and hybrids of the two (b, e). — Abbildung 1: Männliche Hinterleibsanhänge von *Lestes parvidens* (a, d), *L. viridis* (c, f) und Hybriden der beiden (b, e). a, b, c: appendices superiores in dorsal view / von oben gesehen; d, e, f: appendices inferiores in lateral view / in Seitenansicht.

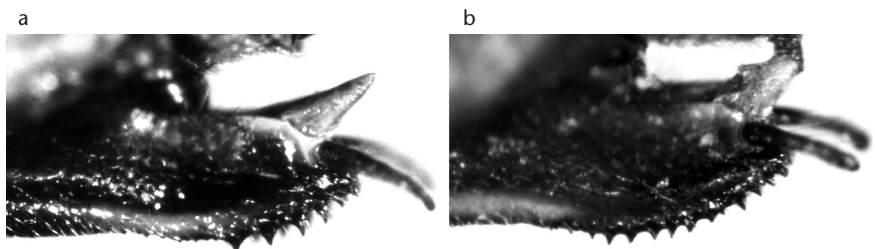


Figure 2: Ovipositor of a typical female *Lestes parvidens* (a) and *L. viridis* (b) in lateral view. — Abbildung 2: Ovipositor eines typischen Weibchens von *Lestes parvidens* (a) und *L. viridis* (b) in Seitenansicht.

Results

Our inquiries yielded secure records of *Lestes parvidens* from 14 European countries (Fig. 3). The state of knowledge in the various countries was highly heterogeneous. Whereas the distribution of *L. parvidens* in the past years was increasingly taken into account in Italy, Slovenia, Greece, and Bulgaria, no information at all was available from Bosnia-Herzegovina, Serbia, Macedonia, and Moldova. Even in countries with a long odonatological tradition like Austria and Hungary the potential occurrence of *L. parvidens* hitherto was almost completely neglected.

The distributional pattern of *L. parvidens* in Europe shows a fragmentary picture of single areas that according to current knowledge seem to be isolated from each other (Fig. 3). The westernmost population is known from the island

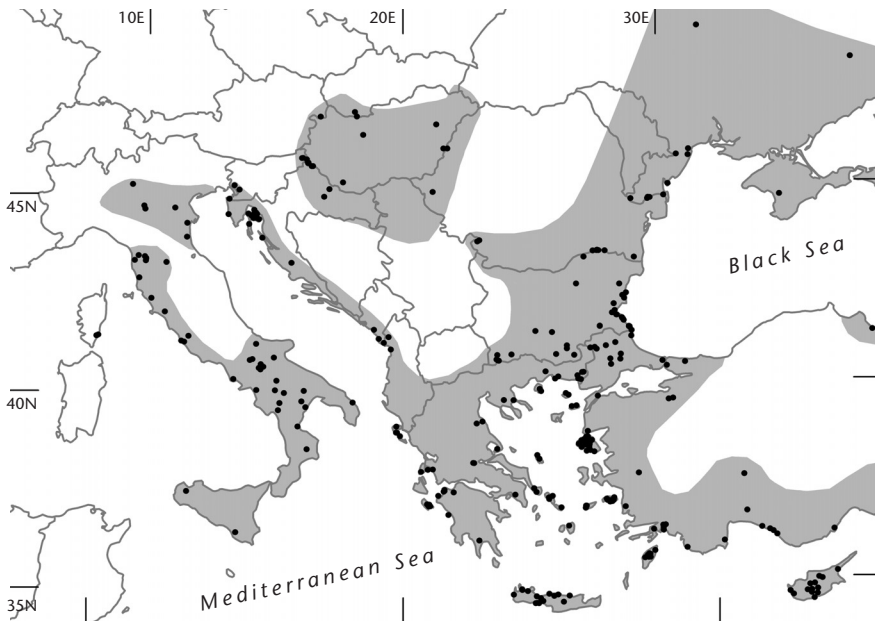


Figure 3: Presently known records of *Lestes parvidens* and hybrids with *L. viridis* in southeastern Europe and adjacent areas. The supposed distribution range of the species is shaded. All localities from Europe and the Aegean islands are listed in Appendix 1. Records for Anatolia are taken from MORTON (1922) and KALKMAN & VAN PELT (2007), and for Cyprus from LOPAU & ADENA (2002). — Abbildung 1: Aktuell bekannte Nachweise von *Lestes parvidens* und Hybriden mit *L. viridis* in Südost-Europa und angrenzenden Regionen. Das angenommene Areal der Art ist grau hinterlegt. Alle Nachweise aus Europa bzw. der Ägäis sind in Appendix 1 aufgelistet. Nachweise aus Anatolien nach MORTON (1922) und KALKMAN & VAN PELT (2007), für Zypern nach LOPAU & ADENA (2002).

of Corsica. In neighbouring Italy, its area reaches along the western coast to the south and probably even to Sicily, although only records of hybrids are known from there by now. In the Adriatic region, the range of *L. parvidens* reaches from the River Po lowlands, the Slovenian Karst and the Istrian peninsula via the Dalmatian coast to Greece, where records focus upon the coastal region and the islands. The Aegean islands and northeastern Greece are the contact zone to Turkey and southern Bulgaria, where it is distributed along the Black Sea coast into Romania and Ukraine. Along the River Danube lowlands *L. parvidens* extends far into the midland, and probably colonised the Pannonian lowlands that way. This distinct, continentally characterised region is separated from the other colonised areas by the mountain ranges of the Alps, the Carpathians, and the Dinarian mountains.

In contrast, our knowledge of the occurrence of *L. viridis* in southeastern Europe is much more incomplete. Unfortunately most older literature sources are not utilisable, and in past years investigations focused more on records of *L. parvidens* than on documenting the occurrence of both species. Hence, satisfying data on *L. viridis* is available probably only for Italy, Slovenia and Bulgaria, whereas for most countries in the Balkans no verifiable information exists. We only have a relatively small number of recent records that seem to show the southern border of the *L. viridis* range reliably (Fig. 4): The southernmost occurrences obviously extend to the extreme south of Europe, in the Greek mainland, Turkish Thrace, and southern Bulgaria.

This short overview of the distribution of both species is now substantiated by annotations on the 18 considered countries. A compilation of all considered records with full references is given in Appendix 1 and 2.

Annotations on the occurrence of *Lestes parvidens* and *L. viridis* in various European countries

France: Corsica

Lestes viridis presumably inhabits the entire island (GRAND & PAPAIZIAN 2000). The first record of *L. parvidens* on the island was published by UTZERI et al. (1994b) from the estuary of River Cavu. GRAND & ROCHÉ (2003) confirmed the presence of *L. parvidens* for River Cavu; however they recorded one male only and noted that all other records during mid-July 2002 on the island pertained to *L. viridis*. According to H.-M. Koch (pers. comm.), at River Cavu both species occur syntopically.

Italy

CONCI & NIELSEN (1956: 68) and CARCHINI et al. (1985) listed only *L. viridis* for the whole country, although MORTON (1922) had already referred to three males from Lazio that resembled the eastern form. The actual occurrence of *L. parvidens* in Italy was first confirmed by the observations of G. Lehmann (in SCHNEIDER 1986: 52) near Ravenna, and later by LOHMANN (1993) near Battipaglia in

Campania. In their large-scale investigation of specimens collected in Italy between 1881 and 1993 and stored in 13 collections, C. Utzeri and co-workers were able to depict a wide distribution of *L. parvidens* in Italy, including a regional co-existence with *L. viridis*: According to UTZERI et al. (1994b), *L. parvidens* occurs in eight regions of peninsular Italy, and as hybrids only in Sicily, whereas *L. viridis* is found in 14 regions of peninsular Italy, in Sicily and Sardinia. Under consideration of further records we were able to detect during this study, *L. parvidens* occurs in 10 regions of peninsular Italy, and as hybrids only in Sicily, whereas *L. viridis* is found in 16 regions of peninsular Italy, in Sicily and Sardinia. The actual distributional picture in Italy is still incomplete, but the basic pattern of the occurrence of both species has become clear:

In peninsular Italy, *L. parvidens* is widely distributed in the southern provinces of Puglia, Basilicata and Campania, its area reaching along the western coast northwards to the River Arno plains in Toscana. The records seem to concentrate in the floodplains of larger rivers like Volturno, Tevere and Ombrone. Further westwards, along the coast of Liguria and in Piemonte, it is obviously absent. Besides, *L. parvidens* inhabits the River Po lowlands in northeastern Italy.



Figure 4: Presently known records of *Lestes viridis* from southern parts of the Balkan peninsula, including hybrids with *L. parvidens*. All localities are listed in Appendix 2. — Abbildung 4: Aktuell bekannte Nachweise von *Lestes viridis* vom südlichen Balkan, einschließlich Hybriden mit *L. parvidens*. Alle Fundorte sind in Appendix 2 aufgelistet.

Recently, it was also recorded at three sites in adjacent Lombardy, northern Italy (FABBRI & PAVESI 2005). These River Po populations are probably isolated, as in the mountainous provinces of eastern central Italy (Abruzzo, Umbria and Marche) only *L. viridis* have been recorded so far. Whether there exists a connection from River Po to the populations at the Slovenian and Croatian Adriatic coast is not known, because the connecting provinces of Veneto and Friuli-Venezia Giulia have not hitherto been sufficiently investigated and have yielded only recent records of *L. viridis* from three localities (FW).

