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The Vjosa-floodplains in Albania as natural habitat for ground beetles: a hotspot of rare and stenotopic species (Coleoptera: Carabidae)

Wolfgang Paill, Johanna Gunczy & Slavčo Hristovski

The ground beetle fauna of the Vjosa floodplains in Albania near Kutë and Poçem was studied in the spring of 2017 over a period of five days. 112 species were documented on the basis of 2.327 captured individuals. Three species (*Dyschirius abditus* (Fedorenko, 1993), *Demetrias imperialis* (Germar, 1823) and *Microlestes fulvibasis* (Reitter, 1901)) were reported for the first time for Albania, three others (*Cylindera germanica muelleri* (Magistretti, 1966), *Cylindera arenaria viennensis* (Schrank, 1781) and *Thalassophilus longicornis* (Sturm, 1825)) were documented for the first time with detailed and trusted data for this country. Several other taxa were found for the second time or were rediscovered after many years. From other parts of the Vjosa valley, two further new or unequivocally documented species for Albania, *Cylindera germanica germanica* (Linnaeus, 1758) and *Parazuphium chevrolatii* (Laporte, 1833) were reported.
Within the study area near Kutë, the highest numbers of carabid species and specimens were caught on silty and moist sediment bars with initial to pioneer vegetation situated either directly along the main channel of the Vjosa or in drying, regularly flooded side arms. Wetlands with reed mace stands at the outer edge of the active floodplain also showed outstanding carabid biodiversity.
In addition to the extraordinary number of species and the high proportion of stenotopic floodplain inhabitants, in particular the rich local population numbers of the beetles *Cicindela monticola albanica*, *Bembidion brunoi*, *Bembidion quadricolle*, *Bembidion striatum*, *Stenolophus discophorus*, and *Poecilus striatopunctatus*, which are very rare throughout of Europe, proves the international importance of nature conservation of the Vjosa.

Paill W., Gunczy J. & Hristovski S., 2018: Die Vjosa-Auen in Albanien als natürlicher Lebensraum für Laufkäfer: Ein Hotspot seltener und anspruchsvoller Arten.
Die Laufkäferfauna der Vjosa-Auen in Albanien bei Kutë nahe Poçem wurde im Frühjahr 2017 über einen Zeitraum von fünf Tagen untersucht. Dabei konnten 112 Arten auf der Basis von 2.327 gefangenen Individuen dokumentiert werden. Drei Arten (*Dyschirius abditus* (Fedorenko, 1993), *Demetrias imperialis* (Germar, 1823) und *Microlestes fulvibasis* (Reitter, 1901)) wurden erstmals für Albanien gemeldet, drei weitere (*Cylindera germanica muelleri* (Magistretti, 1966), *Cylindera arenaria viennensis* (Schrank, 1781) und *Thalassophilus longicornis* (Sturm, 1825)) erstmals mit detaillierten und vertrauenswürdigen Daten für dieses Land belegt. Für zahlreiche weiter Taxa wurden Zweitfunde oder Wiederfunde nach vielen Jahren getätigt. Aus anderen Teilen des Vjosatals wurden zwei weitere Arten erstmals zweifelsfrei für Albanien dokumentiert *Cylindera germanica germanica* (Linnaeus, 1758) und *Parazuphium chevrolatii* (Laporte, 1833).
Innerhalb des Untersuchungsgebietes bei Kutë wurden die höchsten Arten- und Individuenzahlen an Laufkäfern auf feuchten, schluffigen Pionierflächen, sowohl direkt am Hauptfluss als auch in austrocknenden, regelmäßig überfluteten Seitenarmen nachgewiesen. Röhrichte am äußeren Rand der aktiven Auenzone erwiesen sich ebenfalls als Zentren der Laufkäfer-Biodiversität.
Neben der außergewöhnlichen Artenzahl und dem hohen Anteil stenotoper Auenbewohner belegen insbesondere die erheblichen Populationsgrößen der europaweit sehr seltenen Laufkäfer *Cicindela monticola albanica, Bembidion brunoi, Bembidion quadricolle, Bembidion striatum*, *Stenolophus discophorus* und *Poecilus striatopunctatus* die internationale naturschutzfachliche Bedeutung der Vjosa.

Keywords: river Vjosa, floodplain, carabid beetles, ground beetles, faunistics, ecology, international conservation value.

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Introduction

Ground beetles are known to be highly diverse in natural alluvial systems, including a considerable number of specialized stenotopic species (e.g. Antvogel & Bonn 2001, Eyre et al. 2001, Manderbach & Hering 2001, Kahlen 2010). Especially along the riparian zones, they inhabit numerous different microhabitats, making them sensitive and valuable indicators (e.g. Boscaini et al. 2000, Günther & Assmann 2005, Kleinwaechter & Rickfelder 2007, Gerisch 2011, Baiocchi et al. 2012).

The knowledge of carabid beetles in Albania is comparatively good. In a very important paper, Guéorguiev (2007a) comprised the complete data from faunistic as well as systematic literature and reviewed Albanian collections and the most relevant European collections including Albanian samples. However, the intensity of collecting was poor, especially during the last decades. This fact becomes apparent when screening available data from more or less common beetles, e.g. *Clivina collaris*, *Paratachys micros*, *Harpalus pumilus,* or *Oodes gracilis,* as they are represented only by single records (see Guéorguiev 2007a). After Guéorguiev (2007a), who listed 543 species, three new troglobiontic species were described for Albania (Bulirsch & Guéorguiev 2008, Lohaj et al. 2016), and seven species were recorded for the first time in this country (Jaskuła 2007b, Bulirsch & Pavićević 2008, Jaeger et al. 2016, Kataev & Wrase 2016), leaving three *Carabus*-species (*Carabus auronitens, Carabus glabratus, Carabus hungaricus*) uncritically published by Striniqi Laçej et al. (2010) and Striniqi Laçej & Misja (2012, 2015) out of consideration.

Before our study was conducted, 31 carabid beetles from the Vjosa river had been documented, 20 of which during the last three centuries (Guéorguiev 2007a, Bulirsch & Pavićević 2008). In addition, almost nothing had been published about the ecology of floodplain carabids of the central parts of the Balkan Peninsula.

Material and Methods

The study is focused on an area of a few kilometers around the village of Kutë, positioned between Kalivaç and Poçem. In this part, the Vjosa river represents a bar- and island-braided, widely undisturbed river-floodplain type. The heterogeneity within the active channel ("floodplain proper") is very high due to the hydro-geomorphic dynamics. An important aspect is the high content of silt transported by the river, and the low extent of floodplain forests apparently restricted by human use. Backwater or wetland conditions are also very limited at the outer side of the floodplain (see Schiemer et al. 2018 this volume).

The collection of beetles was restricted to the floodplain-system of the river. The material was collected during a sampling period in the spring of 2017 (24.04.–28.04.2017). In five days, 150 pitfall traps (plastic jar, diameter = 7 cm, height = 10 cm, filled with a 6% vinegar solution and detergent) were applied on 30 sites, supplemented by 20 hand collection sites. Collecting was conducted by Wolfgang Paill, Johanna Gunczy, Gernot Kunz and Thomas Frank. While the pitfall traps were set up for 5 days, hand-collecting was done at least 30 minutes on each site, either during the day or at nighttime. In order to gain data on the habitat use of the carabids, the sites were strictly delimited, intending to keep habitat characteristics as homogenous as possible. Besides this standardized collecting scheme, further data from hand-colleting done over larger areas or along transition zones of habi-

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tat types or single catches by chance were incorporated, abdicating an assignment to the habitat types classified above.

Habitat classification

In cooperation with botanist Anton Drescher, the sites were dedicated to a simple scheme of classification of habitat types (partly following Schiemer et al. 2018 this volume). Within the active floodplain, 11 major types were differentiated by regarding in particular 1) the sediment composition (grain size diameter) as a factor of germination (water capacity), 2) the intervals and dimension of flow pulses resulting in a time span for vegetation, and 3) the situation of the groundwater table and its connection with the fine-grained sediment cover i.e. water retention capacity. B1 to B2 and C1 to C4 represent an increasing age of ± undisturbed vegetation development.

Regularly flooded niveaus within the active floodplain of the Vjosa

- B1: Initial stage on coarse-grained (mostly gravel) sediment bars without vegetation [sites: 37, 38, 39, 42/2, 43, 44, 47; see Fig. 5]
- B2: Pioneer stage on coarse-grained (mostly gravel) sediment bars with seedlings of annual and perennial herbs and wood species (less than one year old; 1–30 cm high) [sites: 31/1, 35, 36/1]
- C1: Initial stage on fine-grained (mostly silt) sediment bars without vegetation [sites: 5, 6, 7, 33, 40, 42/1, 45, 46; see Fig. 3, 7]
- C2: Pioneer stage on fine-grained (mostly silt) sediment bars with seedlings of annual and perennial herbs and wood species (less than one year old; 1–30 cm high [sites: 1, 2, 3, 12, 13, 14, 15, 16, 20, 30, 31/2, 32, 36/2, 49; see Fig. 1, 2]
- C3: Early succession stage on fine-grained (mostly silt) sediment bars with perennial herbs, grasses (mostly *Imperata cylindrica*) and woody species like *Salix alba*, *Salix purpurea*, *Vitex agnus-castus*, *Populus alba* and *Platanus orientalis* (1–2 years old; 30–120 cm high) [sites: 4, 8, 9, 10, 11]
- C4: Shrub stage on fine-grained (mostly silt) sediment bars with dominating woody species (like *Platanus orientalis* and *Tamarix parviflora*) and grasses (mostly *Imperata cylindrica*), 2–5(8?) years old; 1–4 m high) [site: 19]

Elevated niveaus within the active floodplain of the Vjosa

- D1: Grassland on fine-grained sediment, species-poor with highly dominant *Imperata cylindrica;* degradation stage by regular burning and grazing [sites: 17, 18, 21; see Fig. 15]
- D2: Grassland on fine-grained sediment, rich in herbs and grasses, shrubs of *Vitex agnus-castus* and others; degradation stage by regular burning and heavy grazing [site: 22]

Wetlands at the outer edge of the active floodplain of the Vjosa

- E1: Reed mace stand (*Typha*) and *Eleocharis*-marsh in disconnected former arm on moist to moderately dry clayish ground [sites: 27, 28, 29; see Fig. 10]
- E2: Reed mace vegetation (*Typha*) and initial softwood forest (*Salix alba*) on wet to moist silty to clayish ground along a stagnant flowing ditch (very small, periodically drying up tributary of the Vjosa) [sites: 24, 25, 26, 34; see Fig. 8]

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Agricultural land close outside the active floodplain (but within the morphological floodplain)

- F1: Fallow land on moderately moist to dry sandy to silty ground [site: 23]
- F2: Field edge on moderately moist to dry sandy to silty ground [site: 48]

Special habitat within the active floodplain (simultaneously at the outer border of the morphological floodplain)

- G1: Steep erosive embankment with unvegetated, moist, loamy ground directly along the main channel of the Vjosa [site: 41]

Sites and sampling data

[sites: 1–50]: southwestern Albania, Fier County, S to SW of the village Kutë, floodplain of Vjosa river, 48–57 m a. s. l. The pitfall traps were maintained between 24.04.-28.04.2017 by Paill W., Gunczy J. and Frank T.

[1] 40°27,500′ 19°44,503′; pitfall traps;
[2] 40°27,500′ 19°44,503′; pitfall traps; 24.04.2017, hand-collecting, leg. Paill W.
[3] 40°27,522′ 19°44,493′; pitfall traps
[4] 40°27,500′ 19°44,530′; pitfall traps
[5] 40°27,526′ 19°44,481′; pitfall traps
[6, 7] 40°27,555′ 19°44,454′; pitfall traps
[8] 40°27,518′ 19°44,549′, pitfall traps
[9] 40°27,529′ 19°44,584′; pitfall traps
[10] 40°27,538′ 19°44,619′; pitfall traps
[11] 40°27,548′ 19°44,615′; pitfall traps
[12] 40°27,672′ 19°44,604′; pitfall traps
[13] 40°27,672′ 19°44,604′; 24.04.-28.04.2017, pitfall traps
[14] 40°27,697′ 19°44,634′; 24.04.-28.04.2017, pitfall traps
[15] 40°27,697′ 19°44,634′, 24.04.-28.04.2017, pitfall traps; 24.04.2017, hand-collecting, leg. Paill W.
[16] 40°27,719′ 19°44,647′; 24.04.-28.04.2017, pitfall traps; 25.04.2017, hand-collecting, leg. Paill W.
[17] 40°27,548′ 19°44,670′; 24.04.-28.04.2017, pitfall traps
[18] 40°27,548′ 19°44,704′; 24.04.-28.04.2017, pitfall traps
[19] 40°27,568′ 19°44,757′; 24.04.-28.04.2017, pitfall traps
[20] 40°27,579′ 19°44,861′; 24.04.-28.04.2017, pitfall traps
[21] 40°27,577′ 19°44,876′; 24.04.-28.04.2017, pitfall traps
[22] 40°27,592′ 19°44,936′; 24.04.-28.04.2017, pitfall traps; 25.04.2017 hand-collecting, leg. Paill W, Gunczy J., & Kunz G.
[23] 40°27,677′ 19°45,251′; 24.04.-28.04.2017, pitfall traps
[24] 40°27,802′ 19°45,218′; 24.04.-28.04.2017, pitfall traps; 25.04.2017, hand-collecting, leg. Paill W.
[25] 40°27,820′ 19°45,251′; 24.04.-28.04.2017, pitfall traps
[26] 40°27,851′ 19°45,480′; 24.04.-28.04.2017, pitfall traps
[27] 40°27,835′ 19°45,267′; 24.04.-28.04.2017, pitfall traps; 26.04.2017 hand-collecting, leg. Gunczy J.

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[28] 40°27,770′ 19°45,363′; 24.04.-28.04.2017, pitfall traps; 27.04.2017 hand-collecting, leg. Paill W. and Gunczy J.
[29] 40°27,770′ 19°45,363′; 24.04.-28.04.2017, pitfall traps; 25.04.2017, hand-collecting, leg. Paill W.
[30] 40°27,830′ 19°44,959′; 24.04.-28.04.2017, pitfall traps; 23.04.2017, hand-collecting, leg. Gunczy J.
[31/1, 31/2] 40°27,851′ 19°44,943′; 25.04.2017, hand-collecting, leg. Paill W, Gunczy J. & Frank T.
[32] 40°27,983′ 19°44,915′; 25.04.2017, hand-collecting, leg. Paill W. & Gunczy J.
[33] 40°28,315′ 19°44,012′; 25.04.2017, hand-collecting, leg. Paill W. & Gunczy J.
[34] 40°28,319′ 19°45,297′; 25.04.2017, hand-collecting, leg. Paill W. & Gunczy J.
[35] 40°28,310′ 19°45,995′; 25.04.2017, hand-collecting, leg. Paill W. & Gunczy J.
[36/1, 36/2] 40°28,312′ 19°45,994′; 25.04.2017, hand-collecting, leg. Paill W. & Gunczy J.
[37] 40°28,597′ 19°45,458′; 26.04.2017, hand-collecting, leg. Paill W. & Frank T.
[38] 40°26,527′ 19°45,365′; 26.04.2017, hand-collecting, leg. Paill W. & Gunczy J.
[39] 40°26,500′ 19°45,631′; 26.04.2017, hand-collecting, leg. Paill W. & Gunczy J.
[40] 40°26,771′ 19°45,162′; 26.04.2017, hand-collecting, leg. Paill W. & Gunczy J.
[41] 40°26,545′ 19°45,640′; 27.04.2017, hand-collecting, leg. Paill W. & Gunczy J.
[42/1, 42/2] 40°26,526′ 19°45,741′; 27.04.2017, hand-collecting, leg. Paill W. & Gunczy J.
[43] 40°26,01′ 19°45,933′, 27.04.2017, hand-collecting, leg. Gunczy J.
[44] 40°26,66′ 19°45,33′; 27.04.2017, hand-collecting, leg. Gunczy J.
[45] 40°26,70′ 19°45,25′; 27.04.2017, hand-collecting, leg. Gunczy J.
[46] 40°27,863′ 19°44,646′; 28.04.2017, hand-collecting, leg. Paill W.
[47] 40°27,914′ 19°44,637′; 28.04.2017, hand-collecting, leg. Paill W.
[48] 40°26,500′ 19°45,631′; 26.04.2017, hand-collecting, leg. Paill W.
[49] 40°27,538′ 19°44,516′; 27.04.2017, hand-collecting, leg. Gunczy J. Kunz G.
[50] floodplain around Kutë without exact localization (between 40°26′ 19°44′ and 40°28′ 19°46′), 24.04.-28.04.2017, hand-collecting, leg. Paill W., Gunczy J., Frank T. & Kunz G.

We also provide additional data on ground beetles of the Vjosa valley collected in 2014 during the GEO Biodiversity Days (see Appendix and Tab. 3).

Taxonomy and Nomenclature

Nomenclature of the taxa and their order in the list (Tab. 1) predominantly follows Löbl & Löbl (2017). In the case of *Pterostichus melas* (Creutzer, 1799) we agree with Hristovski & Guéorguiev (2015), who synonymized *Pterostichus melas depressus* (Dejean, 1828) with the nominotypical taxon. Furthermore, the name *Sinechostictus tarsicus* (Peyron, 1858) is reestablished and need not be renamed to *effluviorum* (Peyron, 1858) following Neri et al. (2015), since Schaum (1861: 212) was the first reviser, who synonymized *effluviorum* with *tarsicum* (written communication, Lorenz W.).

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Determination

All specimens were determined by Wolfgang Paill and Johanna Gunczy, partly using male or female genital characteristics (especially in the genera *Dyschirius*, *Asaphidion*, *Bembidion*, *Harpalus*, *Acupalpus*, *Stenolophus*, *Olisthopus*, and *Microlestes*) to assure correct interpretation of determination keys published in Arndt et al. (2011) and Müller-Motzfeld (2006), and also by Mlynař (1979), Fedorenko (1996), Coulon (2003, 2004a, 2004b, 2005), Bonavita & Vigna Taglianti (2010) Neri et al. (2011) and Neri (2016). The determination of the species in the genus *Dyschirius* was kindly checked and confirmed by Petr Bulirsch, and those of *Cylindera germanica muelleri* by Jörg Gebert. Four taxa, a *Bembidion* (*Nepha*), a *Notiophilus*, as well as *Harpalus* cf. *anxius*, and *Pterostichus* cf. *anthracinus biimpressus* are still not specified.

The material is stored either in the Natural History Museum Graz (Studienzentrum Naturkunde) or in the private collections of Johanna Gunczy and Gernot Kunz.

Results

Species list

In the investigated area around the village of Kutë we documented 112 carabid species among 2.327 collected individuals (Tab. 1). As expected, *Bembidion* is the richest genus with 23 taxa, followed by *Dyschirius* (10), *Acupalpus* (7), *Harpalus* (7) and *Chlaenius* (5). There is also a diverse fauna of Cicindelini (6) and Tachyina (6). In the following pages, selected species are discussed regarding their ecological, faunistic or systematic aspects.

Tab. 1: Annotated list of documented carabid species. ** = first record for Albania, * = first detailed data for Albania, m = male, f = female, s = specimen(s). – Tab. 1: Kommentierte Liste der nachgewiesenen Laufkäferarten. ** = Erstnachweis für Albanien, * = erster detaillierter Datensatz für Albanien, m = Männchen, f = Weibchen, s = Individuum/Individuen.

tribe / species	specimens total	specimens per [site]
Nebriini Laporte, 1834		
Leistus fulvibarbis Dejean, 1826	2	[30]:2s
Nebria brevicollis (Fabricius, 1792)	20	[22]:1f; [23]:1f; [24]:3m; [30]:2m,1f; [48]:6m,2f; [50]:4s
Notiophilini Motschulsky, 1850		
Notiophilus sp.	1	[44]:1s
Notiophilus substriatus G.R. Waterhouse, 1833	1	[22]:1f
Carabini Latreille, 1802		
Carabus granulatus interstitialis Duftschmid, 1812	1	[24]:1f
Carabus coriaceus excavatus Charpentier, 1825	9	[22]:1m; [23]:1f; [24]:1f; [28]3f; [41]:1f; [42/1]:2f
Cicindelini Latreille, 1802		
Calomera fischeri (M.F. Adams, 1817)	10	[2]:5m,1f; [3]:1f; [5]:1m; [6]:1m; [7]:1m
Calomera littoralis nemoralis (Olivier, 1790)	9	[12]:1f; [13]:5m; [15]:1f; [16]:1f; [32]:1s
Cicindela campestris olivieria Brullé, 1832	19	[11]:1f; [23]:1m,1f; [29]:10m,1f; [32]:1s; [42/1]:1f,1s; [43]:1s; [50]:1s

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Tab. 1 continued – Fortsetzung

tribe / species	specimens total	specimens per [site]
Cicindela monticola albanica Apfelbeck, 1909	179	[1]:7m,8f; [2]:27m,11f; [3]:7m,2f; [4]:3m; [5]:1f; [6]:2m,6f; [7]:12m,9f; [8]:9m,7f; [10]:3f; [11]:1m,1f; [12]:1m; [13]:5m,3f; [14]:1m,2f; [15]:3m,9f; [16]:3m,1f; [19]:1m,1f; [20]:4m,5f; [30]:1f; [31/2]:1f; [32]:1s; [40]:1f; [42/1]:1s; [50]:2f,17s
**Cylindera germanica muelleri* (Magistretti, 1966)	1	[11]: 1f
**Cylindera arenaria viennensis* (Schrank, 1781)	4	[13]:1m,1f; [15]:1m; [50]:1f
Omophronini Bonelli, 1810		
Omophron limbatum (Fabricius, 1777)	69	[1]:1m; [3]:7m; [5]:1m; [6]:1m,1f; [13]:1m; [16]:1m; [30]:1s; [31/2]:3m,1f,8s; [32]:1m,1f,16s; [33]:1m,1f; [36/1]:1s; [40]:1m,1f,11s; [41]:2m,2s; [42/1]:1m,1s; [46]:1m; [50]:2s
Clivinini Rafinesque, 1815		
Clivina fossor (Linnaeus, 1758)	9	[24]:1m,1f,1s; [25]:2m; [27]:1f; [50]:3s
Dyschiriini H.J. Kolbe, 1880		
Dyschirius aeneus (Dejean, 1825)	93	[24]:40s; [25]:29s; [26]:1m; [27]:18s; [28]:1m,1f; [42/1]:1s
Dyschirius agnatus Motschulsky, 1844	86	[1]:2m; [2]:6m,1f,1s; [3]:7m,1f; [5]:1f; [7]:8m,2f; [12]:3m; [13]:7s; [15]:9m,3f; [16]:1s; [31/1]:4s; [31/2]:11s; [40]:1s; [42/1]:9s; [45]:3s; [46]:3s; [49]:1s; [50]:2s
Dyschirius minutus albanicus J. Müller, 1922	9	[31/2]:4s; [33]:2s; [42/1]:1s; [43]:1s; [50]:1s
Dyschirius morio Putzeys, 1867	29	[9]:2s; [11]:1f; [33]:2s; [35]:2s; [40]:1s; [41]:1s; [42/1]:19s; [50]:1s
Dyschirius latipennis Seidlitz, 1867	1	[31/2]:1s;
***Dyschirius abditus* (Fedorenko, 1993)	12	[9]:1s; [17]:1f; [21]:1m; [33]:7s; [35]:2
Dyschirius gracilis (Heer, 1837)	18	[15]:1m; [16]:2f; [17]:1f; [19]:2f; [31/1]:1s; [35]:1s; [41]:2s; [42/1]:7s; [45]:1s
Dyschirius importunus Schaum, 1857	7	[25]:5m; [27]:1m; [50]:1s;
Dyschirius parallelus ruficornis Putzeys, 1846	70	[1]:1m,1f; [2]:1s; [3]:3m; [7]:1m; [13]:1m; [14]:1m; [15]:2s; [16]:2s; [32]:5s; [35]:2s; [40]:7s; [42/1]:15s; [49]:20s; [50]:8s
Dyschirius substriatus priscus J. Müller, 1922	28	[5]:2f; [6]:1m,1f; [12]:1s; [31/2]:1s; [32]:11s; [33]:3s; [35]:1s; [42/1]:2s; [42/2]:2s; [50]:3s
Scaritini Bonelli, 1810		
Scarites terricola Bonelli, 1813	7	[1]:1s; [8]:2s; [12]:1f; [13]:1s; [16]:2f

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Tab. 1 continued – Fortsetzung

tribe / species	specimens total	specimens per [site]
Bembidiini Stephens, 1827		
Asaphidion flavipes (Linnaeus, 1760)	47	[17]:1m,1f; [21]:1f; [24]:10m,20f; [25]:5m,5f; [26]:1f,1s; [28]:2m
Asaphidion nebulosum (P. Rossi, 1792)	57	[3]:1m,1f; [6]:1m; [8]:1m,1f; [10]:1m; [11]:2m; [12]:1f; [14]:1m,1f; [19]:1m; [20]:3m; [30]:2s; [33]:1f; [35]:5m,5f; [40]:2m,4f,3s; [42/1]:1m,2f,6s; [45]:1s; [50]:5f,5s
Asaphidion rossii (Schaum, 1857)	175	[10]:2f; [11]:1m; [14]:1m; [20]:2m,1f; [24]:6m,10f; [25]:2m; [30]:1m,1f,3s; [31/1]:3s; [31/2]:6m,8f; [32]:3m,4f; [33]:1m,2f,4s; [35]:2m; [37]:14m,16f; [38]:16m,13f, 1s; [39]:3m,2f; [40]:6m,2f,7s; [41/1]:1f; [42/1]:4m,3f; [43]:1s; [44]:3s; [46]:1f; [48]:3m,6f; [49]:3s; [50]:1m,2f,4s
Asaphidion stierlini (Heyden, 1880)	2	[24]:2m
Bembidion quadripustulatum Audinet-Serville, 1821	82	[24]:18m,6f,4s; [25]:26m,20f; [27]:5m,3f
Bembidion brunoi (Bonavita, 2001)	64	[37]:3m,6s; [38]:5m,4f,9s; [39]:4f; [44]:5s; [47]:17m,8f; [50]:3s;
Bembidion concoeruleum Netolitzky, 1943	3	[42/2]:2f; [43]:1s
Bembidion splendidum Sturm, 1825	8	[15]:1m; [24]:2m; [25]:1f; [35]:1f; [42/1]:1m,2f;
Bembidion azurescens Dalla Torre, 1877	6	[40]:1m,1s; [24]:1s; [42/1]:2f; [49]:1s
Bembidion latiplaga Chaudoir, 1850	40	[14]:1m,1f; [15]:1m,1f; [16]:1m,1f; [32]:6s; [40]:1m,2s; [42/1]:7m,11f; [46]:1f; [49]:5s; [50]:1s
Bembidion tenellum Erichson, 1837	1	[27]:1f
Bembidion combustum Ménétriés, 1832	4	[39]:1m,2f; [50]:1s
Bembidion scapulare Dejean, 1831	29	[7]:1f; [31/1]:1m; [37]:1m,3f; [39]:4m; [43]:7s; [47]:6m; [50]:6s
Bembidion lampros (Herbst, 1784)	5	[25]:3m; [26]:1f; [27]:1m
Bembidion properans (Stephens, 1828)	2	[24]:1f; [41]:1s
Bembidion quadricolle (Motschulsky, 1844)	215	[1]:2m,2f; [2]:15m,8f; [3]:13m,3f; [5]:5m,1f; [6]:5m,3f; [7]:14m,1f; [12]:2m,5f; [13]:17m,9f; [14]:1m,4f; [15]:8m,10f; [16]:3m,3f; [24]:3s; [31/2]:1f; [32]:1s; [36/2]:1f; [40]:7m,11f,14s; [45]:2s; [46]:5m,15f; [49]:20s; [50]:1m
Bembidion (*Nepha*) sp.	2	[40]:1f; [41]:1f
Bembidion varium (Olivier, 1795)	2	[32]:1s; [38]:1s
Bembidion striatum (Fabricius, 1792)	92	[2]:25m,18f; [3]:13m,6f; [5]:1f; [6]:4m,1f; [7]:2f; [32]:1s; [40]:2m,3f,3s; [45]:1s; [46]:2m,5f; [47]:1f, [49]:4s
Bembidion brunnicorne Dejean, 1831	7	[41]:3m,4f

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Tab. 1 continued – Fortsetzung

tribe / species	specimens total	specimens per [site]
Bembidion dalmatinum Dejean, 1831	29	[31/1]:1f; [40]:1s; [41]:4m,6f,3s; [42/1]:3m,2f,4s; [46]:1f; [50]:4s
Bembidion bualei Jacquelin du Val, 1852	112	[1]:1m; [2]:1f; [7]:1f; [8]:1m; [10]:2f; [11]:2m; [15]:2f; [16]:2f; [20]:3m,1f; [26]:1s; [32]:1f; [33]:1m,1f; [37]:1m,1f; [38]:7s; [38/1]:2m,2f; [39]:1f; [40]:3f,2s; [41]:1m,1f; [42/1]:1s; [42/2]:12m,9f; [43]:11s; [44]:19s; [46]:1m,1f; [49]:6s; [50]:2f,9s
Bembidion subcostatum vau Netolitzky, 1913	7	[24]:1m,1s; [25]:2m; [26]:2s; [42/1]:1f
Bembidion decolor Apfelbeck, 1911	27	[24]:1m,5f,5s; [25]:8s; [26]:1f; [28]:1m,1f,1s; [34]:1m,1f,1s; [50]:1s
Bembidion punctulatum Drapiez, 1820	13	[31/1]:2f; [37]:1f; [38]:1f,1s; [47]:3f; [50]:5s
Bembidion articulatum (Panzer, 1796)	7	[26]:1m,1f; [27]:3m,2f
Bembidion octomaculatum (Goeze, 1777)	2	[27]:1m; [34]:1m
Sinechostictus tarsicus (Peyron, 1858)	2	[33]:1s; [41]:1s
Tachys bistriatus (Duftschmid, 1812)	10	[24]:1m,1f,2s; [25]:1m; [27]:1m; [34]:2s; [41]:1s; [47]:1m
Tachys fulvicollis (Dejean, 1831)	6	[24]:2f; [27]:1f; [34]:1s; [40]:1s; [50]:1s
Tachys micros (Fischer von Waldheim, 1828)	13	[1]:2f; [3]:1f; [6]:2m; [7]:2f; [15]:1f; [22]:1m; [30]:1f; [33]:1s; [40]:1f; [42/1]:1s
Tachys scutellaris Stephens, 1828	1	[42/1]:1f
Tachyura hoemorroidalis (Ponza, 1805)	12	[14]:1f; [26]:1f; [27]:2m,1f; [30]:1m,1f; [41]:1s; [42/1]:3f; [50]:1s
Tachyura diabrachys (Kolenati, 1845)	120	[2]:1s; [3]:1f; [7]:1f; [12]:1m,1f; [31/1]:1s; [31/2]:15s; [32]:1m,3f; [33]:1s; [35]:1s; [38]:1s; [39]:4m,5f; [40]:1m,1s; [41]:3m,7f,5s; [42/1]:9m,18f,11s; [43]:12s; [44]:2s; [45]:1s; [46]:1s; [49]:3s; [50]:9s
Pogonini Laporte, 1834		
Pogonus littoralis (Duftschmid, 1812)	1	[50]:1m
Trechini Bonelli, 1810		
Perileptus areolatus (Creutzer, 1799)	12	[31/2]:1s; [38]:1s; [39]:2f; [43]:6s; [44]:1s; [50]:1s
Trechus quadristriatus (Schrank, 1781)	1	[50]:1s
**Thalassophilus longicornis* (Sturm, 1825)	10	[6]:1f; [37/1]:1m,1s; [39]:2m,2f; [44]:1s; [47]:2m
Brachinini Bonelli, 1810		
Brachinus explodens Duftschmid, 1812	2	[48]:2m
Chlaeniini Brullé, 1834		
Chlaenius flavipes Ménétriés, 1832	10	[36/1]:2f; [37]:1m,2f; [44]:1s; [47]:1m,2f; [50]:1s

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Tab. 1 continued – Fortsetzung

tribe / species	specimens total	specimens per [site]
Chlaenius nigricornis (Fabricius, 1787)	1	[24]:1m
Chlaenius vestitus (Paykull, 1790)	13	[26]:2m; [27]:2f; [36/1]:3f; [41]:1s; [42/1]:1m,1f; [44]:1s; [50]:2s
Chlaenius spoliatus (P. Rossi, 1792)	1	[36/1]:1m
Chlaenius festivus (Panzer, 1796)	24	[24]:3f; [25]:3m; [26]:3m,2f; [27]:5m,1f; [36/1]:2m,1f; [42/1]:2m,1f; [50]:1s
Dryptini Bonelli, 1810		
Drypta dentata (P. Rossi, 1790)	3	[24]:1m; [34]:2m
Harpalini Bonelli, 1810		
Harpalus cf. *anxius* (Duftschmid, 1812)	1	[22]:1f
Harpalus autumnalis (Duftschmid, 1812)	4	[13]:1m; [50]:2m,1f
Harpalus dimidiatus (P. Rossi, 1790)	4	[16]:1m; [25]:1f; [28]:1s; [29]:1f;
Harpalus distinguendus (Duftschmid, 1812)	4	[26]:1f; [27]:1f; [28]:1s; [48]:1m
Harpalus punctatostriatus Dejean, 1829	1	[29]:1m
Harpalus pygmaeus Dejean, 1829	18	[22]:3m,2f,9s; [50]:3m,1f
Harpalus serripes Quensel, 1806	2	[48]:1m,1f
Ophonus cribricollis (Dejean, 1829)	1	[34]:1m
Acupalpus flavicollis (Sturm, 1825)	1	[24]:1f
Acupalpus luteatus (Duftschmid, 1812)	2	[24]:1m; [25]:1m
Acupalpus maculatus (Schaum, 1860)	16	[24]:4m,1f; [25]:2m,1f; [27]:2m,2f; [28]:1s; [34]:2s; [50]:1s
Acupalpus meridianus (Linnaeus, 1760)	1	[16]:1m
Acupalpus notatus Mulsant & Rey, 1861	6	[24]:1f; [25]:4m,1f
Acupalpus paludicola Reitter, 1884	1	[49]:1m
Acupalpus planicollis (Schaum, 1857)	1	[25]:1m
Stenolophus discophorus (Fischer von Waldheim, 1823)	21	[14]:3m,5f; [16]:2m,1f; [19]:2m,1f; [42/1]:2m,1f,3s; [46]:1f
Stenolophus mixtus (Herbst, 1784)	3	[24]:1f; [34]:1f,1s
Stenolophus skrimshiranus Stephens, 1828	15	[25]:8m,5f; [34]:1m; [41]:1m;
Stenolophus teutonus (Schrank, 1781)	14	[24]:1m,3f; [25]:2m,3f; [34]:2m,3s
Lebiini Bonelli, 1810		
***Demetrias imperialis* (Germar, 1823)	3	[24]:1m,2s
Microlestes fissuralis (Reitter, 1901)	1	[28]:1f
***Microlestes fulvibasis* (Reitter, 1901)	2	[29]:1m; [42/1]:1f
Odacanthini Laporte, 1834		
Odacantha melanura (Linnaeus, 1767)	2	[24]:1f; [34]:1m
Oodini LaFerté-Sénectère, 1851		
Oodes gracilis A. Villa & G.B. Villa, 1833	15	[34]:11m,4f
Oodes helopioides (Fabricius, 1792)	15	[24]:1m,1w; [34]:6m,1f,3s; [50]:3s
Panagaeini Bonelli, 1810		
Panagaeus cruxmajor (Linnaeus, 1758)	1	[30]:1f
Platynini Bonelli, 1810		
Agonum muelleri (Herbst, 1784)	1	[24]:1f

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Tab. 1 continued – Fortsetzung

tribe / species	specimens total	specimens per [site]
Agonum sordidum Dejean, 1828	1	[27]:1s
Agonum permoestum Puel, 1938	9	[24]:1m,3f; [25]:1m; [34]:1m,1f; [27]:1s; [50]:1s
Anchomenus dorsalis (Pontoppidan, 1763)	10	[24]:1m; [25]:3m,5f; [48]:1s
Olisthopus fuscatus Dejean, 1828	30	[22]:6m,3f,20s; [50]:1s
Olisthopus glabricollis (Germar, 1817)	8	[22]:1m,2f,4s; [50]:1s
Pterostichini Bonelli, 1810		
Poecilus cupreus (Linnaeus, 1758)	6	[24]:3m,3f
Poecilus rebeli (Apfelbeck, 1904)	31	[24]:13m,16f; [25]:1s; [26]:1f
Poecilus striatopunctatus (Duftschmid, 1812)	27	[14]:1f; [15]:1f; [16]:7m,3f; [19]:1f; [35]:3f; [36/1]:2s; [42/1]:2f; [46]:1f; [50]:6s
Pterostichus cursor (Dejean, 1828)	17	[24]:1m,3f,2s; [28]:1s; [30]:1s; [34]:4m,3f; [50]:2s
Pterostichus melas (Creutzer, 1799)	2	[10]:1f; [22]:1f
Pterostichus melanarius (Illiger, 1798)	1	[50]:1s
Pterostichus cf. *anthracinus biimpressus* (Küster, 1853)	7	[24]:1m; [27]:1f; [34]:2m3f
Sphodrini Laporte, 1834		
Calathus circumseptus Germar, 1823	40	[22]:11m,22f,5s; [50]:2s
Calathus fuscipes (Goeze, 1777)	2	[23]:1m; [24]:1f
Zabrini Bonelli, 1810		
Amara aenea (De Geer, 1774)	4	[22]:1f,1s; [50]:2s

Comments on selected species

Cicindela monticola albanica Apfelbeck, 1909

Broad riverbanks with a mixture of grain and coarse sediments in initial to early succession stages are the habitat of this Balkan endemic Cicindelini (Fig. 1), which occurs from Croatia over Bulgaria and Serbia to Greece (Jaskuła et al. 2005, Jaskuła 2007a). Its infrequent status in this area is documented in a few examples for Greece, where *Cicindela monticola albanica* seems to be restricted to the lower reaches of the large rivers Alphios and Erimantos (Franzen 2006). Although there are some recent records of *Cicindela monticola albanica* in Albania (Guéorguiev 2007a, Jaskuła 2007a), the observed population in the active floodplain of Vjosa – at least between Kalivaç and Poçem – is of international significance. We collected 179 specimens and observed a total of several hundred individuals, especially occurring in moist sandy to silty banks along the primary channel or in drying up, disconnected arms and pools along the river.

Cicindela campestris olivieria Brullé, 1832

With records from Bosnia and Herzegovina to Greece and Turkey (Puchkov & Matalin 2017), this taxon is treated as a Balkan endemic (Cassola 1999, Guéorguiev 2007b). Only single individuals could be observed within the active floodplain around the village of Kutë, as the centre of its habitat use clearly lies outside riverside habitats. Thus, 11 specimens were caught in a drying up, disconnected former arm of the Vjosa (Fig. 10),

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Fig. 1: Typical habitat [site 2, habitat type C2] of *Cicindela monticola albanica* and *Calomera fischeri* within the active floodplain of the Vjosa. © Paill W., 24.04.2017. – Abb. 1: Charakteristischer Lebensraum [Probefläche 2, Habitattyp C2] von *Cicindela monticola albanica* und *Calomera fischeri* innerhalb der regelmäßig umgelagerten („aktiven") Aue der Vjosa. © Paill W., 24.04.2017.

two in fallow land outside the active floodplain and many more specimens (which are not registered in this paper) could be observed in a dry, grazed meadow outside the morphological floodplain.

Cylindera germanica muelleri (Magistretti, 1966)

There is no document that contains precise data on this trans-ionian taxon for Albania (Guéorguiev 2007a, Jaskuła 2007a). Hieke & Wrase (1988), as well as Striniqi Laçej et al. (2010), reported *Cicindela germanica* for Albania, but only on species level. Puchkov & Matalin (2003) admittedly listed the ssp. *muelleri* for Albania (without precise data), however, they omitted it for the country in the last version of the Palaearctic Catalogue (Puchkov & Matalin 2017). Within the active floodplain of the Vjosa, one female was collected in an early succession stage on partly vegetated, silty ground, accompanied by single specimens of *Cicindela campestris olivieria* and *Cicindela monticola albanica*, and represents the first detailed record for Albania.

Cylindera arenaria viennensis (Schrank, 1781)

Just as for the species above, there was as yet no indisputeable documentation for Albania of this taxon that is sparsely distributed between Central Europe and Western Sibiria (Guéorguiev 2007a, Jaskuła 2007a). Hieke & Wrase (1988) reported

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Fig. 2: Drying up pool in an annually-flooded, disconnected arm of the Vjosa (sites 12–16, habitat type C2) as habitat of *Cylindera arenaria viennensis*. Accompanying species were *Calomera littoralis nemoralis*, *Scarites terricola*, *Bembidion quadricolle*, *Stenolophus discophorus*, *Poecilus striatopunctatus*. © Paill W., 24.04.2017. – Abb. 2: Austrocknende Tiefenrinne in einem jährlich überschwemmten Seitenarm der Vjosa (Probeflächen 12–16, Habitattyp C2) als Lebensraum von *Cylindera arenaria viennensis*. Vergesellschaftet traten *Calomera littoralis nemoralis*, *Scarites terricola*, *Bembidion quadricolle*, *Stenolophus discophorus* und *Poecilus striatopunctatus* auf. © Paill W., 24.04.2017.

Cicindela arenaria for Albania, but only on species level and without giving detailed data. Puchkov & Matalin (2003) admittedly listed the ssp. *viennensis* for Albania, while they omitted it for the country in the last version of the Palaearctic Catalogue (Puchkov & Matalin 2017). We caught three individuals in a drying up, most likely annually-flooded, disconnected arm of the Vjosa (Fig. 2) and, therefore, provide the first detailed record for Albania.

Dyschirius minutus albanicus J. Müller, 1922

While the nominotypical subspecies is more widely distributed, this Dyschiriini is restricted to the Eastern Balkans and Turkey (Bulirsch & Fedorenko 2007, Bulirsch & Pavićević 2008, Balkenohl 2017). As many other members of the genus, it is highly stenotopic, exclusively inhabiting sandy and silty banks of rivers. Most of our specimens were collected on a bank along an anually-flooded secondary channel of the Vjosa, offering, at least during the time of our study, remaining patches of standing water.

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Dyschirius latipennis Seidlitz, 1867

The area this rare species inhabits is comparatively small, spanning from Slovakia to Turkey (Balkenohl 2017, Fedorenko 1996). While a lot of findings are known from the latter country (Bulirsch & Fedorenko 2007), there are only a few in the Pannonian area and on the Balkans, particularly outside of Bulgaria (e.g. Hůrka 1996, Fedorenko 1996, Szél 2006, Guéorguiev 2011b). Guéorguiev (2007a) published one dataset and Bulirsch & Pavićević (2008) added one more from Albania. Confirming the rarity of this species, we collected *Dyschirius latipennis* in only one single female – making this species the rarest of the 10 Dyschiriini documented in our study. The record was made on a small sandy slope along an anually-flooded secondary channel of the Vjosa, near the above mentioned habitat of *Dyschirius minutus albanicus*. *Dyschirius agnatus*, however, was the only accompanying *Dyschirius* in this case.

Dyschirius abditus (Fedorenko, 1993)

This species also leads a highly stenotopic life on the banks of rivers. However, it seems to prefer somewhat different conditions to *Dyschirius minutus albanicus*, as they were collected on the same bank only once. In some cases occurring syntopically with *Dyschirius morio,* we recorded *Dyschirius abditus* mostly along a cut river bank along the primary channel (Fig. 3), but infrequently also on slightly higher levels of the active floodplain, in grasslands of the predominantly growing *Imperata cylindrica*, apparently caused by burning and grazing. *Dyschirius abditus* was recently published from Macedonia for the first time (Hristovski & Guéorguiev 2015) and we provide the first records for Albania.

Further *Dyschirius* spp.

Most *Dyschirius* species, such as *Dyschirius agnatus*, *Dyschirius morio*, *Dyschirius gracilis*, *Dyschirius parallelus ruficornis*, and *Dyschirius substriatus priscus* are sensitive indicators of natural riverbanks. They inhabit the interstitial space close to the shoreline by digging in the ground. For each species there are hardly any records for Albania (Guéorguiev 2007a, Bulirsch & Guéorguiev 2008).

Asaphidion nebulosum (P. Rossi, 1792)

The taxonomy of the *Asaphidion caraboides*-group is difficult and has recently changed. In former times defined as a subspecies of the pyrenean-alpine-caucasic *Asaphidion caraboides* (Schrank, 1781), *Asaphidion nebulosum* is nowadays treated as a distinct, polytypical species occurring in the mediterranean area (Bonavita & Vigna Taglianti 2005, Coulon 2005, Marggi et al. 2017). According to Bonavita & Vigna Taglianti (2005) the ssp. *balcanicum* Netolitzky, 1918 is distributed on the Balkans (defined as Balkan subendemic following Guéorguiev 2007b), while the nominotypical subspecies is restricted to southeastern France and Italy, and the ssp. *splendidum* (Heyden, 1870) to northeastern Spain. In the most recent Catalogue of Palearctic Coleoptera, however, both ssp. *balcanicum* and ssp. *nebulosum* are listed for Albania (Marggi et al. 2017). Our material (Fig. 4) does not exactly match the male genitalia of an Italian specimen presented by Neri et al. (2011: 171), and also differs from the female genitalia of French specimens illustriated by Coulon (2005: 120). For this reason, we expect the population from the Vjosa to be referred to the ssp. *balcanicum*.

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Fig. 3: Cut river bank along the main channel of the Vjosa near the village Kutë [site 33, habitat type C1]. On the sandy to silty-grained substrate, *Dyschirius abditus* was the most frequently collected ground beetle, occuring together with *Omophron limbatum*, *Dyschirius morio*, *Dyschirius substriatus priscus*, *Asaphidion rossii*, and *Bembidion bualei*. © Paill W., 25.04.2017. – Abb. 3: Prallhang am Hauptarm der Vjosa nahe der Ortschaft Kutë [Probefläche 33, Habitattyp C1]. Auf dem sandig-schluffigen Substrat war *Dyschirius abditus* der häufigste Laufkäfer und trat gemeinsam mit *Omophron limbatum*, *Dyschirius morio*, *Dyschirius substriatus priscus*, *Asaphidion rossii* und *Bembidion bualei* auf. © Paill W., 25.04.2017.

Fig. 4: Male and female genitalia of *Asaphidion nebulosum* from the study area [site 35]. a) median lobe of adeagus, left lateral view, b) median lobe of adeagus, dorsal view, c) median lobe of adeagus, ventral view, d) spermatheca and annulus receptaculi. Scale bare: 0.5 mm. © Paill W. – Abb. 4: Männliche und weibliche Genitalorgane von *Asaphidion nebulosum* aus dem Untersuchungsgebiet [Probefläche 35]. a) Medianlobus des Aedeagus in seitlicher Ansicht (linke Seite), b) Medianlobus des Aedeagus in dorsaler Ansicht, c) Medianlobus des Aedeagus in ventraler Ansicht, d) Spermathek und Annulus receptaculi. Maßstab: 0.5 mm. © Paill W.

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Asaphidion nebulosum is not only a geographical vicariant of *Asaphidion caraboides*, but also replaces the latter in the ecological sense. Thus, *Asaphidion nebulosum* is stenotopic, prefers the more dynamic and actively flooded parts of the floodplain, and occurs mostly near water. This is rather a contrast to the other typical floodplain-inhabiting representative of the genus, *Asaphidion rossii*, which is eurotypic and also occurs at higher-elevated niveaus (see below).

Asaphidion stierlini (Heyden, 1880)

There was only one historic record of this circum-mediterranean species available for Albania to date (Guéorguiev 2007a), its rarity being validated by the first record of this taxon for Macedonia (Hristovski & Guéorguiev 2015) and Bulgaria (Guéorguiev 2011b) only very recently. Corresponding to the observations of Guéorguiev (2011b: 513), who sampled the species in a "damp place near brook" we documented *Asaphidion stierlini* in a swampy reed mace stand along a small, stagnantly flowing ditch ending in the Vjosa (Fig. 8). On the wet, silty to clayey ground, it lives syntopically with *Asaphidion flavipes* and *Asaphidion rossii*, the latter being the most frequent *Asaphidion* in the floodplain around the village of Kutë, occurring from initial stages on coarse-grained sediment bars along the main river-channel to heavily vegetated clayey grounds away from flowing water (Tab. 2).

Fig. 5: Gravel sediment bar directly beside the rapidly flowing main channel of the Vjosa [site 38, habitat type B1] with a high population density of *Bembidion brunoi*, a local endemic and highly stenotopic riparian ground beetle. © Paill W., 26.04.2017. – Abb. 5: Schotterbank direkt am stark durchflossenen Hauptarm der Vjosa [Probefläche 38, Habitattyp B1]. Hier lebt eine individuenreiche Population des lokal-endemischen und hochgradig stenotopen Uferlaufkäfers *Bembidion brunoi*. © Paill W., 26.04.2017.

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Bembidion brunoi (Bonavita, 2001)

This taxon was fairly recently described in Greece (from the Aoos river, which is the headwater of the Vjosa) and was, until now, otherwise only found in Bosnia Herzegovina (Bonavita 2001), Montenegro (Guéorguiev 2011b) and Albania (Guéorguiev 2007a). Because of this restricted area, Guéorguiev (2007b) described the species as locally endemic. As in many other members of the genus, *Bembidion brunoi* is highly stenotopic, exclusively inhabiting initial stages of gravel sediment bars (Tab. 2). We collected 64 individuals in at least five sites between Kalivaç and Poçem, all of them situated directly along the more or less rapidly flowing main channel of the Vjosa. In many cases the species was accompanied by *Asaphidion rossii*, *Bembidion bualei*, and *Tachyura diabrachys*. In the most suitable site, however, where *Bembidion brunoi* showed high densities (Fig. 5), *Bembidion scapulare* was the second most frequent ground beetle.

Bembidion splendidum Sturm, 1825

This riparian ground beetle inhabits a relatively small area ranging from Poland and Germany through northeastern Italy and Slovenia to Syria and Turkey (Marggi et al. 2017, Bonavita & Vigna Taglianti 2005). Its distribution is scattered, and in many parts of the area – especially in the east, outside the Danube watershed – the species is rare (see Netolitzky & Meyer 1936). There are only a few recent records, e.g. from Germany, Italy, and the European part of Turkey (Kahlen 2010, Guéorguiev 2011b, Trautner et al. 2014), while the last findings for Macedonia and Albania date back to 1937 (Guéorguiev 2007a, Hristovski & Guéorguiev 2015). *Bembidion splendidum* lives on the lower reaches of larger rivers (Bonavita & Vigna Taglianti 2005), however, data about its detailed habitat use differ. Franz (1970) observed a preference for dry sand in moderate distance to the shoreline, while Hůrka (1996) stated moist, unshaded or partly shaded, clayish and sandy-clayish edges of waters, the latter corresponding with single data published by Kahlen (2010) and Nagy et al. (2004). At the Vjosa we collected *Bembidion splendidum* very locally but under different conditions, on shores without any vegetation along the main channel and in a drying up, disconnected arm of the Vjosa, as well as in more or less densely vegetated reed mace stands along a small tributary in the outer part of the active floodplain of the main river (Fig. 8). In both cases, however, the soil was moist, silty to clayish, and water was close by.

According to Bonavita & Vigna Taglianti (2005) and Marggi et al. (2017) parts of the Balkan populations (Albania, Bulgaria, parts of Serbia) belong to ssp. *pincum* De Monte, 1957. We could not unambiguously verify our material from the Vjosa by comparing it with material from Austria and with genital-pictures presented by De Monte (1957). In any case, taxonomy and distribution of *Bembidion splendidum* ssp. requires further investigation.

Bembidion scapulare Dejean, 1831

According to Marggi et al. (2017), Albanian populations of the euro-mediterranean *Bembidion scapulare* belong to ssp. *lomnickii* Netolitzky, 1916. However, the subspecific status of the Balkan populations do not yet appear adequately clarified (see Guéorguiev 2007a, 2011b). Because of its stenotopic ripicol habitate use, *Bembidion scapulare* is rare, especially regarding recent findings. Correspondingly, there are only few records published on the Balkans from the past 30 years, one including the first discovery for Bulgaria

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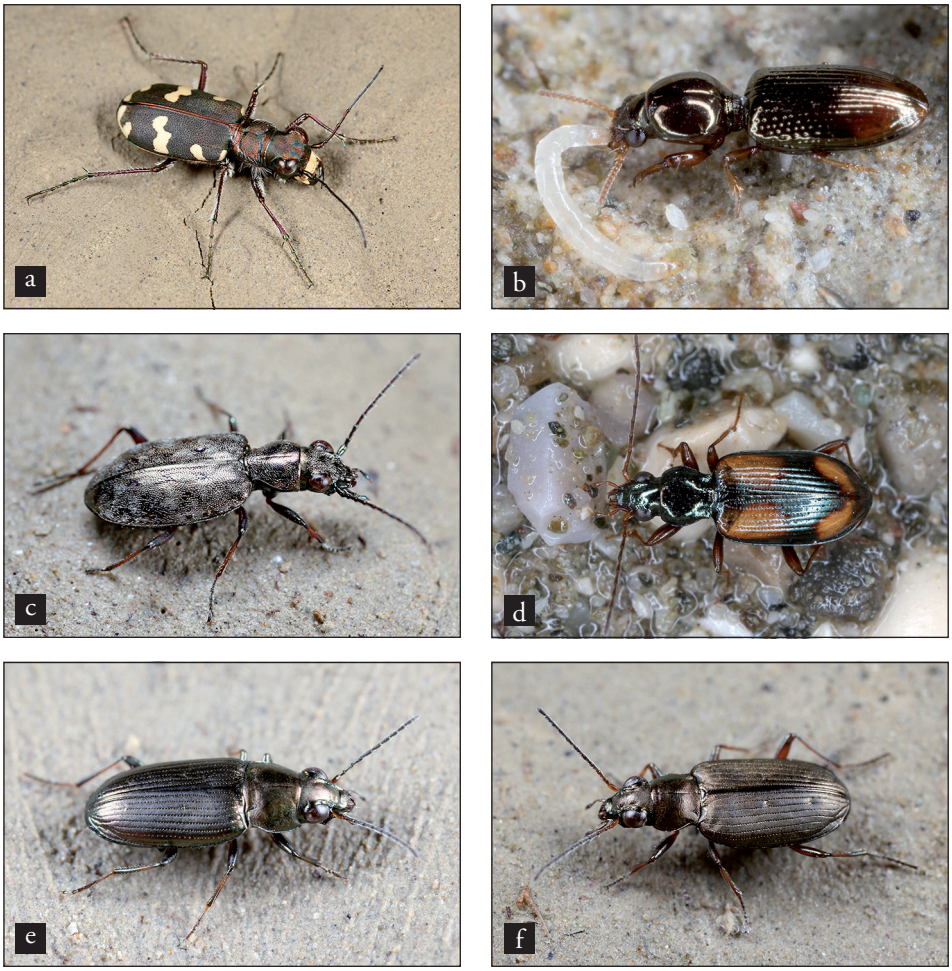

Fig. 6: a) *Cicindela monticola albanica*, b) *Dyschirius substriatus priscus*, c) *Asaphidion nebulosum*, d) *Bembidion scapulare*, e) *Bembidion quadricolle*, f) *Bembidion striatum*. All pictures were taken from beetles at the Vjosa valley near Kutë, 24.04.-28.04.2018. © Paill W. (a, c, e, f), Kunz G. (b, d). – Abb. 6: a) *Cicindela monticola albanica*, b) *Dyschirius substriatus priscus*, c) *Asaphidion nebulosum*, d) *Bembidion scapulare*, e) *Bembidion quadricolle*, f) *Bembidion striatum*. Alle Aufnahmen stammen von Käfern aus dem Vjosatal nahe Kutë, 24.04.–28.04.2018. © Paill W. (a, c, e, f), Kunz G. (b, d).

(Guéorguiev 2011a), and one originating from the Vjosa river (Guéorguiev 2007a). In our study, we collected 29 individuals of *Bembidion scapulare* in at least seven sites, all of them directly at the shoreline (e.g. Fig. 5). There was a clear preference for initial stages on gravel sediment bars, as only one specimen was sampled on a silty to sandy bar (Tab. 2). This behavior is slightly in contrast to the species' habitat use along the Tagliamento in northern Italy, where Kahlen (2010) documented the same degree of importance between coarse-grained and fine-grained sediment bars.

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Bembidion quadricolle (Motschulsky, 1844)

Fine flight capability characterizes this highly stenotopic riparian species. Nevertheless, findings within the turanico-east mediterranean range – at least in Europe – are rare, reflected e.g. by the very low number of records from Romania (Nitzu 2003), Bosnia Herzegovina (Guéorguiev 2011b), Macedonia (Hristovski & Guéorguiev 2015), and Serbia (Guéorguiev 2008, Ćurčić et al. 2007). Some more findings were published for Albania, but none of them is less than 80 years old (Guéorguiev 2007a). Around the village of Kutë, we collected 215 specimens (and observed many more rapidly flying away) in no less than 20 sites. This species is therefore one of the most abundant riparian ground beetles in the study area. It exclusively inhabits initial stages of fine-grained sediment bars, whereby both sites along standing and flowing water are used. In any case, the habitat is characterized by moist ground conditions, cover with silt (and sand) and more or less lacking vegetation (Fig. 1, 2, 7). We observed similar habitat use in some other species, e.g. *Bembidion latiplaga*, *Bembidion striatum*, *Tachys micros*, *Tachyura hoemorroidalis*, and *Stenolophus discophorus*. Nitzu (2003) found *Bembidion quadricolle* associated with *Bembidion laticolle* Duftschmid, 1812. However, the latter species is not yet documented for Albania.

Bembidion striatum (Fabricius, 1792)

Similar to the species mentioned above, the eurosibirian *Bembidion striatum* is a highly stenotopic riparian Bembidiini. Again, there are very few records for the Balkans – mark-

Fig. 7: Silty sediment bar directly at the edge of the Vjosa as typical habitat of *Bembidion quadricolle* and *Bembidion striatum* (sites 6 and 7, habitat type C1]. © Paill W., 26.04.2017. – Abb. 7: Schluffige Sedimentbank direkt an der Vjosa als typischer Lebensraum von *Bembidion quadricolle* und *Bembidion striatum* (Probeflächen 6 und 7, Habitattyp C1]. © Paill W., 26.04.2017.

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ing the southeastern margin of its European distribution – especially outside the watershed of the Danube (e.g. Netolitzky 1918, Geisthardt 1975, Guéorguiev 2007a). In Central Europe, in contrast, many records have been published (e.g. Bräunicke & Trautner 1999, Franz 1970), but almost no populations have survived until now, mainly caused by hydraulic engineering schemes (Bräunicke & Trautner 1999). Around the village of Kutë, we collected 92 specimens (and observed many more rapidly flying away) on 11 sites. The habitat is equivalent to that of *Bembidion quadricolle,* as all sites with more than one individual of *B. striatum* were also inhabited by the former species.

Bembidion decolor Apfelbeck, 1911

Little is known about the ecology of this rare and scattered mediterranean species, which ranges from southern Croatia to Iran (Drovenik & Peks 1999, Marggi et al. 2017). Austin et al. (2008) mentioned findings from freshwater wetlands in Cyprus, and Teofilova et al. (2012) stated halobiontic behavior based on findings from the Black

Fig. 8: Small, stagnantly flowing ditch with *Typha* and *Salix* vegetation: Wetlands at the outer edge of the active floodplain of the Vjosa [site 24, habitat type E2] as habitat of a diverse ground beetle fauna, e.g. *Dyschirius aeneus*, *Asaphidion stierlini*, *Bembidion quadripustulatum*, *Bembidion splendidum*, *Bembidion decolor*, *Acupalpus flavicollis*, *Demetrias imperialis*, *Odacantha melanura*, and *Poecilus rebeli*. © Paill W., 25.04.2017. – Abb. 8: Kleines, langsam fließendes Gerinne mit *Typha*- and *Salix*-Vegetation: Feuchtgebiet am äußeren Rand der regelmäßig umgelagerten („aktiven") Aue der Vjosa [Probefläche 24, Habitattyp E2] als Lebensraum einer artenreichen Laufkäferzönose, z. B. *Dyschirius aeneus*, *Asaphidion stierlini*, *Bembidion quadripustulatum*, *Bembidion splendidum*, *Bembidion decolor*, *Acupalpus flavicollis*, *Demetrias imperialis*, *Odacantha melanura* und *Poecilus rebeli*. © Paill W., 25.04.2017.

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Sea coast, where the only known occurances of *Bembidion decolor* are from Bulgaria (e.g. Hieke & Wrase 1988). Besides the typical material dating from the Buenë River (Guéorguiev 2007a), there is no indication about the possible significance of floodplain-systems. Around the village of Kutë, we found *Bembidion decolor* very locally in two different systems. Most of the 27 sampled individuals were located along a tributary to the Vjosa. This small, stagnantly flowing ditch is characterized by a moist, silty to clayish ground, partly covered by reed mace and *Salix* vegetation (Fig. 8). The conditions at this location are similar to the second occurrence at standing waters along a disconnected former arm of the Vjosa. On both sites, *Bembidion decolor* was commonly accompanied by *Dyschirus aeneus* and *Bembidion quadripustulatum*.

Tachys micros (Fischer von Waldheim, 1828)

This eurosibirian species illustrates the relativly sparse knowledge of the Albanian ground beetle fauna. While there is only one historic finding published from this country (Guéorguiev 2007a), we registered 13 individuals from 10 sites around the village of Kutë. We found the species to prefer initial to pioneer stages of sandy to silty bars, mostly directly at the edge of water.

Thalassophilus longicornis (Sturm, 1825)

The eurocaucasian species is widespread in alpine riversystems but not frequent on the Balkans. Although cited by Apfelbeck (1907) for Albania, Guéorguiev (2007a: 88) stated that "it needs further confirmation for the country". *Thalassophilus longicornis* is highly stenotopic, exclusively inhabiting initial stages of gravel sediment bars. At the Vjosa between Kalivaç and Poçem, it was found to live directly at the edge of flowing water. On the site with its highest local density, *Thalassophilus longicornis* was accompanied by several other stenotopic species, such as *Bembidion brunoi*, *Bembidion combustum*, *Bembidion scapulare*, and *Perileptus areolatus*. We provide the first detailed data for Albania.

Acupalpus flavicollis (Sturm, 1825)

Widely distributed from West Siberia and Kazakhstan across Europe to the northeastern Iberian Peninsula, this species is very common in Central Europe. However, in Albania (Jaeger et al. 2016) as well as Macedonia (Hristovski & Guéorguiev 2015), it was recently documented for the first time, each based on single locations. The species is eurytopic and lives in moist, unshaded margins of standing waters, as well as in wet meadows. We caught a single female in the outer edge of the active floodplain of the Vjosa in a reed mace stand along a small, stagnantly flowing ditch as a tributary to the main river (Fig. 8). Here, it was part of a highly diverse ground beetle-fauna, with high densities of *Dyschirius aeneus*, *Asaphidion flavipes*, *Asaphidion rossii*, *Bembidion quadripustulatum*, *Bembidion decolor*, and *Poecilus rebeli*.

Acupalpus meridianus (Linnaeus, 1760)

For this equally widely distributed (Jaeger & Kataev 2017) and, in many countries, commonly documented species, only one historical finding for Albania was published thus far (Guéorguiev 2007a). It is more eurytopic than the former species and a single male was trapped on a moderately moist, fine-grained pioneer stage at a higher level within the active floodplain.

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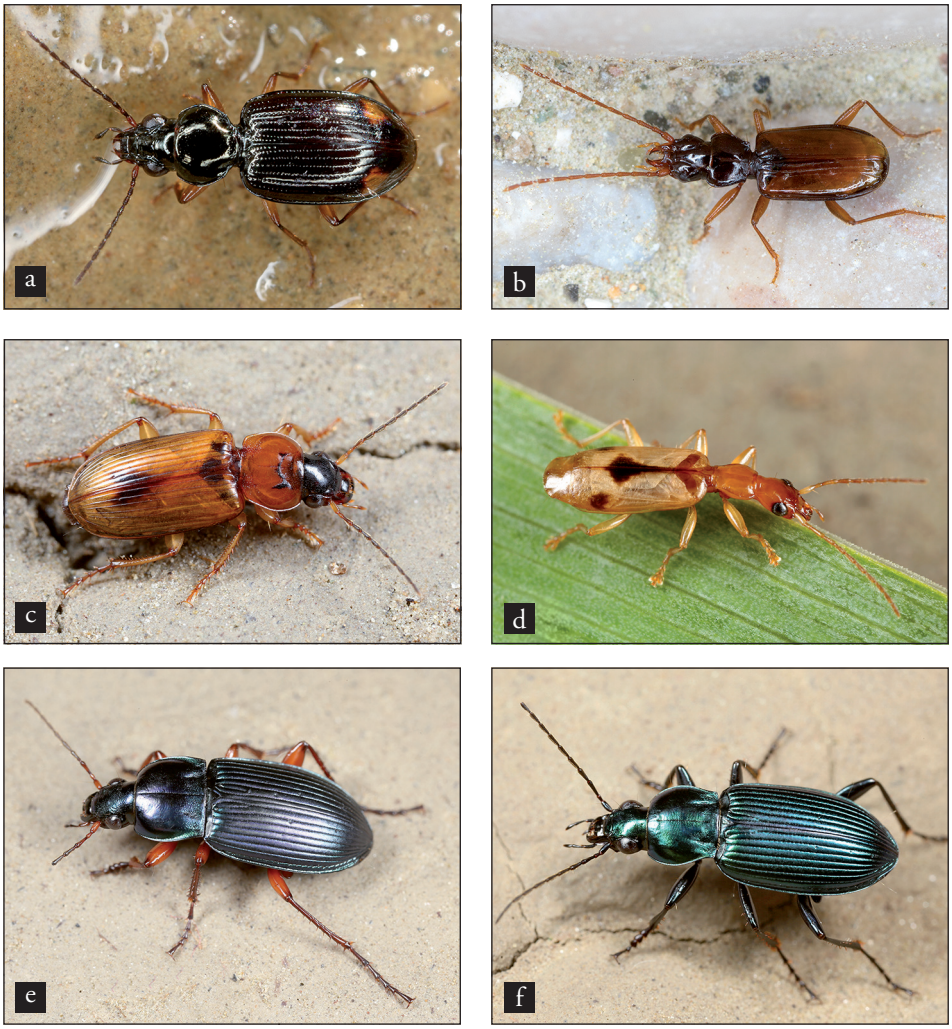

Fig. 9: a) *Bembidion decolor,* b) *Thalassophilus longicornis*, c) *Stenolophus discophorus*, d) *Demetrias imperialis*, e) *Poecilus rebeli*, f) *Poecilus striatopunctatus*. All pictures were taken of beetles at the Vjosa valley near Kutë, 24.04.-28.04.2018. © Paill W. (c-f), Kunz G. (a, b). – Abb. 9: a) *Bembidion decolor,* b) *Thalassophilus longicornis*, c) *Stenolophus discophorus*, d) *Demetrias imperialis*, e) *Poecilus rebeli*, f) *Poecilus striatopunctatus*. Alle Aufnahmen stammen von Käfern aus dem Vjosatal nahe Kutë, 24.04.-28.04.2018. © Paill W. (c-f), Kunz G. (a, b).

Acupalpus planicollis (Schaum, 1857)

This Stenolophina is endemic to the Balkan Peninsula, where it is known from northeastern Italy (Triest), Bulgaria, Albania and Greece (Jaeger et al. 2016, Jaeger & Kataev 2017). Nothing has yet been published about its habitat use. We caught one single male in a reed mace stand in the outer edge of the active floodplain of the Vjosa along a small, stagnantly flowing ditch as a tributary to the main river. The location is similar to the finding of *Acupalpus flavicollis* and also harbours a rich carabid fauna; high densities were

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Fig. 10: Disconected former arm with drying up wetland habitats at the outer edge of the active floodplain of the Vjosa [sites 28 and 29, habitat type E1] © Paill W., 25.04.2017. – Abb. 10: Abgetrennter früherer Flussarm mit auftrocknenden Feuchtflächen am äußeren Rand der regelmäßig umgelagerten („aktiven") Aue der Vjosa. [Probeflächen 28 and 29, Habitattyp E1] © Paill W., 25.04.2017.

documented for *Dyschirius aeneus*, *Asaphidion flavipes*, *Bembidion quadripustulatum*, *Bembidion decolor*, *Stenolophus skrimshiranus*, and *Anchomenus dorsalis*.

Stenolophus discophorus (Fischer von Waldheim, 1823)

The distribution of this stenotopic ground beetle ranges from Central Europe over the mediterranean area until western Sibiria and northwestern China (Jaeger & Kataev 2017). Although *Stenolophus discophorus* may be found at standing waters outside of floodplains (e.g. Paill & Holzer 2015), it clearly prefers active floodplains, where moist sandy to silty grounds without vegetation results from the natural activity and flood dynamics. Observations made by Kahlen (2010) at the Tagliamento are in accordance with our findings at the Vjosa, where *Stenolophus discophorus* was particularly found on almost bare, silty to clayey, drying up, cracked soils, allowing the beetles to shelter between the cracks. *Bembidion latiplaga* and *Bembidion quadricolle* were the most frequent companions.

Demetrias imperialis (Germar, 1823)

Because it climbs reed stands of moist to wet swamps and standing waters, this euroturanian species is hard to find. This may be one of the reasons why it has not been documented in Albania before. Near Kutë we collected three specimens in a reed mace stand (*Typha*

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sp.) along a small, stagnantly flowing ditch at the outer edge of the active floodplain of the Vjosa (Fig. 8). Also (in some cases, only recently) known from the neighboring countries Macedonia (Hristovski 2007, Hristovski & Guéorguiev 2015), Serbia (Ćurčić et al. 2007), and Greece (Arndt et al. 2011), we provide the first data for Albania.

Microlestes fulvibasis (Reitter, 1901)

This turano-mediterranean species is eurytopic and not typical of riverside biotopes. Literature often – especially in Central Europe – refers to saline habitats (e.g. Wrase 1989, Teofilova et al. 2015), including findings near the coast from sandy shores or low marquises (e.g. Contarini 1992, Fattorini & Vigna Taglianti 2002), but also from a forest in a river floodplain (Fülöp & Rudner 2000) or a wet meadow (Hristovski & Guéorguiev 2015). Moderately hygrophilous behavior, as classified by Zanella (2010), applies to our observations made in the floodplain of Vjosa around the village of Kutë. We collected two individuals, one female on a silty sediment bar in an initial stage near the waterline, and one male in a more or less dry, disconnected former arm of the Vjosa at the outer edge of the active part of the floodplain (Fig. 10). Already known from Macedonia (Hristovski & Guéorguiev 2015) and Greece (Arndt et al. 2011), *Microlestes fulvibasis* had been expected in Albania, too. We provide the first records.

Odacantha melanura (Linnaeus, 1767)

There was only one historic specimen known for Albania until now (Guéorguiev 2007a). We collected two specimens at two sites along a small, stagnantly flowing ditch vegetated with reed mace (*Typha*) on a wet clayey ground. At the temporarily submerged site, *Odacantha melanura* was accompanied by *Pterostichus cursor*, *Oodes gracilis*, and *Oodes helopioides*.

Poecilus rebeli (Apfelbeck, 1904)

Endemic to the West Balkan, *Poecilus rebeli* is restricted to Croatia, Bosnia and Herzegovina, Macedonia, Serbia, Albania, and Greece (Bousquet 2017). As there are only single locations published from Croatia (Apfelbeck 1904), Serbia (Ćurčić et al. 2007), Montenegro (Apfelbeck 1904), as well as Macedonia (Hristovski & Guéorguiev 2015), most of the known sites come from Albania (Guéorguiev 2007a). Locations such as Buenë River (Guéorguiev 2007a) or the marshland of the Neretva (Apfelbeck 1904) might give an indication about the significance of floodplains for this notable species. In our investigations around Kutë, all 31 *Poecilus rebeli* individuals were caught in an initial softwood forest (*Salix alba*, *Typha* sp.) on wet to moist silty to clayish ground along a stagnantly flowing ditch, being a small, periodically drying up tributary of the Vjosa (Fig. 8).

Poecilus striatopunctatus (Duftschmid, 1812)

All over its euromediterran area, this stenotopic riverside ground beetle is sporadically distributed and fairly rare. This is especially true considering recent records, which are known only from a few well-preserved lower reaches of larger rivers such as the Po (e.g. Alegro & Sciaky 2001), the Tagliamento (Kahlen 2010), or the Tisa (Hůrka 1996). In Albania the species had been sampled at the Buenë and the Vjosa, both at least 80 year ago (Guéorguiev 2007a). During our studies around the village of Kutë, we discovered a large population of *Poecilus striatopunctatus* and collected 27 specimens from at least 9 sites. All of the sites were moist, sandy to silty pioneer stages at the edge of standing or slowly flow-

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ing waters with, at most, scattered seedlings of herbs. The best site with 20 sampled specimens was a drying up pool in an annually-flooded, disconnected arm of the Vjosa with almost no vegetation (Fig. 2).

Pterostichus cf. *anthracinus biimpressus* (Küster, 1853)

This Balkan subendemic taxon was described from Omiš at the Dalmatian coast of Croatia (Ganglbauer 1899, Guéorguiev 2007a) and is known to be distributed from the Balkans (known from Croatia, Bosnia and Herzegovina, Bulgaria, Albania, and Greece) to Turkey (Guéorguiev & Guéorguiev 1995, Bousquet 2017). Bousquet (2017) also listed Hungary, but there is some doubt as to this, because the author may have been referring to Reitter (1901), who named *biimpressus* for the Beskids (Mähren-Schlesien), which could not be confirmed in recent times. From Bulgaria, Albania, and Greece, both *biimpressus* as well as *anthracinus* have been published (Apfelbeck 1904, Bucciarelli & Sopracordevole 1958, Guéorguiev & Guéorguiev 1995, Guéorguiev 2007a, 2011b). However, there is no data on *biimpressus* from Montenegro, Macedonia, and Serbia, where only *P. anthracinus anthracinus* occurs (Ćurčić et al. 2007, Guéorguiev 2008, 2011, Hristovski & Guéorguiev 2015). Little is known about the Turkish situation. Although Casale & Vigna Taglianti (1999) listed only *biimpressus*, Kesdek & Yildirim (2008) mention *anthracinus*, without subspecific classification.

Our material from the Vjosa might be assigned to *biimpressus*. However, an unequivocal determination is not possible, since the name *biimpressus* is based on material from Middle Dalmatia (Omiš). Material from around there (we checked specimens from Vransko jezero, Sinj, and Metković) shows intermediary characteristics between *P. anthracinus anthracinus* and our material from the Vjosa. The latter is characterized by significant differences in comparsion to Central European *P. anthracinus anthracinus* (Fig. 11–13). In both sexes, the elytrae are apically broadened and their microsculpture is characterized by transverse meshes. In males, the impression on the last visible sternum is comparatively shallow and doesn't reach the apicomedial border, and the aedeagus is deeply notched in its right-angled curve. The latter characteristic is striking, but was not mentioned in the literature before (see Ganglbauer 1899, Müller 1901, Apfelbeck 1904, Bucciarelli & Sopracordevole 1958, Guéorguiev & Skoupý 2010). In females, the elytrae show a deep excision before each tip, whereby this characteristic is usually named by differentiating *anthracinus* from *biimpressus* in literature (Müller 1901, Schatzmayr 1943, Guéorguiev & Skoupý 2010, Guéorguiev 2011a). However, this characteristic varies between both taxa (Apfelbeck 1904, Schatzmayr 1943), as does the microsculpture of the elytrae, which consists of nearly isodiametric meshes in *P. anthracinus anthracinus*, but transverse meshes in specimens from Middle Dalmatia. There seems to be no variance concerning the general form of the elytrae, which are parallel sided in *P. anthracinus anthracinus* from Central Europe as well as in specimens from Middle Dalmatia. This is also true for the above mentioned male characteristics, whereby the impression on the last visible sternum is comparatively deep and almost reaches the apicomedial border, and the aedeagus is not notched in its right-angled curve, both in specimens from Central Europe and Middle Dalmatia. Therefore, our material from the Vjosa should be treated as notably different from *P. anthracinus anthracinus*, which was described from Germany. The name of this taxon, which could be new, however, can only be fixed by studying the type-material of *biimpressus* from Omiš, and by incorporating other closely related taxa within the subgenus *Pseudomaseus*.

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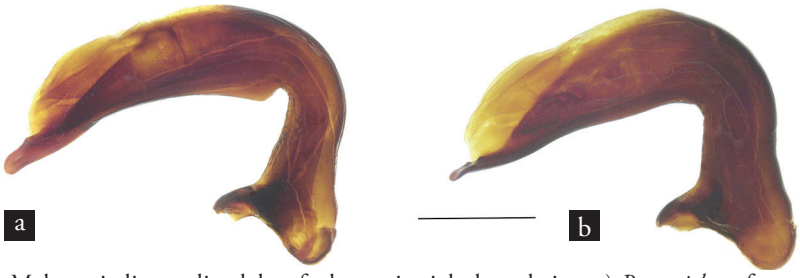

Fig. 11: Male genitalia, median lobe of adeagus in right lateral view, a) *Pterostichus* cf. *anthracinus biimpressus* from the study area [site 34], b) *Pterostichus anthracinus anthracinus* from Kalsdorf/Mur near Graz (Austria). Scale bare: 0.5 mm. © Paill W. – Abb. 11: Männliches Genitalorgan, Medianlobus des Aedeagus in seitlicher Ansicht (rechte Seite), a) *Pterostichus* cf. *anthracinus biimpressus* aus dem Untersuchungsgebiet [Probefläche 34], b) *Pterostichus anthracinus anthracinus* aus Kalsdorf/Mur bei Graz (Österreich). Maßstab: 0.5 mm. © Paill W.

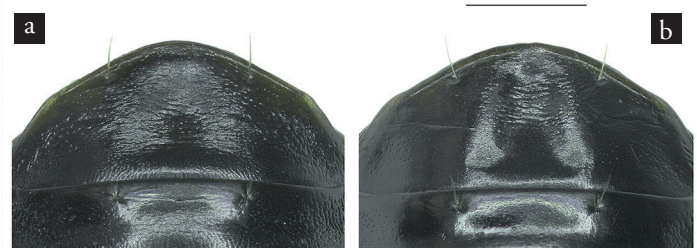

Fig. 12: Last abdominal sternum in males in ventral view, a) *Pterostichus* cf. *anthracinus biimpressus* from the study area [site 34], b) *Pterostichus anthracinus anthracinus* from Orth/Donau near Vienna (Austria). Scale bare: 0.5 mm. © Paill W. – Abb. 12: Letztes abdominales Sternum im männlichen Geschlecht in ventraler Ansicht, a) *Pterostichus* cf. *anthracinus biimpressus* aus dem Untersuchungsgebiet [Probefläche 34], b) *Pterostichus anthracinus anthracinus* aus Orth/Donau bei Wien Vienna (Österreich). Maßstab: 0.5 mm. © Paill W.

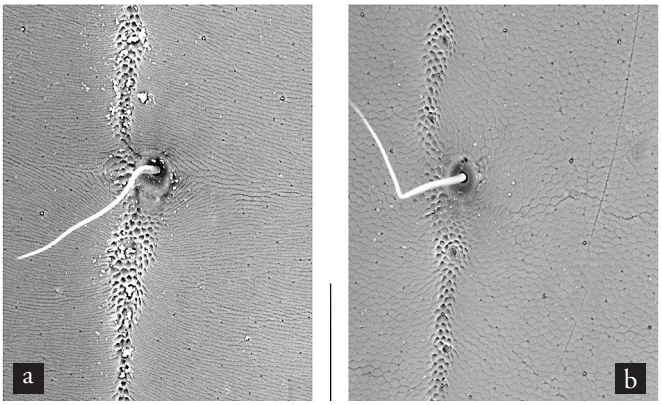

Fig. 13: Microsculpture of the elytrae near the first setiferious puncture on the third stria, a) *Pterostichus* cf. *anthracinus biimpressus* male from the study area [site 34] characterized by transverse meshes, b) *Pterostichus anthracinus anthracinus* male from Orth/Donau near Vienna (Austria) with nearly isodiametric meshes. Scale bare: 0.5 mm. © Paill W. – Abb. 13: Mikroskulptur der Elytren nahe des ersten Porenpunktes im dritten Flügeldeckenstreifen, a) *Pterostichus* cf. *anthracinus biimpressus* Männchen aus dem Untersuchungsgebiet [Probefläche 34] mit Chagrinierung aus quergestreiften Maschen, b) *Pterostichus anthracinus anthracinus* Männchen aus Orth/Donau bei Wien (Österreich) mit Chagrinierung aus nahezu isodiametrischen Maschen. Maßstab: 0.5 mm. © Paill W.

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Further species of faunistic interest

With *Carabus coriaceus excavatus* we collected one further taxon considered as endemic for the Balkan regions by Guéorguiev (2007b). This species, however, is eurytopic and lives mostly outside of floodplains.

Furtheremore, we present data for the following species, for which none had been published from Albania for (at least) the past three centuries (compare e.g. Guéorguiev 2007a): *Clivina fossor*, *Dyschirius aeneus*, *Asaphidion rossii*, *Bembidion azurescens*, *Bembidion latiplaga*, *Bembidion combustum*, *Bembidion striatum*, *Bembidion brunnicorne*, *Bembidion bualei*, *Bembidion articulatum*, *Bembidion octomaculatum*, *Sinechostictus tarsicus*, *Tachys scutellaris*, *Tachyura hoemorroidalis*, *Chlaenius nigricornis*, *Drypta dentata*, *Harpalus autumnalis*, *Harpalus punctatostriatus*, *Acupalpus luteatus*, *Acupalpus paludicola*, *Stenolophus mixtus*, *Stenolophus skrimshiranus*, *Oodes helopioides*, *Panagaeus cruxmajor*, *Agonum sordidum*, *Agonum permoestum*, *Olisthopus glabricollis*, and *Pterostichus cursor*.

Habitate use within the floodplain

Species numbers and population densities

Although the intensity as well as the method of sampling was different between the habitat types, a careful comparison regarding species numbers and population densities was carried out. The total number of species, as well as the number of "site-specific" species, differed greatly between the habitat types (Fig. 14). High numbers of carabids (52 species) were caught on silty and moist sediment bars with initial to pioneer vegetation (habitat types C1, C2), situated either directly along the main channel of the Vjosa or in drying, regularly flooded side arms. Apart from that, wetlands at the outer edge of the active floodplain (E1, E2) also showed outstanding carabid biodiversity (55 species). A conspicuously large number of species was found only here within the study area (here called "site-specific" species), but most of them, such as *Acupalpus* spp., *Stenolophus* spp., or *Agonum* spp. are not restricted to floodplain habitats. The same effect is true for the grassland-habitats on fine-grained sediments (D1, D2), since most of the "site-specific" species, such as *Harpalus pygmaeus* or *Calathus circumseptus,* are widespread outside of floodplains.

Moderately frequent catches (29 species) were made along initial stages of moist gravel sediment bars, mostly located along flowing or at least standing waters (B1, B2). Species which occurred only here within the study area are usally not only "site-specific", but also habitat-specific, being restricted to floodplain-habitats. The same is true for the "site-specific" species of fine-grained sediment bars (C1, C2). Low numbers of species (13–14) were caught in older succession stages on elevated niveaus of the floodplain (C3, C4 and D1, D2; Fig. 15).

Population densities (indictated as the activity density by pitfall trapping) showed the same patterns as the species numbers, with the highest numbers in wetland habitats reaching 2.2 specimens on average per trap-day, and regularly flooded, fine-grained sediment bars (C1, C2) with 1.3 specimens. A considerably lower number of specimens (0.1–0.3 specimens on average per trap-day) was caught in older succession stages on elevated niveaus of the floodplain (C3, C4 and D1, D2).

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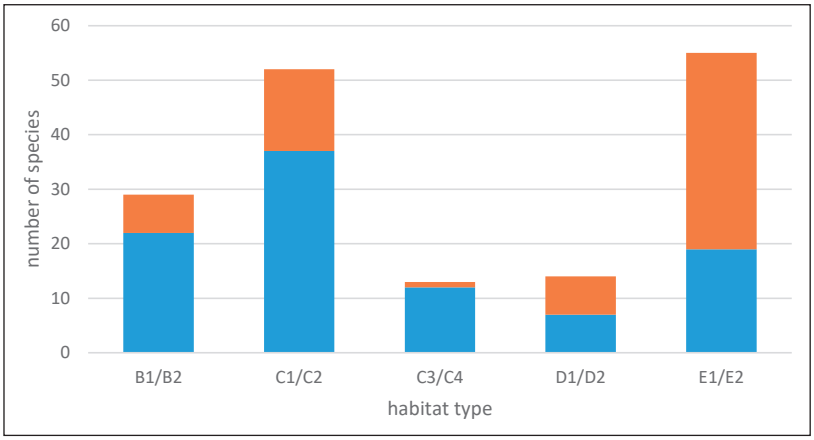

Fig. 14: Total number of species (whole columns) and number of "site-specific" species (upper, orange part of the columns) in comparison between the habitat types. For abbreviations of the habitat types, see chapter "Material and Methods". – Abb. 14: Gesamtartenzahl (gesamte Säulen) und Anzahl „Standort-spezifischer" Arten (oberer, oranger Teil der Säulen) im Vergleich zwischen den Habitattypen. Abkürzungen der Habitattypen siehe Kapitel „Material and Methods".

Fig. 15: Anthropogenically influenced grasslands with *Imperata cylindrica* on elevated niveaus within the active floodplain [site 17, habitat type D1] harbour a low number of ground beetles. © Paill W., 25.04.2017. – Abb. 15: Durch menschliche Nutzungen geprägtes Grasland mit *Imperata cylindrica* auf höheren Niveaus innerhalb der regelmäßig umgelagerten („aktiven") Aue [Probefläche 17, Habitattyp D1] beherbergen eine geringe Zahl an Laufkäfern. © Paill W., 25.04.2017.

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Tab. 2: Habitat specific distribution in species of tribus Cicindelini, Dyschiriini and Bembidiini as the number of caught specimens. For abbreviations of the habitat types, see chapter „Material and Methods", n. a. = habitat type not assigned. – Tab. 2: Lebensraumutzung der Arten der Triben Cicindelini, Dyschiriini and Bembidiini anhand der gefangenen Individuen. Abkürzungen der Habitattypen siehe Kapitel „Material and Methods", n. a. = Habitattyp unbestimmt.

tribe / species	B1/B2	C1/C2	C3/C4	D1/ D2	E1/E2	F1/F2	G1	n. a.
Cicindelini								
Calomera fischeri		10						
Calomera littoralis nemoralis		9						
Cicindela campestris olivieria	1	3	1		11	2		1
Cicindela monticola albanica		134	26					19
Cylindera germanica muelleri			1					
Cylindera arenaria viennensis		3						1
Dyschiriini								
Dyschirius aeneus		1			92			
Dyschirius agnatus	4	80						2
Dyschirius minutus albanicus	5	3						1
Dyschirius morio	2	22	3				1	1
Dyschirius latipennis		1						
Dyschirius abditus	2	7	1	2				
Dyschirius gracilis	2	11	2	1			2	
Dyschirius importunus					6			1
Dyschirius parallelus ruficornis	2	60						8
Dyschirius substriatus priscus	2	23						3
Bembidiini								
Asaphidion flavipes				3	44			
Asaphidion nebulosum	10	31	6					10
Asaphidion rossii	74	63	3		18	9	1	7
Asaphidion stierlini					2			
Bembidion quadripustulatum					82			
Bembidion brunoi	61							3
Bembidion concoeruleum	3							
Bembidion splendidum	1	4			3			
Bembidion azurescens		6						
Bembidion latiplaga		39						1
Bembidion tenellum					1			
Bembidion combustum	3							1
Bembidion scapulare	22	1						6
Bembidion lampros					5			
Bembidion properans					1		1	
Bembidion quadricolle		211			3			1
Bembidion (*Nepha*) sp.		1					1	
Bembidion varium	1	1						
Bembidion striatum	1	91						
Bembidion brunnicorne							7	
Bembidion dalmatinum	1	11					13	4
Bembidion bualei	63	30	5		1		2	11

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Tab. 2 continued – Fortsetzung

tribe / species	B1/B2	C1/C2	C3/C4	D1/ D2	E1/E2	F1/F2	G1	n. a.
Bembidion subcostatum vau		1			6			
Bembidion decolor					26			1
Bembidion punctulatum	8							5
Bembidion articulatum					7			
Bembidion octomaculatum					2			
Sinechostictus tarsicus		1					1	
Tachys bistriatus	1				8		1	
Tachys fulvicollis		1			4			1
Tachys micros		12		1				
Tachys scutellaris		1						
Tachyura hoemorroidalis		6			4		1	1
Tachyura diabrachys	41	55					15	9

Comparative ecological behavior in Cicindelini, Bembidiini, and Dyschiriini

Cicindelini, Bembidiini, and Dyschiriini represent three taxonomical groups with high numbers of stenotopic floodplain species. Their habitat-differentiating distribution within the study area is illustrated in Tab. 2. Thus, only individual species such as *Cicindela campestris olivieria* or *Asaphidion rossii* occur almost evenly across different habitat types, while most carabids of these groups show clear habitat preferences.

Discussion

Biodiversity

The species richness of ground beetles in the Vjosa valley is enormous. From the focused investigated area around the village of Kutë (situated between Kalivaç and Poçem), covering no more than 5 kilometers of river length, 112 species have been documented. Taking into consideration that this data is based on only one collecting period of five days within one year (2017), this richness exceeds ground beetle data from most other near-natural riversystems in Europe (e.g. Plachter 1986). Our data can even compete with the fauna of the outstanding course of the Tagliamento in Northern Italy, from where a remarkable 185 carabid beetles are known (Kahlen 2003, 2010). The Tagliamento data, however, is based on an investigation area of more than 100 kilometers in length, covering headwaters as well as the estuary region. Moreover, the data comprehends investigations from several seasons of the year and was collected over a period of more than 20 years.

The high species richness of ground beetles in the Vjosa valley between Kalivaç and Poçem is explained by the physical disturbances and continued habitat rejuvenation due to high flow rates and floods, which leads to a rich structural diversity of microhabitats. The Vjosa's specific status as a crossover between an anastomosing river character and meandering sections allows a lot of species to find often highly specific habitats there. Therefore, carabid beetles preferring fine-grained sediment bars at salt-influenced tailwaters or estuary-regions, such as *Calomera littoralis nemoralis*, *Scarites terricola*, *Bembidion tenellum*, *Tachys*

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fulvicollis, *Tachys scutellaris*, or *Pogonus littoralis* occur together with species specialized on coarse-grained sediment bars at headwaters, such as *Bembidion concoeruleum*, *Bembidion combustum*, or *Bembidion scapulare.*

Aspects of natural conservation

Not only the huge (only partially known) number of ground beetle species underlines the Vjosa as a highly sensitive river worthy of protection. In addition, the proportion of stenotopic floodplain species is also of great importance. Included are several species which occur in high local population numbers, but which are simultaneously very rare on a European level. This is particularly true for species such as *Cicindela monticola albanica, Bembidion brunoi, Bembidion quadricolle, Bembidion striatum*, *Stenolophus discophorus*, and *Poecilus striatopunctatus*.

Hence, the Vjosa might prospectively act as a very important genetic pool in terms of maintaining source populations of international significance. This might be of vital importance, as typical ground beetle species of floodplain habitats have become extinct due to various alterations of the natural flow regimes of many European river systems, though a lot of effort is put into restoration management at the same time.

Appendix: Additional ground beetle data from the Vjosa

Hereafter we provide additional ground beetle data sampled during 2014 from different regions of the Vjosa valley.

Sites and sampling data

[51] Kelcyre, Vjosa river, ~230 m a. s. l., *Pinus halepensis* stand, 14.06.2014, leg. Hristovski S., det. Hristovski S.
[52] Poçem, Vjosa river, 85 m a. s. l., degraded Kermes oak forest, traps, 13–15.06.2014, leg. Hristovski S. & Komnenov M., det. Hristovski S.
[53] Poçem, Vjosa river, 80 m a. s. l., wet meadow with *Platanus orientalis*, traps, 13–15.06.2014, leg. Hristovski S. & Komnenov M., det. Hristovski S.
[54] Poçem, Vjosa river, 80 m a.s.l., wet meadow, traps, 13–15.06.2014, leg. Hristovski S. & Komnenov M., det. Hristovski S.
[55] Poçem, Vjosa river, 70 m a.s.l., sand & gravel river bank, 13.06.2014, leg. Hristovski S., det. Hristovski S.
[56] Delta of Vjosa river, 1 m a. s. l., sand beach, 15.06.2014, leg. Hristovski S., det. Hristovski S.
[57] Poçem, Vjosa river, 80 m a. s. l., light traps, 13–14.06.2014, leg. Graf W., det. Hristovski S.
[58] SE Tepelenë, Vjosa river, 129 m a. s. l., light traps, 40,28036° N, 20,04435° E, 14.06.2014, leg. Hess M. & Heckes U., det. Lorenz W.
[59] 3 km SE Tepelenë, above the mouth of the river Drinos, Vjosa river, 128 m a. s. l., 14.06.2014, Hess M. & Heckes U. leg., det. Lorenz W.
[60] ESE Selenicë, Vjosa river, 80 m a. s. l., light traps and hand-collecting, 40,50654 N, 19,72641 E, 14.08.2014, Hess M. & Heckes U. leg., det. Lorenz W.

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Tab. 3: Additional ground beetle data from the Vjosa valley. – Tab. 3: Ergänzende Laufkäferdaten aus dem Vjosatal.

tribe / species	specimens total	specimens per [site]
Carabini Latreille, 1802		
Carabus coriaceus excavatus Charpentier, 1825	4	[51]:3; [52]:1
Cicindelini Latreille, 1802		
Cicindela monticola albanica Apfelbeck, 1909	7	[55]:4; [56]:3
**Cylindera germanica germanica* (Linnaeus, 1758)	4	[54]:1; [55]:2; [56]:1
Cylindera trisignata (Dejean, 1822)	5	[56]:5
Omophronini Bonelli, 1810		
Omophron limbatum (Fabricius, 1777)	2	[55]:1; [58]:1
Clivinini Rafinesque, 1815		
Clivina fossor (Linnaeus, 1758)	1	[53]:1
Clivina laevifrons Chaudoir, 1842	1	[58]:1
Dyschiriini H.J. Kolbe, 1880		
Dyschirius aeneus (Dejean, 1825)	2	[58]:1; [59]:1
Dyschirius parallelus ruficornis Putzeys, 1846	2	[57]:1; [60]:1
Dyschirius substriatus priscus J. Müller, 1922	1	[53]:1
Bembidiini Stephens, 1827		
Asaphidion flavipes (Linnaeus, 1760)	9	[53]:5; [59]:4
Asaphidion nebulosum (P. Rossi, 1792)	3	[59]:2; [60]:1
Asaphidion rossii (Schaum, 1857)	6	[59]:6
Bembidion quadripustulatum Audinet-Serville, 1821	1	[57]:1
Bembidion brunoi (Bonavita, 2001)	7	[55]:7
Bembidion latiplaga Chaudoir, 1850	1	[57]:1
Bembidion scapulare Dejean, 1831	4	[55]:2; [58]:2
Bembidion decorum (Panzer, 1799)	2	[53]:1; [59]:1
Bembidion foraminosum Sturm, 1825	1	[58]:1
Bembidion dalmatinum Dejean, 1831	1	[55]:1
Bembidion bualei Jacquelin du Val, 1852	67	[55]:9; [57]:47; [58]:9; [59]:1; [60]:1
Bembidion subcostatum vau Netolitzky, 1913	15	[57]:11; [58]:4
Bembidion tetracolum Say, 1823	1	[58]:1
Bembidion decolor Apfelbeck, 1911	1	[57]:1
Bembidion lunulatum (Geoffroy, 1785)	7	[57]:5; [58]:2
Bembidion punctulatum Drapiez, 1820	12	[55]:5; [57]:4; [58]:3
Sinechostictus tarsicus (Peyron, 1858)	1	[57]:1
Lymnastis galilaeus Piochard de la Brûlerie, 1876	1	[57]:1
Tachys bistriatus (Duftschmid, 1812)	6	[57]:2; [58]:4
Tachyura diabrachys (Kolenati, 1845)	2	[57]:1; [58]:1
Trechini Bonelli, 1810		
Perileptus areolatus (Creutzer, 1799)	1	[58]:1
Chlaeniini Brullé, 1834		
Chlaenius cruralis Fischer von Waldheim, 1829	1	[52]:1
Harpalini Bonelli, 1810		
Parophonus hirsutulus (Dejean, 1829)	11	[57]:6; [58]:5
Acupalpus maculatus (Schaum, 1860)	10	[57]:4; [58]:6
Acupalpus notatus Mulsant & Rey, 1861	2	[57]:2

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Tab. 3 continued – Fortsetzung

tribe / species	specimens total	specimens per [site]
Stenolophus marginatus Dejean, 1829	32	[57]:20; [58]:12
Stenolophus abdominalis persicus Mannerheim, 1844	1	[57]:1
Stenolophus discophorus (Fischer von Waldheim, 1823)	2	[57]:1; [58]:1
Stenolophus mixtus (Herbst, 1784)	1	[57]:1
Lebiini Bonelli, 1810		
Licinus cassideus (Fabricius, 1792)	5	[51]:5
Platynini Bonelli, 1810		
Anchomenus dorsalis (Pontoppidan, 1763)	1	[51]:1
Pterostichini Bonelli, 1810		
Myas chalybeus (Palliardi, 1825)	1	[51]:1
Poecilus rebeli (Apfelbeck, 1904)	6	[53]:6
Poecilus striatopunctatus (Duftschmid, 1812)	1	[55]:1
Pterostichus melanarius (Illiger, 1798)	3	[53]:2; [54]:1
Tapinopterus extensus extensoides (Jedlička, 1936)	3	[51]:3
Zuphiini Bonelli, 1810		
***Parazuphium chevrolatii* (Laporte, 1833)	1	[58]:1
Zuphium olens (P. Rossi, 1790)	1	[58]:1

Short Comments

Data of 49 species from 260 specimens are listed (Tab. 3). At least four of them are of particular interest (see below). 13 are to be added to the list of 112 floodplain inhabitants of the Vjosa river presented above.

Cylindera germanica germanica (Linnaeus, 1758)

Hieke & Wrase (1988) as well as Striniqi Laçej et al. (2010) reported *Cicindela germanica* for Albania, but only on species level. The catalogue of Palaearctic Coleoptera treats the nominotypical subspecies (Puchkov & Matalin 2017), but there is no data incorporated. Thus, we provide the first detailed record of the taxon for Albania.

Bembidion foraminosum Sturm, 1825

For this highly stenotopic riverside inhabitant, only one old record from Albania has been published until now (Guéorguiev 2007a). We present the second record for Albania.

Tapinopterus extensus extensoides (Jedlička, 1936)

Locally endemic in a minor part of Albania, but not an inhabitant of the floodplain of the Vjosa.

Parazuphium chevrolatii (Laporte, 1833)

This rare mediterranean-transcaucasian taxon, divided into several subspecies, is known from the neighboring countries of Bulgaria and Greece (Baehr 2017). We provide the first record for Albania.

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