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Results of odonatological studies in southern Primorye, Russia, in 2011-2020

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Abstract

The odonatological results of five expeditions to two ecologically contrasted regions (forested foothills and coastal plains) in southern Primorsky Krai (or Primorye), Russia, undertaken from 2011 to 2020 are summarised. A total of 64 species have been recorded, including those with a limited presence in Russia, such as *Lestes temporalis*, *Paracercion calamorum*, *P. hieroglyphicum*, *P. plagiosum* (the 4th finding in Russia is reported here), *Trigomphus citimus*, *Macromia manchurica* (the 3rd finding in Russia), *Deilelia phaon*, *Lyriothemis pachygastra* (the 3rd finding in Russia), and *Sympetrum baccha*. *Aeshna caerulea* is for the first time reported to Primorsky Krai, although by a visual observation only. Simultaneous occurrence of the closely related *Coenagrion hastulatum* and *C. lanceolatum* was observed. The differences between *Anax parthenope* and *A. julius*, assumed to be different species, are discussed and illustrated; systematics of *Coenagrion johanssoni*, *Aeshna juncea*, *Sympetrum depressiusculum* and *S. frequens* and dimorphism for the frons maculation in males of *Epophthalmia elegans* are briefly discussed, as well. A steady and profound decrease in number of Odonata for the period 2011-2020 was observed.

Keywords: Odonata, dragonflies, damselflies, Russia, Far East, Primorye, Primorsky Krai, *Coenagrion johanssoni*, *Paracercion plagiosum*, *Aeshna caerulea*, *Aeshna juncea*, *Anax julius*, *Anax parthenope*, *Epophthalmia elegans*, *Macromia manchurica*, *Lyriothemis pachygastra*, *Sympetrum baccha*, *Sympetrum depressiusculum*, *Sympetrum frequens*, long-term decline of abundance.

Introduction

Primorsky Krai or Primorye is situated in the southernmost Far East of Russia. ('Krai', along with 'Oblast' and 'Republic', is a kind of administrative unit of the highest rank in Russia). It has a mild and humid maritime climate and mostly resides in the zone of nemoral forests composed of numerous broad-leaved tree species with participation of some conifers. With elevation, they are replaced with coniferous taiga while the southernmost coastal plains are occupied by humid prairies with sparse broad-leaved trees (Suslov 1954). The local diverse biota is mostly comprised by the so-called Manchurian (or Paleoarchaearctic) species, so the territory is attributed to the East Asian Ecological Region of the Palaearctic Biogeographical Realm.

The Odonata fauna of the Russian Far East (implied to include Primorskiy Krai, the southern part of Khabarovskiy Krai, Jewish Autonomous Province and the southern part of Amurskaya Province) was summarised by Belyshev (1973), Malikova (1995), Malikova & Kosterin (2019) and Onishko & Kosterin (2021) (the paper by Haritonov & Malikova (1998) is irrelevant as outdated at the time of issue and containing many errors). With one species, *Anax nigrofasciatus* Oguma, 1915, added later (Malikova & Chistyakov 2021; Onishko et al. 2021), it now comprises 93 known species, that is 59% of the Odonata fauna of Russia, with 42 species (27 %) present in Russia only there (recalculated after Onishko & Kosterin 2021 with reference to new data). Many of such species extend to Russia at the northern limits of their geographical ranges and were seldom reported. At the same time, no species has yet been proven to recently appear in Russia due to the current climate warming rather than just was previously overlooked. In 2011–2018, V.O. took an advantage of participating in four stationary expeditions of the Young Naturalist Circle at the Zoological Museum of Moscow State University, headed by Evgeniy V. Dunaev, to Khasan and Partizansk District in the southern Primorye, to thoroughly study local Odonata faunas; in 2018 I.V. joined them. These two sites were briefly revisited by V.O. and O.K. in 2020. Besides, V.O. in 2017 and V.O. & I.V. in 2018 made short car trips to some other places of southern Primorye. Most fieldwork took place in late summer/early autumn. Some of the data obtained on these expeditions were mentioned in Russian in Onishko (2019) and, without detail, in a general book by Onishko & Kosterin (2021), while this paper summarises those rich faunal data in detail. Data obtained by V.O. and O.K. elsewhere in the southern Far East of Russia on their joint odonatological expedition in 2020 will be published in a separate paper.

Material and Methods

The main places where observations and collections were made were situated in two districts (Russ. 'rayon') of Primorskiy Krai: the Tigrovoy village environs in Partizansk District (Region I: localities 1–8; 2011, 2015, 2020) and Ryazanovka village environs in Khasan District (Region II: localities 9–22; 2011, 2015, 2017, 2018, 2020). In these regions the fieldwork, by V.O. and in 2018 by V.O. and I.V. had a stationary regime and lasted for different number of days in different years. V.O. shortly visited a number of the same localities on car trips in 2017 and V.O. and O.K. in 2020. Besides, in June 2017, V.O. visited some other localities in the southern Primorye (the locality series III, see below).

Collecting was made mostly with an aerial net. Besides, young and mature individuals of *Anax julius* and *Ischnura asiatica* were repeatedly attracted by street lamps. About 800 specimens were collected in total during this work. They are kept in personal collections of authors; some of the specimens collected in 2020 were forwarded to Naturalis Biodiversity Centre (RMNH).

Photographs were taken by V.O. with Apple iPhone 7 and Canon EOS 1000D with the kit lens, and by O.K. with Canon EOS 350D with Sigma 50 mm macro lens. All they were submitted to the iNaturalist (2022) internet platform, from where they are available by links of the following template <http://inaturalist.org/observations/x>, where x (the integer number of any number of digits) is the specific identifier of an observation. Such observation identifiers are enumerated in the annotated list below along with specimens collected, thus actually referencing to hundreds of external illustrations. The annotation 'posed'

indicates that a dragonfly was posed for photographing, 'in hand' is self-evident, while the absence of such annotations means that a free dragonfly in nature was photographed. A bit more than 400 observations of Odonata from these expeditions were uploaded to iNaturalist. All cited observations in iNaturalist had 'research grade'; and were also adopted by Global Biodiversity Information Facility (GBIF) (iNaturalist contributors, iNaturalist 2022). The dates are provided in dd.mm.yyyy format, or mm.yyyy format if the exact dates were omitted.

All the photos used to illustrate this paper, unless otherwise indicated, were of free dragonflies in natural conditions.

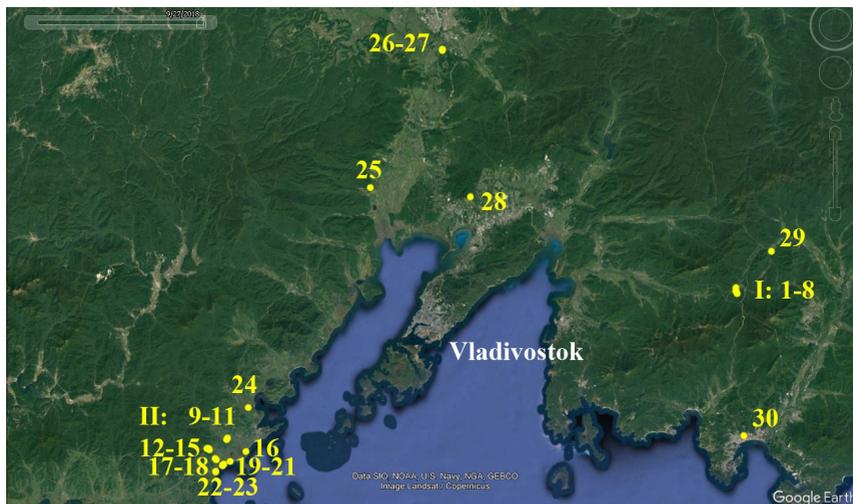


Figure 1. Disposition of localities examined in 2011-2020 in the southernh Primorye, Russia. For explanations of numerals see the text.

Localities examined

Geographic disposition of localities studied, with reference to their numerals below, is shown in Fig. 1.

Region I. Primorskiy Kray, Partizansk District, the environs of Tigrovoy village (Tigrovoe since 2002 to 2011).

A hilly land in southern spurs of the Sikhote-Alin' Mountain Range covered mostly with dark broad-leaved forests and to a less extent with mixed forests. In accordance with local toponyms, the place is good for Amurian tigers (once encountered by V.O. at the forest road, Loc 8) The settlement resides at the Tigrovaya (Sitsa) River near the mouths of its tributaries Levyy (Left) Lesopil'nyy Brook and Pravyy (Right) Lesopil'nyy Brook. There are some forest lakes as well. Dragonflies were also observed on at forest roads and cuttings and at the expedition base.

Loc 1. The Tigrovaya River section ca from 43.182° N, 132.892° E to 43.197° N, 132.903° E, 293-309 m a.s.l. (Fig. 2). A fast, cold river on average 5, up to 10-12 m wide, with pebble bottom and banks, flows through mostly open landscape and inside Tigrovoy village.

Figure 2. The Tigrovaya (Sitsa) River at Tigrovoy village (Loc 1); 8 species, mostly rheophylic, recorded. Top: A. Dunaev, others: O.K.



Odonata species recorded: 8; of which only *Ophiogomphus obscurus* was numerous while others just occurred on dispersal rather than for breeding.

Loc 2. The Pravyy Lesopil'nyy Brook (Fig. 3), studied from its mouth at 43.190° N, 132.896° E to ca 43.164° N, 132.901° E, 299-358 m a.s.l. Flows mostly through the forest, so unfavourable for Odonata. Odonata species recorded: 4; only *Davidius lunatus* preferred this locality, besides, *Somatochlora exuberata*, *S. graeseri* and *Ophiogomphus obscurus* were observed. Curiously, the latter species was mostly represented by ovipositing females while at the Tigrovaya River males were numerous while females were very rare.



Loc 3. A small roundish lake (ca 20 x 20 m) (Fig. 4) between Lesopil'naya Street and the Pravyy Lesopil'nyy Brook (which is 10 m from its N bank), 1.2 km N Tigrovyy Put' Base. 43.180-43.1801° N, 132.893-132.894° E, 309 m a.s.l. Aquatic and semiaquatic vegetation well expressed, S side shallow for 5–8 m from the bank and densely overgrown. W and NW banks partly open, with a swampy sedge meadow with *Cicuta virosa* L. situated 10 m off N bank. Odonata species registered: 17; the richest locality in Region I.



Loc 4. A series of three mostly shaded ponds/small lakes, one ca 20 x 7 m and two others ca 5 x 5 m, between Lesopil'naya Street and the Pravyy Lesopil'nyy Brook 1.2 km N Tigrovyy Put' Base. 43.179° N, 132.893° E, 314 m a.s.l.. Aquatic and



Figure 3. The Pravy Lesopil'nyy Brook at Tigrovoy village (Loc 2), a habitat of *Davidius lunatus* (preferred), *Somatochlora exuberata* and *Ophiogomphus obscurus*. A. Dunaev.



Figure 4. A small forest lake at Tigrovoy village (Loc 3), with 17 species recorded. O.K.

semiaquatic vegetation scarce. No open banks but some glades nearby. Odonata species registered: 7.

Loc 5. The bridge across the Levy Lesopil'nyy Brook and a forest margin S of it; at Lesopil'naya Street, 970 m N of Tigrovoy Put' Base. 43.176° N, 132.892° E, 318 m a.s.l. Odonata species registered: 3.

Loc 6. The Levy Lesopil'nyy Brook (Fig. 5) section studied ca from 43.172° N, 132.887° E to its mouth at 43.178° N, 132.895° E, 320-331 m a.s.l.; deeper and faster than the



Figure 5. The Levy Lesopil'nyy Brook near its mouth at Tigrovoy village (Loc 6), a habitat of *D. lunatus* and *O. obscurus*. A. Dunaev.

Pravy Lesopil'nyy Brook; flows more through landscape hence resembles the Tigrovaya River. Odonata species recorded: 4, most frequent were males of *Davidius lunatus* and *Ophiogomphus obscurus*.

Loc 7. Tigrovyy Put' Tourist Base (a big resort house), serving the expedition base, situated at the end of Lesopil'naya Street in Tigrovoy village on the Pravy Lesopil'nyy Brook 1.4 km SE of Tigrovoe railway station, 43.168° N, 132.895° E, 332 m a.s.l.. There is an artificial pond on the territory filled with water from the brook and rains. Odonata species registered: 15; most interesting was a visual sighting of *Aeshna caerulea*.

Loc 8. The forest road (Fig. 6) starting from the Tigrovyy Put' Base and going southwards parallel to the Pravy Lesopil'nyy Brook (crossing it several times) and up the hills, mostly through dark mixed forest and many glades where dragonflies foraged (sometimes in big swarms composed mostly by *Pantala flavescens* and *Somatochlora* spp). Studied ca from 43.168° N, 132.895° E to 43.155° N, 132.903° E, 332-362 m a.s.l. Odonata species recorded: 11.

Region II. *Primorskiy Kray, Ryazanovka village environs.*

A hilly area covered with moist long-herb meadows with oak groves along the coast of the Boisman Harbour of the Sea of Japan. In 2011 the expedition was housed at the



Figure 6. The road S of Tigrovoy village (Loc 8) where 11 species of Odonata were recorded, including big swarms of *Pantala flavescens* and *Somatochlora* spp. A. Dunaev.

station of the Far East State University (42.794° N, 131.252° E), in 2015 and 2018 at Mayak Tourist Base (42.777° N, 131.263° E), both in Ryazanovka village. Pedestrian routes reached Romashka village and the Poyma River (42.857° N, 131.303° E) ca 16 km N to the north, the Sea Nature Reserve border (42.706° N, 131.237° E) ca 11 km to the south-west, and the Poyma River delta (42.815° N, 131.350° E), ca 19 km to the north-east. Thus, a territory was studied extending for 30 km along the sea coast and up to 9 km inland (Romashka village), including the following water bodies: two middle-sized fast rivers Ryazanovka (Langoukore) and Poyma

(Adimi), one shallow, slow rivulet Zaklychennaya, forming a large coastal swamp extending 500–1000 m inland, several large limans (brackish bays), a forest pond probably of an artificial origin, a bog, and a series of fishery ponds.

Loc 9. The Poyma River section from 42.858° N, 131.303° E to 42.849° N, 131.320° E, 9–14 m a.s.l. The largest river in Region II, on average twice as broad and deep as the Ryazanovka River, has a fast current with many rapids and exclusively pebble bottom. Odonata species recorded: 2 (four times less than at the Ryazanovka River), of which *Calopteryx japonica*, definitely bred there, however abundance of both sexes of *Orthetrum albistylum* was curious.

Loc 10. A swampy meadow at Romashka village, 42.848° N, 131.297° E, 12 m a.s.l. Odonata species recorded: 6.

Loc 11. The Romashka River at Romashka village, 42.847° N, 131.294° E, 13 m a.s.l. A shallow slow river overgrown with semiaquatic vegetation. The only Odonata species found to breed at this locality, *Sympetrum kunckeli*, was recorded only there and had a very large population.

Loc 12. The Ryazanovka River (Fig. 7) section studied between ca 42.827° N, 131.228° E and 42.813° N, 131.253° E, 11–22 m a.s.l. A cold and fast river 0.5–1 m deep. Odonata



Figure 7. The Ryazanovka (Langoukore) River (Loc 12), a habitat of *Calopteryx japonica* and *Ophiogomphus obscurus* and probably some other lotic species recorded nearby. O.K.

species recorded: 8, of which only *Calopteryx japonica* and *Ophiogomphus obscurus* surely bred there, while many used open places along the river for foraging, mostly *Anax julius*, *Pantala flavescens* and *Somatochlora* spp., and most of *Sympetrum* spp. were found there. In 2011, an attempt of oviposition into the river by a female of *Deielia phaon* was observed and males of *Epophthalmia elegans* were twice sighted above the river. At the river bank and close to the bog (Loc 18) a female of *Sieboldius albardae*, was collected, the only individual of this species met outside the sea coast.

Loc 13. An inundated ditch along the road A189. 42.827° N, 131.236° E. 36 m a.s.l.. Odonata species recorded: 5; there the largest population of *Lestes temporalis* was found.

Loc 14. Ecofarm: a series of artificial ponds for fishery and fishing (Fig. 8), 42.820-42.823° N, 131.225-131.233° E, 17-21 m a.s.l. Most of the ponds are deep, have stony bottoms and are devoid of aquatic vegetation; there are some bushes and low trees at banks. The Ryazanovka River flows to the north of them and a large swampy meadow is to the east. The richest locality, Odonata species recorded: 32. *Macromia amphigena fraenata* was recorded only there, while *Epophthalmia elegans* and *Deielia phaon* had there the most abundant populations among those found. This also is the only confirmed breeding locality of *E. elegans* (Onishko 2019). Also here, co-occurrence was recorded of two closely related species, *Sympetrum depressiusculum* and *S. frequens*.



Figure 8. Fishery ponds of Ecofarm near Ryazanovka village (Loc. 14), the richest of the localities studied where 32 species were recorded. I.V.

Loc 15. The ground road between the coast (42.774° N, 131.259° E) and Ecofarm (42.774° N, 131.259° E) (Fig. 9), 0-20 m a.s.l., connecting many locations listed above and so providing numerous sightings and collections of Odonata, species recorded: 27.

Loc 16. The Poyma River delta, including a number of large oxbow lakes and swampy meadows along them. 42.810-42.828° N, 131.346-131.362° E, at the sea level. No trees but there are some low bushes, solitary or in small groups. Odonata species recorded: 6; most interesting was a large population of the rare *Lyriothemis pachygastra*.

Loc 17. The stationary of the Far East State University in Ryazanovka village, 42.794° N, 131.252° E, 43 m a.s.l., which served the expedition base from 20.08.2011 to 10.09.2011. Situated in open broad-leaved forest with numerous glades and ground roads with pools, so providing habitats for numerous Odonata species, 18 of which were recorded. *Lestes temporalis* and *Somatochlora viridiaenea* were common. Mixed



Figure 9. The ground road (Loc 15) between the coast and Ecofarm (Fig. 8), where as many as 27 species were registered on dispersal. I.V.

foraging swarms up to several hundred individuals of different species were observed in dusk.

Loc 18. A peat-moss bog (Fig. 10) 1.7 km NNE of Ryazanovka village, outlined by the Ryazanovka River from the north and elevated above it for several metres as situating on its right terrace. The studied part was 250 x 100 m, 42.812-42.814° N, 131.246-131.252° E, 13-15 m a.s.l. A large quaking (hanging) peat-moss bog without open water, but with some hidden flow forming a series of tiny brooks with a fairly fast flow at the river side, separated with very tall (above 1 m) sedge tussocks; there is a grove or *Alnus japonica* (Thunb.) Steud. in the south. (A spectacular ground orchid *Pecteilis radiata* (Thunb.) Raf. was abundant and another one, *Habenaria linearifolia* Maxim. occurred among peat-moss, see Fig. 11.) Odonata species recorded: 22. This is the only confirmed breeding place of *Somatochlora arctica* and *S. viridiaenea*, and the largest population of *Sympetrum parvulum* was found there. The open area of this bog was used for foraging by many Odonata species, such as *Ophiogomphus obscurus* (arriving from the river nearby), *Sympetrum uniforme*, *Anax julius*; on 30.08.2018, a female of *Macromia* sp. was sighted in a mixed swarm of *Anax julius*, *Aeshna soneharai*, *Somatochlora* spp and *Pantala flavescens*.

Loc 19. Several interconnected limans, brackish sea bays of variable low salinity, along the Boisman Harbour. 42.792-42.806° N, 131.292-131.314° E, at the sea level. They reside in open area, ca 4 km from the west to east and ca 3 km inland, without any arbo-



Figure 10. The peat-moss bog by the Ryazanovka River (Loc 18), a rich habitat with 22 species recorded. Above: I.V., below: O.K.

real vegetation and separated from the sea with a narrow sandy spit known as Golden Sands. Odonata species recorded: 25.

Loc 20. The Ryazanovka River delta and its surroundings, 42.784-42.788° N, 131.277-131.281° E, at the sea level. At its mouth, the river forms several arms almost without current (Fig. 12), the westernmost one extending along a cliff and very close to the sea. The area was bordered with a rocky hill covered with oak forest in the southwest and a sandy beach in the east. Odonata species recorded: 16; most interesting were such rare species as *Platycnemis phyllopoda*, *Anisogomphus maackii*, *Sieboldius albardae* and *Macromia manchurica* (one of the two specimens collected of the latter species in total).

Loc 21. The cliffy northern sea coast from Mechta Tourist Base (42.780° N, 131.270° E) to the Ryazanovka River delta (42.783° N, 131.277° E; both at sea level), with well heated screes and cliffs (Fig. 13) bearing atop oak forest with many glades. Odonata species recorded: 24, of which most interesting were *Sieboldius albardae*, *Anisogomphus maackii* (most sightings of both were there), *Macromia daimoji*, *M. manchurica*, *Somatochlora viridiaenea* and *Sympetrum fonscolombii*.

Figure 11. Ground orchids *Habenaria linearifolia* Maxim. (top left) and *Pecteilis radiata* (Thunb.) Raf. (the rest) at the peat-moss bog by the Ryazanovka River (Loc 18, Fig. 10). O.K.



Figure 12. An arm of the Ryazanovka River delta (Loc 20), with 16 species recorded, including *Platycnemis phyllo-poda*, *Anisogomphus maackii*, *Sieboldius albardae* and *Macromia manchurica*. A. Dunaev.





Figure 13. Coastal cliffs between Ryazanovka and Zaklyuchennaya River mouths (Loc 21), a place of foraging of many large dragonflies, where 24 odonate species were registered. I.V.



Figure 14. A swamp at the Zaklyuchennaya River mouth (Loc 22), with 22 odonate species recorded. A. Dunaev.

Loc 22. A swamp formed by the Zaklyuchennaya Rivulet at its mouth (Fig. 14) and extending for ca 1.2 km long, from 42.760° N, 131.255° E to 42.777° N, 131.263° E but variable in size in different years, at the sea level, covered with dense reed and hardly accessible. Odonata species recorded: 22, including such rare ones as *Deiella phaon* and *Paracercion plagiosum*.

Loc 23. The cliffy western sea coast from the Zaklyuchennaya River mouth (42.766° N, 131.256° E) to Rozhdestvenskaya tourist base (42.757° N, 131.256° E, both at sea level), in general similar to Loc. 21 but with less vegetation on cliffs, resulting in less Odonata species recorded: 13, however there most sightings of *Atrocalopteryx atrata* (both sexes) took place.

Locality series III

Miscellaneous localities examined from 10.06.2017 to 23.06.2017 by V.O., on 28.08.2018 by V.O. and I.V. on a car trip across the Primorskiy Kray, and on 4.08.2020 by V.O. and O.K.

Loc 24. The railroad bridge at Bamburovo village, Khasan District, 42.920° N, 131.324° E, 15 m a.s.l. Odonata species found: 3.

Loc 25. The Ananyevka (Large Elduga) River at the bridge near Venivitinovo village, Khasan District, 43.413° N, 131.740° E, 2 m a.s.l. Odonata species found: 10.

Loc 26. A small roadside pond at Utesnoe village, Ussuriysk Municipality, 43.741° N, 131.945° E. 18 m a.s.l. Odonata species found: 2 (*Coenagrion hylas* and *C. johansoni*).

Loc 27. Lake Soldatskoe, Ussuriysk Town, 43.774° N, 131.942° E, 13 m a.s.l. Odonata species found: 2.

Loc 28. A medium-sized, roundish, cold forest lake at Solovey-Klyuch Town, Nadezhdino District, 43.398° N, 132.056° E, 70 m a.s.l. Odonata species found: 9.

Loc 29. The Malennaya River in Brovnichi village, Partizansk District, 43.287-43.288° N, 133.018-133.019° E; on 4.08.2020 examined at this point and also 2.5 km upstream (SW of Brovnichi village), at 43.271-43.273° N, 133.012-015° E. A small rivulet with a slow current and pebble bottom. Odonata species found: 10.

Loc 30. A small pond near Lake Lebedinoe in Nakhodka Town, 42.850° N, 132.897° E. Strongly overgrown, banks boggy. Odonata species found: 4, including a very large population of *Coenagrion ecornutum*.

Annotated list of species

LESTIDAE (5 species)

1. *Lestes dryas* Kirby, 1890

Loc 4: 5.08.2011: 1 ♂ photographed (37814945), Loc 7: 08.2011: several ♂ ♂ sighted. 1 ♂ collected. Loc 18: 7.08.2020: 2 ♀ ♀ collected. Loc 20: 30.08.2015: 1 ♂ photographed (37812260, posed). Loc 21: 30.08.2015: 1 ♂ collected. A lake at Sputnik railway station, 43.238 N, 132.038 E: 20.06.2017: numerous teneral of both sexes sighted (4 localities).

Observations. Found in six localities only and numerous only in one of them (out of the locality list), where observations were made in June rather than in August-September,

as elsewhere; also observations in Loc 7 were made in early August. So most probably in Primorye, as well as in the European Russia, *L. dryas*, has a rather early flight period. The only male collected in Ryazanovka village (Loc 21) was very old.

2. *Lestes japonicus* Selys, 1883

(Fig. 15)

Loc 19: 30.08.2011: 1 ♂ photographed (37816504); 08.2011: 1 ♂, 1 ♀ collected; 01.09.2011: 1 ♂ photographed (37756789); 1.09.2011, 08-09.2011 and 08-09. 2015: numerous ♂♂ and ♀♀ sighted. Loc 20: 19.08.2015, 1 ♂ collected and photographed (37812059, posed); ♂♂ and ♀♀ sighted. Loc 21: 31.08.2015: 1 ♂ (37756686, posed), 1 ♀ collected. Loc 22: 20.08.2011: 1 ♂, 1 ♀ photographed (37816585); 30.08.2011: 1 ♂, 1 ♀ collected and photographed (37756735); 08.2018: 4 ♂♂, 3 ♀♀ collected; 08-09.2011, 08-09.2015 and 08-09.2018: numerous ♂♂ and ♀♀ sighted; 5.09.2018: 2 ♂♂ (37812049, 37523114), 2 ♀♀ (37812028, 37523123) photographed (Fig. 15) (4 localities).

Observations. Found only in Region II and only along the coast. It was most numerous at shoreline swamps at the Zaklyuchennaya River moth (Loc 22) where it predominated among *Lestes* spp, while at the limans (Loc 17) it was inferior to *L. sponsa*. Solitary individuals, especially young ones, occurred along the whole coast from Loc 20 to Loc 22. This species occurred at banks with dense grass and never at barren banks. It is noteworthy that the closely related Euro-Siberian species *L. virens* does not show such a strong preference in the European Russia and occurs at any water bodies, both with abundant semiaquatic vegetation and practically devoid of it.



Figure 15. ♂ (left) and ♀ (right) of *Lestes japonicus* at Loc 22, 5.09.2018. V.O.

3. *Lestes sponsa* (Hansemann, 1823)

Loc 7: 08.2011: 1 ♂, 1 ♀ collected. Loc 3: 08.2011, many ♂♂, ♀♀ sighted; 14.08.2015: 2 ♂♂, 4 ♀♀ collected; ♂♂, ♀♀ sighted, 1 ♂ photographed (37811754). Loc 13: 28.08.2015: few ♂♂, ♀♀ sighted, 1 ♀ photographed (37812304); 30.08.2018: 2 ♂♂, 2 ♀♀ collected; 04.09.2018 and 08.09.2018: ♂♂, ♀♀ sighted. Loc 14: 09.2015, 30.08.2018,

1-2.09.2018 and 8-9.09.2018: ♂♂, ♀♀ sighted. Loc 18: 29.08.18: 1 ♀ sighted. 07.08.2020: 1 ♀ photographed (63812260). Loc 19: 08.2011: 2 ♂♂, 2 ♀♀ collected, many ♂♂, ♀♀ sighted; 28.08.2015: many ♂♂, ♀♀ sighted. Loc 20: 08.2011: ♂♂ sighted, 15.08.2015: 1 ♂, 1 ♀ collected, 31.08.2015: 1 ♂ collected and photographed (37812248, posed). Loc 21: 19.08.2015: few ♂♂, ♀♀, sighted, 1 ♂ and 1 ♀ photographed (37812073, 37811765, posed); 2.09.2018: 1 ♂ collected. Loc 22: 14.08.2015: 1 ♀ collected and photographed (37812277, posed); ♂♂, ♀♀ sighted (10 locations).

Observations. The commonest lestid species in the region.

4. *Lestes temporalis* Selys, 1883

(Fig. 16)

Loc 13: 8-9.2011: 5 ♂♂, 4 ♀♀ collected, numerous ♂♂, ♀♀ sighted; 26 and 27.08.2011: 2 ♀♀ photographed (37816605, 37756825); 1.09.2015: ♂♂, ♀♀ sighted, 1 ♂, 2 ♀♀ photographed (37812488, 37812470, 37812448, posed); 7.08.2020: 3 ♂♂, 3 ♀♀ collected, 2 ♂♂, 4 ♀♀ photographed (63812022, 63812000, 63811941, 63811895 (in hand), 63811881 (in hand), 63811864) (Fig. 16). Loc 14: 9.09.2018: 2 ♂♂, 2 ♀♀ collected, 1 ♂ photographed (37756521). Loc 17: 08.2011: 2 ♂♂, 2 ♀♀ collected; 1 ♂ photographed (37816491); 30.08.2018: ♂♂, ♀♀ collected, 1 ♂ and ♀♀ photographed (3 localities).

Remarks. Strikingly, the ecology and behaviour of this species is nearly identical to the two species of the West Palearctic genus *Chalcolestes*. Tandems of both oviposit into branches of trees and bushes and do not use grasses, except for the thickest and highest ones. For this they often ascend to tree or bush crowns, while males search for females moving in them vertically rather than horizontally. Besides, *L. temporalis* is very similar to *Chalcolestes* also in morphology: the males have disproportionally long abdomen as compared to the other three *Lestes* spp. in the region, while in females S9 is club-like swollen. Most probably *L. temporalis* actually belongs to *Chalcolestes*, be it a genus or subgenus. Anyway, the genus *Lestes* has not yet been revised with the use of molecular phylogeny and is still a mess as including a number of tropical species far more dissimilar to its type species than *Chalcolestes* spp.; and such a revision is badly missing (Kosterin 2018).



Figure 16. ♂ (left) and ♀ (right) of *Lestes temporalis* at Loc 13, 7.08.2020. V.O.

Observations. This species is local in Primorye as being there at the northern margin of its range. There it prefers a seasonally drying small water bodies, mostly shaded by woods. Thus, at Loc 17 a large population inhabits an inundated section of a forest ground road, where it breeds together with *Sympetrum risi*. (It is noteworthy that the latter species always co-occurred with *L. temporalis*). At Ecofarm (Loc 14), *L. temporalis* was found exclusively in bush and tree groves on inundated meadows and did not extend to the ponds.

5. *Sympecma paedisca* Brauer 1877

Loc 17: 7.09.2011: ♂ collected. Loc 18: 1.09.2018: 1 ♀ photographed (37528698). Loc 21: 30.08.2015: 1 ♂ collected and photographed (37816328, posed); 3.09.2015: 1 ♀ collected and photographed (37816308, posed). 42.804 N, 131.252 E (inundated ditches along the railroad): 29.08.2018: 1 ♀ photographed (37528723, posed). 43.574 N, 131.854 E: 21.06.2017: 1 ♀ photographed (37423613) (3 localities).

Observations. Only solitary young individuals were met with.

CALOPTERYGIDAE (2 species)

6. *Atrocalopteryx atrata* (Selys, 1853)

Loc 21: 08.2011, 1 ♂ collected, several sighted; 5.09.2015: 1 ♂ collected and photographed (38831312, posed); 7.09.2018: 1 ♂ collected and photographed (37520145). Loc 23: 08-09.2011: 4 ♂♂, 2 ♀♀ collected, numerous sighted; 14.08.2015: 1 ♂ collected and photographed (103815262, posed); 28.08.2015: 2 ♀♀, 1 ♂ collected, 3 ♂♂ photographed (37815432 (posed), 37815378 (posed), 37815399); 29.08.2015: 1 ♂ collected and photographed (37815415, posed); 6.09.2018: 1 ♀ collected and photographed (37520158, in hand); 7.09.2018: 1 ♂ sighted (2 localities).

Observations. Interestingly, this species has never been observed by us at rivers while solitary individuals, rarely small groups, quite often occurred at the sea coast. On 7.09.2018, two males were observed which patrolled an inundated ditch (Loc 21) and a pool (Loc 23). It remains unknown if the species is able to breed in such water bodies or the male territorial behaviour was misplaced, however Yakubovich (2014) reported facts of this species' breeding in a lentic habitat, an artificial pond near Khabarovsk.

7. *Calopteryx japonica* Selys, 1869

Loc 1: 08.2011: 4 ♂♂, 2 ♀♀ collected, numerous ♂♂, ♀♀ sighted. Loc 5: 14.08.2015: 1 ♂ collected and photographed (37815690, posed); 15.08.2015: 1 ♀ collected and photographed (37462084, posed). Loc 7: 4.08.2011: 1 ♂ collected and photographed (37815698); 7.08.2011: 1 ♂ collected and photographed (37815645), few ♂♂ sighted; 14.08.2011, 1 ♂ collected and photographed, several ♂♂, ♀♀ sighted. Loc 8: 14.08.2015; 1 ♂ collected and photographed (37462105); Loc 9: 08.2011: 1 ♂ collected, numerous ♂♂ and ♀♀ sighted; 23.08.2011: 1 ♀ photographed (37815712, posed). Loc 12: 08-09.2011, 6 specimens collected; numerous ♂♂ and ♀♀ sighted; 30.08.2011: 1 ♀ photographed (37815750); 23.08.2015: 1 ♀ photographed (37815581); 07.2017: few ♂♂ sighted. Loc 14: 30.08.2018: 1 ♂ sighted; 1.09.2018: 1 ♀ sighted. Loc 15: 30.08.2018: 1 ♀ sighted. Loc 21: 08-09.2011: few individuals sighted; 30.08.2018: 1 ♀ collected and photographed (37811360).

Loc 23: 28.08.2015: 1 ♂ collected and photographed (10 localities).

Observations. Common at rivers of any type.

