Odonatologica 35(2): 167-185 *June 1, 2006*

THE ODONATA OF SOUTH URAL, RUSSIA, WITH SPECIAL REFERENCE TO *ISCHNURA ARALENSIS* HARITONOV, 1979

V.A. YANYBAEVA[1], H.J. DUMONT[2], A.Yu. HARITONOV[3] and O.N. POPOVA[3]

[1] Bashkirian State Nature Reserve, RUS-453592 Sargaya, Bashkortostan Republic, Russia; – bashart@bashnet.ru

[2] Animal Ecology, University of Ghent, Ledeganckstraat 35, B-9000 Gent, Belgium

[3] Institute of Animal Systematics and Ecology, Siberian Branch, Russian Academy of Sciences, ul. Frunze 11, RUS-630091 Novosibirsk, Russia; – pc@eco.nsc.ru

Received July 8, 2005 / Reviewed and Accepted September 10, 2005

The odon. fauna of S. Ural (Russia), as known from literature data and new collections, is composed of 59 spp. *Coenagrion ecornutum*, *Ischnura pumilio*, *Somatochlora graeseri* and *Selysiothemis nigra* are first records for S. Ural; the presence of *Ischnura aralensis* Haritonov, 1979 (syn. *I. haritonovi* Dumont, 1997), *Aeshna cyanea*, *Anax imperator* and *Libellula depressa* is confirmed, but that of *Pyrrhosoma nymphula*, *Sympecma fusca*, *Cordulegaster boltonii* and *Libellula fulva* is not. *Aeshna undulata* Bartenev, 1909 is a probable synonym of *A. juncea* Linnaeus, 1758. *I. aralensis*, *C. ecornutum*, *Enallagma cyathigerum* risi and *S. graeseri* were found W as well as E of the Ural River, and thus are part of the fauna of Europe. Several western spp. reach their limit of eastward extent in S. Ural and, conversely, several eastern (Siberian) spp. reach their limit of westward extent there too. The range of *I. aralensis* is discussed in the light of the contractions and expansions of the Caspian-Aral lakes during the Late Pleistocene. The current disjunct positions of its colonies is understood as the result of the present phase of aridity in middle Asia.

INTRODUCTION

The Ural Mountains separate Europe from Asia, stretching from North to South over a length of almost 2000 km. The South Ural extends approximately between 50° and 57°N. Most of its territory consists of mountain ridges and hills not higher than 1000-1600 m, directed from the North to the South. The ridges are separated by valleys with altitude 500-700 m a.s.l. In the West and East, the South Ural merges with the Russian plain and the West-Siberian lowland, and drains towards the rivers Volga (via the Belaya River; see Fig. 15) and Ob, respec-

tively. In the South it drains towards the Ural River and, ultimately, the Caspian Sea; here, the mountains grade to the Mugodzhary Hills. In the North, they continue as the mountains of the Middle Ural. The South Ural range is covered in forests, while the plains to the West and East are occupied by forest-steppes. The southern outskirts of the region are covered in true steppe. There are many lakes and rivers in the South Ural, with innumerable large and small lakes situated in its eastern zone. This wide variety of landscapes and abundance of lakes and rivers form the physical basis for the existence of a rich local fauna of dragonflies.

The climate of the South Ural is continental, with average temperature ca -17°C in January and ca +20°C in July. In winter, there is snow cover for170-200 days and many shallow water-bodies freeze to the bottom. Summers are hot and the sum of average daily temperatures above +10°C is not less than 1600 degrees in the mountains and 2300 degrees in the plains, which allows many odonate species to round their life cycle. In administrative terms, the western half of South Ural is occupied by the Republic of Bashkortostan (Bashkiriya), the eastern part is in Chelyabinsk district, and the south is part of Orenburg district. The northern part, finally, belongs to the Yekaterinburg district of the Russian Federation (more information in GERASIMOV et al., 1968).

Currently, analysis of regional faunas has regained importance, because practically all natural areas are increasingly affected by human activity, resulting in changes of distributions, species abundance, and faunal richness of biota, including dragonflies. Fortunately, the analysis of the spatial distribution of the dragonflies of South Ural has a reasonable level of previous knowledge to build on. By publishing a study on the dragonflies of Lake Uvil'dy (loc. 5 sensu this paper, see hereafter), A.N. BARTENEF (1908) began his long odonatological career in the South Ural, and so did A.Yu. Haritonov at the end of the 1960's and in the 1970's (HARITONOV, 1972; 1975a, 1975b; 1976; 1978; 1989; 1997; OKOROKOV & HARITONOV, 1971). Their contributions revealed much of the local species diversity and facilitated later work by local researchers (BAYANOV, 1974, 1975; BOEV et al., 1989; ZEI-NECHAEVA & BAYANOV, 1975). The Uralian odonate fauna was also dealt with by ALEKSEEV (1987; 1989), VORONTSTOVSKII (1909), and KOLOSOV (1927), but none of these references contain exact records. Here, we add to the knowledge so far accumulated, and critically examine some earlier records, especially those by non-professional odonatologists.

LOCALITIES VISITED

Our collecting effort was composed of visits, once or several times, to the 53 localities shown in Figure 15. Our main data sources are:

1) The Ph.D. study of A.Yu. Haritonov (1975), extending from 1968 to 1974 and some later collections in the 1980-1990s. Most of the material resides in the collections of the Institute of Systematic and Ecology of Animals Siberian Branch of the Russian Academy of Sciences (ISEA SB RAS), Novosibirsk.

2) The Ph.D. study of V.A. Yanybaeva (2004), extending from 1996 to 2000. Most of the material has been deposited in the collections of the Bashkirian State Nature Reserve (BSNR) at Sargaya Settlement, with some specimens also kept at the ISEA SB RAS, Novosibirsk. For a list of papers by Yanybaeva, see the list of references at the end of this article.
3) A concerted exploration effort by the authors of this paper in the framework of a NATO collaborative grant in July 2004. The objective of this grant was to explore dragonfly ranges as possible indicators of environmental change, including climate change. For this, the South Ural is a strategic area. Any material collected was deposited at ISEA SB RAS (Haritonov's and Popova's collections), or split between H. Dumont's personal collection (HJD) and that of the Royal Institute of Natural Sciences, Brussels (RINSB).

List of localities visited:

(1) Izhevsk sity, Upper Izh River; 56°32'N, 53°26'E; 78 m asl
(2) Yekaterinburg City, Iset' River; 56°34'N, 60°39'E; 285 m asl
(3) Alabuga Lake; 55°36'N, 62°18'E; 110 m asl
(4) Brodokolmak village, Techa River; 55°37'N, 62°04'E; 118 m asl
(5) Uvil'dy Lake; 55°30'N, 60°30'E; 215 m asl
(6) Argayash Lake; 55°28'N, 60°50'E; 200 m asl
(7) Akakul' Lake; 55°42'N, 60°34'E; 210 m asl
(8) Dolgoderevenskoe village, Miass River; 55°23'N, 61°28'E; 122 m asl
(9) Shibanovo Lake; 55°25'N, 61°50'E; 156 m asl
(10) Atlyan village, Atlyan River; 55°00'N, 59°53'E ; 480 m asl
(11) Turgoyak Lake; 55°10'N, 60°05'E; 370 m asl
(12) Chebarkul' Lake; 54°55'N, 60°30'E; 325 m asl
(13) Miasskyi pond; 54°50'N, 60°10'E; 270 m asl
(14) Large Tatkul' Lake; 55°06'N, 60°16'E; 350 m asl
(15) Large Miassovo Lake; 55°07'N, 60°17'E; 348 m asl
(16) Kisegach Lake; 55°05'N, 60°25'E; 245 m asl
(17) Chelyabinsk City, Miass River; 55°09'N, 61°26'E; 210 m asl
(18) Miasskoe village, Miass River; 55°18'N, 61°45'E; 160 m asl
(19) Selezyan Lake; 54°48'N, 61°46'E; 175 m asl
(20) Duvankul' Lake; 54°36'N, 61°33'E; 208 m asl
(21) Butash Lake; 54°36'N, 62°05'E; 170 m asl
(22) Ufa City, Belaya River; 54°40'N, 56°00'E; 150 m asl
(23) Orlovka village, Upper Miass River; 54°47'N, 59°46'E; 476 m asl
(24) Upper Miass River; 54°46'N, 59°38'E; 498 m asl
(25) Upper Miass River, artificial ponds; 54°45'N, 59°43'E; 480 m asl
(26) Starobayramgulovo village, Aushkul' Lake; 54°30'N, 59°33'E; 638 m asl
(27) Uchaly district, Urgun Lake; 54°24'N, 59°24'E; 620 m asl
(28) Uchaly district, Karagayly Lake; 54°19'N, 59°28'E; 620 m asl
(29) Uchaly district, Mindyak village, roadside lake; 53°59'N, 58°49'E; 654 m asl
(30) Uchaly district, Kazakkulovo village, Mindyak River; 53°58'N, 58°46'E; 635 m asl
(31) Uchaly distr., Mindyak village, canal of Mindyak River; 53°56'N, 58°48'E; 640 m asl
(32) Beloretsk City, Belaya River; 53°54'N, 58°22'E; 625 m asl
(33) North Ulyandy Lake; 53°51'N, 58°58'E; 450 m asl
(34) Small Ulyandy Lake; 53°56'N, 58°54'E; 450 m asl
(35) Bannoe Lake; 53°35'N, 58°40'E; 480 m asl
(36) Surtandy Lake; 53°33'N, 58°42'E; 464 m asl
(37) Martyshy Lake; 53°34'N, 58°44'E; 445 m asl
(38) Mikhailovka village, Upper Yangel'ka River; 53°28'N, 58°42'E; 450 m asl

(39) Kizil River; 53°47'N, 58°39'E; 705 m asl
(40) Abzelilovo district, Karatash mountain range; 53°36'N, 58°30'E; 1026 m asl
(41) Karabalykty Lake; 53°38'N, 58°41'E; 466 m asl
(42) Chebarkul' Lake; 53°22'N, 58°42'E; 470 m asl
(43) Askarovo village, upper Large Kizil River; 53°20'N, 58°32'E; 530 m asl
(44) Upper Zingeika River; 53°48'N, 60°15'E; 290 m asl
(45) Upper Gumbeika River; 53°42'N, 59°40'E; 296 m asl
(46) Magnitogorsk City, Upper Ural River; 53°22'N, 59°03'E; 320 m asl
(47) Yangel'ka River; 53°18'N, 58°40'E; 336 m asl
(48) Uzyan village, Belaya River; 53°42'N, 57°45'E; 720 m asl
(49) Kagarmanovo village, Belaya River; 53°38'N, 57°44'E; 730 m asl
(50) Bashkirskyi Nature Reserve: 53°30'-53°15'N, 57°43'-58°11'E; 520-928 m asl
(51) Shul'gan-Tash Nature Reserve; 52°50'N, 56°45'E; 580 m asl
(52) Umaguzino village, Belaya River; 52°55'N, 56°20'E; 315 m asl
(53) Orenburg City, Ural River; 51°45'N, 55°06'E; 140 m asl

Administratively, the localities visited are situated in the following regions of South Ural: Udmurtia (Udmurtskaya Republic), loc. 1; – Yekaterinburg district, loc. 2; – Chelyabinsk district, locs 3-21, 44-46; – Bashkiriya (Republic of Bashkortostan), locs 22-43, 47-52; – Orenburg district, loc. 53.

LIST OF SPECIES

Numbers in bold correspond to the locality numbers given above and are followed by date(s) of collecting. If more than ten specimens were collected, "series" is used. If less than ten, the exact number of specimens (= spec.) is given (without sex). Some localities, mainly sampled together by the July 2004 expedition, are cited collectively.

– *Calopteryx splendens* (Harris, 1782)

Series, **32**: VII-1971; **39**: VII-1968; VII-1969; **44**: V-1999; **46**: VII-1968, VII-1969, VII-1984, VII-2000; **48**: VIII-1969, VIII-1970; **5**, **44**: VI-1972; **2**, **50**: VII-1993; VI-1997; VI-1998; VIII-1999; **25**, **31**, **40**: VII-2004.

– *Calopteryx virgo* (Linnaeus, 1758)

Series, **39**: VII-1968; **44**: V-1999; VII-1969; **46**: VII-1968, VII-1969, VII-1984; **48**: VIII-1969, VIII-1970; **49**: VIII-1971; **50**: VI/VII-1992; VII-1993; VI/VII-1996; VI/VII-1997; VI/VII-1998; **31**, **39**: VII-2004.

– *Lestes barbarus* (Fabricius, 1798)

21: 6 spec., VII-1974; **37**: 3 spec., VII-1980; **40**: 1 spec. VII-2004 ; **46**: 2 spec. VII-1979; **50**: 1 spec. IX-2000.

– *Lestes dryas* Kirby, 1890

Series, **2**: VI-1969; **7**: VII-1970; **8**: VII-1970; **12**: VII-1973; **13**: VI-1998; **17**: VII-1969; **21**: VII-1974, VII-1980; **31**: VI-1998; **33**: VII-1996, VII-1998; **37**: VII-1975; **38**: VII-1975; **39**: VII-1997; **41**: VIII-1998, VIII-1999; **46**: VII-1970, VIII-2000; **50**: VII-1993, VII-1994, VI-1995, VII-1996, VI, VII-1997, VIII-1999; **30**, **33**, **34**, **40**, **41**: VII-2004.

– *Lestes macrostigma* Eversmann, 1836

3: 6 spec., VII-1983; **19**: 10 spec.,VIII-1968; **21**: 2 spec., VII-1974; **34**: 2 spec., VIII-1999, 1 spec., VII-2004; **38**: 5 spec., VII-1975.

– *Lestes sponsa* (Hansemann, 1823)

Series, **2**: VI-1969; **3**: VII-1983; **7**: VII-1970; **8**: VII-1970; **12**: VII-1973; **13**: VI-1998; **17**: VII-1969; **21**: VII-1974, VII-1980 ; **28**: VI-1998; **31**: VI-1998; **33**: VII-1996, VII-1998; **34**: VI-1997, VII-1998, VIII-1999; **37**: VII-1975; **38**: VII-1975; **39**: VI-1996; **41**: VIII-1998, VIII-1999; **43**: VII-1985; **46**: VIII-1979;

50: VI/VII-1996, VI/VII-1997, VII-1998, VIII-1999; **27**, **28**, **29**, **31**, **33**, **34**, **40**, **41**: VII-2004.

– *Lestes virens* Rambur, 1842

21: 7 spec., VII-1974, 2 spec., VIII-1980; **37**: 5 spec., VIII-1984; **40**: 1 spec., VII-2004; **46**: 2 spec., VII-1979.

– *Sympecma fusca* (Vander Linden, 1823)

Known only from the collection of ZMBSU (BOEV et al., 1989)

– *Sympecma paedisca* (Brauer, 1877)

Series, **4**: V-1979; **17**: IV-1984; **19**: VII-1971; **20**: VII-1971; **9**: IV-1972; **35**: VIII-1970; **37**: V-1968; **46**: V-1968, V-1969; **50**: IV/V-1995, VI-1996, VI-1997; V-1998; IV-1999; **14**, **25**, **30**: VII-2004.

– *Coenagrion armatum* (Charpentier, 1840)

Series, **4**: V-1975; **7**: VI-1974; **8**: V-1969; **9**: V-1969; **10**: VII-1972; **11**: VI-1979; **13**: V/VI-1998; **19**: V-1970; **28**: VI-1998; **33**: VII-1996, VI-1997; **34**: VI-1997, V/VI/VII-1998; **35**: V-1969; **37**: V-1968, VI-1970; **41**: VI-1998; **44**: V-1998; **45**: V-1982; **46**: V-1968, VI-1971; **50**: VII-1994, V-1995, VI-1996, VI-1998; **29**, **30**, **33**: VII-2004.

– *Coenagrion ecornutum* (Selys, 1872)

Series, **28**: VI-1998; **33**: VII-1996; **27**, **28**, **31**, **33**: VII-2004.

– *Coenagrion hastulatum* (Charpentier, 1825)

Series, **1**: VI-1969; **2**: VI-1969; **3**: VIII-1983; **4**: V-1975; **7**: VI-1974; **8**: V-1969; **9**: V-1969; **10**: VII-1972; **11**: VI-1979; **13**: VI-1998; **19**: V-1970; **20**: V-1970; **21**: VII-1980; **28**: VI-1998; **30**: VII-2004; **33**: VII-1996, VI-1997, V, VI-1998; **34**: VI-1997, V/VI/VII-1998; **35**: V-1969; **37**: VI-1968, VI-1970; **43**: VII-1985; **44**: V-1998; **45**: V-1982; **46**: VI-1971; **50**: VII-1993, VII-1994, V/VI/VII-1995, VI/VII-1996, VI/VII-1997, V/VI/VII-1998.

– *Coenagrion johanssoni* (Wallengren, 1894)

7: 1 spec., VI-1974; **10**: 2 spec., VII-1972; **11**: 5 spec., VI-1979.

– *Coenagrion lunulatum* (Charpentier, 1840)

Series, **4**: V-1975; **7**: VI-1974; **9**: V-1969; **10**: VII-1972; **11**: VI-1979; **13**: VI-1998; **19**: V-1970; **28**: VI-1998; **33**: VII-1996, V-1998; **34**: VI-1997, VII-1998; **35**: V-1969; **37**: V-1968, VI-1970; **44**: V-1998; **45**: V-1982; **46**: V-1968, VI-1971; **50**: VI-1998, VI, VII-1999; **29**, **30**, **33**, **40**: VII-2004.

– *Coenagrion puella* (Linnaeus, 1758)

Series, **4**: V-1975; **7**: VI-1974; **10**: VII-1972; **11**: VI-1979; **21**: VII-1980; **33**: V-1998; **37**: VI-1970; **39**: VII-1968; **46**: VII-1968, VII-1969, VI-1971; **50**: V-1995, VI, VII-1996; **14**, **30**, **31**, **40**: VII-2004.

– *Coenagrion pulchellum* (Vander Linden, 1825)

Series, **3**: VIII-1983; **4**: V-1975; **7**: VI-1974; **10**: VII-1972; **11**: VI-1979; **13**: VI/VII-1998; **21**: VII-1980; **28**: VI-1998; **33**: VII-1996, VI-1997, VII-1998; **34**: VI/VII-1998, V/VI/VII-1998; **37**: VI-1970; **39**: VII-1968; **41**: VI-1998; **44**: V-1999; **46**: VII-1968, VII-1969, VI-1971; **50**: VII-1994, V-1995, VI-1996; **14**, **27**, **33**, **34**, **41**: VII-2004.

– *Erythromma najas* (Hansemann, 1823)

Series, **3**: VI-1968; **4**: VI-1969; **5**: VI-1973, VI-1979; **6**: VI-1974; **7**: VI-1974; **10**: VII-1972; **11**: VI-1979; **13**: V/VI-1998; **28**: VI-1998; **34**: VII-1996, VI-1997, VI/VII-1998; **37**: VI-1968; **42**: VII-1975; **44**: V-1998; **46**: VI-1971, VI-1973; **50**: VII-1998; **14**, **15**, **25**, **31**, **33**: VII-2004.

– *Nehalennia speciosa* (Charpentier, 1840)

7: 3 spec., VI-1974; **10**: 1 spec., VII-1972; **12**: 2 spec., VII-1973.

– *Pyrrhosoma nymphula* (Sulzer, 1776)

Known only from the collection of ZMBSU (Zei-Nechaeva & Bayanov, 1975)

– *Enallagma cyathigerum* Charpentier, 1840

Series, **2**: VI-1969; **7**: VII-1970, VI-1974; **8**: VIII-1968, VII-1970; **9**: VI-1972; **10**: VII-1972; **12**: VII-1973; **13**: VI-1998; **17**: VII-1969; **19**: VII-1971; **20**: VII-1971; **28**: VI-1998; **33**: VII-1996; **34**: VII-1996, VI-1997, VI/VII-1998; **37**: VII-1968, VI-1970; **39**: VII-1996; **41**: VI-1998; **44**: V-1998; **46**: VII-1975,

VII-1979; **50**: VI-1997, VII-1998; **14**, **15**, **25**, **26**, **27**, **28**, **30**, **31**, **33**, **34**, **40**, **41**: VII-2004.

– *Ischnura aralensis* Haritonov, 1979 (Figs 1-14, 16)

Series, **7**: VIII-1974, VII-1976; **14**: VIII-1986; **16**: VII-1986; **33**: VII-1998; **41**: VIII-1998, VIII-1999, VII-2000; **50**: VI-1997, VI-1998; **25**, **26**, **33**, **34**, **41**: VII-2004.

– *Ischnura elegans* (Vander Linden, 1823)

Series, **6**: VI-1974; **7**: VI-1974; **13**: VI-1998; **34**: VI-1997, VI/VII-1998, VIII-1999; **41**: VIII-1999; **42**: VII-1975; **46**: VI-1973, VII-1979; **50**: VII-1993, VII-1998; **15**, **26**, **31**, **33**, **34**, **41**: VII-2004.

– *Ischnura pumilio* (Charpentier, 1825)

50: 2 spec., V-1995.

– *Platycnemis pennipes* (Pallas, 1771)

Series, **31**: VII 2004; **32**: VII-1971; **46**: VII-1968, VII-1969, VIII-2000; **47**: VII-1972; **48**: VII-1973; **50**: VII-1993, VII-1994, VII-1995; VI-1998, VI/VII-1999.

– *Aeshna affinis* Vander Linden,1825

35: 2 spec., VIII-1970.

– *Aeshna crenata* Hagen, 1856

7: 1 spec., VII-1970; **12**: 2 spec., VII-1973; **13**: 2 spec., VII-1973; **15**: 1 spec., VII-2004; **25**: 2 spec., VII-2004; **34**: 1 spec., VIII-1999; **35**: 3 spec., VIII-1970; **39**: 1 spec., VII-1968, 1 spec., VII-1969; **41**: 1 spec., VII-1998; **46**: 2 spec., VII-1968.

– *Aeshna cyanea* (Müller, 1764)

Series, **50**: VI, VII-1995, VI-VIII-1996, VII-1997, VII-1999, VIII-2000.

– *Aeshna grandis* (Linnaeus, 1758)

Series, **6**, **7**, **10**, **35**, **39**, **46**: VII/VIII-1968-1976; **13**, **41**, **44**, **50**: VI/VIII-1995-1999; **24**, **25**, **27**, **31**, **33**, **40**, **41**: VII-2004.

– *Aeshna juncea* (Linnaeus, 1758)

Series, **7**, **10**, **12**, **13**, **16**, **35**, **39**, **41**, **46**: VII/VIII-1968-2000; **13**, **33**, **41**, **50**: VI/VIII-1992-1999; **14**, **24**, **25**, **27**, **34**: VII-2004.

– *Aeshna mixta* Latrielle, 1805

7: 3 spec., VII-1970; **21**: 1 spec., VIII-1980; **34**: 1 spec., VIII-1999; **37**: 4 spec., VIII-1984; **46**: 3 spec., VIII-1979.

– *Aeshna serrata* Hagen, 1856

Series, **3**, **4**, **6**, **7**, **11**, **37**, **46**: VI/VIII-1968-2000; **28**, **34**, **41**, **44**: VI/VIII-1997-1999; **24**, **25**, **27**, **28**, **33**, **34**, **40**, **41**: VII-2004.

– *Aeshna viridis* Eversmann, 1836

7: 4 spec., VII-1970; **12**: 2 spec., VII-1973; **13**: 2 spec., VII-1973; **16**: 3 spec., VII-1974; **25**: 1 spec., VII 2004; **35**: 3 spec., VIII-1970; **39**: 2 spec., VII-1968, 1 spec., VII-1969; **41**: 2 spec., VII-1975, 1 spec., VII-1998, 1 spec., VIII-1999; **46**: 3 spec., VII-1968.

– *Anax imperator* Leach, 1815

30: 1 spec., VII-2004; **31**: 2 spec., VII-2004.

– *Anax parthenope* Selys, 1839

7: 3 spec., VI-1974; **41**: 1 spec., VII-2004; **46**: 2 spec., VII-1971; 3 spec., VII-1972.

– *Brachytron pratense* (Müller, 1767)

14: 2 spec., VII-1970.

– *Gomphus flavipes* (Charpentier, 1825)

17: 4 spec., VII-1969, 3 spec., VII-1974; **46**: 2 spec., VII-1968.

– *Gomphus vulgatissimus* (Linnaeus, 1758)

39: 2 spec., VII-1968, 4 spec., VII-1969; **46**: 1 spec., VII-1968; **48**: 1 spec., VIII-1969, 3 spec., VIII-1970; **50**: 3 spec., VII-1994, 5 spec., VI-1996.

– *Onychogomphus forcipatus* (Linnaeus, 1758)
Series, **33**: VII-2004; 49: VIII-1968; **50**: VI-1992, VII-1993, VI/VIII-1995, VI-1996, VI-1997, VI-1998, VI-1999; **51**: VIII-2000; **52**: VIII-1969.

– *Ophiogomphus cecilia* (Fourcroy, 1758)
39: 1 spec., VII-1968; **44**: 2 spec., V-1998; **46**: 3 spec., VII-1968; 2 spec., VII-1969, 2 spec., VII-1984; **49**: 2 spec., VIII-1971; **50**: 1 spec., VII-1993, 1 spec., VII-1994, 1 spec., V-1995, 1 spec., VI-1995, 1 spec., VII-1996.

– *Cordulia aenea* (Linnaeus, 1758)
Series, **7**: VI-1974; **8**: VI-1979; **10**: VII-1972; **13**: VI-1998; **19**: V-1970; **28**: VI-1998; **33**: V-1998; **37**: VI-1970; **41**: VII-1998; **45**: V-1982; **46**: VI-1974; **50**: V/VI-1995, VII-1996, VI/VII-1998, VII-1999; **14, 15, 25, 41**: VII-2004.

– *Epitheca bimaculata* (Charpentier, 1825)
Series, **6**: VII-1976; **7**: VI-1974; **10**: VII-1972; **28**: VI-1998; **35**: VIII-1970; **46**: VI-1968; **34**: VII-1998; **41**: VII-1998; **39, 40, 41**: VII 2004; **50**: VI-1995, VI-1997.

– *Somatochlora flavomaculata* (Vander Linden,1825)
7: 4 spec. VI-1970; **14**: 3 spec. VII 2004; **17**: 2 spec. VII-1969; **24**:1 spec. VII-2004.

– *Somatochlora graeseri* (Zetterstedt, 1840)
50: 1 spec., VII-1992, 2 spec., V-1995, 1 spec., VI-1995, 2 spec., VII-1996, 1 spec., VIII-1996, 2 spec., VIII-1997, 3 spec., VIII-2000.

– *Somatochlora metallica* (Vander Linden,1825)
Series, **4**: VII-1975; **6**: VII-1976; **7**: VI-1974; **10**: VII-1972; **11**: VI-1979; **12**: VII-1970; **35**: VII-1969; **50**: VII-1993, VII-1994, V-1995, VII-1996, VII-1997, VII-1998; **14, 15, 30, 31**: VII-2004.

– *Libellula depressa* Linnaeus, 1758
40: 2 spec., VII 2004; **50**: 1 spec., VI-1992, 2 spec.,V-1995; 3 spec., VI-1996, 1 spec., VI-1998, 1 spec., VII-1999; **31**: 1 spec., VII-2004.

– *Libellula fulva* Müller, 1764
Known only from the collection of ZMBSU (Zei-Nechaeva & Bayanov, 1975)

– *Libellula quadrimaculata* Linnaeus, 1758
Series, **4, 7, 9-11, 19, 35, 37, 45, 46**: V/VII-1968-1982; **13, 28, 33, 34, 41, 44, 50**: V/VIII-1995-1999; **14, 31, 33, 34**: VII-2004.

– *Orthetrum cancellatum* (Linnaeus, 1758)
14: 4 spec., VII-2004; **25**: 2 spec., VII-2004; **26**: 4 spec., VII-2004; **31**: 1 spec., VII-2004.

– *Sympetrum danae* (Sulzer, 1776)
Series, **1-21, 26-31, 33-38, 41-47, 53**: VI/IX-1968-2000; **13, 34, 50**: VI/VIII-1994-1998; **14, 15, 27, 28, 33, 34**: VII-2004.

– *Sympetrum flaveolum* (Linnaeus, 1758)
Series, **2-21, 26-49, 51-53**: VI/IX-1968-2000; **13, 27-31, 33, 34, 39, 41, 44, 50**: VI/VIII-1993-1999; **14, 25, 26, 31, 33, 34, 41**: VII-2004.

– *Sympetrum pedemontanum* (Müller, 1766)
Series, **7**: VII-1976; **10**: VII-1972; **17**: VIII-1986; **35**: VIII-1970; **37**: VII-1975; **42**: VII-1975; **25, 31**: VII-2004.

– *Sympetrum sanguineum* (Müller, 1764)
4: 2 spec., VII-1970; **9**: 2 spec., VIII-1979; **28**: 1 spec., VII-2004.

– *Sympetrum vulgatum* (Linnaeus, 1758)
Series, **2-21, 26-31, 33-47, 51-53**: VII/IX 1968-2000; **34, 41, 44, 50**: VII/VIII-1994-1999; **14, 25, 28, 31, 33, 34, 41**: VII-2004.

– *Leucorrhinia albifrons* (Burmeister, 1839)

7: 5 spec., VI-1974; **10**: 4 spec., VII-1972, 3 spec., VII-1979; **14**: 2 spec., VII-2004; **25**: 5 spec., VII-2004; **28**: 1 spec., VII-2004.

– *Leucorrhinia caudalis* (Charpentier, 1840)

7: 1 spec., VI-1974; **10**: 3 spec., VII-1979; **25**: 1 spec., VII-2004.

– *Leucorrhinia dubia* (Vander Linden, 1825)

Series, **4**: V-1975; **6**: VII-1976; **7**: VI-1974, VII-1976; **10**: VII-1972; **13**: V/VI-1998; **19**: V-1970; **35**: V-1969; **41**: VIII-1998; **46**: V-1968; **50**: VI-1997, V/VII-1998, V-1999.

– *Leucorrhinia pectoralis* (Charpentier, 1825)

Series, **4**: V-1975; **7**: VI-1974, VII-1976; **10**: VII-1972; **11**: VI-1979; **13**: VI-1998; **19**: V-1970; **28**: VI-1998; **33**: V-1998; **46**: V-1968; **50**: VI-1997; **25, 27**: VII-2004.

– *Leucorrhinia rubicunda* (Linnaeus, 1758)

Series, **4, 6-11, 19-21, 35, 37, 45, 46**: V/VII-1968-1982; **13, 33, 34, 50**: V/VII-1996-1999; **25, 27**: VII-2004.

– *Selysiothemis nigra* (Vander Linden, 1825)

50: 1 spec. (a teneral ♂), 6-VIII-2000.

DISCUSSION: IMPORTANT RECORDS

In all, 59 species were recorded, including the following four, not heretofore reported from South Ural.

Coenagrion ecornutum (Selys, 1872)

A species previously thought to range from the Pacific coast to West Altai (BELYSHEV, 1973). Since it has not (yet) been found in the well-studied West Siberian Plain, we now suppose that the South Uralian population represents a western isolate, separated some 2000 km from the species' main range. Quite abundant in the sites mentioned, especially on Lake Karagaily of the Uchaly group In 2004, it had visibly expanded, and was now even found in riverine environments. It was also found West as well as East of the Ural River, and technically is a new entry to the list of European species.

Ischnura pumilio (Charpentier, 1825)

Collected by V. Yanybaeva at the Kaga River oxbow, a 15×20 m pond created by a spring flood that undermined the river bank. It is well heated, with shingle bottom still not covered with ooze, and banks fragmentary grown with sedge.

Somatochlora graeseri Selys, 1887.

Thought to range from the Pacific to the Yenisei and Altai (BELYSHEV, 1973) but later also found in the Polar Ural (HARITONOV, 1974). The present finding extends the Uralian part of the range to this entire mountain range, including its western (European) part. Yet, the species seems to be absent from the West Siberian lowlands. An abundant population was first discovered in the Bashkirian Nature reserve by V. Yanybaeva in 1995. In 2000 it was found also in the Belaya River headwaters. It inhabits oxbows of the mountain forest zone of South Ural and is absent from the foothills and lakes.

Selysiothemis nigra (Vander Linden, 1825)

One teneral male from mountain spring Sargaya within the Bashkirian Reserve was collected on 6-VIII-2000 by V. Yanybaeva & O. Popova (specimen in the collection of ISEA SB RAS). This unexpected finding demands further monitoring of the dragonfly fauna of this reserve, to reveal whether it is a steady habitat of this species, or whether an occasionally vagrant female, having migrated up the valley of the Ural river, had laid its eggs there to produce the teneral. The Caucasian and central Asian discoveries of this Irano-Turanian species are situated at least 1700 km from the Bashkirian Reserve.

Next, we confirm the presence of some species, reported for South Ural earlier:

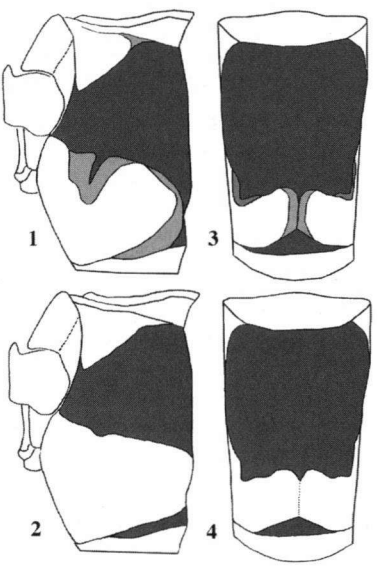
Pyrrhosoma nymphula (Sulzer, 1776).

Reported from the South Ural by ZEI-NECHAEVA & BAYANOV (1975). Several specimens found in the Zoological Museum of the Bashkirian State University confirm this record.

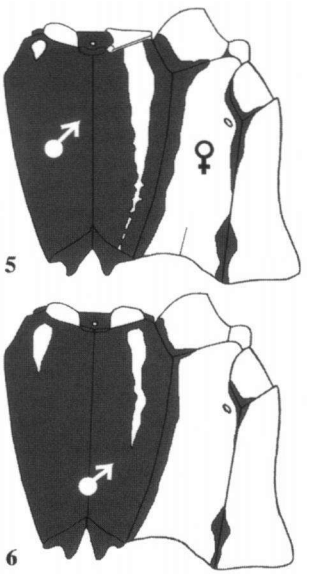
Ischnura aralensis Haritonov, 1979 (Figs 1-14, 16).

New synonym: *Ischnura haritonovi* Dumont, 1997.

This little-known species was described by HARITONOV (1979), based on a single female. Later, he discovered it to be rather widespread in the arid zone of Kazakhstan, in Kyzyl-Orda, Taldy-Kurgan and Dzhambul provinces, and also, surprisingly, in the Ilmen' lake group in Chelyabinsk province, South Ural. He published these records, the description of the male, and the polymorphism of the females in a later paper (HARITONOV, 1988). The male is easily recognizable, having a dark dorsal synthorax, a peculiar pattern of black and blue on segment two of the abdomen (Figs 1-4), orange flanks of segments 3-6 (fig. 8), and segment 8 fully blue (Figs 7-8). Variability in the black coloration of the synthorax is shown in figures 5 (left side) and 6. In extreme dark males, the entire dorsum of the synthorax is black, save the back side of the flanges of the laminae which are live blue. At the other extreme, a blue antehumeral stripe extends to just over halfway the dorsum. Structurally, males have a characteristic pronotum and laminae mesostigmales (Figs 10-11), the latter with up-



Figs 1-4. *Ischnura aralensis* male, blue-black abdominal marking of segment 2 in dorsal and lateral views: (1, 3) average (dark grey) and maximal (light grey) extent of black; – (2, 4) minimum extent of black.



Figs 5-6. *Ischnura aralensis*, synthoracic markings: (5, left) a dark male (in extreme cases, all blue may disappear from the synthorax); – (5, right) an androchrome heteromorphic female with almost complete antehumerals; – (6) variation in the incomplete blue antehumerals of the males. – Note that the back of the mesostigmal flange is always live blue.

right caudal flanges. Their appendices superiores are provided with a strong, inwardly turned hook (Fig. 12). Females, by coloration and morphology (e.g. a strong vulvar spine, Fig. 14), are represented by three types:

(a) Homochromic homomorphs, identical to males in coloration (generally blue/black) and in morphology of the lamina mesostigmalis, which is unique by having two erected semicircular leaf-like flanges on its caudal rim.

(b) Homochromic heteromorphs, resembling males in coloration but lacking the mentioned peculiar lobes on the lamina mesostigmalis (Fig. 13). The difference of such females in coloration from males is confined to the black spots on abdominal segments 2 and 8 being very variable, from wide and extending throughout the tergite to missing. The black stripes on the pterothorax are also variable, but typically wider and more complete than in males (Fig. 5, right side). The holotype is of this form.

(c) Heterochromic heteromorphs, lacking the 'male' mesostigmal lobes and characterized by a strong reduction of black coloration, especially on the brown to bright orange pterothorax, where only a median black stria, split into a V-shape, occurs (Fig. 9). The pronotum is black with two egg-shaped orange spots, and all tibiae are orange as well. In extreme specimens, the thorax, legs and first two abdominal tergites miss all black colour completely. The general coloration is variable: beige, greyish, orange, but old females darken considerably, becoming almost black at an advanced age.

The existence of forms (b) and (c) is common among *Ischnura* species but the homomorphic females are unique in the palaearctic fauna, although they do occur rather commonly in North American species of the *damula*-group (WESTFALL & MAY, 1996). At Kyzyl-Orda, where the species is now probably extinct because of the salinisation that followed the drying out of the Aral lake, A. Haritonov observed the species in its natural environment and found that all three female types mate with the monomorphic males (unpublished). Later, Haritonov discovered that the species had been known to A.N. Bartenev, who gave it the manuscript name *Ischnura calicis*, but never published a description: in the Zoological Institute RAS (St Petersburg) he found a number of paper en-

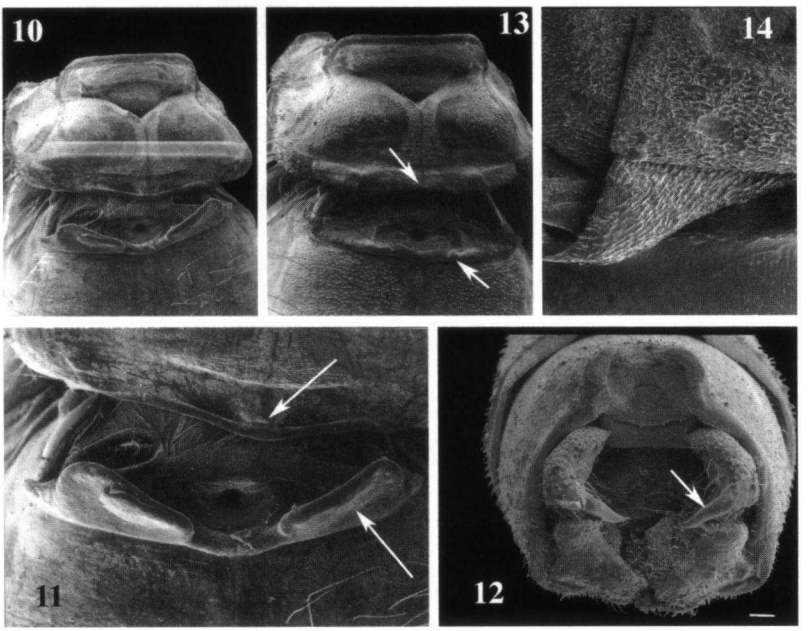
velopes labeled '*Isch. calicis*'. The collections were made in 1933-1936. The full Turkic toponyms in Bartenev's handwriting are unreadable, but the majority of envelops start with "Kyzyl-Orda region" or, less frequently, "Aral Sea" (in one case "Tashkent *** "). All animals in the envelopes were *I. aralensis*. According

Figs 7-9. *Ischnura aralensis*: (7-8) perched males at Karabalykty Lake; – (9) a heterochrome heteromorphic female in the orange phase. – Note the V-shape of the black marking on the dorsum of the synthorax.

to a count made by O. Kosterin (pers. comm.), there were 32 males, all with the peculiar flanges on the lamella mesostogmalis, 3 homomorphic homochromic females, 8 heteromorphic homochromic females, and 8 heteromorphic heterochromic females. It is clear that Bartenev was familar with the puzzling polymorphism of this species, and considered all these damselflies to be conspecific. *Ischnura calicis* was mentioned by A.N. POPOVA (1951) who adopted it from Bartenev's manuscripts, as a *nomen nudum*.

The publication by HARITONOV (1988), in Russian, attracted little attention of odonatologists. REINHARDT (1995) collected two orange-colored females of *I. aralensis* at Lake Balkhash in Kazakhstan that lead to a redescription of *I. aralensis* by DUMONT (1996), based on a male and a homomorphic homochromic female obtained from A. Haritonov. Later, having examined the holotype, DUMONT (1997) renamed *I. aralensis* sensu Dumont, 1996 into *I. haritonovi* Dumont, 1997, believing the females with and without the peculiar mesostigmal lobes did not belong to the same species. He thought that the males of 'true' *I. aralensis* were still to be found. However, this position is now known to be invalid, hence the synonymy cited above.

In 1996-1999 this species was found to inhabit the piedmont lakes of the Abzezil lake group (Lakes Karabalykty, Sabakty, Bol'shoe or North Ulyandy). In 1999,



Figs 10-14. *Ischnura aralensis*, sem: (10-11) male pronotum and lamina mesostigalis; – (12) male terminal appendages, posterior view; – (13) female (heteromorphic form) pronotum and lamina mesostigmalis; – (14) female ovipositor.

and again in 2004, it turned out to be abundant at Lake Karabalykty and other lakes in the same area. All males have the notorious flanges and are identical to those from Kazakhstan; among females, all three forms were present, but homomorphic females were rare.

The female polymorphism and structural peculiarities of both sexes are striking, and raise the question of the phylogenetic position of the species. In theory, a link with the North-American species group that also occasionally carries mesostigmal flanges would appear possible, but a molecular examination of the 18S rDNA gene (H.J. Dumont, unpublished) has revealed that *I. aralensis* clusters with the Irano-Turanian *I. fountaineae* and *I. evansi*, not with the *damula*-group sensu CHIPPINDALE et al., 1999. It is thus the result of local speciation in Central Asia, rather than a relict of a former cross-Beringian connection.

Aeshna cyanea (Müller, 1764)

Our data confirm BAYANOV's (1974) record of *A. cyanea* in wooded mountainous areas. Common but not abundant on river oxbows and other semi-lotic and small lentic water bodies in the montane forest. Not on large lakes and foothills.

Anax imperator Leach, 1815

Our data also confirm BAYANOV's (1974) record of *A. imperator* in wooded mountainous areas. A few specimens were observed and collected in 2004 on lakes and ponds in the montane forest zone.

Libellula depressa Linnaeus, 1758

Reported as a common species for the South Ural by BOEV et al. (1989) and mentioned by ZEI-NECHAEVA & BAYANOV (1975). Our studies confirm that it is rather common in montane forest as well as in the foothills. In the Bashkirskii Nature Reserve it occurs on oxbows and pools of various origin. It was not recorded on the lakes of the Abzelil and Uchaly groups, while at Lake Il'menskoe it was one of the most abundant species in late June 1998. This species is among the earliest fliers.

ZOOGEOGRAPHICAL ANALYSIS

The odonate fauna of South Ural is allochtonous and can be subdivided into two groups, according to the current main range of its species: western (European and Mediterranean; 23 spp., 40% of the total) and eastern (Siberian and Mesasiatic; 17 spp., 29% of the total). Eighteen species are of uncertain origin.

Zoogeographical analyses can be of two kinds: static or dynamic. In a static analysis, faunal assemblages are related to present-day climatic zones and environments. In a dynamic analysis, past environmental changes are counted in to

explain, in particular, disjunct distribution patterns. According to the static system of BELYSHEV (1974) and BELYSHEV & HARITONOV (1981), the Ural belongs to the Euro-Siberian sub-area of the Holarctic. Belyshev divided this Euro-Siberian sub-area into a Forest Province and a Forest-Steppe Province. According to HARITONOV (1975), the Forest Province is characterized by a poor specific structure, a wide distribution of the constituent species, and a faunal enrichment in its southern part. He emphasized that in the southern (taiga) zone of this Province, some European elements occur which are missing in the northern part. Belyshev's Forest-Steppe Province, on the contrary, is rich in species but their distribution is very uneven in its different parts. From a geographical point of view, the Forest-Steppe Province was further subdivided into four sub-provinces: the East European, South-Uralian, West Siberian and Kuznetsk-Altaian. It is of interest to test whether this subdivision is supported by odonate distribution.

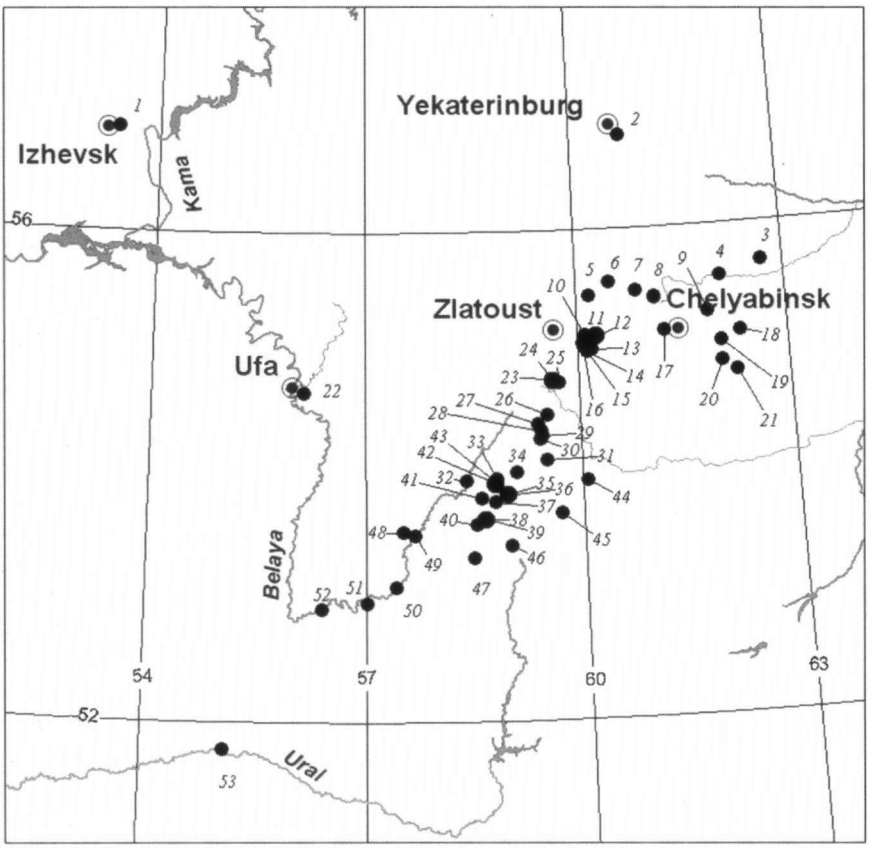


Fig. 15. Dragonfly collecting sites in South Ural

To date, the East European sub-province of the Forest-Steppe Province had been largely deprived of the attention of odonatologists: we used the faunistic compilation in BELYSHEV et al. (1989) and the few works on the dragonflies of central Russia by ULYANIN (1869), KOLESOV (1949), LEVI (1968); TARANOVA (1980) and DYUZHAEVA & LYUBVINA (1995). According to these, the local odonate fauna includes 51 species. We draw the eastern border of the East European sub-province at the western foothills of South Ural, along the line Elabuga-Samara-Orenburg. At this boundary four species, *Sympetrum meridionale, S. striolatum, S. depressiusculum,* and *Orthetrum brunneum*, find their eastern range limit, but all of them extend further East in more southern latitudes.

The territory of the South Ural, with at least 59 species of dragonflies, has a high species richness. Earlier, HARITONOV (1975) had suggested to isolate this territory as a zoogeographical subprovince, to be further subdivided into districts. We isolated three, based on the geographical and ecological differences between the western and eastern foothills and the mountainous part. Probably, the eastern border of the Western Foothill District provides the eastern limit (at these latitudes) for such western species as *Sympecma fusca, Pyrrhosoma nymphula, Cordulegaster boltonii, Libellula fulva* and, to the best of our present knowledge, the western limit of *Somatochlora graeseri.* The Montane Forest District, with a self-explanatory name, occupies the most elevated part of South Ural. So far, within its limits, only three species were found: *Ischnura pumilio, Anax parthenope* and *Somatochlora graeseri.* In 1975, HARITONOV (1975) delineated the Foothill (Chelyabinsk) District. Here, we call it the Eastern Foothill Forest-Steppe District and somewhat change its southwestern border by shifting it to the Bol'shoi Kizil River basin. This district harbours *Ischnura aralensis*, of which more later, whereas its western border provides the eastern limit at these latitudes for *Anax parthenope, Aeshna cyanea, Onychogomphus forcipatus, Libellula depressa,* and the western limit for *Coenagrion ecornutum.*

It is evident that the dragonfly species richness increases as one approaches the mountains. This confirms BARTENEV's (1909) opinion, that the territory of South Ural, and of the Ural as a whole, attracts as well western as eastern dragonfly species, while at the same time, setting a natural limit to the range of many of them. This high species richness can be explained by the great landscape diversity of the mountains as compared with the plains. The foothill forest-steppe and mountain forest parts, until present not so much affected by human activity, may "accumulate" dragonfly species and serve as a refugium. From a dynamic point of view, it can also be supposed that the moderately elevated and subdivided Uralian territories could retain landscapes and microclimates, providing favorable conditions during coolings and inundations of the Pleistocene, that is, could act as a Pleistocene refugium. Both circumstances led to the fact that the odonate fauna of the South Ural possesses a good share (14.8%) of true Mediterranean species.

Fig. 16. Known occurrences of colonies of *Ischnura aralensis* (populations of sites 8-10 on the Amu and Syr Darja Rivers now probably extinct).

Ischnura aralensis, is a very interesting case that merits to be discussed separately: its range (Fig. 16), mainly mesasiatic but extending into the far East of Europe, is to be understood in the framework of the Caspian basin sensu lato, of which the Aral lake is a constituent. Throughout history, the Caspian level has fluctuated greatly, responding to alternations of wetter and drier periods. At high levels, the Caspian and Aral lakes expanded greatly, and merged. At such occasions, central Asia became much wetter and less saline, and dragonflies could disperse freely, even expanding east of the Caspian basin into the Irtysh and Balkash (Ily) areas. Today is a period of relative drought, which followed upon a relatively wet phase (the Lavlakansky pluvial period, 9000-3000 BP, during which the Aral lake greatly expanded and evacuated excess water to the Caspian via the Uzboy channel in its eastern part, for details, see BOOMER et al., 2000). During that period, species like *I. aralensis* were greatly favoured, and when a drought set in around 1,600-450 BP, its populations contracted, but its range remained large, colonies surviving in isolation in many suitable places of central and western Asia, and adjacent eastern Europe, including South Ural. Exactly how far *I. aralensis* might still extend into the Volga basin today is currently unknown, the dragonflies of the lower Volga catchment still being little studied.

ACKNOWLEDGEMENTS

The July 2004 expedition was made possible by NATO collaborative linkage grant 979506 to HJD and AYH. The authors thank Mr J. VERMEIR for his help in the field during the 2004 expedition, and particularly for his photographs (Figs 6 and 7) of *Ischnura aralensis*.

REFERENCES

ALEKSEEV, D.S., 1987. Fauna strekoz Srednego Urala [Dragonfly fauna of Middle Ural]. *Fauna i ekologiya nasekomykh Urala*, Sverdlovsk, pp. 26-32. – [Russ.]

ALEKSEEV, D.S., 1989. Strekozy goroda Sverdlovska [The dragonflies of Sverdlovsk city]. *In*: N.V. Nikolaeva, [Ed.], *Nasekomye v biogeocenozakh Urala*, Akad. Nauk, Sverdlovsk pp. 3-4. – [Russ.]

BARTENEV, A.N., 1908. Kollektstiya strekoz iz okrestnostei oz. Uvil'dy Ekaterinburgskogo uezda Permskoi gubernii [A collection of dragonflies from the environs of Uvilda Lake, Ekaterinburg district, Perm province]. *Trudy Obshch, Estest. imp. kazan. Univ.* 41(1): 1-40. – [Russ.]

BARTENEF, A.N., 1930. Noch einmal über die Artengruppe Aeschna juncea (Odonata, Aeschninae) in der Palaearktik. *Zool. Anz.* 89: 229-245.

BAYANOV, M.G., 1974. Strekozy Bashkirii kak promezhutochnye khozyaeva gel'mintov [Dragonflies of Bashkiria as intermediate hosts of helmints]. *Gel'minty zhivotnykh, cheloveka i rastenii na Yuzhnom Urale*, Ufa, 1: 77-86. – [Russ.]

BELYSHEV, B.F., 1973. The dragonflies (Odonata) of Siberia. Vol. 1, pts 1, 2. Nauka, Novosibirsk. – [Russ.]

BELYSHEV, B.F., 1974. The dragonflies (Odonata) of Siberia. Vol. 2, pt 3. Nauka, Novosibirsk. – [Russ.]

BELYSHEV, B.F. & A.Yu. HARITONOV, 1981. Geografiya strekoz (Odonata) Boreal'nogo faunisticheskogo tsarstva [Geography of dragonflies (Odonata) of the Boreal Faunistic Kingdom], Nauka, Novosibirsk. – [Russ.]

BELYSHEV, B.F. et al., 1989. *Fauna i ekologiya strekoz.* [*Fauna and ecology of dragonflies*]. Nauka, Novosibirsk. – [Russ.]

BOOMER, I., N. ALADIN, I. PLOTNIKOV & R. WHATLEY, 2000. The palaeolimnology of the Aral Sea: a review. *Quarter. Sci. Rev.* 19: 1259-1278.

CHIPPINDALE, P.T., V.K. DAVE, D.H. WHITMORE & J.V. ROBINSON, 1999. Phylogenetic relationships of North American damselflies of the genus Ischnura (Odonata: Zygoptera: Coenagrionidae) based on sequences of three mitochondrial genes. *Mol. Phylog. Evol.* 11: 110-121.

GERASIMOV, I.P., [Ed.], 1968. *Ural i Priural'e*. Nauka, Moscow. (South Ural pp. 338-344). – [Russ.]

DUMONT, H.J., 1996. On the nature of Ischnura aralensis Haritonov, 1979 (Zygoptera: Coenagrionidae). *Odonatologica* 25: 179-182.

DUMONT, H.J., 1997. Ischnura aralensis revisited: I. haritonovi nom. nov. pro I. aralensis sensu Dumont, 1996 (Zygoptera: Coenagrionidae). *Odonatologica* 26: 71-73.

DYUZHAEVA, I.V. & I.V. LYUBVINA, 1996. Dopolneniya k faune strekoz (Odonata) Zhigulevskogo zapovednika [Additions to the dragonfly fauna of the Zhigulevskii Nature Reserve]. *Samarskaya Luka Byull.* 6: 11-12. – [Russ.]

HARITONOV, A.Yu., 1972. Rasprostranenie strekoz na territorii Chelyabinskoi oblasti [Dragonfly distribution on the territory of Chelyabinsk district]. *Tezisi Dokl. nauchno-kraeved. Konf. geogr. Obshch. USSR, Chelyabinsk*, pp. 51-52. – [Russ.]

HARITONOV, A.Yu., 1974. Zayeniseiskie strekozy na Polyarnom Urale [Trans Yenisei dragonflies in the Polar Ural]. *In*: A. Cherepanov, [Ed.], *Voprosy entomologii Sibiri*, pp. 68-69, Nauka, Novosibirsk. – [Russ.]

HARITONOV, A.Yu., 1975a. *Strekozy Urala i Zaural'ya (fauna, ekologiya, zoogeografiya)*. [*Dragonflies of Ural and Transuralia (fauna, ecology, zoogeography)*]. Diss. Kand. Biol. Nauk, Akad. Nauk SSSR, Novosibirsk. – [Russ.]

HARITONOV, A.Yu., 1975b. Strekozy Il'menskogo zapovednika [Dragonflies of Il'menskii Nature Reserve]. *Vopr. Zool.* 1975(2): 63-65. – [Russ.]

HARITONOV, A.Yu., 1976. Fauna strekoz (Insecta, Odonata) Urala i vostochnogo Priural'ya [Dragonfly fauna of Ural and eastern Priural]. *Fauna Sibiri* 18: 157-161. – [Russ.]

HARITONOV, A.Yu., 1978. Zoogeographicheskoe raionirovanie vostochnogo Priural'ya na osnovanii rasprostraneniya strekoz [Zoogeographic division of eastern Priural based on dragonfly distribution]. *Fauna Sibiri* 34: 47-54. – [Russ.]

HARITONOV, A.Yu., 1979. New species of dragonfly of the genus Ischnura Charp. (Odonata, Coenagrionidae) from southern Kazakhstan. *New Species of Insects*, pp. 5-7, Nauka, Leningrad. – [Russ.]

HARITONOV, A.Yu., 1988. Strekozy roda Ischnura Charp. (Insecta, Odonata) fauny SSSR [Dragonflies of the genus Ischnura Charp. (Insecta, Odonata) of the USSR fauna]. *Taxon. Zhivot. Sibiri*. 20: 32-46. – [Russ.]

HARITONOV, A.Yu., 1989. Redkie i okhranyarmye strekozy Urala [Rare and protected dragonflies of the Ural]. *In*: I.V. Nikolaeva, [Ed.], *Nasekomye v biogeocenozakh Urala*, pp. 71-72, SSSR Akad. Nauk, Sverdlovsk. – [Russ.]

HARITONOV, A.Yu., 1997. Strekozy Urala [Dragonflies of the Ural]. *Uspekhi entomologii na Urale*, pp. 39-42, Russ. Acad. Sci., Ekaterinburg. – [Russ.]

KOLESOV, V.G., 1930. Ekologiya Odonata Moskovskoi gubernii [Ecology of Odonata in Moscow province]. *Zap. biol. Sta. Bol'shevo* 4: 59-129. – [Russ.]

KOLOSOV, Yu.M., 1927. Zametki o strekozakh Chelyabinskogo okruga [Notes on dragonflies of Chelyabinsk district]. *Sb. Mater. Izuch. chelyabinsk. Okr.* 1: 7-13. – [Russ.]

LEVI, E.K., 1968. [To the dragonfly fauna of Kirov region]. *Latv. Ent.* 12: 77-84. – [Russ.]

OKOROKOV V.I. & A.YU. HARITONOV, 1971. Fauna i biologiya strekoz na Yuzhnom Urale i ih rol' kak promezhutochnykh khozyaev gel'mintov [Fauna and biology of dragonflies on South Ural and their role as intermediate hosts of helmints]. *Vopr. Zool.* 1971(2): 32-40. – [Russ.]

POPOVA, A.N., 1951. Strekozy (Odonata) Tadzhikistana [Dragonflies (Odonata) of Tadzhikistan]. *Trudy zool. Inst. Akad. Nauk SSSR* 9: 861-894. – [Russ.]

REINHARDT, K., 1995. Dragonfly records from Lake Balkhash, Kazakhstan. *Notul. odonatol.* 4: 82-85.

TARANOVA, V.M., 1980. Sezonnoe razvitie fauny strekoz (Odonata) pribrezhya Rybinskogo vodokhranilishcha i prilegayushchikh k nemu vodoemov [Seasonal development of the dragonfly fauna of the coastal area of the Rybinsk Water Reserve and adjacent water bodies]. *Trudy Inst. Biol. vnutr. Vod* 41(44): 145-154. – [Russ.]

ULYANIN, V., 1869. Materialy dlya entomologii gubernii Moskovskogo uchebnogo okruga, 2: Spisok setychatokrylykh and pryamokrylykh nasekomykh. [On entomology of the provinces of the Moscow Tutorial District, 2: List of neuropteran and orthopteran insects.]. *Izv. imp. Obshch. Lyub. Estest. Antrop. Etnogr. imp. mosk. Univ.* 6: 120 pp. – [Russ.]

VORONTSTOVSKII, P., 1909. Materialy k faune strekoz okrestnostei g. Orenburga [Data on the dragonfly fauna of the Orenburg city area]. *Izv. orenburg. Otd. imp. russ. geogr. Obshch.* 21: 113-120. – [Russ.]

WESTFALL, M.J. & M.L. MAY, 1996. *Damselflies of North America*. