

Larval data of *Caliaeschna microstigma* (Schneider, 1845) from the Balkan Peninsula, with contributions to its biology (Odonata: Aeshnidae)

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ABSTRACT: Based on larvae or exuviae, we present 59 new localities of *Caliaeschna microstigma* from Albania (17), Bulgaria (6), Croatia (1), Greece (18), Macedonia (2), Montenegro (11), and from the European part of Turkey (4). Collecting sites are depicted on a map. Summary on the habitat and biology of the species is given, and morphological characters of the larvae are shown on several figures. Due to the different larval cohorts collected, we conclude that the species has semivoltine life cycle.

Introduction

The authors are carrying out regular water insect samplings in running waters of the Balkan Peninsula since 11 years. Some data on the larvae/exuviae of *Caliaeschna microstigma* (Schneider, 1845) from Albania have already been published by MURÁNYI (2007), while some Greek data have been summarised in the work by LOPAU (2010). Herein we publish our further faunistical data on the species, with a summary of our experiences considering its habitat and biology.

Material and methods

For collecting methods of larvae see KOVÁCS et al. (1998), exuviae were singled along waterflows. The material has been preserved in 70% ethanol, and housed in the Hungarian Natural History Museum (Budapest) and the HNHM Mátra Museum (Gyöngyös).

Abbreviations: *Life stages:* L = larva, * = larvae of different cohorts (small – middle aged – large), E = exuviae. *Collectors:* CSz = Szilvia Czigány, DL = László Dányi, EÁ = Árpád Ecsedi, EZ = Zoltán Eröss, FZ = Zoltán Fehér, JP = Péter Juhász, KJ = Jenő Kontschán, KT = Tibor Kovács, MD = Dávid Murányi, MG = Gábor Magos, PG = Gellért Puskás, PV = Vladimir Pešić, SP = Pertti Sevola, SzT = Tímea Szederjesi, UZs = Zsolt Ujvári, UL = László Urbán. *Depositories:* Hungarian Natural History Museum = HNHM, Mátra Museum of the Hungarian Natural History Museum = MM.

List of data

Albania: Delvinë district, Gjerë Mts, Bistricë, forest karst spring E of the village, N39°55.125', E20°08.799', 105 m, 13.10.2013, 1 L, JP-KT-MD-PG (MM: 2013-109); Gjerë Mts, Muzinë, Syri i Kaltër, karst springs SW of the village, N39°55.286', E20°11.330', 155 m, 13.10.2013, 1 L, JP-KT-MD-PG (MM: 2013-110) – Dibër district, Lurë area, Fushë Lurë, brook in pine forest S of the village, N41°48.547', E20°12.598', 1155 m, 21.05.2010, 1 L, (0-0-1), FZ-MD-UZs (HNHM: 2010/28) – Gjirokastrë district, Fushëbardhë, bushy brook and pasture S (above) of the village, N40°05.623', E19°59.672', 505 m, 13.10.2013, 1 L, JP-KT-MD-PG (MM: 2013-113); Tsamantas Mts, Sotirë, stream and its plane tree gallery in the village, N39°49.150', E20°21.612', 500 m, 13.10.2013, 1 L, JP-KT-MD-PG (HNHM: 2013/44) – Kolonjë district, Barmash, large spring, outlet in tall rush stands, and pasture NE of the

village, N40°17.034', E20°37.814', 955 m, 15.10.2013, 3 L*, JP-KT-MD-PG (1 HNHM: 2013/56, 2 MM: 2013-119) – Librazhd district, Qukës Shkumbin, karst sidespring of the Shkumbin River, N41°05.786', E20°26.551', 380 m, 22.06.2012, 1 L (0-0-1), FZ-KT-MD (HNHM: 2012/66); 11.10.2013, 1 L, JP-KT-MD-PG (MM: 2013-103) – Mirditë district, Oroshi area, Ndërshenë, brook in a pine forest at the village, N41°49.898', E20°05.480', 990 m, 21.05.2010, 2 L*, (0-1-1), FZ-MD-UZs (HNHM: 2010/31) – Sarandë district, Borsh, Ixuor Spring and its outlet stream in the village, N40°03.686', E19°51.462', 105 m, 12.10.2013, 3 E, JP-KT-MD-PG (HNHM: 2013/34) – Shkodër district, Laç-Qyrsaç, brook NE of the city, N42°01'00.8", E19°39'38.2", 113 m, 08.03.2008, 2 L* (1-1-0), CSz-MD (HNHM: 2008/6); Prokletije Mts, Mollë, Maljag Stream and its gorge on the right bank of Koman Lake, N42°11.673', E19°49.063', 185 m, 18.06.2012, 1 E, FZ-KT-MD (MM: 2012-100); Vau i Dejës, brook in mixed macchia along the road to Koman, NE of the city, N42°01.013', E19°39.636', 115 m, 17.06.2012, 2 E, FZ-KT-MD (HNHM: 2012/30) – Tepelenë district, Dragot, sidebrook of Vjosë River and its plane tree gallery S of the village, N40°17.030' E20°04.100', 145 m, 14.10.2013, 1 L, JP-KT-MD-PG (MM: 2013-115); Griba Mts, Bencë, Bencë River at the Turkish aqueduct, N40°15'51.9", E20°00'26.3", 222 m, 13.03.2008, 1 L (0-1-0), CSz-MD (HNHM: 2008/26); Kurveleshi area, Progonat, Gurrit Stream spring area, E of the village, N40°12.629' E19°58.237', 1045 m, 14.10.2013, 3 L*, JP-KT-MD-PG (2 HNHM: 2013/48, 1 MM: 2013-114) – Tropojë district, Palc, forest stream on the right bank of Koman Lake, N42°15.496', E19°54.599', 215 m, 18.06.2012, 1 E, FZ-KT-MD (MM: 2012-104) – Vlorë district, Dhërmi, Dhërmi Stream in the village, N40°09'19.8", E19°38'22.4", 139 m, 11.03.2008, 1 L (0-1-0), CSz-MD (HNHM: 2008/13). – **Bulgaria:** Burgas province, Strandzha (Bosna), Karamlak stream above Mladezhko, N42°09'04.8", E27°21'55.1", 210 m, 07.04.2007, 1 L (0-1-0), DL-EZ-FZ-KJ-MD (HNHM: 2007/81); Strandzha (Bosna), left side brook of Ropotamo River 0.5 km E of Krushevets, N42°16'10.7", E27°29'49.3", 113 m, 10.10.2011, 1 L, EÁ-KT-PG (MM: 2011-178.b); Strandzha (Bosna), Ropotamo River 0.5 km E of Krushevets, N42°16'10.6", E27°29'53.2", 109 m, 10.10.2011, 1 L, EÁ-KT-PG (MM: 2011-178); Strandzha (Bosna), Ropotamo River between Veselie and Yasna Polyana, N42°18'38.8", E27°37'26.6", 20 m, 10.10.2011, 4 L* (2-2-0), EÁ-KT-PG (MM: 2011-177); Strandzha (Bosna), stream 5 km of Malko Tarnovo, N42°01'45.7", E27°28'25.1", 280 m, 07.04.2007, 2 L (0-0-2), DL-EZ-FZ-KJ-MD (HNHM: 2007/78) – Varna province, Black Sea coastal hills, Pobitiite kamani, brook, N43°13'24.4", E27°42'23.1", 102 m, 02.09.2005, 1 L, Mihály Földvári-KJ-MD-Tamáš Szűts (HNHM: 2005/2). – **Croatia:** Split-Dalmatia county, between Podgrade and Slime, Cetina River, N43°25'55.5", E16°52'15.1", 57 m, 01.07.2011, 2 E, Péter Olajos (MM: 2011-110.a); 18.08.2011, 1 L, Iván Jákó-KT (MM: 2011-110). – **Greece:** Ahaia county, Klitoria, small river S of the village, N37°53'22.6", E22°07'31.5", 505 m, 06.04.2009, 3 L* (0-1-2), DL-KJ-MD (HNHM: 2009/56) – Arkadia county, Isaris, stream E of the village, N37°22'06.1", E22°01'36.1", 595 m, 05.04.2009, 2 L* (0-2-0), DL-KJ-MD (HNHM: 2009/46); Magouliana, stream SE of the village, N37°39'25.5", E22°08'43.8", 1035 m, 06.04.2009, 1 L (0-0-1), DL-KJ-MD (HNHM: 2009/51); Parnon Mts, Mesorrah, stream S of the village, N37°22'13.3", E22°32'07.3", 900 m, 02.04.2009, 2 L* (1-1-0), DL-KJ-MD (HNHM: 2009/2); Parnon Mts, Platanos, small stream N of the village, N37°20'12.1", E22°39'14.3", 580 m, 02.04.2009, 2 L* (1-1-0), DL-KJ-MD (HNHM: 2009/6); Parnon Mts, Sitena, small stream in the village, N37°17'28.6", E22°38'52.3", 630 m, 02.04.2009, 2 L* (1-0-1), DL-KJ-MD (HNHM: 2009/8) – Central Greece, Phthiotis peripheral unit, Agios Georgios, Sperchios River W of the village, N38°57'00.5", E21°56'42.7", 365 m, 08.05.2011, 1 L (0-0-1), KJ-MD-SzT-UZs (HNHM: 2011/35) – Epirus, Preveza peripheral unit, Thesprotiko Mts, Vrisoula, stream S of the village, N39°14'54.2", E20°41'44.1", 220 m, 05.05.2011, 1 L (0-0-1), KJ-MD-SzT-UZs (HNHM: 2011/11) – Ionian Islands, Lefkada peripheral unit, Rahi, stream W of the village, N38°43'21.8", E20°41'24.2", 50 m, 06.05.2011, 1 E, KJ-MD-SzT-UZs (HNHM: 2011/19) – Lakonia county, Potamia, stream E of the village, N36°55'19.9", E22°29'52.6", 220 m, 03.04.2009, 1 L (0-1-0), DL-KJ-MD (HNHM: 2009/17); Taigetos Mts, Poliana (Krioneri), Varbaras Stream above the village, N36°57'57.1", E22°22'53.0", 985 m, 03.04.2009, 1 L (0-1-0), DL-KJ-MD (HNHM: 2009/19) – Phocis county, Vargiani, springs and torrent in the village, N38°38'29.9", E22°25'30.9", 970 m, 08.04.2009, 1 L (0-1-0), DL-KJ-MD (HNHM: 2009/73) – South Aegean, Naxos regional unit, Koronidha, stream and its plane tree gallery N of the village, N37°09.850', E25°32.730', 125 m, 06.04.2013, 1 L (0-1-0), KJ-MD-SzT (HNHM: 2013/49); Koronidha, stream in a gorge below the village, N37°08.580', E25°31.857', 455 m, 06.04.2013, 3 L* (0-1-2) KJ-MD-SzT (HNHM: 2013/50); Skeponi, bushy brook W of the village, N37°08.277', E25°28.910', 165 m, 07.04.2013, 1 L (0-1-0) KJ-MD-SzT (HNHM: 2013/59) – South Aegean, Rhodes regional unit, Epta Piges, karst springs and their outlet, N36°15.195', E28°06.859', 80 m, 10.11.2012, 1 L, KJ-MD (HNHM: 2012/28); Laerma, stream SE of Aghios Ioannis monastery, N36°11.593', E27°54.362', 215 m, 09.11.2012, 2 L, KJ-MD (HNHM: 2012/21); Salakos, 'Butterfly River', a gorge NE of the city, N36°17.391', E27°57.007', 135 m, 10.11.2012, 3 L*, KJ-MD (HNHM: 2012/26). – **Macedonia:** Pelagonia region, Bitolsko Pole, Kukurečani, bushy brook in the village, N41°05.525' E21°19.411', 625 m, 02.10.2013, 5 L, KT-MD, (3 HNHM: 2013/7, 2 MM: 2013-85) – Southeastern region, Nikolik, brook in macchia

W of the village, N41°15.546', E22°43.967', 215 m, 15.03.2008, 1 L, CSz-MD (HNHM 2008/34). – **Montenegro:** Bar municipality, Rumija Mts, Godinje, macchia brook at the village, N42°13.245', E19°06.705', 30 m, 16.06.2012, 2 E, FZ-KT-MD (MM: 2012-92); Rumija Mts, Stari Bar, M. Mikulići, Rikavac, N42°06'16.7", E19°08'55.8", 320 m, 28.05.2009, 1 L (0-0-1), 4 E, KT-MG-UL (MM: 2009-59); 09.11.2011, 8 L* (2-4-2), KT-MG (MM: 2011-243); Rumija Mts, Stari Bar, Špilja, right side brook of Rikavac, N42°06'01.9", E19°08'31.1", 182 m, 19.05.2004, 1 L (0-0-1), JP-KT-PV-SP (MM: 2004-53); Rumija Mts, Stari Bar, Špilja, Rikavac, N42°06'01.6", E19°08'30.8", 180 m, 26.05.2009, 2 E, KT-MG-UL (MM: 2009-55); Rumija Mts, Sutorman, Brusica, small stream, N42°08'54.5", E19°07'13.3", 550 m, 19.05.2004, 2 L* (0-1-1), JP-KT-PV-SP (MM: 2004-52); Rumija Mts, Tudemili, Banja, Velja reka, N42°07'40.8", E19°08'37.2", 280 m, 28.05.2009, 2 E, KT-MG-UL (MM: 2009-60); Rumija Mts, Vukići, Kamenički most, Medurečka reka, N42°01'22.8", E19°13'08.5", 205 m, 26.05.2009, 1 E, KT-MG-UL (MM: 2009-53); Rumija Mts, 1 km above Stari Bar, towards M. Mikulići, streams and their gallery, N42°06.026', E19°08.514', 180 m, 14.10.2008, 4 L* (0-2-2), DL-FZ-KJ-MD (HNHM: 2008/84) – Cetinje municipality, Rijeka Crnojevica, Rijeka Crnojevica River above the village, N42°21.297', E19°01.122', 15 m, 15.06.2012, 1 L (0-0-1), FZ-KT-MD (MM: 2012-90) – Kolasin municipality, Komovi Mts, Drijen, Jabuka, right side brook of Sjevernica River, N42°42'55.6", E19°24'22.4", 274 m, 10.11.2011, 1 L, KT-MG (MM: 2011-246); Moraca's Mts, Mrtvo Duboko, right side brook of Mrtvica River, N42°43'43.3", E19°20'23.1", 260 m, 07.05.2003, 2 L* (0-0-2), JP-KT-PV-SP (MM: 2003-56) – Ulcinj municipality, Rumija Mts, Gornji Kosići, Midanska reka, N42°02'28.0", E19°15'46.9", 413 m, 27.05.2009, 1 E, KT-MG-UL (MM: 2009-57). – **Turkey:** Kırklareli region, Istranca Mts, Alabalik stream along the Pinarhisar-Demirköy road, N41°44'40.0", E27°39'16.7", 538 m, 06.04.2007, 1 L (0-1-0), DL-EZ-FZ-KJ-MD (HNHM: 2007/69); Istranca Mts, Degirmen stream at Canli Alabalik (1 km of Demirköy), N41°49'18.0", E27°45'05.1", 253 m, 06.04.2007, 1 L (0-1-0), DL-EZ-FZ-KJ-MD (HNHM: 2007/72) – Tekirdağ region, Tekir Mts, brook W of Gaziköy, N40°45'38.8", E27°20'22.5", 12 m, 06.04.2007, 1 L (0-1-0), DL-EZ-FZ-KJ-MD (HNHM: 2007/65); Tekir Mts, spring along the seashore road (E of Çumakdere), N40°47'53.3", E27°21'51.7", 90 m, 06.04.2007, 1 L (1-0-0), DL-EZ-FZ-KJ-MD (HNHM: 2007/67).

Results and discussion

Among the 59 localities of larvae/exuviae of *Caliaeschna microstigma*, 17 are from Albania, 6 from Bulgaria, 1 from Croatia, 18 from Greece, 2 from Macedonia, 11 from Montenegro, and 4 from the European part of Turkey. We mapped these localities on Fig. 1, together with already published records of the authors' collectings: 12 from Albania (MURÁNYI 2007), and 5 from Greece (LOPAU 2010). As LOPAU (2010) not mentioned specimens but published only the localities, herein we enumerate the larvae/exuviae data, completed with some further informations: "Falakro Mts; Mikrokliśsoúra; forest stream (41°22'38.5"N, 24°2'12.5"E): 31.03.2007; Muranyi" – 41°22.717', 24°02.139', 480 m, 1 L (0-1-0), (HNHM: 2007/19). "Kamertsi Mts; Sminthi torrent in a limestone gorge 3 km W of the village (41°14'53.3"N, 24°50'58.0"E): 03.04.2007; Muranyi" – 41°14.728', 24°54.273', 310 m, 2 L* (1-0-1), (HNHM: 2007/48). "Koula Mts; Oréo; Aspro stream beneath the willage (45°15'36.1"N, 24°50'25.5"E): 03.04.2007; Muranyi" – 41°16.369', 24°51.275', 550 m, 1 L (0-0-1), (HNHM: 2007/45). "Métsovo; spring E of the city (39°46'17.4"N, 21°11'23.5"E): 13.05.2006; Muranyi" – 39°45.277', 21°08.940', 1025 m: 1 L (0-1-0), (HNHM: 2006/103). "Sminthi; small river S of the willage at conjunction to Eora (41°13'47.4"N, 24°52'52.3"E): 03.04.2007; Muranyi" – 41°12.495', 24°51.752', 200 m, 1 LE (0-1-0), (HNHM: 2007/43).

On the basis of our collectings, we can conclude that *Caliaeschna microstigma* develops in cold and fast flowing, well oxygenated running water with stony, pebble or gravel substrate. These are usually small brooks or streams (width 0.5-2 m), but occasionally we found it even a 30 meter wide waterflow (Cetina River). Elevation of the habitats are between 10 and 1155 meters above sea level. Most of the inhabited running water lack aquatic vascular plants,

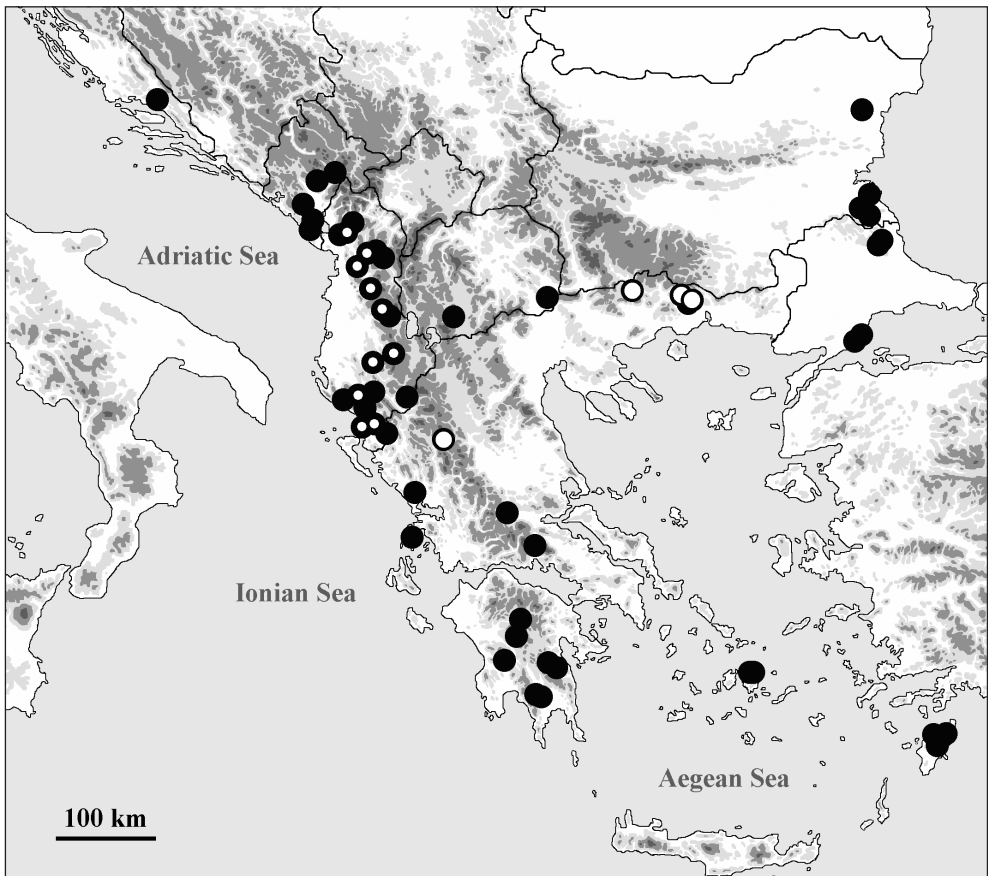


Fig. 1. Larvae/exuviae data of *Caliaeschna microstigma* collected by the authors: full circle = new data, ring = data published in LOPAU 2010, circle with central dot = data published in MURÁNYI 2007

larvae were mostly found under large stones, between leaf-packs, occasionally on living tree roots or on submerged moss. Even in the lower sections where vascular vegetation was present, the larvae live on the substrate.

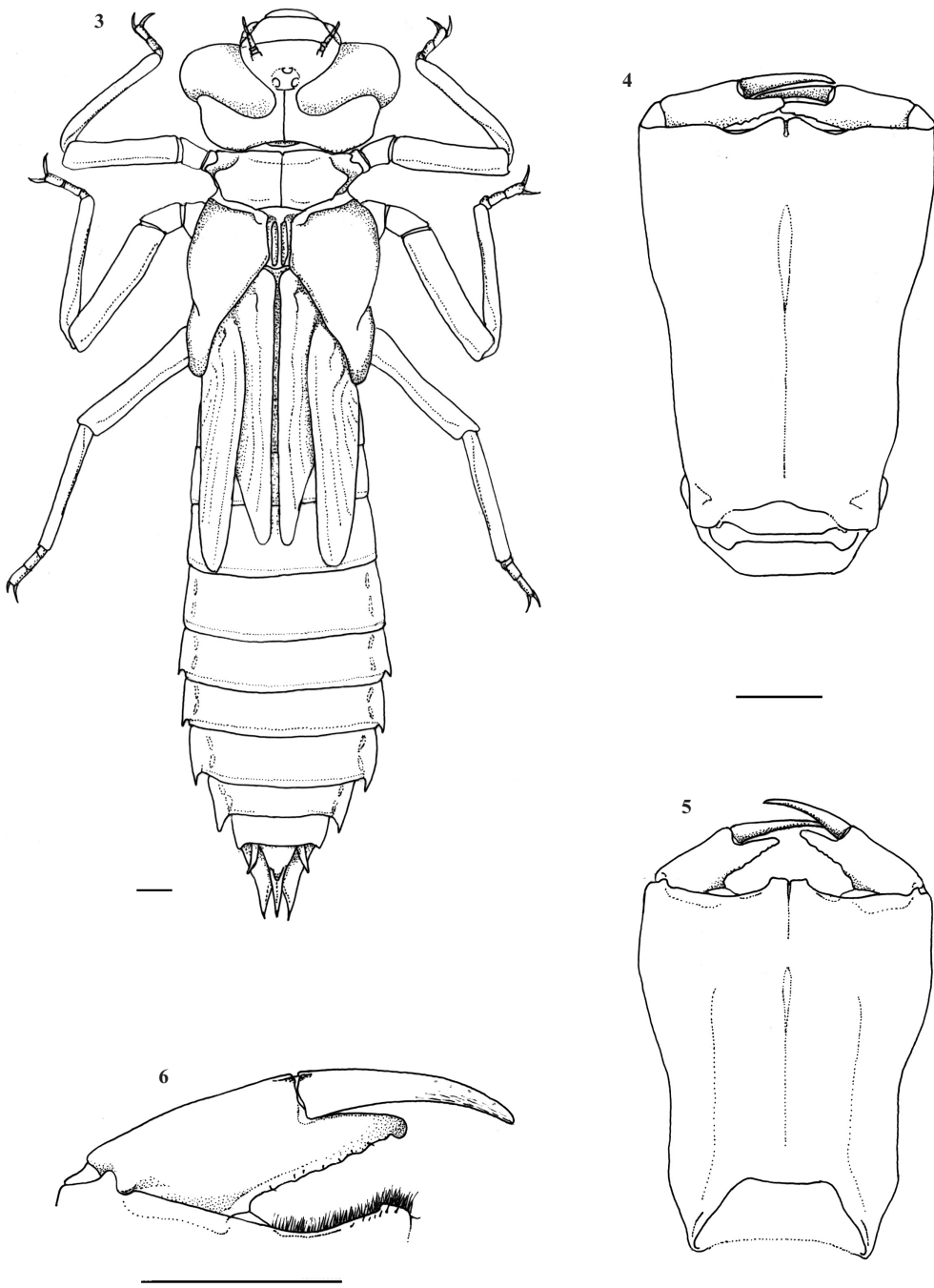
The accompanying Odonata fauna of *Caliaeschna microstigma* includes the following species, on the basis of MURÁNYI & KOVÁCS (2013) and our unpublished larvae/exuviae data: *Calopteryx splendens* ssp. (2011-110), *Calopteryx virgo festiva* (Brullé, 1832) (2009/51, 2009/56, 2011-178, 2012-100), *Epallage fatime* (Charpentier, 1840) (2007/65, 2012/21), *Lestes viridis/parvidens* (2012/30=2012-98), *Platycnemis pennipes pennipes* (Pallas, 1771) (2011-110), *Platycnemis pennipes nitidula* (Brullé, 1832) (2009/51), *Pyrrhosoma elisabethae* Schmidt, 1948 (2013-110), *Ischnura elegans elegans* (Vander Linden, 1820) (2012/30=2012-98), *Ceriagrion tenellum* (Villers, 1789) (2012/30=2012-98), *Anax imperator* Leach, 1815 (2012/30=2012-98), *Gomphus vulgatissimus* (Linnaeus, 1758) (2011-110, 2011-177, 2011-178), *Onychogomphus forcipatus forcipatus* (Linnaeus, 1758) (2009-53, 2009/56, 2011-110, 2011-177, 2011-178, 2012/66), *Onychogomphus* sp. (2013/49), *Cordulegaster bidentata*

Sélys-Longchamps, 1843 (2004-54=2008/84, 2008/34, 2009-57, 2009-59=2011-243, 2012-100, 2013-119, 2013-109), *Cordulegaster helladica buchholzi* Lohmann, 1993 (2013/50), *Cordulegaster heros* Theischinger, 1979 (2011/35), *Cordulegaster picta* Sélys-Longchamps, 1854 (2005/2, 2011-178.b), *Somatochlora meridionalis* Nielsen, 1935 (2011-178), *Libellula fulva* Müller, 1764 (2011-110), *Orthetrum brunneum* (Fonscolombe, 1837) (2012/30=2012-98), *Orthetrum coerulescens* (Fabricius, 1798) (2011-110). The most frequent accompanists are *Cordulegaster bidentata* (7 sites), *Onychogomphus forcipatus forcipatus* (6 sites) and *Calopteryx virgo festiva* (4 sites); we found it together with *Cordulegaster* species in 11 localities. Among the 59 localities, it was the single odonate at 36 (61%) sites, found together with one species at 16 (27,1%), with two species at 4 (6,8%) sites, while it was common with more (4, 5, 6) species only in 3 (5,1%) waterflows. Species list of the latter three localities are: *C. virgo festiva*, *G. vulgatissimus*, *O. forcipatus*, *S. meridionalis* (2011-178); *L. viridis/parvidens*, *I. elegans*, *C. tenellum*, *A. imperator*, *O. brunneum* (2012/30); *C. splendens* ssp., *P. pennipes*, *G. vulgatissimus*, *O. forcipatus*, *L. fulva*, *O. coerulescens* (2011-110).

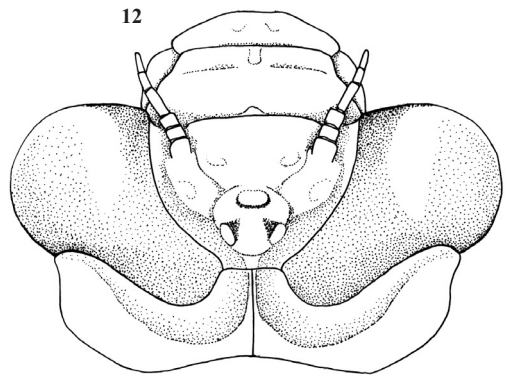
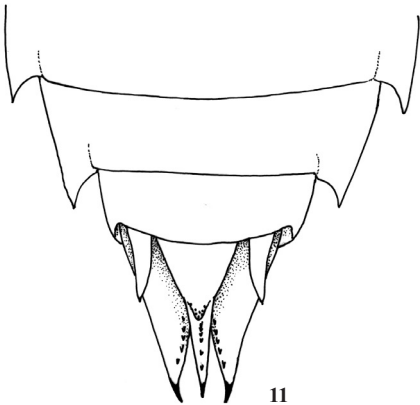
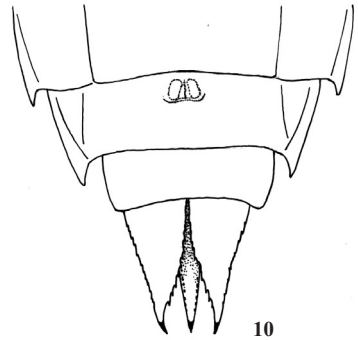
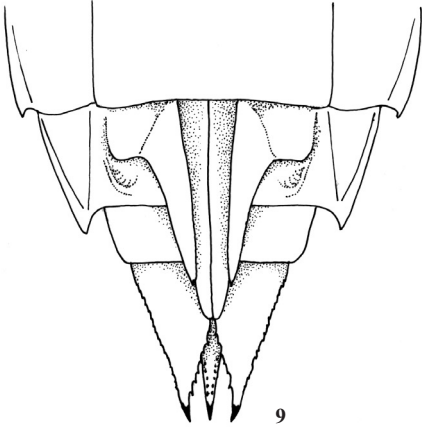
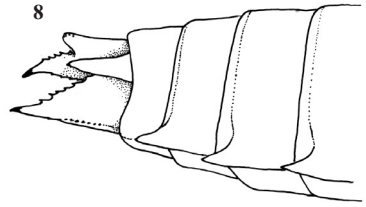
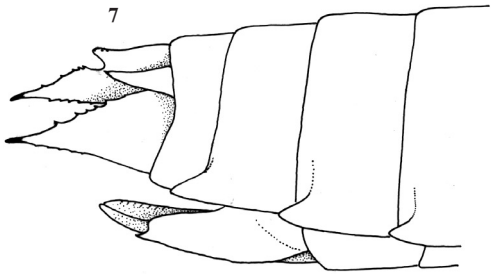
Due to the different cohorts collected in the same time at the given localities, we can conclude that the species is semivoltine, and larval development usually takes 3 years. The different larval stages are the more conspicuous before emergence (April-May), but with catching plenty larvae it can be observed anytime (Fig. 2). Long life cycle of this smallest



Fig. 2. *Caliaeschna microstigma* larvae of different cohorts: upper row = Montenegro, Rumija Mts, Stari Bar, M. Mikulići, Rikavac, 09.11.2011, (2-2-2); lower row = Greece, Pamón Mts, 02.04.2009, (2-1-1)



Figs 3–6. Matured larva of *Caliaeschna microstigma*: 3 = habitus, 4 = labia in ventral view, 5 = labia in dorsal view, 6 = labial palp; scale: 1 mm



Figs 7–12. Matured larva of *Caliaeschna microstigma*: 7 = female terminalia in lateral view, 8 = male terminalia in lateral view, 9 = female terminalia in ventral view, 10 = male terminalia in ventral view, 11 = female terminalia in dorsal view, 12 = head; scale: 1 mm

European aeshnid is similar to the usually accompanying, large bodied *Cordulegaster* species, and probably explicable with low water temperature. Presence of different cohorts would also refer to a bivoltine life cycle, but single peak of the seasonal distribution diagram based on 443 Greek imago data (LOPAU 2010: p.75) clearly contradicts this hypothesis.

Wintering in larval stages was supposed by HECKER (1999) and MARINOV (2000). A 6 mm long larva found in mid-August (2011-110) denote that eggs hatch immediately or shortly after oviposition; data from August by HECKER (1999: p. 26) also support it.

As taxonomical characters of the larvae are poorly known (only a few figures exist e.g. in PETERS 1987), and are not included even in monographs like that by ASKEW (1998, 2004), we present here some figures on its larval morphology (Figs 3–12).

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