COENAGRIONIDAE (10 species)

8. *Coenagrion ecornutum* (Selys, 1872)

Loc 27: 19.06.2017: numerous ♂♂ and ♀♀ sighted. Loc 28: 21.06.2017: 1 ♂ collected and photographed (37461912, posed), numerous ♂♂ and ♀♀ sighted. Loc 29: 18.06.2017: ♂♂ sighted. Loc 30: 21.06.2017: 2 ♂♂ collected, 1 ♂ photographed (37461896, posed), ♂♂ and ♀♀ sighted. 43.375 N, 131.747 E: 19.06.2017: 1 ♂, 1 ♀ collected and photographed (37461959, 37461949, both posed), numerous ♂♂ and ♀♀ sighted (5 localities).

Observations. This species, very numerous in the region in the first half of the summer, predominated over other Coenagrionidae at localities where it occurred.

9. *Coenagrion glaciale* (Selys, 1872)

Loc 27: 19.06.2017: 1 ♂ sighted and photographed (104270342, posed). Loc 30: 21.06.2017: 1 ♂ collected and photographed (37461729) (2 localities).

Observations. While other *Coenagrion* spp. were widespread in the region, this one was met only twice, within 19th-21st June, most probably for its well-known early flight period. The male found at Lake Soldatskoe (Loc 27) demonstrated a very aggressive territorial behaviour not observed in other *Coenagrion* spp. The male perched on a fishermen's fork stick protruding from the water, from time to time made fast flights for 5-7 m and returned immediately. During them it tried to chase out not only zygopterans but also anisopterans, e.g., *Trigomphus nigripes*. Another male was collected, among numerous *C. ecornutum*, at Nakhodka Town (Loc 30), in dense grass at a small pond where the damselflies concentrated at rainy weather.

10. *Coenagrion hastulatum* Charpentier, 1825

Loc 25: 18.06.2017: 1 ♂ collected, ♂♂ sighted. Loc 29: 21.06.2017: 3 ♂♂ collected and photographed (104270623, 37461518, 37436971, all posed), ♂♂ sighted (2 localities).

Observations. A species rare in the region. Curiously, at Loc 25 it was found together with a very close species *C. lanceolatum*, which predominated. Only males were found. They were smaller than those of *C. lanceolatum*, and almost never abandoned dense vegetation, by this behaviour rather resembling *C. johanssonii*. At the same time males of *C. lanceolatum* often appeared at open water and more readily exhibited territorial behaviour.

11. *Coenagrion hylas* Trybom 1889

(Fig. 17)

Loc 3: 2-15.08.2011: 5 ♂♂, 5 ♀♀ collected, many ♂♂, ♀♀ sighted; 13.08.2015: many ♂♂, ♀♀ sighted, 3 ♂♂ photographed (37837473, 37777848 (posed), 37437250 (posed)); 3.08.2020: 3 ♂♂ collected, 3 ♂♂, 1 ♀♀ photographed (63811092 (in hand), 61473175, 61473063) (Fig. 17), many ♂♂, ♀♀ sighted. Loc 4: 06-09.2011: 2 ♂♂, 2 ♀♀ collected; 6.08.2011: 1 ♂ photographed (37837277, posed); 9.08.2011: 1 ♀ photographed (37815071, posed). Loc 14: 3.09.2015: several ♂♂ sighted. Loc 22: 08.2011: solitary ♂♂ sighted.

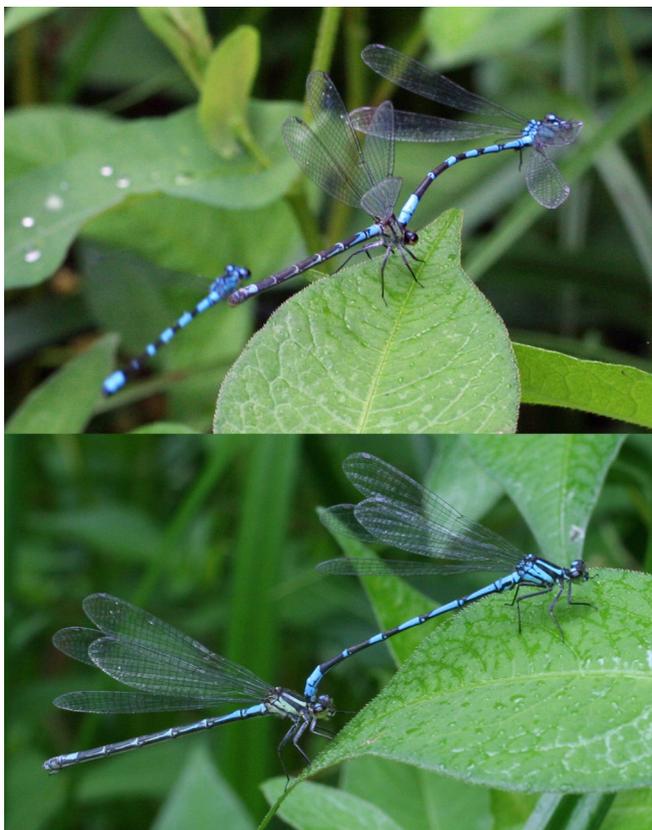


Figure 17. Tandems of *Coenagrion hylas* at a small forest lake at Tigrovoy village, Loc 3, 3.08.2020. O.K.

Loc 26: 06.2017: 3 ♂♂, 2 ♀♀ collected, 1 ♂, 1 ♀♀ photographed (37437212, 37437175, both posed), many ♂♂, ♀♀ sighted (5 localities).

Observations. Occurs at forest lakes and ponds and is more common in taigous habitats. In the coastal zone of Region II, it occurred by solitary individuals and was inferior to its congeners in number. Males readily appear at open water and can for a long time scrutinise their territories, thus resembling *Enallagma*. However, such behaviour was rare where the species was abundant.

12. *Coenagrion johanssoni* (Wallengren, 1894)

(Fig. 18)

Loc 3: 2-15.08.2011: 2 ♂♂, 2 ♀♀ collected, many ♂♂, ♀♀ sighted; 13.08.2015: 1 tandem photographed (37437128); 15.08.2015: many ♂♂, ♀♀ sighted, 1 ♂, 1 ♀ photographed (3777795 (posed), 37837507); 3.08.2020: 3 ♂♂, 2 ♀♀ collected; many ♂♂, ♀♀ sighted, 1 ♂, (63810895), 2 ♀♀ (63811175, 63811149 both in hand), 2 tandems (63811127, 61481105) (Fig. 18a) photographed. Loc 18: 08.2011: few ♂♂ sighted; 6.09.2018: 1 ♂ sighted; 7.08.2020: 2 ♂♂, 2 ♀♀ collected, 1 ♂ (63811459, in hand), 2 ♀♀ (63812090 (in



Figure 18. Tandems of *Coenagrion johanssoni*: a - at the forest lake at Tigrovoy village, Loc 3, 3.08.2020; b – at a peat-moss bog by the Ryazanovka River, Loc 18, 7.08.2020. O.K.

hand), 63812058), 3 tandems (62634773; 62634776, 63812048) (Fig. 18b) photographed, many ♂♂, ♀♀ sighted. Loc 22: 08.2011: ♂♂, ♀♀ sighted; 31.08.2018: 1 ♂ sighted. Loc 26: 21.06.2017: many ♂♂, ♀♀ sighted. Loc 30: 20.06.2017: few ♂♂ sighted (5 localities).

Remarks. Females from Region I strongly differed from those from European Russia and Siberia in coloration of their abdomen tip. They had their S8-S10 largely blue above, S8 with a black ring at middle and S9 at its anterior margin (and the regular lateral black stripes) (Fig. 18a), while in the European and Siberian females the blue or green colour predominates only on S10, is confined to the lateroposterior spots and posterior ring S9, and to the posterior ring on S8. In females of Khasan District, even the S8 central ring was somewhat reduced (Fig. 18b). In males, the abdominal black spots are also shrunken as compared to the European and Siberian specimens, occupying less than half of the dorsal sides of S3-S6; the black streak on the interpleural suture is interrupted to result in an isolated dot, and the black lateral stripes on S2 do not reach the posterior segment margin (Fig. 18). These characters perfectly fit to those of *Coenagrion convalescens* Bartenef, 1914, described from Imyanpo Station in Manchuria (presently China, Heilongjiang Province, Shangzhi County, Yimianpo) (Bartenef 1914) and downgraded to the subspecies *Agrion concinnum convalescens* by Haritonov (1976) (the implied specific name *Agrion concinnum* Johansson, 1859 was replaced with *johanssoni* as a junior homonym of *Agrion johanssoni* Rambur, 1842).

At the same time, already in females of *C. johanssoni* from the more northerly situated Kirovskiy District of the same Primorye, the black colour expands on S8 to occupy most of its dorsal side, while the interruption of the black streak on the interpleural suture and the S2 lateral black stripes in males is variable (see our photos of tandems in iNaturalist observations 59843367 and 59798646). So, even within Primorye, there seems to be a cline of shrinkage of the black colour in *C. johanssoni*, which is in line with a similar

clinal reduction of the black pattern from north to south observed in many damselfly and dragonfly species all over the Palaearctic. This makes isolation of subspecies in *C. johanssoni* problematic and hardly deserved (Onishko & Kosterin 2021).

Observations. A numerous species preferring water bodies and bogs densely overgrown with sedge and grasses, where it can be the most numerous damselfly.

13. *Coenagrion lanceolatum* (Selys, 1872)

Loc 3: 15.08.2011: few ♂♂, ♀♀ sighted. 14.08.2015 1 ♂ photographed (37777770, posed).
Loc 4: 08.2011: 2 ♂♂, 2 ♀♀ collected, of them 1 ♂ photographed (37814873, posed) on 5.08.2011, 1 ♀ photographed (37757126, posed) on 8.08.2011. Loc 7: 08.2011: 1 ♂, 1 ♀ collected in tandem. Loc 20: 08.2011: 3 ♂♂ collected. 19.08.2015: 1 ♂ photographed (37777738, posed). Loc 22: 08.2011: 2 ♂♂ collected. Loc 25: 19.06.2017: 1 ♂ collected and photographed (37777570, posed), few ♂♂ sighted (6 localities).

Observations. The commonest damselfly in the region, occurring at water bodies of any type, including lotic ones.

14. *Erythromma najas humerale* Selys, 1887

Loc 14: 03.09.2015: 5 ♂♂, 2 ♀♀ collected, few ♂♂, ♀♀ sighted. Loc 19: 08.2011: 2 ♂♂, 3 ♀♀ collected, many ♂♂, ♀♀ sighted; 26.08.2015: 3 ♂♂, 3 ♀♀ collected, of them 1 ♂ photographed (37838234, posed), many ♂♂, ♀♀ sighted. Loc 30: 19.06.2017: 2 ♂♂ collected, of them 1 ♂ photographed (37838672, posed), few ♂♂ sighted (3 localities).

Observations. A rather common but rarely abundant species occurring at larger lentic water bodies (lakes) where it keeps to open water, as a rule together with representatives of the related genus *Paracercion*, with which this species also shares its ecology.

15. *Ischnura asiatica* (Brauer, 1865)

(Fig. 19)

Loc 14: 08-09. 2015: many ♂♂, ♀♀ seen; 27.08.2015: 1 ♂ photographed (37435651, posed); 28.08.2015: 1 ♀ photographed (37435675, posed); 30.08–06.09.2018: ♂♂, ♀♀ many seen, 5 ♂♂, 5 ♀♀ collected. Loc 15: 08.2011, 2015, 2018: many sightings of solitary ♂♂, ♀♀ on dispersal; 29.08.2018: 1 ♀ photographed (37589051); 10.09.2018: 1 ♂ photographed (37465717). Loc 18: 19.08.2011 1 ♂ collected, 30.08-06.09. 2018: ♂♂, ♀♀ many seen; 1.09.2018: 1 ♀ photographed (37589063); 7.08.2020: 1 ♀ photographed (62538642) (Fig. 19c) and collected. Loc 19: 25.08 – 04.09 2011: ♂♂, ♀♀ many seen, 5 ♂♂, 5 ♀♀ collected; 25.08–04.09 2015: many ♂♂, ♀♀ seen. Loc 20: 08–09.2011, 2015, 2018: many ♂♂, ♀♀ sighted; 23.08.2011: 1 ♂ photographed (37839923, posed); 30.08.2018: 3 ♂♂, 3 ♀♀ collected. Loc 21: 08.2011, 2015, 2018: many sightings of solitary ♂♂, ♀♀ on dispersal; 30.08.2018: 1 ♂ photographed (37589088) (Fig. 19a). Loc 22: 08-09.2011, 2015, 2018: many ♂♂, ♀♀ sighted; 25.08.2011: 1 copula photographed (37815012) and collected; 27.08.2011: 1 ♂ photographed (37839913, posed), 31.08.2018: 1 ♀ photographed (37409354) (Fig. 19b). Loc 23: 08.2011, 2015, 2018: many sightings of solitary ♂♂, ♀♀ on dispersal. Loc 28: 28.08.2018: 1 ♀ collected (9 localities).

Observations. Common in Khasan District but never numerous. Both young and mature imagines were regularly observed until 6 September (the end of fieldwork), often far



Figure 19. ♂ (a) and ♀♀ (b-c) of *Ischnura asiatica*: a – at the cliffy coast S of the Ryazanoka River delta, Loc 21, 30.08.2018, V.O.; b – at a swamp at the Zaklyuchennaya River mouth, 31.08.2018, V.O.; c – at a peat-moss bog by the Ryazanovka River, Loc 18, 7.08.2020. O.K.

from water. This evidences a prolonged emergence and active dispersal soon thereafter, so that imagines mature beyond their breeding places.

16. *Nehalennia speciosa* (Charpentier, 1840)

(Fig. 20)

Loc 18: 19.08.2011: 1 ♂ collected, 3.08.2020: many ♂♂, ♀♀ sighted, 1 ♀ photographed (62649322)

(Fig. 20). Loc.29: 20.06.2017: few ♂♂ sighted (2 localities).

Observations. Occurs in dense riparian sedge and on peat-moss bogs. While in the western part of the range this species mostly prefers the latter habitats (Bernard & Wildermuth 2005), its flourishing in sedgy habitats is a feature of the Far Eastern populations (Onishko & Kosterin 2021). Still abundant in early August but becomes rare to the end of this month.

17. *Paracercion calamorum calamorum* (Ris, 1916)

(Fig. 21)

Loc 14: 09.2015: many ♂♂, ♀♀ sighted; 30.08.2018–06.09.2018: 3 ♂♂, 4 ♀♀ collected, many ♂♂, ♀♀ sighted; 30.08.2018: 1 ♂ (37527127, Fig. 21, right), 1 ♀ (37519717, posed) photographed, 1 and 8.09.2018: 2 ♂♂ photographed (37527178, 37527136); 9.09.2018: 1 ♂, 1 tandem photographed (37779147, 37465403, Fig. 21 left). Loc 19:



Figure 20. An androchromatic female of *Nehalennia speciosa* at the peat-moss bog by the Ryazanovka River, Loc 18, 7.08.2020. O.K.



Figure 21. A tandem (left) and male (right) of *Paracercion calamorum calamorum* at fishery ponds at Ecofarm, Loc 14, 30.08.2018 (left) and 9.09.2018 (right). V.O.

25.08.2011–04.09. 2011: 2 ♂♂, 2 ♀♀ collected, many ♂♂, ♀♀ sighted; 28.08.2011: 1 tandem photographed (37757184); 1.09.2011: 1 ♂ photographed (37757212, posed); 25.08.2015–04.09 2015: many ♂♂, ♀♀ sighted. Loc 28: 28.08.2018: many ♂♂, ♀♀ sighted (3 localities).

Observations. This most common and abundant representative of the genus in the southern Primorye, which may predominate among Zygoptera in certain habitats, has not however been registered in Region I. Prefers open lakes with scarce bank vegetation. Males patrol open aquatories, perching on floating vegetation, in this behaviour resembling *E. najas*.

18. *Paracercion hieroglyphicum* (Brauer, 1865)

(Fig. 22a)

Loc 14: 31.08.2018: 1 ♂, 1 ♀ photographed (103471295, Fig. 22a); Loc 20: 08-09.2015, 08-09.2018: many ♂♂, ♀♀ sighted; 31.08.2018: 1 ♂, 1 ♀ photographed (37527207 (posed), 37519922); 30.08.2018: 2 ♂♂, 1 ♀ collected. Loc 19: 25.08.2011–04.09.2011: 2 ♂♂, 2 ♀♀ collected, many ♂♂, ♀♀ sighted; 19.08.2015: many ♂♂, ♀♀ sighted, 1 ♀ photographed (37519605); 28.08.2015: 1 ♀ photographed (37519702, posed) (3 localities).

Observations. Habitats and habits as in *P. calamorum* and *P. v-nigrum* but strongly inferior to them in number.

19. *Paracercion plagiosum* (Needham, 1930)

Loc 22: 30.08.2011: 1 ♀ collected (1 locality).

Observations. The only female was found at a small pool near the Zaklyuchennaya River.



Figure 22. ♂♂ of *Paracercion hieroglyphicum* (a) and *P. v-nigrum* (b) at fishery ponds at Ecofarm, Loc 14, 31.08.2018 (left) and 30.08.2018 (right). V.O.

20. *Paracercion v-nigrum* (Needham, 1930)

(Fig. 22b)

Loc 14: 30.08.2018–06.09.2018: 3 ♂♂, 4 ♀♀ collected, many ♂♂, ♀♀ sighted; 30.08.2018: 3 ♂♂ photographed, (37519672 (Fig. 22b), 37519664 (posed)). Loc 19: 25.08.2011–04.09.2011: 3 ♂♂, 2 ♀♀ collected, many ♂♂, ♀♀ sighted; 25.08.2015–04.09.2015: many ♂♂, ♀♀ sighted; 25.08.2015: ♂ photographed (37519935, posed). Loc 22: 30.08.2011: 2 ♂♂ collected (3 localities).

Observations. Common in southern Primorye, resembles *P. calamorum* in the lifestyle but more readily occurs in grass at some distance from water, and is also inferior to it in number.

PLATYCNEMIDIDAE (1 species)

21. *Platycnemis phyllopoda* Djakonov, 1926

Loc. 10: 27.08.2015: 1 ♀ photographed (37424194, posed). Loc 14: 30.08.2018–06.09.2018: 2 ♂♂, 4 ♀♀ collected, many ♂♂, ♀♀ sighted; 30.08.2018: 1 ♂ photographed (37527595, posed). Loc. 16: 19.08.2015: 1 ♂ photographed (37424186, posed). Loc 19: 25.08.2011–04.09.2011: 2 ♂♂, 2 ♀♀ collected, many ♂♂, ♀♀ sighted; 25.08.2015–04.09.2015: many ♂♂, ♀♀ sighted; Loc. 20: 23.08.2011: 1 ♀ photographed (37757551). Loc 22: 23.08.2011: 1 ♂ photographed (37815126). Loc 28: 28.08.2018: 1 ♂ collected (7 localities).

Observations. A common but never abundant damselfly occurring at lentic water bodies or river reaches without current. Mature males often examine vegetation up to 5-10 m apart from water for females.

AESHNIDAE (4 species)

22. *Aeshna caerulea* (Ström, 1783)

Loc 7: 5.08.2011: 1 ♂ sighted.

Observations. At about 10 a.m. of the above-mentioned day, a male landed on a wooden ladder in the tourist base yard and was scrutinised visually in detail and so reliably identified by V.O. An attempt to take a picture failed: the dragonfly flew high into tree crowns. Small lakes with peat-moss banks, suitable for this species, were never found in Region I by us but could exist higher in the mountains, so most probably we observed a far stray.

23. *Aeshna crenata* Hagen, 1856

(Fig. 23)

Loc 1: 08.2011: 1 ♂ collected, few ♂♂ sighted. Loc 3: 08.2011: 5 ♂♂, 5 ♀♀ collected, many ♂♂, ♀♀ sighted; 12.08.2011: 1 ♂, 2 ♀♀ (Fig. 23 right) photographed (38826159, 37463073); 13.08.2015: 2 ♂♂, 2 ♀♀ collected; many ♂♂, ♀♀ sighted, 1 ♀ photographed (37463039, posed); 14.08.2015: 1 ♂ photographed (37462933, posed). 3.08.2020: 1 ♂ photographed (63811077, in hand), several ♂♂ sighted. Loc 4: 08.2011: many ♂♂, ♀♀ sighted; 4.08.2011: 1 ♂ photographed (38826152); 9.08.2011: 1 copula (37463314), 1 ♀ (103487994, posed) photographed; 12.08.2011: 1 ♂ photographed (37405978, posed). Loc 7: 08.2011: 10 ♂♂, 5 ♀♀ collected, many ♂♂, ♀♀ sighted; 9.08.2011: a copula (37463283, Fig. 23 left) and 2 ♀♀ (103488035 (posed), 37463335 (in hand)) photographed; 10.08.2011:

1 ♂ photographed (37405976, in hand); 14.08.2011: 1 ♂ photographed (374059771, in hand); 08.2015 ♂♂, ♀♀ many seen. Loc 8: 08.2011: many ♂♂, ♀♀ sighted; 9.08.2011: 1 ♂ photographed (37405980, 37405981, both in hand). Loc. 13: 25.08.2011: 1 ♀ photographed (103487907, posed). Loc 14: 09.2015: many ♂♂, ♀♀ sighted; 1 and 7.09.2015: 2 ♂♂ photographed (104271233, 38831384, both posed) 30.08.18, 1.09.2018, 2.09.2018, 8.09.2018, 9.09.2018: many ♂♂, ♀♀ sighted, Loc 15: 08-09.2011: 3 ♂♂ 2 ♀♀ collected, numerous ♂♂, ♀♀ sighted foraging, also after sunset; 30.08–09.09.2018: 3 ♂♂ 3 ♀♀ collected, many ♂♂, ♀♀ sighted; 30.08.2018: 1 ♀ photographed (37519972); 6.09.2018: 1 ♀ photographed (103471945, in hand). Loc 17: 08-09.2011: 5 ♂♂, 5 ♀♀ collected, numerous ♂♂, ♀♀ sighted on foraging, also after sunset. Loc 18: 29.08.18: 1 ♂ seen; 7.08.2020: 1 ♂ collected and photographed (63812349, in hand). Loc 19: 09.2011: few ♂♂ sighted; 13.08.2015: few ♂♂ sighted, 1 copula photographed (103487768). Loc 22: 08-09.2011: few solitary ♂♂ sighted at open places at bridges; 01.09.2015: 1 ♂ photographed (37462899, posed); 1–8.09.2018: solitary ♂♂ sighted. Loc 28: 28.08.2018: many ♂♂, ♀♀ sighted (13 localities); Loc 29: 4.08.2020: 1 ♂ sighted (14 localities).

Observations. The most numerous representative of Aeshnidae in southern Primorye. Occurs at various water bodies, preferring forest biotopes. These dragonflies forage at daytime and in the evening at forest margins, along roads, sometimes along the sea coast, often along with other dragonflies but does not form swarms. On these foraging flights they do not pay attention to other dragonfly species, either as rivals or prey.



Figure 23. A copula (left) and ovipositing female (right) of *Aeshna crenata* in Tigrovoy settlement: at Tigrovyy Put' Tourist Base, Loc 7, 9.08.2011 (left) and the small forest lake, Loc 3, 12.08.2011 (right). V.O.

24. *Aeshna juncea* (Linnaeus, 1758) ssp.

(Fig. 24)

Loc. 1: 3.08.2020: 1 ♂ photographed (63811268, in hand). Loc 3: 08.2011: 10 ♂♂, 5 ♀♀ collected; 10.08.2011: 1 ♀ photographed (38832207, posed), many ♂♂, ♀♀ seen; 08.15: 2 ♂♂, 3 ♀♀ collected; many ♂♂, ♀♀ sighted; 17.08.2015: 5 ♂♂ photographed



Figure 24. ♂ of *Aeshna juncea* by the road between Ecofarm and the coast in the Ryazanovka village vicinities, Loc 15, 08.09.2018. V.O.

(38832419 (in hand), 38832408, 38832380, 38831266, 37462843, all posed); 2.08.2020: 1 ♀ collected and photographed (63810857, in hand); 3.08.2020: 1 teneral ♂ photographed (61748424), 1 ♂, 1 ♀ sighted. Loc 4: 08.2011: 2 ♂♂ (1 teneral) collected; 5.08.2011: 1 ♂ photographed (38832291, in hand). Loc 7: 08.2011: 5 ♂♂ collected, many ♂♂, ♀♀ sighted; 6.08.2011: 1 ♂ photographed (37463131, in hand); 10.08.2011: 1 ♂ photographed (37814924, posed). Loc 8: 08.2011: many ♂♂, ♀♀ sighted; 5.08.2011: 1 ♂ photographed (38832488 posed); 7.08.2011: 1 ♂ photographed (38826371 in hand); 8.08.2011: 1 ♀ photographed (38826377, in hand); 11.08.2011: 1 ♀ photographed (37814908, posed); 15 and 16.08.2015: 2 ♀♀ photographed (38832512, 38832340); 17.08.2015: 1 ♂ photographed (38832529, posed). Loc 13: 8.09.18: 1 ♂ sighted. Loc 15: 8.09.2018: 1 ♂ photographed (37409963) (Fig. 24). Loc 17: 5 ♂♂, 5 ♀♀ collected. 08-09.2011: numerous ♂♂, ♀♀ sighted foraging, also after sunset. Loc 18: 08-09.2011: 5 ♂♂, 1 ♀ collected, many ♂♂, ♀♀ sighted; 1-9.09.2018: 5 ♂♂ 3 ♀♀ collected, many ♂♂, ♀♀ seen; 8.09.2018: 1 ♂ photographed (37594366, posed); 7.08.2020: 2 ♀♀ collected and photographed (63812304, 63812040, both in hand). Loc 28: 28.08.2018: many ♂♂, ♀♀ sighted (10 localities).

Remarks. In South Primorye, all males of this species strongly differ from those from the European Russia, Ural, Siberia and Kamchatka by broader and brighter antehumeral stripes and presence of additional backward tooth at the middle of each pale spot of the central dorsal pair on S2-S5 (Fig. 24) (being simple triangles in the above-mentioned regions), sharing the latter character with *A. subarctica* Walker, 1908 (Onishko & Kosterin 2021). Females from Primorye are more similar to those from elsewhere but their humeral stripes are also broader and longer.

Bartenev (1929) described the subspecies *Aeshna juncea orientalis* Bartenev, 1929 with reference to his series of 8 ♂♂ from the Odarka River in Primorye, 2 ♂♂ and 2 ♀♀ from the Khabarovsk District, 1 ♀ from Nikolaevsk-na-Amure in the Amur River lowermost reaches (Bartenev 1914), and an additional female from Kamchatka (Bol'shoy reik). In his huge and seemingly comprehensive Table 2 (Bartenev 1929) he enumerated states of numerous characters, often quantitative, but did not mention the additional tooth on the middle pair dorsal spots of the abdominal segments (MD in his terms). The name *orientalis* Bartenev, 1929 is available for a subspecies of *A. juncea* from the southern Far East, if any, however isolation of subspecies in this very variable species is problematic (Belevich 2005).

Observations. Common and often numerous in Primorye, mostly associated with forest lakes and bogs; often forages at forest margins and above roads. It was regularly observed on evening foraging flights, along with other Anisoptera.



Figure 25. Copula (left) and ♂♂ of *Aeshna soneharai* at the Poyma River delta, Loc 16, 2.09.2011. V.O.

25. *Aeshna soneharai* Asahina, 1988

(Fig. 25)

Loc 14: 30.08.2018: 1 ♂ sighted; 01.09.2018: few ♂♂ sighted; 02.09.2018: few ♂♂ sighted. Loc 15: 08-09.2011: numerous ♂♂ and ♀♀. 30.08–06.09.2018: many ♂♂, ♀♀ sighted. Loc 16: 2.09.2011: 5 ♂♂ collected, 1 copula (37596115), 2 ♂♂ (37405696) photographed (Fig. 25), many ♂♂, ♀♀ sighted. Loc 17: 08-09.2011: 5 ♂♂ collected, numerous ♂♂ and ♀♀ sighted; 2.09.2011: 1 ♂ photographed (37596143). Loc 18: 29.08.2011:

1 ♂ collected and photographed (posed); 4.09.2018: ♂♂, ♀♀ many seen (on evening forage flight). Loc 19: 2.09.2011: 3 ♂♂, 1 ♀ collected, ♂♂, ♀♀ sighted, 1 ♀ photographed (37405697, in hand). Loc 22: 08-09.2011: 5 ♂♂ collected, many ♂♂, ♀♀; 1-5.09.2015: many ♂♂, ♀♀ sighted; 1-8.09.2018: 3 ♂♂ collected; many ♂♂, ♀♀ sighted; 2.09.2018: 1 ♂ photographed (37596079) (7 localities).

Remarks. The specimens from Primorye have smaller pale spots of the abdomen as compared to the European and Siberian ones but demonstrate all other diagnostic features of this species considered by Onishko et.al. (2022) while substantiating the split of what used to be known as *Aeshna mixta* Latreille, 1805 in two species.

Observations. Found only in Region II and mostly in coastal habitats. Most common at the lowermost river reaches with thick ridge thickets near the sea, where it predominates over other Aeshnidae. Solitary imagines often forage along the sea coast the evening until darkness, neither forming swarms of their own nor participating in forage swarms of other species.

26. *Anax julius* Brauer, 1865

(Fig. 26-27)

Loc 12: 08.2011: 5 ♀♀ collected, many ♂♂ and ♀♀ many sighted; 22.08.2011: 1 ♀ photographed (37462378, in hand and posed); 26.08.2011: 1 ♀ photographed (103512557); 31.08.2011: 1 ♂ photographed (37462409); 1.09.2011: 1 ♀ photographed (103512482); 1-9.09.2015: 5 ♂♂ collected, numerous ♂♂, ♀♀ sighted foraging, also after sunset; 1-8.09.2018: 5 ♂♂, 2 ♀♀ collected, many ♂♂, ♀♀ sighted. Loc 14: 20.08.2015: 1 ♂ photographed (103511310, posed); 5.09.2015: 1 ♂ collected and photographed (38833376); 7.09.2015: 1 ♂ photographed (38831400, posed); 30.08.2018: 3 ♂♂, 3 ♀♀ collected, many ♂♂, ♀♀ sighted; 1.09.2018: many ♂♂, ♀♀ sighted; 2.09.2018; many ♂♂, ♀♀ sighted, 1 ♂, 1 ♀ photographed (37610135 (Fig. 26a), 37410394). Loc 15: 08-09.2011: many ♂♂, ♀♀ sighted foraging, also after sunset; 31.08.2011: 1 ♂ photographed (103512529); 1.09.2015: 1 ♀ photographed (103511240). Loc 16: 02.09. 2011: many ♂♂, ♀♀ seen. Loc 17: 08-09.2011: solitary ♂♂ and ♀♀ sighted foraging, also after sunset; 1.09.2011: 1 ♂



Figure 26. a young ♂ (a) and ♀ (b) of *Anax julius*: a – at fishery ponds of Ecofarm, Loc 14, 2.09.2018; b - Loc 21, 6.09.2018. V.O.

photographed (103512502). Loc 18: 4.09.2018: many ♂♂, ♀♀ sighted on foraging after sunset. Loc 19: 2.09.2011: 5 ♂♂, 1 ♀ collected, many ♂♂, ♀♀ sighted; 20.08.2015: 2 ♂♂ photographed (103511432, 37462368, both posed); 5.09.2015: many ♂♂, ♀♀ sighted. Loc 20: 08–09.2011: 1 ♀ collected, many ♂♂, ♀♀ sighted; 1–10.09.2015: many ♂♂, ♀♀ seen. Loc 21: 08–09.2011: 5 ♂♂, 5 ♀♀ collected, many ♂♂, ♀♀ sighted; 22.08.2011: 1 ♀ photographed (103511171, posed); 30.08.2011: 1 ♂ photographed (37778041, posed); 18.08–9.09.2015: many ♂♂, ♀♀ sighted foraging, also after sunset; 1–8.09.2018: 3 ♂♂, 3 ♀♀ collected, many ♂♂, ♀♀ seen; 6.09.2018: 1 ♀ photographed (37610149, Fig. 26b). Loc 22: 08–09.2011: 5 ♂♂ collected, many ♂♂, ♀♀ sighted 20.08–9.09.2015: numerous ♂♂ and ♀♀ sighted foraging including after sunset, 5 ♂♂ collected, 19.08.2015: 3 ♀♀ photographed (103511574 (in hand), 103511551, 1 f 103511534 (posed), 20.08.2015: 4 ♂♂ (103511487, 103511093, 103511056, 37462355, all posed); 1.09.2015: 1 ♂ (37462446, 37462430, posed); 1–8.09.2018: 5 ♂♂, 2 ♀♀ collected, many ♂♂, ♀♀ sighted. Loc 23: 08–09.2011: many ♂♂, ♀♀ sighted; 1–9.09.2015: many ♂♂, ♀♀ sighted foraging, also after sunset; 1–8.09.2018: many ♂♂, ♀♀ sighted (11 localities).

Remarks. The taxon *julius* Brauer, 1865 used to be considered as the East Palearctic subspecies of *Anax parthenope* (Selys, 1839) but was treated as *bona species* by Kalkman & Proess (2015). It differs from the West Palearctic *A. parthenope* s. str. by a longer pterostigma, a green rather than brown thorax (Fig. 26), the male cerci shape (Kalkman & Proess 2015), absence of the distinct female morph with strongly smoked wings and the abdomen dull brownish throughout, without a green/blue area at S1–S2 (females of *julius* may have variably smoked wings but always have the abdomen base largely green, see Fig. 26b), and a sedentary rather than migratory lifestyle (Onishko & Kosterin 2021). Their geographical ranges may meet or overlap in China (Kalkman & Proess 2015) but there the taxa seem not to have been distinguished so no exact information exists.

Recently, Makbun et al. (2022) undertook a phylogenetic analysis of some *Anax* spp. based on a mitochondrial *COI* gene fragment. In the tree resulted, both specimens of *A. parthenope* s. str. from Europe (Italy and Austria) resided in the branch which also included *A. imperator* Leach, 1815 and *A. nigrofasciatus* while the opposite, sister branch was formed by three specimens of '*A. parthenope*' from South Korea, which were actually *A. julius*, for some reason together with a specimen of '*A. parthenope*' from United Arab Emirates. The latter area is expected to be occupied by the western *A. parthenope* s. str. but this position suggests it was *A. julius* as well, unless some label confusion was involved. Anyway, the deep separation of *A. parthenope* s. str. and *A. julius*, with two other distinct species clustered with the former, suggests doubtless specific status of both.

The shape of the anal appendages of both species is illustrated in Fig.27. The differences are more than obvious. The apices of the male cerci are somewhat converging as curved towards each other in *A. julius* (Fig. 27a) but not so in *A. parthenope* (Fig. 27b). The longitudinal ridges of the cerci are sharp and much better defined in *A. parthenope* (Fig. 27b) while gentle in *A. julius* (Fig. 27a). Most important, in *A. parthenope* they are straight and continue to the apical spine (Fig. 27b), while in *A. julius* they are apically curving towards the inner margin and each other, as if to enclose an oval shape, while the apical spine sprouts from the flat cercus surface (Fig. 27a). The cercus is relatively shorter in *A. julius* than in *A. parthenope*: if measured from the point where its outer margin appears from S10 to

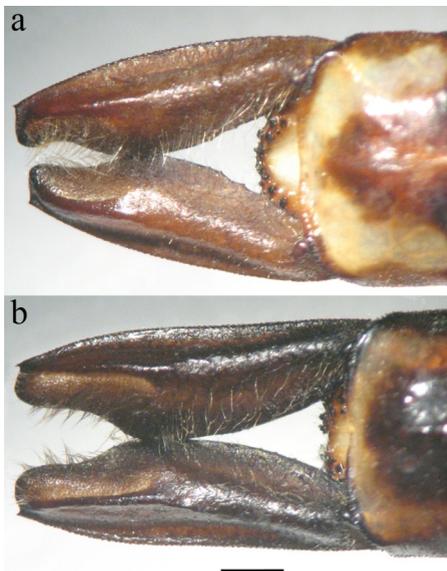


Figure 27. Male cerci of *Anax julius* (a) and *Anax parthenope* (b) and in dorsal view. a - Russia, Primorskiy Kray, Kirovskiy District, a big pond at Gornye Klyuchi village SE environs, 46.22° N, 133.51° E, 29.07.2020, V. Onishko & O. Kosterin leg.; b - Russia, Republic of Dagestan, Tabasaran District, 3 km SW of Sirtych village, the big reservoir at the Karchag-Su River, 41.82° N, 48.19° E, 22.06.2021, V. Onishko & O. Kosterin leg.

the apical spine, its length is ca 1,38 greater than the S10 breadth in the former while ca 1.50 in the latter (Fig. 27). The epiproct is longer and rounded in *A. julius* but very short and with a straight hind margin in *A. parthenope* (Fig. 27).

Observations. On 15.09.2015, V.O. observed a large *Anax* sp. with bright green head and thorax and bright red abdomen, which appeared at the forest lake of Loc 3, made several patrolling rounds with attempts to chase out numerous males *A. crenata* and then disappeared. Strikingly, this was the only *Anax* observed in Region I. Its obvious territorial behaviour suggested its being a mature male, but mature males of *A. julius* are not so coloured (with a brownish abdomen, only immature males can have reddish, but never bright red abdomen, see Fig. 26 left). That dragonfly was noticeably larger and stouter than males of *A. crenata*. It is noteworthy that in July 2015, a very hot weather lasted for about three weeks, which could favour migration of southern species. It is not excluded that this individual represented some other species of *Anax*, not yet recorded in Russia, although we failed to figure out candidates. In this respect it is noteworthy that in 2021, two cases of such a penetration into Primorye of the more southerly ranging *A. nigrofasciatus* (although by no means looking as described above) have been reported (Malikova & Chistyakov 2021; Onishko et al. 2021).

GOMPHIDAE (6 species)

27. *Anisogomphus maackii* (Selys, 1872)

(Fig. 28)

Loc 14: 28.08.2015: 1 ♀ photographed (37462272, posed), 5.09.2015: 1 ♂ seen. Loc 20: 09.2011: several individuals sighted; 20.08.2015: 1 ♀ photographed (103512803,



Figure 28. ♂ of *Anisogomphus maacki* at coastal cliffs between the Ryazanovka and Zaklyuchennaya River mouths, Loc 21, 31.08.2018, V.O.

posed). Loc 21: 2.09.2011: 2 ♂♂, 1 ♀ collected and photographed (103512735, 103512689, 37462241, all posed); 20.08.2015: 1 ♀ collected and photographed (37462285, posed); 31.08.2018: 2 ♂♂ photographed (37610225 (posed), 37410542 (Fig. 28)). Loc 23: 31.08.2018: 1 ♂ photographed (4 localities).

Observations. For some reason, solitary old individuals were met with mostly at the sea shore, where they landed on rocks and cliffs; few individuals were found at Ecofarm (Loc 14). At the same time the only potential breeding place of this species in the region could be the Ryazanovka River, where it was never observed; few individuals occurred only at its delta (Loc 20), nevertheless along the sea and cliffs rather than river arms.

28. *Davidius lunatus* (Bartenev, 1914)

(Fig. 29)

Loc 1: late-07-mid-08 2011: few old ♂♂, ♀♀ sighted, photographed; 5.08.2011: 1 ♂ photographed (104270819, posed), 6.08.2011: 2 ♂♂ photographed (38248402, 7436395, both posed), 10.08.2011: 1 ♂ photographed (37777483, posed); 3.08.2020: 1 ♀ collected and photographed (63810970, in hand). Loc 2: late-07-mid-08. 2011: 2 ♂♂, 3 ♀♀ collected, numerous ♂♂, ♀♀ sighted. Loc 3: 2.08. 2020: 1 ♀ collected and photographed (62173124 (Fig. 29), 63811363 (in hand)). Loc 5: late-07-mid-08 2011: few old ♂♂, ♀♀ sighted, photographed (posed). Loc 6: late-07-mid-08 2011: many ♂♂, ♀♀ sighted; 6.08.2011: 1 ♂ photographed (104270876, posed). Loc 7: late-08–mid-09.2011: 2 old ♂♂ collected, few old ♂♂, ♀♀ sighted. Loc 29: 19.06.2017: 1 ♀ collected,

2 ♀♀ photographed (37757777 (in hand), 37757724, (posed)), ♂♂, ♀♀ sighted (7 localities).

Observations. Found only in Region I, where it is associated with the Tigrovaya River and maybe its tributaries.



Figure 29. ♀ of *Davidius lunatus* on a damp meadow by the small forest lake at Tigrovoy village, Loc 3, 2.08.2020, O.K.

29. *Ophiogomphus obscurus* Bartenev, 1909

(Fig. 30)

Loc 1: late-07-mid-08.2011: 7 ♂♂, 2 ♀♀ collected, many ♂♂, ♀♀ sighted, photographed 6.08.2011: 1 ♂ photographed (37744383), 14.08.2011: 2 ♂♂ photographed (37744325, 37424534, Fig. 30), 15.08.2011: 1 ♂ photographed (37744363); 08.2015: many ♂♂, ♀♀ sighted; 3.08.2020: several ♂♂, ♀♀ sighted, 1 ♀ collected; 4 ♂♂ photographed (63811337, 63811289, 63811240 (in hand), 61480259). Loc 2: late-07-mid-08.2011: 3 ♂♂, 3 ♀♀ collected. Loc 5: late-07-mid-08.2011: 4 ♂♂, 3 ♀♀ collected, many ♂♂, ♀♀ sighted. Loc 6: late-07-early-08.2011: few ♂♂, ♀♀ sighted; 5 and 13.08.2011: 2 ♂♂ collected and photographed (37744271, 37744224, both posed). Loc 8: late-07-early-08.2011: few ♂♂, ♀♀ sighted; 08.2015: many ♂♂ sighted; 13.08.2015: 1 ♀ photographed (37424543, posed). Loc 12: mid-08-early-09. 2011: 3 ♂♂ collected, few ♂♂ sighted; 28.08.2011: 1 ♂ photographed (37744313, in hand); 09.2018, few ♂♂ sighted. Loc 15: 09.2018: 1 ♀ collected. Loc 18: mid-08-early-09.2011: 1 ♂ collected, few ♀♀ sighted as arriving from the Ryzanovka River; 09.2015: few ♂♂ sighted; 09.2018: 2 ♂♂, 1 ♀ collected, few ♂♂, ♀♀ sighted as arriving from the Ryzanovka River. Loc 29: 4.08.2020: many ♂♂, few ♀♀ sighted,



Figure 30. ♂ of *Ophiogomphus obscurus* at the Tigrovaya River, Loc 1, 14.08.2011, V.O.

2 ♂♂, 4 ♀♀ photographed (61400633, 64163179, 64163150, 64163132, 64163109, 63811448, (in hand), 64163082) (9 localities).

Observations. Common and sometimes numerous at the Tigrovaya River from where it disperses broadly over Region I. In Region II was scarce at the Ryazanovka River from where sometimes it penetrated to the nearby bog or ground road.

30. *Sieboldius albardae* Selys, 1886

Loc 12: 22.08.2011: 1 ♀ collected and photographed (37423844, posed). Loc 20: late-08-early.09.2011: few ♂♂, ♀♀ sighted, 29.08.2011: 1 ♂ collected and photographed (37424144, 37423839) (both posed); 6.09.2018: 1 ♂ collected and photographed (37527706, posed); 7.09.2018: 1 ♂ sighted. Loc 23: 09.2011: 1 ♂ collected. Loc 29: 4.08.2020: 1 ♂ photographed (64163210), 1 ovipositing ♀ sighted (4 localities)

Observations. In Region II, this species most probably breeds in the Ryazanovka River, although just one female was obtained near it. At the same time, solitary old individuals were repeatedly observed in 2011 and 2018 on coastal cliffs. Most probably, August-September was too late for this species and in June-July it would be properly observable at the river. Also found at the Malennaya River (Loc. 29), which is close to Region I.

31. *Trigomphus citimus* (Needham, 1931)

Loc 29: 19.06.2017: 2 ♂♂ photographed (62987317, 62987251) (1 locality).

Observations. A rare species, found only at the Malennaya River in June 2017.

32. *Trigomphus nigripes* (Selys, 1887)

Loc 10: 21.07.2017: 2 ♂♂ collected (1 locality).

Observations. Common in S Primorye (Malikova 1995; Kosterin 2019; Onishko & Kosterin 2021), breeds in lentic habitats. Our data are scarce because of too late dates for this species.

MACROMIIDAE (4 species)

33. *Epophthalmia elegans* (Brauer, 1865)

(Figs 31-32)

Loc 12: late-08.2011: 1 ♂ sighted. Loc 14: 09.2015: 6 ♂♂, 2 ♀♀ collected, many ♂♂, ♀♀ sighted; 27.08.2011: 2 ♂♂, 1 ♀ photographed (104271603, 104271594 (posed), 104271503); 28.08.2011: 1 ♂, 3 ♀♀ photographed (104271558 (posed), 104271545 (posed), 104271525, 37436008 (in hand)); 1.09.2011: 5 ♂♂, 1 ♀ photographed (10427408, 104271510, 104271092, 104271170 (in hand), 104271360 (posed), 104271056 (posed)); 1.09.2011: 1 ♂ photographed (38833342, posed), 7.09.2011: 1 ♂ photographed 38831354 (posed), late-08-09.2018: 15 ♂♂, 1 ♀ collected, many ♂♂, ♀♀ sighted; 30.08.2018: 2 ♂♂, 3 ♀♀ photographed (37586516, 37586500 (posed), 37586478 (Fig. 31 left), 37586467 (posed)); 1.09.2011: 2 copulae (37586294, 37586225 (Fig. 31 right)), 1 ♂ (37586239), 1 ♀ (37586264, posed) photographed; 7.09.2011: 1 ♂ photographed (37586398); 9.09.2018: 6 ♂♂ photographed



Figure 31. ♀ (left) and copula of *Epophthalmia elegans* at the fishery ponds of Ecofarm, Loc 14, 30.08 and 1.09.2018, respectively, V.O.

(103471431 (in hand, Fig. 32b), 103471595, 103471481 (in hand, Fig. 32a), 37586186, 37586145 (posed)). Loc 15: 09.2015: 1 ♀ sighted. Loc 21: 6.09.2011 1 ♂ seen. (4 localities).

Remarks. The males appeared nearly dimorphic with respect to the central part of the frons which was either unmarked (Fig. 32b) or bore twin central spots (Fig. 32a) variable in size and contacting to each other (in some cases also fused to the lateral spots). Among male specimens considered, 10 had the spots, 2 had vestigial spots and 9 had no spots. We failed to notice any morphological difference between such specimens. All examined females did not have the central spots.

Observations. In 2015 and 2018, a large population of this species existing at artificial ponds made for carp breeding and fishing at Ryazanovka village (Ecofarm, Loc 14) was studied. The ponds had current water and stony bottoms. Their banks were overgrown with sagebrush (*Artemisia* sp.), which *E. elegans* preferred to rest on; their copulae were also frequently startled from that sagebrush. Males patrolled ponds at any weather: sunny, overcast and even under weak rains. They demonstrated two kinds of flight: they either flew in circles along banks not bound to a particular territory (alike males of *Somatochlora* spp.), or mostly soared over certain definite plots (alike males of *Aeshna* spp. or *Anax* spp.). Females oviposited at banks, both in scarce emerging vegetation and clear water surface. Males actively persuaded females, which tended to fall into grass when being attacked.

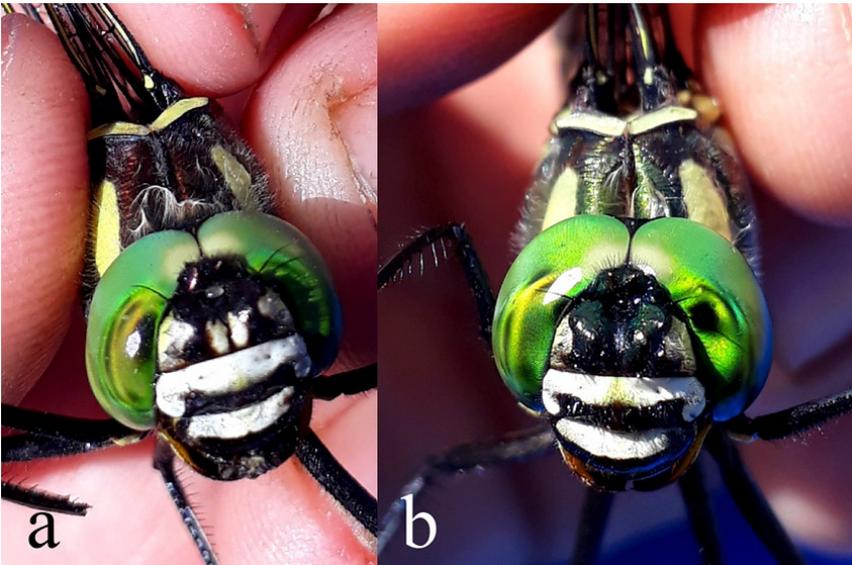


Figure 32. Dimorphism for the presence (a) versus absence (b) of central twin pale spots on the frons of ♂♂ of *Epophthalmia elegans* at Loc 14, 9.09.2018, respectively, V.O.

34. *Macromia amphigena fraenata* Martin, 1906

(Fig. 33a)

Loc 14: 30.08.2018, 1 ♂ collected and photographed (37525025 (Fig. 33a), 37524997 (posed)); 2.09.2018, 1 ♂ collected, one more ♂ photographed (37525047) (1 locality).

Observations. Just few very old males were met (among numerous *E. elegans*), which appeared, made several rounds at a pond and then flew away to land on sagebrush or into tree crowns.

35. *Macromia manchurica* Asahina, 1964

(Fig. 33b)

Loc 15: mid-08-early-09.2011: few observations of supposedly this species flying high above the road; 24.08.2011: 1 ♂ photographed (37424627, Fig. 33b) and collected. Loc 20: 19.08.2015: 1 ♂ collected and photographed (37424687, posed). (2 localities).

Observations. This rare in Russia and little-known species was observed repeatedly in mid- and late August 2011 hunting above the road or at coastal cliffs of the Boismann and Baklan Harbours. For some reason, for seven years (2011-2018) of active observations in Region II, the species was never observed at water. Foraging individuals could approach water passing by but without any territorial or reproductive behaviour.

CORDULIIDAE (6 species)

36. *Cordulia aenea amurensis* Selys, 1887

Loc 29: 19.06.2017 1 ♂ sighted (1 locality).

Observations. That male patrolled a small section of an inundated ditch.



Figure 33. ♂♂ of *Macromia* spp.: a – *M. amphigena fraenata* at fishery ponds of Ecofarm, Loc 14, 30.08.2018; b – *M. manchurica*, by the road between Ecofarm and the coast in the Ryazanovka village vicinities Loc 15, 24.08.2011, V.O.

37. *Epitheca bimaculata* (Charpentier, 1825)

Loc 7: late-07-early-08.2011: 2 old ♂♂ collected, few old individuals sighted (1 locality).

Observations. Old individuals rarely appeared over a small artificial pond, usually after rains. Two of such just fell in water and were so collected. Rarity of observations of this otherwise common species in our view was due to its flying mostly early in summer (Onishko & Kosterin 2021).

38. *Somatochlora arctica* Zetterstedt, 1840

Loc 15: 21.08.2011: 1 ♂ collected, photo (37423822) (posed). Loc.16: 5.09.2015: 1 ♂ collected. Loc 18: 09. 2011: 2 ♂♂ collected, several sighted; 09.2018: ♂♂, ♀♀ sighted; 1.09.2018: 3 ♂♂, 1 ♀ collected, of them ♂, 1 ♀ photographed (37527867, 37527844, both posed); 7.08.2020: 2 ♂♂, 2 ♀♀ collected and photographed (63812244, 63812230, 63812212, 63812172) (3 localities).

Observations. Common at the peat-moss bog by the Ryazanovka River (Loc 18), where it was recorded in all observation years. Solitary individuals rarely occurred somewhat apart of this bog; such a dispersal is common for the species (Onishko & Kosterin 2021).

39. *Somatochlora exuberata* Bartenev, 1910

(Fig. 34)

Loc 1: 5.08.2011: 2 ♂♂ collected, 1 of them photographed (104397933, posed); 08.2015 many ♂♂, ♀♀ sighted; 13.08.2015: 1 ♀ photographed (104397822, Fig. 34 left); 3.08.2020: ♂♂ sighted, 1 ♂ collected and photographed (106761285, in hand). Loc 2: late-07-08.2011: many ♂♂ sighted. Loc 3: 08.2011: 2 ♂♂, 2 ♀♀ collected, many ♂♂, ♀♀ sighted; 08.2015: ♂♂ sighted. Loc 4: 08.2011: 2 ♂♂ collected, few ♂♂ sighted. Loc 6: late-07-08: many ♂♂ sighted. Loc 7: late-07-mid-08.2011: 5 ♂♂ collected, 2 of them photographed (104398194, 104398044, both posed), ♂♂, ♀♀ sighted. Loc 8: 08.2011: 4 ♂♂, 6 ♀♀ collected, many ♂♂, ♀♀ sighted; 08.2015, many ♂♂, ♀♀ sighted. Loc 14: 9.09.2018, 1 ♂ collected. Loc 15: 08-09.2011: 2 ♂♂ collected, ♂♂, ♀♀ sighted; 09.2018: 2 ♂♂, 2 ♀♀ collected; 29.08.2018: 2 ♂♂ photographed (106760617, 106760566), both posed); 2.09.2018: 1 ♂ (106760845, Fig. 34 right), 2 ♀♀ (106760749, 106760664, both posed), ♂♂, ♀♀ sighted. Loc 17: 08-09.2011: 2 ♂♂ collected; many ♂♂, ♀♀ sighted, also after sunset; 13.08.2015 1 ♂ photographed (104397750, posed). Loc 21: 08-09.2011: 2 ♂♂ collected, ♂♂, ♀♀ sighted; 6.09.2018: few ♂♂ sighted. Loc 22: 08-09.2011: 2 ♂♂ collected, ♂♂ sighted (12 localities).

Observations. Mostly a riverine species (Kosterin & Zaika 2010; Onishko & Kosterin 2021), so it is inferior to *Somatochlora graeseri* at lakes, where it most likely occurs by accident because of its abundance in the region.

40. *Somatochlora graeseri* Selys, 1887

(Fig. 35)

Loc 1: 3.08.2020: 2 ♀♀ photographed (63811191, 63811055, both in hand). Loc 2: late-07-08.2011: many ♂♂ sighted. Loc 3: 08.2011: 5 ♂♂, 2 ♀♀ collected, many ♂♂, ♀♀ sighted; 08.2015: ♂♂ sighted; 2-3.08.2020: many ♂♂ and several ♀♀ sighted; 2.08.2020: 2 ♂♂,



Figure 34. ♀ (left) and ♂ (right) of *Somatochlora exuberata*: left – at the Tigrovaya River, Loc 1, 13.08.2005; right - by the road between Ecofarm and the coast in the Ryazanovka village vicinities Loc 15, 2.09.2015, V.O.



Figure 35. ♂ of *Somatochlora graeseri*: left – at the coastal cliffs between Zaklyuchennaya and Ryazanovka River mouths, Loc 21, 30.08.2018, V.O.

1 ♀ collected, of them 1 ♂, 1 ♀ photographed (63810943, 63810920, both in hand), 3.08.2020: 1 ♀ collected, 1 ♂ photographed (63811020, in hand). Loc 4: 08.2011: 5 ♂♂, 4 ♀♀ collected, many ♂♂, ♀♀ sighted; 9.08.2011: 1 ♀ photographed (37423732, posed). Loc 6: late-09-08.2011: many ♂♂ sighted. Loc 7: late-07-mid-08.2011, 2 ♂♂ collected, ♂♂, ♀♀ sighted; 9.08.2011: 1 ♀ photographed (37423699, posed). Loc 8: 08.2011: 2 ♂♂,

2 ♀♀ collected, many ♂♂, ♀♀ sighted; 08.2015: many ♂♂, ♀♀ sighted. Loc 14: 09.2018: 3 ♂♂ collected, ♂♂ many seen. Loc 15: 08-09.2011: 2 ♂♂ collected; 25.08.2011: 1 ♂ photographed (37423765, posed), ♂♂, ♀♀ sighted; 08-09.2018: 2 ♂♂, 2 ♀♀ collected, ♂♂, ♀♀ sighted; 30.08.2018: 1 ♂ photographed (37528259, posed); 2.09.2018: 1 ♀ photographed (37528082, posed); 7.09.2018: 1 ♂ photographed (37528153, posed). Loc 17: 08-09.2011: many ♂♂, ♀♀ sighted, also after sunset. Loc 18: 08.2011, 2 ♂♂ collected; 09.2018, 4 ♂♂ collected; 7.08.2020: several ♂♂ sighted, 3 ♂♂ collected, 1 of them photographed (63812146, in hand). Loc 21: 08-09.2011: ♂♂, ♀♀ sighted; 08-09.2018: many ♂♂ sighted; 30 and 31.08.2011: 2 ♂♂ photographed (37528207 (Fig. 35), 37528181, both posed). Loc 22: 08-09.2011: 2 ♂♂ collected, ♂♂ sighted; 25.08.2011: 1 ♀ photographed (37423746). Loc 29: 4.08.2020: 1 ♂ photographed (63811415, in hand), few ♂♂ sighted (14 localities).

Observations. The species prefers lentic habitats, up to inundated roadsides. At rivers it is strongly inferior in abundance to *S. exuberata* and is rarely territorial.

41. *Somatochlora viridiaenea* (Uhler, 1858)

Loc 15: 27.08.2011: 1 ♂ collected and photographed (37423646); 6.09.2018, 1 ♀ collected
Loc 17: 25.08.2011: 1 ♀ collected and photographed (37743477), posed, 30.08.2011: 1 ♀ collected and photographed (37743451, 37423635, both in hand), 27.08.2011: 1 ♀ collected and photographed (46595883, posed). Loc 18: 08-09.2018: 4 ♂♂ collected, many ♂♂ sighted; 30.08.2018: 1 ♂ photographed (37528398, posed); 7.08.2020: 3 ♂♂ collected, 4 ♂♂ photographed (63812332, 63812285, 63812118, 59800789, all in hand), several ♂♂ sighted. Loc 21: 08-09.2011: 1 ♂, 1 ♀ collected, few ♂♂, ♀♀ seen (4 localities).

Observations. According to our observations, this species was tightly connected to a large bog, the only such in Region II, at the Ryazanovka River, where it was persistent in 2018 and 2020. Its behaviour there was very similar to that of the western *Somatochlora flavomaculata* (Vander Linden, 1825) (Onishko & Kosterin 2021). The males ranged over small patches at the bog margin with open tree stand or bushes, often hovering at the same place for long. They are distinctly segregated ecologically from *S. arctica*, which ranged over open bog at its middle, apart from trees and bushes. *S. viridiaenea* flies as a rule 2-3 m above the bog surface while *S. arctica* at the height of 0.5 – 1 m. Solitary individuals of *S. viridiaenea* were repeatedly met above bogs and at the coast, that suggests a broad dispersal of this species from its breeding places.

LIBELLULIDAE (23 species)

42. *Deielia phaon* (Selys, 1883)

Loc 14: late 08-09.2015: 4 ♂♂ collected, many ♂♂, ♀♀ sighted; 28.08.2015: 1 ♂ photographed (37436245, posed), 08-09.2018: 6 ♂♂, 2 ♀♀ collected, many ♂♂, ♀♀ sighted; 30.08.2018: 1 ♀ photographed (37587758); 2.09.2018: 2 ♂♂ photographed (37587737 (posed), 37408947). Loc 19: 09.2011: few ♂♂ sighted; 1.09.2011: 1 ♂, 1 ♀ collected, the latter photographed (37436133, posed), 08-09.2015: few ♂♂ sighted, 20.08.2015: 1 ♂, 1 ♀ photographed (37587869, 37436193, both posed). Loc 22: 08.2011: few ♂♂ sighted. 20.08.2015: 1 ♂ photographed (37436294, posed) (3 localities).

Observations. This species is most probably actively expanding over the southern Far East of Russia (Onishko & Kosterin 2021). According to our data, in 2011 just few individuals were observed for the entire August and the first week of September, while in 2018 this species was among the most numerous Anisoptera at some water bodies (e.g., at Ecofarm, Loc 14). Males of this species fly along banks without territories and almost without conflicts with other dragonflies, and rarely land. Females oviposit solitarily at water surface with floating vegetation some 2-10 m off banks.

43. *Leucorrhinia intermedia* Bartenev, 1910

Loc 24: 21.07.2017: 1 ♂ collected, 3 ♂ ♂ sighted (1 locality).

Observations. This is an early species flying mostly in late May – mid. June (Onishko, & Kosterin 2021), so on our later observation period we met just few individuals at a small ditch at Bamburovo village.

44. *Leucorrhinia orientalis* Selys, 1887

Loc 3: 08.2011: few ♂ ♂ sighted; 11-12.08.2011: 2 ♂ ♂ collected and photographed (37435259, 37435218, both posed); 3.08.2020: 1 ♂ photographed (63811109, in hand).
Loc 19: 08.2011, few ♀ ♀ sighted. Loc 24: 21.07.2017: 1 ♂, 1 ♀ collected, ♂ ♂ sighted (3 localities).

Remarks. The males demonstrated both versions of abdominal maculation found across the taxon's range: the yellow spot is present on either both S6 and S7 or only on S7 (see the photographic observations cited).

Observations. Common at various water bodies in southern Primorye but rarely observed by us due to late season.

45. *Libellula quadrimaculata* Linnaeus, 1758

Loc 3: 08.2011: few ♀ ♀ sighted; 12.08.2011: 1 ♀ collected and photographed (37434651, posed), 08.2015: 1 ♂ sighted. Loc 14: 2.09.2018: 1 ♂ and 1 ♀ photographed (37524780, 37524756). Loc 15: 22.08.2011: 1 ♂ collected; 2.09.2018: few individuals sighted (3 localities). Loc 19: 08-09.2011, 3 ♀ ♀ collected; 22.08.2011: 1 ♂ photographed (37434556, posed); 2.09.2011: 1 ♀ photographed (37754878, posed) (4 localities).

Observations. As for the two above species, common at various water bodies but rarely observed by us because of late season.

46. *Lyriothemis pachygastra* (Selys, 1878)

Loc 16: 2.09.2011: 2 ♂ ♂ collected and photographed (37754683, 37434362, both posed), many ♂ ♂ sighted. Loc 19: 2.09.2011: 1 ♀ collected and photographed (37434401) (2 localities).

Observations. Found in two locations only: an old female at coastal swamps (Loc 19) and few old males at a small pool in the Poyma River delta (Loc 16). Males had small territories, perched on tall grasses and often hovered 1 – 1.5 above the water surface. For the time being, these are the northernmost records of this species in the world.

47. *Orthetrum albistylum* (Selys, 1848)

(Fig. 36)

Loc 1: 13.08.2011, 1 ♂ collected and photographed (37424466, posed). Loc 9: 29.08.2011: ♂♂, ♀♀, many sighted. Loc 14: 08.2015: many ♂♂, ♀♀ sighted; 08-09.2018: 5 ♂♂, 5 ♀♀ collected, many ♂♂, ♀♀ sighted; 30.08.2018: 1 ♂ photographed (37525665, posed), 1.09.2018: 1 ♀ photographed (37525647, posed); 9.09.2018: 1 copula photographed (37465605, Fig. 36 top). Loc 15: 21.08.2011, 1 ♂ photographed (37424459); 2.09.2018: 1 ♂ sighted. Loc 19: 08-09.2011: many ♂♂, ♀♀ sighted, 5 ♂♂, 8 ♀♀ collected; 09.2015:

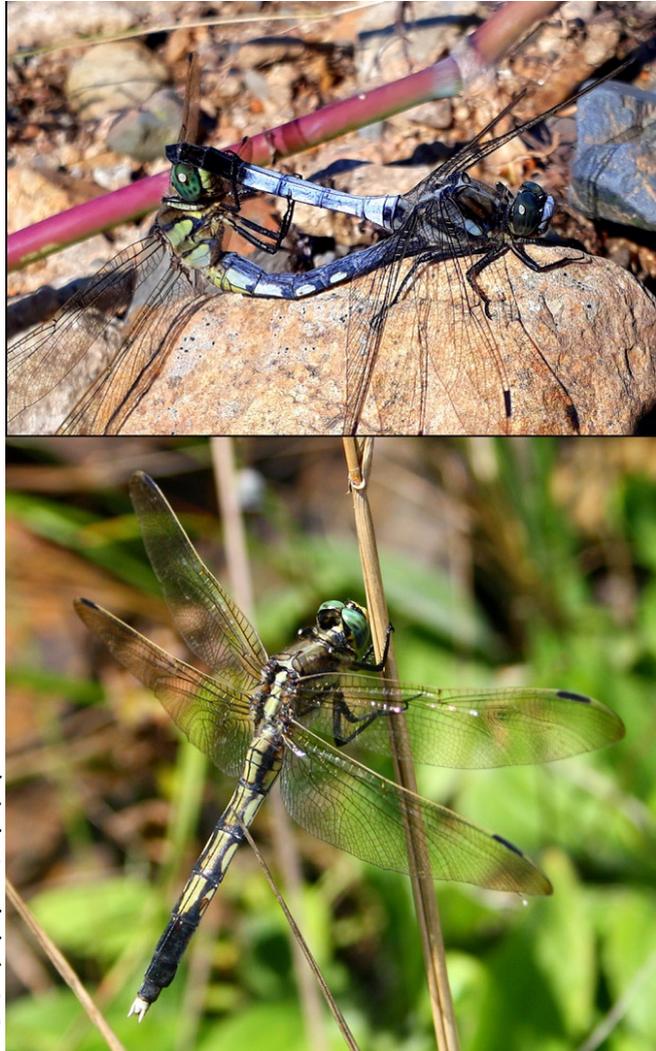


Figure 36. Copula (top) and ♀ (bottom) of *Orthetrum albistylum*: top – at fishery ponds of Eco-farm, Loc 14, 9.09.2018; bottom – at the coastal cliffs between Zaklyuchennaya and Ryazanovka River mouths, Loc 21, 7.09.2018, V.O.

many ♂♂, ♀♀ sighted. Loc 21: 08-09. 2011, 09.2018: few individuals sighted, 7.09.2018: 1 ♀ photographed (37525676, Fig. 36, bottom). Loc 22: 08-09.2011: few individuals sighted (7 localities).

Observations. Common in Southern Primorye, inhabits larger lentic water bodies. Solitary individuals, especially old females, may disperse far from their breeding places to occur at any open place and at roads.



Figure 37. Numerous young individuals of *Pantala flavescens* roosting on shrubbery at the coastal cliffs between Zaklyuchennaya and Ryazanovka River mouths, Loc 21, 2.09.2011, V.O.

48. *Pantala flavescens* (Fabricius, 1798)

(Fig. 37)

Loc 7: 08.2011: 5 ♂♂, 5 ♀♀ collected, many ♂♂, ♀♀ sighted; 6.08.2011: 1 ♀ photographed (37424294, posed); 08.2015, many sighted; 2.08.2020: 1 ♀ photographed (63810830, in hand), several individuals seen. Loc 8: 14.08.2011, 1 ♂ photographed (37424274), 08.2015: many ♂♂, ♀♀ sighted. Loc 12: 08.2011: 5 ♀♀ collected, many ♂♂, ♀♀ sighted. Loc 15: 08-09.2011: many ♂♂, ♀♀ sighted; 1–9.09.2015: many ♂♂, ♀♀ sighted; 30.08–6.09.2018: many ♂♂, ♀♀ sighted; 30.08.2018: 1 ♂ photographed (37527089); 4.09.2018: 1 ♂ photographed (37527106). Loc.16: 5.09.2015, 9.09.2015, 08-09.2018: many ♂♂, ♀♀ sighted. Loc 16: 2.09.2011: many ♂♂, ♀♀ sighted. Loc 17: 08-09.2011: solitary ♂♂, ♀♀ sighted, also after sunset. Loc 18: 09.2018: many ♂♂, ♀♀ sighted. Loc 19: 09.2011: 3 ♂♂, 3 ♀♀ collected, many ♂♂, ♀♀ sighted; 5.09.2015: many ♂♂, ♀♀ sighted. Loc 20: 08-09.2011: many ♂♂, ♀♀ sighted; 1-10.09.2015:

many ♂♂, ♀♀ sighted. Loc 21: 08–09.2011: 5 ♂♂, 5 ♀♀ collected, many ♂♂, ♀♀ sighted; 2.09.2011: numerous roosting individuals photographed (145904192, Fig. 37); 1–9.09.2015: many ♂♂, ♀♀ sighted; 08–09.2018: 3 ♂♂ 3 ♀♀ collected, many ♂♂, ♀♀ sighted; 1.09.2018: 1 ♂ photographed (37527069); 8.09.2018: 1 ♂ photographed (37527047). Loc 22: 08-09.2011: many ♂♂, ♀♀ sighted; 1-9.09.2015: 5 ♂♂ collected, many ♂♂, ♀♀ sighted; 1–8.09.2018: 2 ♂♂ 2 ♀♀ collected, many ♂♂, ♀♀ sighted. Loc 23: 08-09.2011: many ♂♂, ♀♀ sighted; 1–9.09.2015: many ♂♂, ♀♀ sighted; 1–8.09.2018: many ♂♂, ♀♀ sighted. Loc 25: 28.08.2018: many ♂♂, ♀♀ sighted. Loc 28: 28.08.2018: many ♂♂, ♀♀ sighted; Loc 29: 4.08.2020: few individuals sighted (16 localities).

Observations. On 11.08.2011, a tandem of mature individuals was observed ovipositing onto a pool on a ground road (Loc 8), Besides, for a week, solitary mature males were observed at that place exhibiting territorial behaviour. At all other locations, all individuals seemed to be young.

49. *Sympetrum baccha matutinum* Ris, 1911

(Fig. 38)

Loc 14: late-08-09.2015: 2 ♂♂ collected, ♂♂ sighted; late-08-early-09.2018: 4 ♂♂, 2 ♀♀ collected, many ♂♂, ♀♀ sighted; 1.09.2018: 2 ♂♂ photographed (42833372, 42833351, both posed); 4.09.2018: 1 ♂ photographed (42833405, posed); 8.09.2018:



Figure 38. ♂ of *Sympetrum baccha matutinum* at fishery ponds of Ecofarm, Loc 14, 8.09.2011, V.O.

1 ♂ photographed (37528752, Fig. 38). Loc 21: 7.09.2018: 1 ♂ sighted. Loc 15: 08-09.2011: few ♂♂ sighted; 20 and 21.08.2011: 2 ♂♂ collected and photographed (42833494) (posed); 37423564 (in hand)). Loc 19: late 08-09.2011: 3 ♂♂ collected, ♂♂ sighted; 31.08.2011 and 1.09.2011: 2 ♂♂ photographed (37423593, 42833575, both (posed)). Loc 25: 28.08.2018: 1 ♂ collected, many ♂♂ sighted (5 localities).

Observations. Males demonstrate active territorial behaviour: they make flights for 5 – 10 m away from banks where they hover in the same place for several minutes, attacking any dragonfly passing by. Oviposition takes place in tandems, almost at the middle of a water body, where the female makes solitary hits on water surface each 3 – 5 seconds of their flight.

50. *Sympetrum cordulegaster* (Selys, 1883)

(Fig. 39)

Loc 1: 3.08.2020: 1 ♂ collected, 1 ♀ sighted. Loc 3: late-07-08.2011, 08.2015: few immature ♂♂, ♀♀ sighted; 3.08.2020: 1 ♂ (63810999, in hand), 1 ♀ photographed (61540504, Fig. 39 bottom). Loc 7: late-07-08.2011: 2 ♂♂, 2 ♀♀ collected, few immature ♂♂, ♀♀ sighted. Loc 8: late-07-08.2011: few immature ♂♂, ♀♀ sighted; 11 and 12.08.2011: 2 ♂♂ photographed (37423556 (posed), 37423526, Fig. 39 top). Loc 10: 29.08.2011, many ♂♂, ♀♀ sighted. Loc 12: 08-09.2011, many ♂♂, ♀♀ sighted; late-08-09.2018: many ♂♂, ♀♀ sighted. Loc 14: late-08-09.2018: many ♂♂, ♀♀ sighted; 1.09.2018: 1 ♀ photographed (37528831). Loc 15: 08-09.2011, 09.2015, late-08-09.2018: many ♂♂, ♀♀ sighted; 30.08.2011: 1 ♀ photo-



Figure 39. ♂ (top), mature ♀ (middle) and young ♀ of *Sympetrum cordulegaster*: top – the forest road S of Tigrovoy village, Loc 8, 12.08.2011, V.O.; middle – The Ananyevka River at the bridge near Venivitinovo village, Loc 25, 28.08.2018, V.O.; bottom – the forest lake at Tigrovoy village, Loc 3, 3.08.2020, O.K.

graphed (37528888). Loc 16: 2.09.2011: many ♂♂, ♀♀ sighted. Loc 17: 08-09.2011: 2 ♂♂, 8 ♀♀ collected, many ♂♂, ♀♀ sighted. Loc 18: 08-09.2011, 09.2015, late-08-09.2018: many ♂♂, ♀♀ sighted; 7.08.2020: 1 ind. seen. Loc 19: 09.2011: 2 ♂♂, 2 ♀♀ collected, many ♂♂, ♀♀ sighted; 1.09.2011: 1 ♂ photographed (37423543, posed); 09.2015: many ♂♂, ♀♀ sighted. Loc 20: 08-09.2011: many ♂♂, ♀♀ sighted; 09.2015: many ♂♂, ♀♀ sighted; late-08-09.2018: many ♂♂, ♀♀ sighted. Loc 21: 08-09.2011: many ♂♂, ♀♀ sighted; 09.2015: many ♂♂, ♀♀ sighted; 08-09.2018: many ♂♂, ♀♀ sighted. Loc 22: 08-09.2011: many ♂♂, ♀♀ sighted; 09.2015, late-08-09.2018: many ♂♂, ♀♀ sighted. Loc 23: 08-09.2011, 09.2015, late-08-09.2018: many ♂♂, ♀♀ sighted. Loc 25: 28.08.2018: 1 ♀ photographed (37528795, Fig. 39 middle), many ♂♂, ♀♀ sighted. Loc 28: 28.08.2018: many ♂♂, ♀♀ sighted (18 localities).

Observations. Along with *S. eroticum*, this is most widespread and very abundant dragonfly species.

51. *Sympetrum croceolum* (Selys, 1883)

(Fig. 40)

Loc 3: 12.08. 2015: 1 ♂, 1 ♀ sighted in tandem. Loc 10: 29.08.2011: 1 ♀ collected and photographed (37423516, posed), 1 tandem sighted. Loc 14: 08.2015: ♂♂, ♀♀ many seen; 28.08.2015: 1 ♀ photographed (37423099, posed); 30.08.2018-09.09.2018: 3 ♂♂, 2 ♀♀ collected, many ♂♂, ♀♀ sighted; 2.09.2018: 1 ♂ photographed (37535671, posed); 9.09.2018: 2 ♂♂ photographed (37779174, 37465584, Fig. 40). Loc 20: 5.09.2015: 1 ♂ collected and photographed (38831323, posed), many ♂♂ sighted; 30.08.2018: 1 ♂ photographed (37535699, posed) (4 localities).

Observations. Rather rare in South Primorye, prefers larger open lakes, although rare individuals may be seen at any water body. The maximum abundance was observed at the fishery ponds of Ecofarm (Loc 14). Oviposition in this species in Primorye resembled that of *S. baccha*: a female rarely hits the water while the tandem flies over the water very fast not following any certain aquatory, then they rise very high and fly away, to re-appear after some while. Curiously, on 6.09.2001 at Lake Manzherok in North Altai, West Siberia, O.K. observed many cases of oviposition of this species, but only in half of the cases this was in tandem, while in the other half of the cases, single females oviposited, accompanied by a male hovering above (Kosterin 2017). (Unfortunately, Onishko & Kosterin (2021) stated in error that at that lake only single females oviposited.) Also, all ovipositions at Lake Manzherok took place under the sedge hanging over the water from the bank, and never at open water, so that ovipositing dragonflies were more readily found by rustling sound of their wings over the sedge rather than by sight.

52. *Sympetrum depressiusculum* Allioni, 1766

(Fig. 41a)

Loc 14: 08-09.2018: few ♂♂ sighted; 30.08.2018: 1 ♂ photographed (37463522, posed). Loc 17: 08-09.2011: 3 ♀♀ collected, many ♂♂, ♀♀ sighted; 21.08.2011: 1 ♀ photographed (37423436, posed). Loc 18: 08-09.2011: 2 ♂♂, 2 ♀♀ collected, many ♂♂, ♀♀ sighted; 08.2015: few ♂♂ sighted; 19.08.2015: 1 ♂ photographed (103469731); 08-09.2018: 5 ♂♂, 3 ♀♀ collected, many ♂♂, ♀♀ sighted; 29.08.2018: 1 ♀ photographed



Figure 40. ♂♂ of *Sympetrum croceolum* at fishery ponds of Ecofarm, Loc 14, 9.09.2018, V.O.

(37463430, Fig. 41a). Loc 19: 08-09.2011: many ♂♂, ♀♀ sighted. Loc 21: 19.08.2015: 1 ♂ photographed (103469750, (posed); 31.08.2015: 1 ♀ collected, several ♂♂ seen, (5 localities).

Observations. Common and often numerous in South Primorye, ecologically similar to *S. cordulegaster* and *S. eroticum*. The imagines may occur apart from their breeding places.

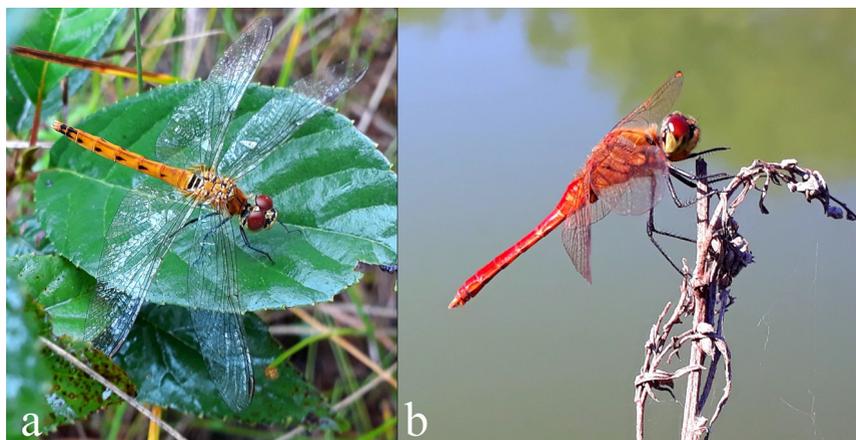


Figure 41. ♀ of *Sympetrum depressiusculum* (a) and ♂ of *Sympetrum frequens* (b); a – the peat-moss bog by the Ryazanovka River, Loc 18, 29.08.2018; b - fishery ponds of Ecofarm, Loc 14, 9.09.2018, V.O.

53. *Sympetrum eroticum* (Selys, 1883)

(Fig. 42)

Loc 3: late-07-08.2011: 10 ♂♂, 5 ♀♀ collected, many ♂♂, ♀♀ sighted; 12.08.2011: 1 ♂ photographed (37423211); 08.2015: many ♂♂, ♀♀ sighted; 13.08.2015: 1 ♂ photographed (37686381, posed). Loc 7: late-07-08.2011, 2 ♂♂, 2 ♀♀ collected, few young ♂♂, ♀♀ sighted; 11.08.2011: 1 ♂ photographed (37686335, posed); 12.08.2011: 1 ♀ photographed (37423258, posed); 2.08.2020: 1 teneral ♂ sighted. Loc 8: late-07-08.2011, few young ♂♂, ♀♀ sighted. Loc 10: 29.08.2011: many ♂♂, ♀♀ sighted. Loc 12: 08-09.2011: many ♂♂, ♀♀ sighted; late-08-09.2018: many ♂♂, ♀♀ sighted. Loc 14: 09.2015: many ♂♂, ♀♀ sighted; late-08-09.2018: 5 ♂♂, 5 ♀♀ collected, many ♂♂, ♀♀ sighted; 1.09.2018: 1 ♂ (37550602, Fig. 42 top), 1 copula (37550581) photographed. Loc 15: 08-09.2011, 09.2015: many ♂♂, ♀♀ sighted; late-08-09.2018: 4 ♂♂, 4 ♀♀ collected, many ♂♂, ♀♀ sighted; 29.08.2018: 1 ♂ photographed (37550608); 10.09.2018: 1 ♂, 1 ♀ photographed (103471781, 37465668 (Fig. 42, bottom)). Loc 16: 02.09.2011: many ♂♂, ♀♀ sighted. Loc 17: 08-09.2011, ♂♂, ♀♀ many seen, 10 ♂♂, 2 ♀♀ collected. Loc 18: 08-09.2011, 09.2015: many ♂♂, ♀♀ sighted; late-08-09.2018: many ♂♂, ♀♀ sighted. Loc 19: 09.2011: many ♂♂, ♀♀ sighted; 09.2015: many ♂♂, ♀♀ sighted. Loc 20: 08-09.2011, 09.2015, late-08-09.2018: many ♂♂, ♀♀ sighted; 29.08.2018: 1 ♀ photographed (37550627). Loc 21: 08-09.2011: many ♂♂, ♀♀ sighted; 08-09.2015: many ♂♂, ♀♀ sighted; 19.08.2015: 1 ♀ photographed (37423496, posed); late-08-09.2018: many ♂♂, ♀♀ sighted; 29 and 30.08.2018: 2 ♀♀ photographed (37550622, 37550618). Loc 22: 08-09.2011, 09.2015: many ♂♂, ♀♀ sighted; late-08-09.2018: many ♂♂, ♀♀ sighted; 10.09.2018: 1 ♀ photographed (Fig. 42 bottom). Loc 23: 08-09.2011, 09.2015: many ♂♂, ♀♀ sighted; late-09-09.2018: many ♂♂, ♀♀ sighted. Loc 25: 28.08.2018: many ♂♂, ♀♀ sighted. Loc 28: 28.08.2018: many ♂♂, ♀♀ sighted (17 localities).

Observations. The most numerous and omnipresent species in the region.



Figure 42. ♂ (top) and ♀ (bottom) of *Sympetrum eroticum*; top - fishery ponds of Ecofarm, Loc 14, 1.09.2018; bottom – the road from Ecofarm to the coast, Loc 15, 10.09.2018, V.O.

54. *Sympetrum flaveolum* (Linnaeus, 1758)

Loc 4: 5.08.2011: 1 ♂ collected, 2 ♂♂ sighted. Loc 10: 4.09.2018: 2 ♂♂ sighted, 1 ♂ photographed (37550640, posed). Loc 21: 9.09.2011: 1 ♂ sighted. Loc 23: 8.09.2011: 1 ♂ sighted; 09.2015: few ♂♂, ♀♀ sighted (4 localities).

Observations. Rare in the southern Primorye, occurring solitarily anywhere. We registered not more than a couple of dozens individuals for the whole study and never witnessed reproductive behaviour.

55. *Sympetrum fonscolombii* (Selys, 1840)

(Fig. 43)

Loc 14: 30.08.2018: 1 ♂ collected and photographed (37408690, Fig. 43 right). 30.08.2018 – 9.09.2018: few ♂♂, ♀♀ sighted. Loc 15: 29.08.2018: 2 ♀♀ photographed (37587139 (posed),

37408659, Fig. 43 left), 2 ♂♂ sighted. Loc 23: 30–31.08.2015: 5 ♂♂, 2 ♀♀ collected; 2 ♂♂ (37587085, 37423477, both posed), 2 ♀♀ (37587058, 42833983, both posed) photographed, many ♂♂, ♀♀ sighted; 5.09.2018: 1 ♂ sighted (3 localities).

Observations. This species was observed during this study, in 2015, for the first time in the Far East of Russia, that was reported by Onishko (2019). In 2018 it was found again, as more abundant and in several localities at Region II. All collected, photographed or sighted imagines were mature, and males demonstrated territorial behaviour at water. Most probably all them were migrants from the south. Curiously, in the Caucasus and the middle zone of European Russia, such migrants appear in spring and the first half of the summer, while in late summer already locally bred young imagines appear (Onishko & Kosterin 2021). The life cycle of the Primorian *S. fonscolombii* is still to be investigated.



Figure 43. ♀ (left) and ♂ (right) of *Sympetrum fonscolombii*; left – a road between Ecofarm and the coast, Loc 15, 29.08.2018; right – fishery ponds of Ecofarm, Loc 14, 30.08.2018, V.O.

56. *Sympetrum frequens* (Selys, 1883)

(Fig. 41b)

Loc 19: 1.09.2011: 2 ♂♂ collected, 1 of them photographed (37423463, posed), few ♂♂, ♀♀ sighted; 09.2015: many ♂♂, ♀♀ sighted. Loc 14: late-08-09.2018: 5 ♂♂, 2 ♀♀ collected, many ♂♂, ♀♀ sighted; 1.09.2018: 2 ♂♂ photographed (39270607, 37463463); 9.09.2018: 2 ♂♂ photographed (37585446, 37465620 (Fig. 41b)). Loc 15: 09.2018: ♂♂, ♀♀ sighted. Loc 20: 19.08.2015: 1 ♂ collected. (4 localities).

Remarks. This taxon, mainly ranging in Japan from where it regularly penetrates to the continent coasts, used to be considered as a subspecies of *S. depressiusculum* (including by us, see Malikova & Kosterin 2019) but regarding it as *bona species* is recently becoming

established (Inoue & Tani 2001; Nagahata et al. 2017; Cho 2021; Onishko & Kosterin 2021). We found these taxa co-occurring and well differing: *S. frequens* is larger and a stronger flier, its males are bright-red, rather than ochre-reddish (see Fig. 41 for comparison); the black lateral spots on abdomen are situated at the segment lateral ribs rather than indented from them; and are often obscured by the bright red ground colour in mature males, the black stripe across the frons does not descend along the eye margins and has no distinct projections; the incomplete black stripe on the interpleural suture is longer and thicker (Onishko & Kosterin 2021). Also, this is the second, after Nagahata et al. (2017), record of *S. frequens* in the continental coast in Russia: earlier it was considered to occur only for Sakhalin and the Kuril Islands (Malikova & Kosterin 2019).

Observations. Found only in Region II, where it was mostly associated with large lentic water bodies of different types. It was found most abundant at the fishery ponds of Ecofarm (Loc 14) where it occurred together with the closely related *S. depressiusculum*. Males occupy relatively large (for the genus) territories at banks, from where try to chase out any dragonflies, up to such large ones as *Epophthalmia elegans* and *Anax julius*.



Figure 44. ♂ (top) and ♀ (bottom) of *Sympetrum infuscatum* at the small lake at Tigrovoy settlement, Loc 13, 12 (top) and 31 (bottom). 08.2011, V.O.

57. *Sympetrum infuscatum* (Selys, 1883)

(Fig. 44)

Loc 3: 08.2011: 4 ♂♂, 2 ♀♀ collected, many ♂♂, ♀♀ sighted; 12.08.2011: 1 ♂ photographed (37423276, Fig. 44 top); 31.08.2011: 1 ♀ photographed 37423340, Fig. 44 bottom); 08.2015: many ♂♂, ♀♀ sighted. Loc 8: 11.08.2011, 1 ♀ collected and photographed (37686484, posed); 08.2015: few ♂♂, ♀♀ sighted. Loc 14: 09.2015: many ♂♂, ♀♀ sighted; 08-09.2018: 1 ♂, 2 ♀♀ collected, few ♂♂, ♀♀ sighted. Loc 15: 08-09.2011: 4 ♂♂, 4 ♀♀ collected, many ♂♂, ♀♀ sighted; 09.2018: few ♂♂, ♀♀ sighted. Loc 17: 08-09.2011: 6 ♂♂, 4 ♀♀ collected, many ♂♂, ♀♀ sighted. Loc 18: 29.08.2018: 1 ♀ photographed (37686595, posed); 1.09.2018: few ♂♂, ♀♀ sighted, 1 ♀ photographed (37550661). Loc 19: 28.08.2011: 1 ♀ photographed (37686553, posed); 09.2011: 1 ♂ collected, few ♂♂, ♀♀ sighted. Loc 21: 08-09.2011: 4 ♂♂, 2 ♀♀ collected, many ♂♂, ♀♀ sighted; 09.2018: few ♂♂, ♀♀ sighted. Loc 22: 08-09.2011: few ♂♂, ♀♀ sighted. Loc 25: 28.08.2018: 1 ♂ collected, 3 ♂♂ sighted (10 localities).

Observations. For the period since 2011 to 2020, the abundance of this species decreased profoundly: in 2011 it was found in great numbers almost all over Region II, while in 2018 just solitary individuals were met.

58. *Sympetrum kunckeli* (Selys, 1884)

Loc 11: 4.09. 2018: 2 ♂♂, 2 ♀♀ collected, of them 1 ♂, 1 ♀ photographed (37550679, 37550673, both posed); many ♂♂, ♀♀ sighted (1 locality).

Observations. Found only at a small stagnant reach of the Romashka River, where it was the only representative of the genus that demonstrated reproductive behaviour. *S. eroticum* and *S. cordulegaster* occurred solitarily at banks but did not interact with *S. kunckeli*. The latter was quite abundant: up to 10 individuals in sight simultaneously.

59. *Sympetrum parvulum* Bartenev, 1913

(Fig. 45)

Loc 15: 08-09.2018: few ♂♂, ♀♀ sighted. Loc 17: 08-09.2011: 4 ♂♂, 4 ♀♀ collected, many ♂♂, ♀♀ sighted; 21.08.2011: 1 ♀ photographed (37613192); 29.08.2018: 1 ♀ photographed (37550761; Fig. 17 bottom right). Loc 18: 08-09.2011: 10 ♂♂, 6 ♀♀ collected, many ♂♂, ♀♀ sighted; 26.08.2011: a copula photographed (37423164, Fig. 45 top right)); 09.2015: many ♂♂, ♀♀ sighted; 08-09.2018: 4 ♂♂, 4 ♀♀ collected, many ♂♂, ♀♀ sighted; 1.08.2018: 1 ♀ (37550797, posed) photographed; 29.08.2018: 1 ♂ (37550753, Fig. 45 top right) photographed; 7.08.2020: 2 ♂♂, 4 ♀♀ collected, 2 ♂♂ (63811850, 62648891), 2 ♀♀ (63811808, 62648834) photographed; very many teneral ♂♂, ♀♀ sighted. Loc 21: 08-09.2011: many ♂♂, ♀♀ sighted; 08-09.2018: many ♂♂, ♀♀ sighted. Loc 25: 28.08.2018: 1 ♂ collected (5 localities).

Observations. Found only in Region II, where it was mostly confined to the large bog at the Ryazanovka River (Loc 18), where it prevailed over other *Sympetrum* spp. In 2011, it was so numerous that the imagines occurred up to 10 km from that bog, sometimes in large quantities. However, in 2018 it became rare beyond the bog. Unlike other congeners, mature males scarcely exhibit territoriality, they rest among dense grass and weakly react to each other.



Figure 45. Copula (left), ♂ (top right) and ♀ (bottom right) of *Sympetrum parvulum*: left and top right – at the peat-moss bog by the Ryazanovka River, Loc 18, 26.08.2011 and 29.08.2018, respectively; bottom right – at Ryazanovka village, Loc 17, 29.08.2018 (right), V.O.

60. *Sympetrum pedemontanum pedemontanum* (Müller in Allioni, 1776)

Loc 8: 9.09.2011: 1 ♂ collected and photographed (37423148, posed). Loc 14: 5 ♀ ♀ sighted. Loc 10: 4.09.2018: 1 ♀ sighted. Loc 15: 02.09.2018, 1 ♂ seen (4 localities).

Observations. Rather rare in Primorye, where occurs by solitary individuals.

61. *Sympetrum risi risi* Bartenev, 1914

(Fig. 46)

Loc 3: 08.2011: 5 ♂ ♂, 4 ♀ ♀ collected, many ♂ ♂, ♀ ♀ sighted, 12.08.2011: 1 ♂ photographed (37423135); 08.2015: many ♂ ♂, ♀ ♀ sighted. Loc 7: 3.08.2020: 1 ♀ photographed (63811401, Fig. 46 bottom). Loc 13: 09.2018: few ♂ ♂, ♀ ♀ sighted; 7.08.2020: 1 general ♂ collected and photographed (63811917, in hand). Loc 14: 09.2015: many ♂ ♂, ♀ ♀ sighted; 08-09.2018: 5 ♂ ♂, 5 ♀ ♀ collected, many ♂ ♂, ♀ ♀ sighted; 1.09.2018: 1 ♂ photographed (37550868; Fig. 46 top). Loc 15: 08-09.2011: 4 ♂ ♂, 4 ♀ ♀ collected, many ♂ ♂, ♀ ♀ sighted; 08-09.2015: many ♂ ♂, ♀ ♀ sighted, 27.08.2015: 1 ♀ photographed (37613096, posed); 09.2018: few ♂ ♂, ♀ ♀ sighted. Loc 17: 08-09.2011, ♂ ♂, ♀ ♀ many seen, 10 ♂ ♂, 6 ♀ ♀ collected; late 08-09.2018: 2 ♂ ♂, 2 ♀ ♀ collected, many ♂ ♂, ♀ ♀ sighted; 30.08.2018: 1 ♂, 1 ♀ photographed (37550882, 37550873 (posed); 5.09.2018: 1 ♀ photographed (42833618, posed). Loc 18: 1.09.2018: few ♂ ♂, ♀ ♀ sighted. Loc 19: 08-09.2011, 09.2015: many ♂ ♂, ♀ ♀ sighted; 19.08.2011: 1 ♂ photographed (37613100, posed). Loc 20: 08-09.2011, 09.2015: many ♂ ♂, ♀ ♀ sighted. Loc 21: 08-09.2011: many ♂ ♂, ♀ ♀ sighted; 09.2018: few ♂ ♂, ♀ ♀ sighted. Loc 22: 08-09.2011, 09.2015: many ♂ ♂, ♀ ♀ sighted. Loc 25: 28.08.2018: 1 ♂ collected, 3 ♂ ♂ sighted (12 localities).

Figure 46. ♂ (top) and ♀ (bottom) of *Sympetrum risi risi*: top – at fishery ponds of Ecofarm, Loc 14: 1.09.2018; bottom – in Tigrovoy village, 3.08.2020, V.O.



Observations.

Common in South Primorye, usually occurs at lentic water bodies but not rare beyond the water; prefers shady forest pools where often is the only representative of the genus.

62. *Sympetrum striolatum imitoides* Bartenev, 1919

(Fig. 47)

Loc 3: 08.2015: few teneral ♂♂ sighted; 15.08.2015: 2 teneral ♂♂ collected and photographed (105487667, 37584578, both posed). Loc 13: 09.2018: few ♂♂, ♀♀ seen. Loc 14: 09.2015: many ♂♂, ♀♀ sighted; 08-09.2018: 5 ♂♂, 5 ♀♀ collected, many ♂♂, ♀♀ sighted; 9.09.2018: 1 copula photographed (37585409, Fig. 47 left). Loc 15: 08-09.2011: 10

♂♂, 10 ♀♀ collected, many ♂♂, ♀♀ sighted; 09.2015: 4 ♂♂, 4 ♀♀ collected; 08-09.2018: many ♂♂, ♀♀ sighted; 14.08.2018: 1 ♀ photographed (37584601, posed); 30.08.2018: 1 ♀ photographed (37550957, Fig. 47 centre); 1.09.2018: 1 ♂ (37408017), 1 ♀ (37528862, Fig. 47 right) photographed; 9.09.2018: 1 ♂ photographed (103471682). Loc 17: 08-09.2011: 5 ♂♂, 2 ♀♀ collected, many ♂♂, ♀♀ sighted. Loc 19: 08-09.2011: many ♂♂, ♀♀ sighted; 09.2015: many ♂♂, ♀♀ sighted; 14.08.2015: 1 ♀ photographed (37584601, posed). Loc 20: 08-09.2011, 09.2015, 08-09.2018: many ♂♂, ♀♀ sighted. Loc 21: 08-09.2011: many ♂♂, ♀♀ sighted; 08-09.2015: many ♂♂, ♀♀ sighted, 19.08.2015: 1 ♀ photographed (37584533, posed); 28.08.2015: 1 ♂ photographed (105487710, posed); 1.09.2015: 1 ♂ photographed (37407867, posed); late 08-09.2018: few ♂♂, ♀♀ sighted; 30.08.2018: 1 ♂, 1 ♀ photographed (37585373, 37585345, both posed). Loc 22: 08-09.2011: 2 ♂♂, 4 ♀♀ collected; 09.2015, 08-09.2018: many ♂♂, ♀♀ sighted; 18.08.2015: 1 young ♂ photographed (105487731, posed). Loc 25: 28.08.2018: 1 ♂ seen (11 localities).

Observations. One of the most numerous species in South Primorye, especially in September and especially in hills clad with oak forests in Region II. Occurs at stagnant water of any type and also along roads, forest margins and sea coast.



Figure 47. Copula (left) and ♀♀ (centre and right) of *Sympetrum striolatum imitoides*, all mature: left – at fishery ponds of Ecofarm; centre and right – by the road from Ecofarm to the coast, Loc 15; left to right 9.09.2018, 30.08.2018; 1.09.2018, respectively, V.O.

63. *Sympetrum uniforme* (Selys, 1883)

(Fig. 48)

Loc 14: 08-09.2018: 2 ♂♂ collected; 29.08.2018: 1 ♂ photographed (37586926, posed); 1.09.2018: 1 ♂ photographed (37408590, posed)). Loc 15: 08-09.2011: few ♂♂, ♀♀ sighted; 08-09.2018: 2 ♂♂ collected, few ♂♂, ♀♀ sighted. Loc 17: 22.08.2011, 1 ♂ collected and photographed (105487591, posed); 22.08.2011: 1 ♂ photographed (37422925). Loc 18: 08-09.2011, many ♂♂, ♀♀; 08-09.2018: 1 ♂ collected, few ♂♂, ♀♀ sighted; 1.09.2018: 1 ♂ photographed (37586828, Fig. 48). Loc 20: 1.09.2015: 2 ♂♂ collected, 4 ♂♂ photographed (105487550, 105487481, 105487434, 37423057, all posed), several ♂♂ sighted (5 localities).

Observations. Relatively common but in Region II only. Solitary imagines, both young and mature, occurred anywhere but were most common at the bog (Loc 18) and along forest margins and roads.

Figure 48. *Sympetrum uniforme* at the bog by Ryazanovka River, Loc_18, 1.09. 2018, V.O.



Figure 49. Young ♂ of *Sympetrum vulgatum imitans* at the road between Ecofarm and the coast, Loc 15, 21.08. 2011, V.O.



64. *Sympetrum vulgatum imitans* Selys, 1886

(Fig. 49)

Loc 15: 21.08.2011 1 ♂ photographed and collected (37423417, Fig. 49) (1 locality).

Observations. Just one specimen was reliably registered for the whole period of study. In addition, in 2018 at the bridge across Ryazanovka River (Loc. 13), V.O. sighted a female that simultaneously resembled *S. striolatum imitoides* and *S. v. imitans*, with the wings less coloured than in the former, but failed to catch it.

Discussion

The local fauna of Odonata of the Region I, situating in the Sikhote-Alin' S foothills, was not rich, with 29 species revealed, most of which represented the Boreal fauna and only five species (*Anax* sp., *Davidius lunatus*, *Sympetrum cordulegaster*, *Sympetrum infuscatum* and *S. risi*), were Manchurian elements. *Aeshna caerulea* was for the first time recorded in Primorye, unfortunately by a visual observation only. Examination of higher elevations of the Sikhote-Alin' Mts in the same Partizansk District is highly needed to confirm this finding with specimens; this might reveal further Boreal species in the region as well.

In contrast, the coastal Region II appeared very rich both in the number of species (55, which is 35 % of the entire fauna of Russia and 59% of the fauna of the southern Russian Far East) and of individuals, so that numerous collections and interesting findings were made just by roads apart from any water. Twenty-eight species there (51% of the local fauna) were Manchurian elements. The most striking feature of this region was huge trophic swarms in dusk composed of a mix of species, with many species participating up to sole large *Sympetrum* spp.

According to V.O.'s observations, the number of dragonflies and damselflies in the Region II decreased dramatically from 2011 to 2018. This was especially noticeable with respect to the above-mentioned dusk swarms, which in 2011 took place each evening and counted hundreds of individuals but were not at all observed in 2018. Also in 2011, the sides of the ground road of Loc 15 were littered with killed *Sympetrum* spp., while in 2018, there were few of those. Only *Pantala flavescens* and *Anax julius* did not decrease in number. On the contrary, the latter was more numerous in 2015 and 2018 than in 2011.

During this study, some Manchurian species with limited presence (few known localities, for the review see Kosterin 2019) in Russia, as follows. *Macromia manchurica* and *Lyrithemis pachygastra* were known from Russia by three reports each (see Kosterin 2019), and for both two localities were added during this study. There were three reports of *Paracercion plagiosum* from Russia (see Kosterin 2019), in this study the 4th Russian locality has been found. There were also three reports from Russia of *Sympetrum baccha matutinum*, all from Khasan District of Primorye (see Malikova 1995); here we report it for the fourth time adding five localities, although in the same district. Few Russian localities were hitherto known also for *Lestes temporalis*, *Paracercion calamorum*, *P. hieroglyphicum*, *Trigomphus citimus*, *Deielia phaon* (Note that Kosterin (2019) missed the second and third localities reported to that year for *D. phaon* by Malikova & Streltsov (2015), in Bureya and Konstantinovo District of Amur Province).

Simultaneous occurrence of the closely related *Coenagrion hastulatum* and *C. lanceolatum* was observed perhaps for the first time.

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