On the other hand, *L. viridis* is widely distributed in almost the entire country, and seems to be missing only in the extreme southeast in Basilicata and southern Puglia. The alpine regions as well as those of the northern and central Appenin seem to harbour exclusively populations of *L. viridis*.

As regards Sicily, according to MORTON (1922) specimens from the British Museum in London showed the characteristics of typical *L. viridis*. There are several documented recording sites of *L. viridis* that concentrate in the eastern and south-eastern part of the island (UTZERI et al. 1994b, BEDJANIČ & ŠALAMUN 1999, coll. BMNH, checked by MB). A secure record of *L. parvidens* from Sicily is still missing, but there exist three males that show the characters of hybrids, originating from Vittòria in the south (UTZERI et al. 1994b), and from Segesta in the northwest (coll. von Rosen in ZSM, checked by FW). Probably the unconfirmed presence of *L. parvidens* in Sicily is just accidental and due to the small number of hitherto checked specimens.

From Sardinia, hitherto only records of *L. viridis* are known (UTZERI et al. 1994b), but the presence of *L. parvidens* cannot be excluded a priori.

Austria

Whereas *L. viridis* is widely distributed in Austria, the occurrence of *L. parvidens* was not seriously taken into consideration until recently (cf. RAAB et al. 2006). Only STARK (1976: 39) wrote, concerning the occurrence of *L. viridis* in Styria and around Lake Neusiedl, «Das vorliegende Material ist der Nominatform zuzuordnen. Die im Untersuchungsgebiet vermutete ostmediterrane Vikariante *Lestes viridis parvidens* Artobolewski (1929) kommt bei uns nicht vor», meaning that from his material he explicitly excluded the possibility of *L. parvidens* occurring in the region.

However, contrary to Stark's assumption, OLIAS (2005) obtained the first Austrian records of *L. parvidens* at a drainage ditch near Pamhagen in Burgenland, close to the border with Hungary. This site pertains to the Fertö/Lake Neusiedl Nature Reserve, being similar climatically and zoogeographically to the steppe lakes of the Pannonian lowlands. At the same site *L. viridis* was recorded, and hybridization was observed. Apart from that record it will not be unexpected to encounter *L. parvidens* at other sites in Burgenland or in southern Styria, where records were taken in adjacent Slovenia at a distance of approximately only 30 km from the Austrian border (MB).

Slovakia

Spot checks of populations in the River Danube floodplain in southwestern Slovakia revealed the syntopic occurrence of *L. parvidens* and *L. viridis* at two sites (OLIAS 2005). Investigations from other parts of the country are not available, but in regions pertaining to the Pannonian lowlands further records of *L. parvidens* can be expected, as an adjunct to the Hungarian populations.

Hungary

The potential existence of *L. parvidens* in Hungary was not taken into account until recently. All hitherto published records of «*Lestes viridis viridis*» are actually not utilisable regarding the information given at the (sub-)specific level. Some of them even pertain to records of larvae, for which it is still impossible to separate *L. parvidens* from *L. viridis*.

OLIAS (2005) deliberately checked the populations at five sites distributed across Hungary, and recorded *L. viridis* at one site in the northwest and *L. parvidens* at four sites in central, southern and eastern Hungary. Two populations in

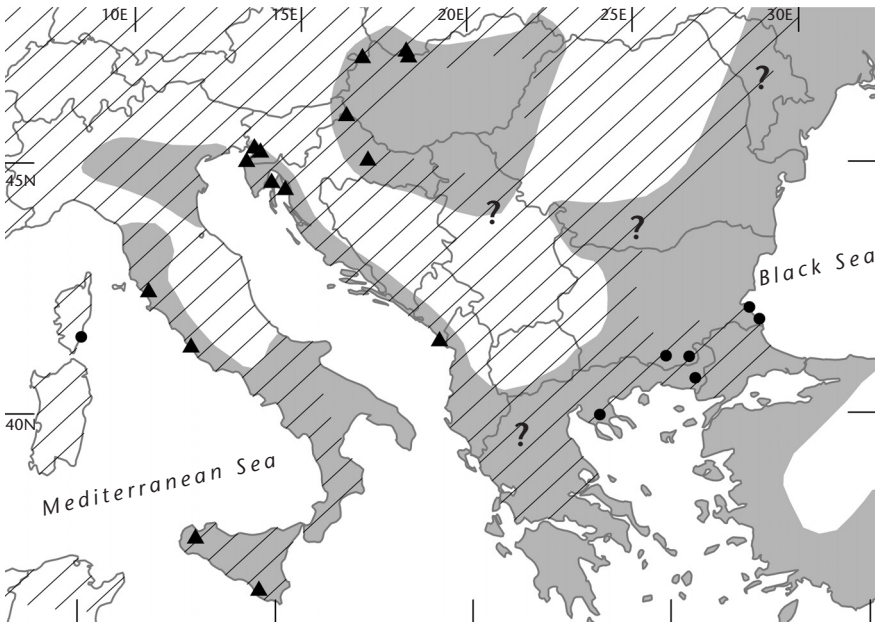


Figure 5: Overlapping ranges of *Lestes parvidens* (shaded) and *L. viridis* (hatched) in south-eastern Europe. — Abbildung 5: Überlappung der Verbreitungsgebiete von *Lestes parvidens* (grau) und *L. viridis* (schraffiert) in Südost-Europa. ● syntopic populations of the spp., syntope Populationen beider Arten; ▲ localities with detected hybridization, Fundorte mit nachgewiesener Hybridisierung; ? areas with a high uncertainty of distribution patterns, Gebiete mit nicht genau bekannten Verbreitungsmustern.

the surroundings of Székesfehérvár und Komádi turned out to be pure *L. parvidens*. Hence, *L. parvidens* seems to be the more frequent species, at least in the pontically influenced Pannonian lowlands, where it probably even is the sole representative of the two species.

A female *L. parvidens*, labelled «Bihar Com Csehkaelera, 5.7.1913», is stored in coll. BMNH (MB). The Comitatus of Bihar, which was formerly situated around Debrecen in the border area of the Pannonian lowlands, covered an area that today pertains to parts of both Hungary and Romania. Hence, this specimen cannot be assigned to one of these countries with certainty.

Slovenia

Due to substantial investigations that were performed only recently, the distributional pattern of both species in Slovenia is quite well known (ŠALAMUN & BEDJANIČ 2005). For *L. viridis* secure records from 33 localities are known that show a wide distribution of the species, from the Adriatic coast via the karst mountains and the foothills of the Alps into the Pannonian region (MB, AŠ).

KOTARAC (1997: 26) was the first to consider the occurrence of *L. parvidens* in Slovenia. As this account consists only of photographs of male appendages of museum specimens from northeastern Slovenia, which meanwhile have unfortunately been lost, there remains some uncertainty concerning their actual specific affiliation and hybridization status. However, the occurrence of *L. parvidens* later was confirmed in this region at five sites, of which two were syntopic with *L. viridis* (MB), and in one also hybrids were found. These records are from the River Mura floodplain, an extension of the Pannonian lowlands near the borders to Hungary and Croatia. Besides, *L. parvidens* was found at four sites at the Slovenian Adriatic coast and the adjacent karst plateau, in at least two cases being syntopic with *L. viridis* (AŠ), also with an indication of hybridization. These populations are the hitherto northernmost on the Adriatic coast.

In the central part of Slovenia only *L. viridis* has been recorded so far; so there obviously exist two separated areas of *L. parvidens*, in the Adriatic and in the Pannonian region.

Croatia

The first Croatian record of *L. parvidens* was taken 1996 in the Krka River National Park in Dalmatia (FRANKOVIĆ 1997a). Later the species was recorded at various sites on the Adriatic coast: near Rovinj in the Istrian peninsula (FW), and in the islands of Krk, Cres, and Pag (OLIAS & SERBEDIJA 1998, MB, MO). Further records derive from the Pannonian region in northern Croatia (OLIAS 2005, PEROVIĆ & PEROVIĆ 2007), probably pointing to two areas of distribution that are separated by the Dinaric mountains.

On the other hand, *L. viridis* occurs regularly in northern and central Croatia, e.g. as the sole species in the environs of Zagreb (M. Franković, pers. comm.), and is regarded as common in the Pannonian region along River Drava (BOGDANOVIĆ 2001). Secure evidence however derives also from the entire coastal

region as far as southern Dalmatia. There it was recorded at the Dubrovačka Rijeka, and at small lakes with marshy vegetation in the Konavli area and in the island of Mljet (ADAMOVIĆ 1967; these records were re-examined later by ADAMOVIĆ 1996). FRANKOVIĆ (1997b) recorded *L. viridis* in the island of Cres, but the specimens he referred to actually pertained to hybrids with *L. parvidens* (M. Franković, pers. comm.). Seen locally, *L. viridis* may be significantly less abundant than *L. parvidens*. A thorough survey in the island of Krk revealed 14 sites for *L. parvidens*, compared to only one for *L. viridis*. At this recording site, a small river, both species occurred syntopically and also produced hybrids. In contrast, all other waters of the island revealed pure populations of *L. parvidens*, without any clue for a possible hybridization (OLIAS & SERBEDIJA 1998).

Bosnia-Herzegovina

No information is available.

Serbia

No information is available. However, the occurrence of *L. parvidens* in southwestern Romania around Timișoara (C.-O. Manci, pers. comm.) and at the Danube River (MO) points to the likelihood that it also occurs at least in the adjacent Serbian Banat region.

Montenegro

ADAMOVIĆ (1996) recorded *L. parvidens* near Donji Štoj in the vicinity of Lake Skadar. Two more records derive from the environs of Ulcinj and Virpazar (coll. von Rosen and coll. Seidenbusch in ZSM, checked by FW). The Ulcinj individuals show some characteristics of hybridization. In addition, so far only the occurrence of *L. parvidens* has been documented in Montenegro, but all information pertains to a small region near Lake Skadar only, close to the Mediterranean coast. The occurrence of *L. viridis* in the mountainous regions of the inland is quite likely but hitherto lacking evidence.

Macedonia

No information is available, but the presence of both species is likely. The closest recording sites of both species are situated approximately only 25 km from the Macedonian border: *Lestes parvidens* in the Pirin mountains in Bulgaria (MM), and *L. viridis* in Albania (BILEK 1966).

Albania

There are only few current, utilisable records; however both species are documented for Albania. KALKMAN (2000) was the first to publish a record of *L. parvidens* for the country, from the Drin delta in northern Albania, and another specimen in coll. NMW originated from the Lake Skadar region. Concerning *L. viridis*, the record of a female was listed by BILEK (1966). The specimen concerned is stored in coll. DEI, and a recent check actually proved this identity (MO).

Greece

Contrary to most other countries, the occurrence of *L. parvidens* in Greece has been taken into consideration for quite some time already. BATTIN (1989) added his material from the island of Crete on the species without exception, and LOHMANN (1993) documented its presence in the island of Andros in the Cyclades. Later, LOPAU & WENDLER (1995: 86) assumed that *L. parvidens* occurs in Greece as the sole representative of the two species.

Secure records that have been documented so far reveal a wide distribution of *L. parvidens* on the coastal mainland of Greece, and especially in the Greek islands. On the mainland, only scattered records derive from the provinces of western and central Greece, Thessaly, and Attica (LOPAU 1999a, 2000, 2005, VAN PELT 1999). A few more records originate from the island of Evia and the Peloponnese (LOPAU 1999a, b, c, BREUER et al. 2000). Conspicuously many records are from northeastern Greece, i.e. the Chalcidice peninsula and the province Thrace, that merge with the populations of Turkish Thrace and of the Bulgarian Rhodope mountains (SCHNAPAUFF et al. 1996, LOPAU 1999c, GREBE et al. 2005, OLIAS & GÜNTHER 2005). In contrast, the total absence of records from the inland of northwestern Greece is striking, as this region can be regarded as odonatologically sufficiently investigated. This was already noted by LOPAU & WENDLER (1995: 86) who assumed that the paucity of records may be caused by the cryptic lifestyle of these lestids. However, on the Greek mainland records of *L. parvidens* concentrate in the immediate vicinity of the coast and on the coastal floodplains of larger rivers. In contrast, almost no information is available from the mountainous inland, especially in the northwest.

Most Greek records of *L. parvidens* however originate in the well-investigated islands. In the Ionean Sea the species was recorded from Corfu, Lefkada and Zakynthos (LOPAU 1999c, 2006a). In the Aegean Sea it inhabits the islands of Thasos, Samothrace, Kos, Lesbos, Skiros, Rhodes, Naxos, Tenos, Samos and Andros (LOHMANN 1993, LOPAU 1995a, b, 1996a, 1999c, 2004, 2005, 2006b, STOBBE 1995, HOESS et al. 1999, KOHL 1999, VAN PELT 1999, HOCHBNER et al. 2000), and there are also numerous localities with records of the species in Crete (BATTIN 1989, LOPAU 1996b, 1999c, 2000).

The potential occurrence of *L. viridis* in Greece was not taken into consideration until recently, because this seemed to be impossible by the species' zoogeography, and became likely only with Bulgarian records that were taken close to the Greek border (MARINOV 1999). The first secure Greek record of *L. viridis* however does not originate in that region, but was taken at a mountain stream in the Chalcidice peninsula, where this species was found syntopically with *L. parvidens* (OLIAS & GÜNTHER 2005). In 2006 *L. viridis* was confirmed at the same locality by W. Lopau (pers. comm.), who also discovered another syntopic occurrence in the extreme northeast of Greece at River Megálo Réma near Dadiá. A third record originates from the southern Pindos mountains in central Greece (coll. RMNH). Hence, further records of *L. viridis* in the mountainous regions of the entire Greek mainland seem likely.

Turkey

Lestes parvidens is distributed locally in Turkey, being recorded along the Mediterranean coast of Anatolia and in the environs of Istanbul as well as in the European part of Turkey, Turkish Thrace (MORTON 1922, KALKMAN & VAN PELT 2007). Until recently, all Turkish records were attributed to *L. parvidens* simply on geographic grounds. However, due to recent records in neighbouring Bulgaria, *L. viridis* was then regarded as likely to occur in Turkey, pending confirmation by vouchers (KALKMAN et al. 2003). One of the Bulgarian recording sites of *L. viridis*, near Ahtopol in the Istranca mountains (MM), is only 15 km north of the Turkish border.

Older records from the Turkish Thrace region that had been published as pertaining to *L. viridis* by HAVZA & AKTAÇ (1987) and HACET & AKTAÇ (1997) were reviewed recently by HACET & AKTAÇ (2004) and attributed to *L. parvidens* without exception. HACET & AKTAÇ (2004) doubted the true identity of only one male and three female specimens from three recording sites, although they regarded their morphological characteristics as being within the range of variation of *L. parvidens*. We re-checked these four critical specimens and concluded that at least the male is beyond doubt a typical specimen of *L. viridis*, hence providing the first secure record of the species for Turkey. The locality concerned is close to the Marmara Sea in southern Thrace. The actual status of the three females remains unclear, as the number of carinal teeth on the ovipositor in lateral view is nine to 12, which may be in the range of variation of both species or pertain to hybrids. However, it is highly probable that, at least the specimen with 12 teeth, originating from a site in central Thrace, can be regarded as *L. viridis*. With the exception of that female, we refer in our compilation of records only to those sites that are associated with securely determined males. HACET & AKTAÇ (2004) list for *L. parvidens* four more localities that are not included in our list due to uncertainty regarding their actual specific affiliation. It cannot be excluded that at some sites in Turkish Thrace both species occur syntopically, as they do in neighbouring Bulgaria.

Bulgaria

MARINOV (1999) compiled the hitherto known records of both species for Bulgaria. Since then, several new observations have been added to the Bulgarian list, which specify the known distributional pattern: Records of *L. parvidens* derive chiefly from the eastern and southern part of the country. They are distinctly concentrated along the Black Sea coast and in the Danube floodplain, in the border region to Romania. Besides, *L. parvidens* was recorded in the Pirin mountains close to the Greek and Macedonian border (MM). For *L. viridis* there exist only a few Bulgarian records from eight sites around Ahtopol in the Istranca mountains (MM) and from the Rhodope mountains (MM); obviously the species is rare in Bulgaria and occurs only locally.

While the distribution is clear in the odonatologically well researched east and south of Bulgaria, no utilisable observations are available for the north-

west of the country where no intensive fieldwork has been done so far. Hence it is still unknown whether further populations of *L. viridis* occur in the Balkan mountains, or how far *L. parvidens* penetrates into central Bulgaria. However, a wider distribution of *L. parvidens* than hitherto known must be expected generally, especially in the Danube plains and surrounding regions.

Romania

Little information is available; however both species have been reliably documented for Romania. The first record of *L. parvidens*, published by OLIAS (2005), originated near Salonta in western Romania, close to the Hungarian border. Another *L. parvidens* specimen, originating from the Danube floodplain near the Bulgarian border, is stored in coll. NMW (checked by MO). MANCI (2005, 2006), lacking information on the separation of the species at that time, published recent records of *L. viridis* from Timișoara and River Mureș near Arad, in southwestern Romania. These records pertain to typical *L. parvidens* (C.-O. Manci, pers. comm.), and a recent check of a population near Timișoara confirmed the occurrence of *L. parvidens* in that region (MO, O. Brauner). *Lestes parvidens* probably inhabits the whole of southern Romania, whereas *L. viridis* obviously seems to be absent there (C.-O. Manci, pers. comm.).

On the other hand, the first secure record of *L. viridis* for Romania was obtained only in 2007. A pure population of the species was found at a tributary of the Danube near the "Iron Gate", in the Banat mountains of southwestern Romania (MO et al.). Probably *L. viridis* has a wider distribution in the mountainous parts of central, northern and eastern Romania.

Moldova

No information is available. DYATLOVA (2005: 93) recorded *L. parvidens* only a few kilometers away from the Moldovan border in adjacent Ukraine.

Ukraine

After the description of *L. parvidens* by ARTOBOLEVSKII (1929) from the type locality in the Crimea peninsula, there were no further published records from Ukraine until GORB & ERMOLENKO (1996) recorded the species in the Danube delta (Odessa district, SW Ukraine). They assumed that *L. parvidens* occurred in the entire coastal region of the Black Sea and in the Crimea. This was confirmed later by DYATLOVA (2005: 93), who recorded it at seven more sites in the Odessa district, including one situated close to the Moldovan border, and MATUSHKINA (2006), who lists three specimens from Tataru island in the Danube delta.

Meanwhile the occurrence of *L. parvidens* has also been documented for central (Tscherkasy district; MATUSHKINA 2004), northeastern (KHROKALO & SHESHURAK 2006) and southeastern Ukraine (Donezk district; MARTYNOV & MARTYNOV 2004). Therefore it is assumed that *L. parvidens* has a far wider distribution in Ukraine than hitherto known, not only in the Black Sea region, but also in the steppe regions of the country.

Apart from *L. parvidens*, GORB et al. (2000) list also *L. viridis* for Ukraine, referring to records from western Ukraine in the Carpathian mountains and from the L'viv region. However, these records are only literature records prior to 1990 that cannot be accepted as credible in this regard. Hence, the actual occurrence of *L. viridis* in Ukraine still awaits confirmation. However, MATUSHKINA (2006) provides drawings of the structure of the female ovipositor in three specimens of Ukrainian origin, and discusses potential intermediate features. One drawing shows an ovipositor with ten carinal teeth, which is within the range of *L. viridis*.

Discussion

Overlap of ranges and hybridization

The European ranges of *Lestes parvidens* and *L. viridis* overlap across wide areas of Italy, the Balkans and southeastern regions of central Europe (Fig. 5). The area boundaries of both species are still highly uncertain in the southern and eastern Balkans, especially in northern Greece, in northern Serbia, and east of the Carpathian mountains in Romania and further to the north. Hence, the ranges shown in Figure 5 can give only an approximate idea of the actual distribution.

Where the species' ranges overlap, numerous records of syntopic occurrences support the fact that both species are able to exist in the same habitats. Hybridization is likely to occur wherever there are syntopic occurrences. Missing evidence of hybridization in Greece and Bulgaria is probably due to the absence of investigations. The backcross of hybrids with their parent species is possible and supported by the appearance of F-n hybrids in Italian and Croatian populations (DELL'ANNA et al. 1996, 1999, OLIAS & SERBEDIJA 1998).

Are there ecological and biological differences?

Very few clues exist to suggest that *L. parvidens* and *L. viridis* occupy different ecological niches. In Italy both species were recorded at running waters as well as standing waters. The syntopic occurrences near Rome pertained to «plain forest ponds», whereas *L. parvidens* also colonised surrounding temporary waters there (COBOLLI et al. 1994). In the Adriatic island of Krk *L. parvidens* inhabited a wide range of running and standing waters, both temporary and permanent, whereas *L. viridis* was recorded only at a brook (OLIAS & SERBEDIJA 1998). Probably the choice of the breeding habitat mirrors the general tolerance of the species concerning either moist and cool or hot and dry climatic conditions. This would mean that *L. viridis* further to the south increasingly prefers thermostable, cooler habitats such as streams and rivulets. In contrast, *L. parvidens* obviously prefers very warm waters, sometimes of a temporary nature, which restricts its occurrence further to the north and with increasing altitude.

Both species are specialised to oviposit in lignified plant tissue and hence depend on wood near the water margin. Oviposition in non-woody plants is an exception (JÖDICKE 1997: 101 f). However, there are clues that egg development in non-woody plants is occasionally possible: In a Greek river estuary LOPAU (1996a) found numerous newly emerged *L. parvidens* on *Bolboschoenus maritimus*, which he assumed to be the plant for oviposition because wood was absent from the vicinity. In the Greek islands of Corfu and Zakynthos LOPAU (2006a) observed also numerous emergences at four waters without woody plants on their banks, and later noted several ovipositions in *Schoenoplectus*. These observations however must not be taken as evidence for a higher tolerance of *L. parvidens* with regard to herbaceous plants for oviposition. Contrary to other Lestidae, the ovipositors of both species are clearly adapted to penetrate woody plants. The carina carries only a small number of strong, large teeth to serrate the bark prior to egg deposition. These carinal teeth are even more reduced and coarser in *L. parvidens*, for which reason the ovipositor seems to be even more suited for oviposition in wood. Most probably, the behaviour observed by LOPAU (1996a) represents the use of a suboptimal oviposition substrate in the absence of a better alternative.

Phenological differences are known from two syntopic populations, near Castel Porziano in Italy (UTZERI et al. 1995), and in the Adriatic island Krk (OLIAS & SERBEDIJA 1998). In Castel Porziano the emergence of *L. parvidens* began in late May, four weeks earlier than that of *L. viridis*. On the other hand, the maturation period of *L. parvidens* took eight weeks and was much longer than that of *L. viridis* which was only five weeks. On the island of Krk the emergence of *L. parvidens* also started late in May, at least one month earlier than that of *L. viridis*, which was not seen before July. However, both species were then seen at their reproductive sites synchronously in August, for which reason the maturation period of *L. viridis* must also have been distinctly shorter. Besides, UTZERI et al. (1995) recorded a difference in the daily activity of both species when occurring syntopically: *Lestes parvidens* reached its activity peak at 12:00 h, but *L. viridis* in the afternoon at 14:00 h. Comparable studies from other populations are not available.

Finally, there exist also morphological differences in syntopic populations. UTZERI et al. (1995) determined the overall and the forewing lengths of both species, and found significant differences: When occurring syntopically, *L. viridis* was significantly larger than *L. parvidens*. OLIAS & SERBEDIJA (1998) measured the forewing lengths in syntopic and pure populations in Krk, and obtained the same result.

Consequences for the taxonomic status

The taxonomic status of *L. parvidens* and *L. viridis* cannot be determined with certainty using the conventional biological species concept of MAYR (1942). The overlapping of ranges and the differences in morphology and biology support

the status of separate species, whereas F-n hybrids substantiate a gene flow between the taxa and the backcrossing of hybrids with parental forms. Hence, *L. parvidens* and *L. viridis* seem to form a borderline case that will not fit easily into traditional taxonomic categories. However, we are firmly convinced that the morphological, genetic and biological features clearly favour the status of *L. parvidens* as a separate species. Our results concerning the distribution and the overlapping of ranges in southeastern Europe substantiate this point of view using chorological criteria.

Genetic analyses from both syntopic and allotopic populations near Rome, Italy, have confirmed differences in eight diagnostic loci and an average genetic distance between the two taxa at a specific level, even higher than in the clearly separated species *L. barbarus* and *L. virens* (COBOLLI et al. 1994, UTZERI et al. 1994a, DELL'ANNA et al. 1994, 1999). For that reason, even though they are prone to intercrossing, the populations investigated retain deeply differentiated genetic structures that are explicable only by reproductive barriers (UTZERI et al. 1994a). COBOLLI et al. (1994) justify the species rank of *L. parvidens* with these morphological, biological and genetic differences found in Italy. In spite of these arguments, until today this point of view has not become widely accepted, inter alia because corresponding studies from other contact areas have been missing (cf. JÖDICKE 1997: 99).

Our review of the hitherto inadequately known distribution of both taxa in southeastern Europe corroborates the Italian results for a much larger area. *Lestes parvidens* and *L. viridis* have established basically sympatric forms, which overlap at their borders. Hybrids may appear in practically all contact zones. However, their proportion within the populations seems to be marginal in as much as the two forms never will merge completely in a population. So far, large numbers of individuals have been studied only in few mixed populations (UTZERI et al. 1995, OLIAS & SERBEDIJA 1998, OLIAS 2005), but always with the result that parental forms prevailed, along with probable hybrids. No case of a complete intermixture has been encountered so far. Therefore in the entire contact area there obviously exists a reproductive separation that prevents uninhibited gene flow between both taxa. We do not know yet which mechanisms have been established concerning a partial reproductive isolation, but they clearly must exist.

As a mechanism of species identification chiefly the identification of the conspecific male by the female during copula can be considered. The clear differences in the morphology of male appendages notwithstanding, this mechanism is not yet sufficiently differentiated in *L. parvidens* and *L. viridis* to prevent heterospecific copulations. In this context the different daily activity times recorded by UTZERI et al. (1995) may reinforce reproductive isolation in syntopic populations. In addition, the significant differences in size recorded by DELL'ANNA et al. (1996) and OLIAS & SERBEDIJA (1998) in syntopic populations will reduce the probability of heterospecific copulation. These adaptations also may serve as

evidence for the long coexistence of both taxa at the studied localities, which led to the local development of relevant adjustments. Not yet known is whether hybrids possess reduced fertility that would reduce the proportion of backcrosses with parental forms. But without doubt the gene flow between *L. parvidens* and *L. viridis* is restricted to a level that has not diminished their genetic integrity. They have passed a «point of no return» (cf. PETERS 1998) in their speciation process, which results in an irreversible state of autonomy and self-preservation as distinct species.

Hence, in practice *L. parvidens* and *L. viridis* have to be regarded as well defined species in future. Their separation is even possible in the field, e.g. by reference to JÖDICKE (1997) or DIJKSTRA & LEWINGTON (2006). Hybrids may present problems of classification, but then individuals of the parent species should be present in each case. In conclusion, our study has left enough open questions for future odonatological research, especially at localities where *L. parvidens* and *L. viridis* occur syntopically, but also concerning the determination of actual distribution ranges on a finer, regional scale.

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Appendix 1: Compilation of documented, secure European records of *Lestes parvidens*, including hybrids with *L. viridis*. AŠ, FW, MB, MM, MO = initials of authors. For museum acronyms see text.

France: Corsica

- 41°41'N 09°19'E Lecci-di-Porto-Vecchio, pond near l'Ovu Santo (GRAND & ROCHÉ 2003)
 41°42'N 09°23'E Cavu River, estuary; syntopic with *L. viridis* (UTZERI et al. 1994b, H.-M. Koch, pers. comm.)

Italy: peninsular Italy

- 39°09'N 16°46'E Cotronei (Crotone), Neto River (D'ANTONIO 1996b)
 39°44'N 16°26'E Sibari (Cosenza) (UTZERI et al. 1994b)
 40°07'N 15°45'E Lagonegro (Potenza), Sirino Lake (D'ANTONIO 1994a)
 40°13'N 16°40'E Policoro (Matera), Agri River (D'ANTONIO 1994a)
 40°19'N 15°47'E Tramutola (Potenza), Agri River (D'ANTONIO 1994a)
 40°23'N 16°32'E Pisticci (Matera), Cavone River (D'ANTONIO 1994a)
 40°23'N 18°17'E San Cataldo (Lecce) (UTZERI et al. 1994b)
 40°35'N 15°55'E Brindisi Montagna (Potenza), Basento River (D'ANTONIO 1994a)
 40°36'N 14°58'E Battipaglia (Salerno), Sele River (LOHMANN 1993)
 40°38'N 15°37'E Picerno (Potenza), Picerno Rivulet (D'ANTONIO 1994a)
 40°39'N 16°36'E Matera, Bradano River (D'ANTONIO 1994a)
 40°52'N 14°10'E Naples, Astroni Crater (D'ANTONIO 1996a)
 40°52'N 15°39'E Atella (Potenza), Atella Rivulet (D'ANTONIO 1994a)
 41°09'N 15°05'E Ariano Irpino (Avellino), Ufita River (D'ANTONIO 1995)
 41°11'N 15°01'E Montecalvo Irpino (Avellino), Miscano River (D'ANTONIO 1995)
 41°13'N 15°10'E Savignano Irpino (Avellino), Cervaro Rivulet (D'ANTONIO 1995)
 41°17'N 15°05'E Castelfranco in Miscano (Benevento), Miscano River (D'ANTONIO 1995)
 41°23'N 14°42'E Montagna di San Giorgio (Benevento), reservoir (D'ANTONIO 1995)
 41°24'N 14°47'E Castelpagano (Benevento) (D'ANTONIO 1995)
 41°28'N 15°32'E Foggia (UTZERI et al. 1994b)
 41°44'N 12°23'E Castel Porziano (Roma), ponds; syntopic with *L. viridis*, hybridization (UTZERI et al. 1994b)
 41°45'N 12°17'E Ostia (Roma) (UTZERI et al. 1994b)
 41°48'N 14°53'E Larino (Campobasso) (UTZERI et al. 1994b)
 41°53'N 12°30'E Rome (UTZERI et al. 1994b)
 42°27'N 11°40'E Canino (Viterbo), Fiora River (D'ANTONIO 1994b)
 42°46'N 11°06'E Baccinello (Grosseto); possible hybrid male (UTZERI et al. 1994b)
 43°16'N 10°36'E Bibbona (Livorno) (UTZERI et al. 1994b)
 43°42'N 10°23'E Tozzo ab Lago (Pisa); 1 ♂, 14-x-1934, in coll. NMW; checked by MO
 43°43'N 10°47'E Padule di Fucecchio (Pistoia), Lake Sibolla, ditch (UTZERI et al. 1994b, TERZANI & CARFI 1999)
 43°44'N 11°31'E Vallombrosa (Firenze) (UTZERI et al. 1994b)
 43°50'N 10°30'E Lucca, Sibilla Lake (UTZERI et al. 1994b)
 43°50'N 10°44'E Ponte Buggianese (Pistoia), Stanghe River (TERZANI & CARFI 1999)
 43°57'N 11°20'E Larciano (Pistoia), Bosco di Chiusi, Paduletta di Ramone (TERZANI & CARFI 1999)
 44°25'N 12°12'E Ravenna (SCHNEIDER 1986, LOHMANN 1993)
 44°47'N 12°09'E Pineta di S. Vitale (Ravenna) (TERZANI et al. 1994)
 45°03'N 10°35'E Gazzuolo (Mantova), ditch at Nature Reserve "Torbiere di Belforte" (FABBRI & PAVESI (2005)
 45°07'N 10°32'E Marcaria (Mantova), Canicossa, little swamp at Oglio River (FABBRI & PAVESI (2005)
 45°09'N 11°40'E Villa Estense (Padova) (UTZERI et al. 1994b)
 45°39'N 10°02'E Provaglio d'Iseo (Brescia), Nature Reserve "Torbiere del Sebino" (FABBRI & PAVESI (2005)

Italy: Sicily

- 37°55'N 12°50'E Álcamo (Trapani), rivulet near Segesta; 2 ♂, G. von Rosen leg., 16-viii-1976, in coll. ZSM; hybrid specimens, checked by FW
 36°57'N 14°32'E Vittoria (Ragusa); possible hybrid male (UTZERI et al. 1994b)

Austria

47°43'N 16°53'E Pamhagen (Burgenland), drainage ditch; syntopic with *L. viridis*, hybridization (OLIAS 2005)

Slovakia

47°45'N 18°15'E Komárno, Danube River oxbow near Iža; syntopic with *L. viridis*, hybridization (OLIAS 2005)

47°52'N 18°10'E Hurbanovo, Žitava River; syntopic with *L. viridis*, hybridization (OLIAS 2005)

Slovenia

45°29'N 13°37'E Piran, Sečovlje (ŠALAMUN & BEDJANIČ 2005)

45°32'N 13°37'E Piran, Strunjan, channel of Borgola rivulet at road to Borgolo; syntopic with *L. viridis*, hybridization (ŠALAMUN & BEDJANIČ 2005)

45°44'N 13°56'E Majcni village N of Štorje, karst pond; hybridization, 2007 AŠ

45°47'N 13°45'E Kregolišče village S of Komen, karst pond; syntopic with *L. viridis*, hybridization, 2007 AŠ

46°31'N 16°28'E Petišovci, oxbow of Mura River N of lake Petišovsko jezero (ŠALAMUN & BEDJANIČ 2005)

46°32'N 16°27'E Petišovci, oxbow Kapitany lap; syntopic with *L. viridis*, hybridization (ŠALAMUN & BEDJANIČ 2005)

46°36'N 16°25'E Mostje, gravel pit in Črni log, 500 m SW of Banuta (ŠALAMUN & BEDJANIČ 2005)

46°38'N 16°14'E Lipovci, gravel pit Vučja jama S (ŠALAMUN & BEDJANIČ 2005)

46°39'N 16°15'E Gančani, gravel pit Nova Graba 800 m SSE of Šadlov mlin (ŠALAMUN & BEDJANIČ 2005)

Hungary

46°02'N 17°42'E Szigetvár, fishponds (OLIAS 2005)

46°55'N 21°31'E Komádi, fishponds (OLIAS 2005)

47°16'N 18°30'E Székesfehérvár, reservoir near Pátka (OLIAS 2005)

47°33'N 21°16'E Nagyhegyes, fishpond near Elep (OLIAS 2005)

Croatia

43°54'N 15°58'E Krka River National Park (Dalmatia) (FRANKOVIĆ 1997a)

44°32'N 14°54'E Novalja (Pag Island), stream Vrulja 5 km S, MB

44°52'N 14°22'E Cres Island, Lake Vransko Jezero; 1 ♂, 15-vi-2005, MO leg.

44°59'N 14°42'E Baška Draga (Krk Island), rivulet Vela Rika; syntopic with *L. viridis*, hybridization (OLIAS & SERBEDIJA 1998)

45°01'N 14°37'E Punat (Krk Island), ponds (OLIAS & SERBEDIJA 1998)

45°02'N 14°34'E Krk (Krk Island), ponds (OLIAS & SERBEDIJA 1998)

45°04'N 14°27'E Milohnič (Krk Island), pond (OLIAS & SERBEDIJA 1998)

45°04'N 14°33'E Lake Ponikve (Krk Island) (OLIAS & SERBEDIJA 1998)

45°05'N 13°39'E Rovinj (Istria), Lake Palud; 2 ♂, 2 ♀, 13-ix-2002, FW leg., 24-ix-2004, FW

45°08'N 14°34'E Sužan (Krk Island), ponds (OLIAS & SERBEDIJA 1998)

45°08'N 14°35'E Dobrinj (Krk Island), rivulet Veli Potok (OLIAS & SERBEDIJA 1998)

45°08'N 14°39'E Šilo (Krk Island), ponds (OLIAS & SERBEDIJA 1998)

45°09'N 14°21'E Beli (Cres Island), pond (FRANKOVIĆ 1997b); hybrid specimens (M. Franković, pers. comm.)

45°09'N 14°36'E Čižići (Krk Island), ponds (OLIAS & SERBEDIJA 1998)

45°10'N 14°33'E Njivice (Krk Island), Lake Jezero (OLIAS & SERBEDIJA 1998)

45°12'N 14°33'E Omišalj (Krk Island), ponds (OLIAS & SERBEDIJA 1998)

45°39'N 17°06'E Grubišno Polje (Slavonia), fishponds near Veliki Zdenci; hybridization (OLIAS 2005)

45°51'N 17°17'E Špišić-Bukovica (Slavonia), reservoir (OLIAS 2005)

46°26'N 16°36'E Muršćak near Domašinec (Međimurje), pond (PEROVIĆ & PEROVIĆ 2007)

46°26'N 16°39'E Bara Fučička near D. Hrašćan (Međimurje), old oxbow of Mura River (PEROVIĆ & PEROVIĆ 2007)

46°30'N 16°28'E Peklenica near Križovec (Međimurje) (PEROVIĆ & PEROVIĆ 2007)

Montenegro

41°55'N 19°13'E Ulcinj, rivulet 10 km N; 7 ♂, 6 ♀, viii-1990, R. Seidenbusch leg., in coll. ZSM; hybrid specimens, checked by FW

41°55'N 19°21'E Ulcinj, Donji Štoj (ADAMOVIĆ 1996)

42°15'N 18°59'E Virpazar, Oranouska River; 1 ♂, 7-viii-1979, G. von Rosen leg., in coll. ZSM; checked by FW

Romania

43°53'N 28°18'E Comana (Constanța); 1 ♂, x-1902, A.L. Montandon leg., in coll. NMW; checked by MO

(Romania)

- 44°30'N 22°42'E Ostrovu Cordului, oxbow of Danube River O; 2 ♂, 2 exuviae, 16-vii-2007, MO, O. Brauner
 44°32'N 22°46'E Hinova, oxbow of Danube River SW; 10 ♂/♀, 16-vii-2007, MO, O. Brauner
 46°55'N 21°40'E Salonta, fishponds near Cefa (OLIAS 2005)
 44°30'N 22°42'E Timișoara, 10 km NW, Niarad River; 1 ♂, 21- vii-2007, MO, O. Brauner

Ukraine

- 45°04'N 33°48'E Skvorzovo, Simferopolskij district (MARTYNOV & MARTYNOV 2004)
 45°21'N 28°59'E Ismail, Ismailskij district, Lake Malij Tataru (DYATLOVA 2005)
 45°22'N 29°04'E Ismail, Ismailskij district, Lake Malij Daller (DYATLOVA 2005)
 45°23'N 28°17'E Nagornoje, Reniskij district (DYATLOVA 2005)
 45°23'N 29°00'E Kisliza, Kilijskij district (DYATLOVA 2005)
 45°24'N 29°35'E Vilkovo, Kilijskij district (GORB & ERMOLENKO 1996, GORB et al. 2000)
 45°41'N 29°47'E Primorskoje, Kilijskij district (GORB & ERMOLENKO 1996, GORB et al. 2000)
 46°22'N 30°38'E Prilimanskoje, Ovidiopolskij district, Suchyi Lyman (DYATLOVA 2005)
 46°25'N 30°12'E Majaki, Beljajevskij district (DYATLOVA 2005)
 46°31'N 30°40'E Usatovo, Beljajevskij district (DYATLOVA 2005)
 48°18'N 37°15'E Dimitrov, Schachterskij district (MARTYNOV & MARTYNOV 2004)
 49°42'N 31°32'E Pekari, Kanevskij district (MATUSHKINA 2004)

Bulgaria

- 41°25'N 23°20'E Marikostenovo, Struma River at road to Petrich; 23-vii-1999, MM, B. Grebe
 41°26'N 23°18'E Novo Konomladi, gravel pit by the downstream of Melnishka River; 15-vii-2003, MM, N. Dilchev, A. McGeeney, D. Smallshire; 03-viii-2004, MM, S. Beshkov; 14-vi-2005, MM; 26-vii-2005, 23-vii-2006, MM, S. Beshkov, D. Powell
 41°27'N 23°15'E Rupite, fish-farms near "Rupite" area (MARINOV 1999)
 41°27'N 23°15'E Rupite, canal N from "Rupite" area; 28-vii-1997, MM, S. Beshkov, N. Dilchev
 41°29'N 25°57'E Zhelezino, artificial lake; syntopic with *L. viridis*; 04-vii-2004, MM, S. Beshkov, D. Smallshire; 29-vi-2005, MM, S. Beshkov, A. McGeeney; 22-vii-2005, 19-vii-2006, MM, S. Beshkov, D. Powell
 41°32'N 25°19'E Plazishte, floods of a stream; syntopic with *L. viridis*; 01-vii-2005, MM, S. Beshkov, A. McGeeney; 23-vii-2005, 20-vii-2006, MM, S. Beshkov, D. Powell leg.
 41°34'N 23°17'E Sandanski, Bistritsa River (MARINOV 1999)
 41°34'N 23°46'E Gotse Delchev, Mesta River and artificial lake at road to Dospat; 1 ♀, 10-viii-2002, N. Simov leg.
 41°39'N 25°42'E Madzhari, artificial lake; 05-vii-2004, MM, S. Beshkov, D. Smallshire; 21-vii-2005, MM, S. Beshkov, D. Powell
 41°44'N 25°43'E Silen, artificial lakes; 28-viii-1998, MM, S. Avramov
 42°01'N 28°00'E Silistar River between Rezovo and Sinemorets (MARINOV 1999)
 42°06'N 25°13'E Parvomai, Maritsa River (MARINOV 1999)
 42°06'N 27°57'E Ahtopol, town, syntopic with *L. viridis* (MARINOV 1999)
 42°06'N 27°57'E Ahtopol, small stream at road to Tsarevo 1 km N (MARINOV 1999)
 42°07'N 27°55'E Varvara (MARINOV 1999)
 42°09'N 24°39'E Orizari, Maritsa River; 26-vii-1999, MM, B. Grebe
 42°11'N 26°54'E Bolyarovo, small stream near road to Sredets 8 km NE; 20-vii-2003, MM, N. Dilchev, A. McGeeney, D. Smallshire
 42°17'N 27°46'E Primorsko, "Blato Stamopolo" Protected Area; 21-viii-1998, MM
 42°19'N 27°43'E Primorsko, "Arkutino" Protected Area; MARINOV (1999); 23-ix-2005, MM, D. Smallshire
 42°19'N 27°44'E Ropotamo River at road Primorsko-Burgas; MARINOV (1999); 27-ix-1999, MM
 42°20'N 27°44'E Primorsko, small stream SW from "Arkutino" Protected Area; 16/18-vii-1998, MM
 42°21'N 27°42'E Sozopol, Lake Alepu near Dyuni 5 km SE; syntopic with *L. viridis*; 4 ♂, 3 ♀, 30-ix-2004, A. Günther leg.; checked by MO
 42°26'N 27°31'E Burgas, "Chengene skele" Protected Area 4 km S; MARINOV (1999); 21-vii-2003, MM, N. Dilchev, A. McGeeney, D. Smallshire
 42°26'N 27°32'E Burgas, Otmanli River by the "Strandzha" hut 15 km S; MARINOV (1999); 25-vii-1998, MM; 21-vii-2003, MM, N. Dilchev, A. McGeeney, D. Smallshire

- 42°30'N 27°22'E Burgas, "Vaya" fish-farms (MARINOV 1999)
 42°33'N 27°28'E Burgas, "Atanasovsko ezero" Reserve (MARINOV 1999)
 42°43'N 27°42'E Nesebar, Lake Poroj at Eskikshla 5 km W; 1 ♂, 26-ix-2004, A. Günther leg., checked by MO
 42°51'N 27°50'E Obzor, Drojnicia River between Dyulino and Popovich 8 km W; 2 ♂, 26-ix-2004, A. Günther leg.; checked by MO
 42°55'N 27°47'E Dyulino, artificial lake at road Burgas-Varna; 04-ix-2005, MM, A. Brandon; 24-ix-2005, MM, D. Smallshire
 42°59'N 27°55'E Kamchiya, pools near Black Sea coast E of Novo Oryahovo; MARINOV (1999); 04-ix-2005, MM, A. Brandon
 43°13'N 27°42'E Varna, floods by the spring within "Pobitite kamani" area (MARINOV 1999)
 43°18'N 26°10'E Popovo, floods 3 km W (MARINOV 1999)
 44°01'N 26°30'E Nova Cherna, fish-farms (MARINOV 1999)
 44°06'N 27°16'E Silistra, artificial lake 1 km S (MARINOV 1999)
 44°07'N 26°51'E Malak Preslavets, artificial lake near Danube River bank; Marinov (1999); 18-viii-2004, MM
 44°07'N 26°59'E Popina, floods by Danube River bank; 20-ix-1999, MM, B.B. Georgiev
 44°07'N 27°03'E Srebarna, Biosphere Reserve 20 km W of Silistra; MARINOV (1999); 18-viii-2004, MM
 44°08'N 27°01'E V tren, springbrook near Danube River bank; 10-viii-1999, 12-viii-2006, MM

Albania

- 41°45'N 19°35'E Drin delta (KALKMAN 2000)
 42°04'N 19°30'E Shkodër at Lake Skadar, surroundings; 1 ♂, 1895, in coll. NMW; checked by MO

Greece: mainland

- 37°58'N 23°43'E Athens (Attica); 1 ♂, 1872, Lange leg., in coll. NMW; checked by MO
 38°47'N 20°47'E Katoúna (western Greece), periodical lake in valley E (LOPAU 1996a)
 38°47'N 20°58'E between Páleros and Pagoniá (western Greece), marshes and river swamps (LOPAU 1996a)
 38°49'N 22°21'E Gorgopótamos (central Greece), carst brook W (LOPAU 2000)
 38°50'N 22°23'E Gorgopótamos (central Greece), spring brooklet 1,5 km W (LOPAU 2005)
 39°50'N 22°30'E Lárisa (Thessaly), Pinios River W Omólio (VAN PELT 1999)
 39°53'N 22°42'E Lárisa (Thessaly), river 1 km SE Stómio (LOPAU 2000)
 40°24'N 23°47'E Gómati (Chalcidice peninsula, Macedonia), rivulet (LOPAU 1999c)
 40°25'N 23°27'E Palaiokastro (Chalcidice peninsula, Macedonia), rivulet 2 km S; syntopic with *L. viridis* (OLIAS & GÜNTHER 2005)
 40°51'N 26°08'E Loutros (Thrace), Loutros River 4 km SSE (GREBE et al. 2005)
 40°52'N 26°02'E Loutros (Thrace), river 2 km S (LOPAU 2000)
 40°54'N 25°14'E Alkión (Thrace), mouth of rivulet 4,5 km WNW (LOPAU 1999c)
 40°57'N 25°21'E Imeros (Thrace), canal 2 km SW (LOPAU 1999c)
 40°57'N 26°12'E Kavisos (Thrace), Mega Rema River at road Ardani-Itea (GREBE et al. 2005)
 41°02'N 26°11'E Lefkími (Thrace), gravel pit NW (GREBE et al. 2005)
 41°02'N 26°14'E Provatonas (Thrace), Provatonas River at road to Lefkími (GREBE et al. 2005)
 41°03'N 26°04'E Megalo Rema River (Thrace), 15 km SW of Dadiá; syntopic with *L. viridis*; 5 ♂, 3 ♀, 03-x-2006, W. Lopau leg.
 41°06'N 24°56'E Nestos Delta (Thrace); 1 ♂, 02-ix-1990, A. Günther, F. Radow leg., in coll. ZMHB; checked by MO

Greece: Ionian Islands

- 37°44'N 20°51'E Zakynthos Island, drainage ditch SW airport (LOPAU 2006a)
 37°44'N 20°54'E Kalamáki (Zakynthos Island), pool in dunes (LOPAU 2006a)
 37°46'N 20°52'E Zákynthos (Zakynthos Island), drainage ditch (LOPAU 2006a)
 37°47'N 20°48'E Zákynthos (Zakynthos Island), drainage ditch (LOPAU 2006a)
 38°37'N 20°36'E Vasilíki (Lefkada Island), rivulet (LOPAU 2006a)
 39°32'N 19°54'E Benítses (Corfu), rivulet (LOPAU 2006a)
 39°37'N 19°46'E Gianádes (Corfu), canal (LOPAU 2006a)
 39°37'N 19°48'E Corfu, Rópa Rivulet near Vátos (LOPAU 1999c)
 39°47'N 19°47'E Sidári (Corfu), rivulet near Róda 8 km E (LOPAU 1999c)

Greece: Aegean Islands

- 36°10'N 27°50'E Apollona (Rhodes), Moni Kariona 4,7 km W (HOESS et al. 1999)

(Greece: Aegean Islands)

- 36°10'N 28°00'E Epta Piges (Rhodes) (HOESS et al. 1999)
 36°11'N 27°57'E Láerma (Rhodes), spring brook of Gaidourás (LOPAU 1999c)
 36°13'N 27°58'E Láerma (Rhodes), spring brook of Gaidourás 9 km N (LOPAU 1995b)
 36°14'N 27°55'E Apollóna (Rhodes), spring brooks 5 km W (LOPAU 1999c)
 36°15'N 27°58'E Eleúsa (Rhodes), spring brook 1 km NW (LOPAU 1999c)
 36°15'N 28°06'E Epta Pigés (Rhodes), spring brooks (LOPAU 1995b)
 36°15'N 28°07'E Epta Pigés (Rhodes), Loutáni River (LOPAU 1995b, 1999c, 2005)
 36°16'N 27°58'E Dimíliá (Rhodes), rivulet 3 km N (LOPAU 1999c)
 36°20'N 28°10'E Rhodes, Rhodini Garden (HOESS et al. 1999)
 37°07'N 25°26'E Engarés (Naxos), river (LOPAU 2004)
 37°33'N 26°01'E Ikaría Island (Samos), brooklet 6-7 km SW Christós (VAN PELT 1999)
 37°36'N 25°13'E Liváda (Tenos), river 1 km SW (LOPAU 2004)
 37°36'N 26°02'E Ikaría Island (Samos), Chalaris brook , 4 km SW Armenistís (VAN PELT 1999)
 37°36'N 26°03'E Ikaría Island (Samos), rivulets W Christós Rachés (LOPAU 1999c)
 37°40'N 26°50'E Potámi (Samos), river at road to Mitilíni (KOHLE 1999)
 37°40'N 26°54'E Samos, swamp SW of airport (LOPAU 1995b)
 37°42'N 26°50'E Koumaradaí (Samos), river SW (LOPAU 1995b)
 37°42'N 26°57'E Pythagório (Samos), Mitilíni River NE (LOPAU 1999c)
 37°43'N 26°45'E Skoureika (Samos), rivulet 1 km SE (LOPAU 1995b)
 37°45'N 26°43'E Agio Theodorí (Samos), river NW (LOPAU 1995b)
 37°46'N 26°58'E Samos, Botanical Garden (LOPAU 1999c)
 37°50'N 24°50'E Ándros Island (Cyclades), rivulet in Katakílos (LOHMANN 1993)
 37°52'N 24°49'E Ándros Island (Cyclades), rivulet in Katakílos (LOPAU 2004)
 37°54'N 24°57'E Ándros Island (Cyclades), Áchlas River NE Vourkotí (LOPAU 2004)
 38°52'N 24°34'E Parália Aspóus (Skíros Island), rivulet (LOPAU 2006b)
 38°58'N 24°30'E Skíros Island, rivulet E airport (LOPAU 2006b)
 38°59'N 26°25'E Plomári (Lesbos), rivulet 7 km E (HOEGBNER et al. 2000)
 39°00'N 26°10'E Makará (Lesbos), river estuary (LOPAU 2005)
 39°01'N 26°17'E Drotá (Lesbos), Priona River (LOPAU 1995a)
 39°06'N 26°16'E Vassiliká (Lesbos), Mikrí Límni 3 km E (LOPAU 2005)
 39°07'N 26°01'E Tavári (Lesbos), river estuary in Podarás 2 km E (LOPAU 2005)
 39°09'N 26°18'E Achladerí (Lesbos), Vouvarís River (LOPAU 1995a)
 39°10'N 23°10'E Pílión (Kos), rivulet near Chórto (LOPAU 1996a)
 39°10'N 26°08'E Parákila (Lesbos), beach lagune (LOPAU 2005)
 39°10'N 26°17'E Achladerí (Lesbos), Vouvárís River 1,5 km NE (HOEGBNER et al. 2000)
 39°11'N 26°08'E Parákila (Lesbos), Taxiarchis River 0,5 km SW (LOPAU 1995a)
 39°11'N 26°08'E Parákila (Lesbos), swamp 3 km NE (LOPAU 2005)
 39°12'N 25°55'E Eréssos (Lesbos), Chalándra River 3 km NNE (HOEGBNER et al. 2000)
 39°12'N 25°58'E Eréssos (Lesbos), Chalándra River 8 km NNE (LOPAU 1995a)
 39°12'N 26°16'E Kalloní (Lesbos), mouth of Kalámi River 10 km SE (LOPAU 2005)
 39°13'N 26°08'E Potamiá River (Lesbos), western tributary 8 km above mouth (LOPAU 1995a)
 39°13'N 26°11'E Kalloní (Lesbos), downstream of Potamiá River 4 km SW (LOPAU 2005)
 39°13'N 26°17'E Agía Paraskewí (Lesbos), Mylopotamus River 4 km SSO (LOPAU 1995a)
 39°16'N 26°05'E Skalochorí (Lesbos), pond at plateau 2 km NE (HOEGBNER et al. 2000)
 39°16'N 26°07'E Fíliá (Lesbos), dried up pond 2 km NW (HOEGBNER et al. 2000)
 39°16'N 26°15'E Agía Paraskewí (Lesbos), Tsikiniás River at road to Pétra (LOPAU 1995a, HOEGBNER et al. 2000)
 39°16'N 26°22'E Aspropótamus (Lesbos), mouth of Levkaria River 4 km SE (LOPAU 1995a, HOEGBNER et al. 2000)
 39°17'N 26°01'E Antissa (Lesbos) (LOPAU 1995a)
 39°18'N 26°07'E Ánaxos (Lesbos), pond W (HOEGBNER et al. 2000)
 39°18'N 26°11'E Lafiónas (Lesbos), rivulet (LOPAU 1999c)
 39°19'N 26°05'E Skoutaros (Lesbos), rivulet at sea coast 5 km WNW (LOPAU 1995a)
 39°19'N 26°10'E Pétra (Lesbos), rivulet in valley of the mills SE (LOPAU 1995a, 2005)

- 39°20'N 26°13'E Vafios (Lesbos), rivulet S (LOPAU 1995a)
- 39°21'N 26°10'E Mithimna (Lesbos), rivulet 1,5 km S (LOPAU 1999c)
- 39°22'N 26°11'E Mólivos (Lesbos), river estuary 1 km S (LOPAU 1995a)
- 39°22'N 26°11'E Mólivos (Lesbos), reservoir 2 km S (LOPAU 2005)
- 39°22'N 26°14'E Vafios (Lesbos), river 3 km NE at road to Sikaminea (LOPAU 1995a)
- 40°28'N 24°40'E Mnimória (Samothrace), spring brook (LOPAU 1999a)
- 40°31'N 25°35'E Áno Kariótes (Samothrace), rivulet and pond N (LOPAU 1999a)
- 40°36'N 24°44'E Alíki (Thasos) (STOBBE 1995)
- 40°40'N 24°41'E Theologos (Thasos) (STOBBE 1995)
- Greece: Crete**
- 35°10'N 24°14'E Frangokastélló, mouth of small stream (LOPAU 1999c)
- 35°10'N 24°20'E Koxaré, Koutalióti River (LOPAU 1996b)
- 35°11'N 24°17'E Ano Rodákino, rivulet between Plakiás and Chóra Sfakión (BATTIN 1989)
- 35°11'N 25°08'E Iraklion; 1 ♂, 25-vi-1942, Zimmermann leg., in coll. ZMHB; checked by MO
- 35°13'N 24°29'E Spili, rivulet SW of Mixórouma (LOPAU 2000)
- 35°18'N 24°24'E Kaloniktís, Petres Rivulet (LOPAU 2000)
- 35°19'N 25°19'E Iraklion, Aposelemis Rivulet E (BATTIN 1989)
- 35°20'N 24°50'E Fódele, rivulet (LOPAU 1996b)
- 35°21'N 24°17'E Georgóupoli, mouth of Petres Rivulet (LOPAU 2000)
- 35°22'N 24°58'E Iraklion, rivulet near Fodhele (BATTIN 1989)
- 35°24'N 24°41'E Geropotamos, between Roumeli and Pánormos (LOPAU 2000)
- 35°25'N 23°33'E Sfinári, rivulet at sea shore (LOPAU 2000)
- 35°28'N 23°34'E Ayios Gheorghios, stream; 3 ♂, 1 ♀, 26-vi-1959, G.A. Mavromoustakis leg., in coll. BMNH; checked by MB
- 35°30'N 24°00'E Chaniá; BATTIN (1989); 1 ♂, 1 ♀, 19-vii-1942, Zimmermann leg., in coll. ZMHB; checked by MO
- 35°32'N 23°49'E Kolimbári, Spiliakos River (LOPAU 2000)
- 35°33'N 23°49'E Tavronitis, rivulet at road E (BATTIN 1989)
- Greece: Peloponnese**
- 36°50'N 22°30'E Lefkochóra, Evrotas River (LOPAU 1996a)
- 37°30'N 21°30'E Zacháro, swamp at sea shore NW (LOPAU 1996a)
- 38°00'N 21°10'E Konoupélli, Lámia swamp E (LOPAU 1996a, 1999c)
- 38°05'N 21°41'E Ísoma, Péfros River (LOPAU 1999c)
- 38°07'N 21°23'E Konoupélli, 3 km SE (BREUER et al. 2000)
- 38°09'N 21°23'E Patras, 2 km SSE Kalogria (BREUER et al. 2000)
- Greece: Évia Island**
- 38°01'N 24°25'E Káristos, river (LOPAU 1999c)
- 38°07'N 24°21'E Paradísi, river in Chánia 3 km WSW (LOPAU 1999b)
- Turkey: Turkish Thrace**
- 40°24'N 26°40'E Çanakkale, Gelibolu (HACET & AKTAÇ 2004)
- 41°10'N 28°59'E İstanbul-Sarıyer (Bahçeköy-Bilezikçi farm) (HACET & AKTAÇ 1997)
- 41°11'N 27°12'E Tekirdağ, Hayrabolu-Çene (HACET & AKTAÇ 2004)
- 41°18'N 27°32'E Kırklareli, Lüleburgaz-Büyükkarlı tiran (HACET & AKTAÇ 2004)
- 41°19'N 27°11'E Tekirdağ, Hayrabolu-Küçük Karakarlı (HACET & AKTAÇ 2004)
- 41°26'N 27°34'E Kırklareli, Lüleburgaz-Ahmetbey (HACET & AKTAÇ 2004)
- 41°36'N 26°44'E Edirne, Oğulpaşa stream and pond (HACET & AKTAÇ 2004)
- 41°39'N 26°31'E Edirne, Karaağaç (HACET & AKTAÇ 2004)
- 41°39'N 26°40'E Edirne, Köşençiftliği (HACET & AKTAÇ 2004)
- 41°40'N 27°04'E Kırklareli, İnce (HACET & AKTAÇ 2004)
- 41°44'N 27°24'E Kırklareli-Üsküp (HACET & AKTAÇ 1997)
- 41°52'N 27°59'E Kırklareli-Demirköy/İğneada (HACET & AKTAÇ 1997)
- Turkey: Aegean Islands**
- 40°10'N 25°45'E Gökçeada Island, between Uğurlu and Dereköy, small pools near roadside (HACET & AKTAÇ 2006)
- 40°10'N 25°55'E Gökçeada Island, between Gökçeada and Aydıncık, pools near roadside (HACET & AKTAÇ 2006)

Appendix 2: Compilation of documented records of *Lestes viridis* from southern parts of the Balkans, including hybrids with *L. parvidens*. FW, MM, MO = initials of authors. For museum acronyms see text.

Croatia: Dalmatia

- 42°32'N 18°19'E Konavli, River Ljuta (ADAMOVI 1967, 1996)
42°40'N 18°06'E Dubrovnik, River Dubrovačka Rijeka (ADAMOVI 1967, 1996)
42°44'N 17°36'E Island Mljet, Sovra, Blatina (ADAMOVI 1967, 1996)
43°52'N 15°46'E Pirovac, tributary of Guduča River near Čista; 4 ♂, 3 ♀, 31-vii-1975, G. von Rosen leg.; in coll. ZSM, checked by FW

Romania

- 44°36'N 22°15'E Dubova, valley of river Morilor SE; 50 ♂/♀, 4 exuviae, 20-vii-2007, MO, O. Brauner, V. Kalkman, A. Wouters

Montenegro

- 41°55'N 19°13'E Ulcinj, rivulet 10 km N; 7 ♂, 6 ♀, viii-1990, R. Seidenbusch leg., in coll. ZSM; hybrid specimens, checked by FW

Albania

- 42°05'N 20°25'E Kula e Lumës near Kukësi, Luma River (BILEK 1966); in coll. DEI, re-checked by MO

Bulgaria

- 41°24'N 25°54'E Byalgradets, Deimin (Hambar) dere River W; 28-vii-1999, MM leg.; 04-vii-2004, MM, S. Beshkov, D. Smallshire leg.; 29-vi-2005, MM, S. Beshkov, A. McGeeney leg.; 22-vii-2005, 19-vii-2006, MM, S. Beshkov, D. Powell leg.
41°26'N 25°56'E Gugutka, stream 5 km N; 19-vii-2003, MM, N. Dilchev, A. McGeeney, D. Smallshire leg.
41°29'N 25°57'E Zhelezino, artificial lake near the village; 04-vii-2004, MM, S. Beshkov & D. Smallshire leg.; 19-vii-2006, MM, S. Beshkov, D. Powell leg.
41°32'N 25°19'E Plazishte, floods of a stream; syntopic with *L. parvidens*; 01-vii-2005, MM, S. Beshkov, A. McGeeney; 23-vii-2005, 20-vii-2006, MM, S. Beshkov, D. Powell leg.
41°36'N 25°38'E "Valchi Dol" Reserve, springbrook on bottom of a valley about village of Studen kladenets; 18-vii-2006, MM, S. Beshkov, D. Powell leg.
41°36'N 25°43'E Arda River at road between Dolno Cherkovishte and Oreshari (MARINOV 1999)
41°36'N 25°43'E Silen, small stream at road to Dolno Cherkovishte, 2 km N of bridge over Arda River; 20-vi-2004, MM, S. Beshkov leg.
41°40'N 25°46'E Topolovo, small stream E; 05-vii-2004, MM, S. Beshkov, D. Smallshire leg.
42°06'N 27°57'E Ahtopol, town; syntopic with *L. parvidens* (MARINOV 1999)
42°16'N 27°29'E Krushovets, Izvorska River; 1 ♂, 03-viii-1996, MM leg.
42°21'N 27°42'E Sozopol, Lake Alepu near Dyuni 5 km SE; syntopic with *L. parvidens*; 1 ♂, 30-ix-2004, A. Günther

Greece

- 38°29'N 22°12'E Lídoriki (central Greece), brooklet 7 km S; 1 ♂, 22-vii-2001, A. Kop leg.; in coll. RMNH, checked by MO; listed in LOPAU (2005) erroneously as *L. parvidens*
40°25'N 23°27'E Palaiokastro (Chalcidice peninsula, Macedonia), rivulet 2 km S; syntopic with *L. parvidens* (OLIAS & GÜNTHER 2005); 6 ♂, 06-x-2006, W. Lopau (pers. comm.)
41°03'N 26°04'E Megalo Rema River (Thrace), 15 km SW of Dadiá; syntopic with *L. parvidens*; 4 ♂, 5 ♀, 03-x-2006, W. Lopau (pers. comm.)

Turkey: Turkish Thrace

- 40°36'N 27°06'E Tekirdağ, Şarköy; 1 ♂, 10-viii-1998 (HACET & AKTAÇ 2004); re-checked and determined clearly as *L. viridis*
41°06'N 26°59'E Tekirdağ, Hayrabolu-Kutlugün; 1 ♂, 15-vii-1998 (HACET & AKTAÇ 2004); re-checked and regarded with high probability as *L. viridis*

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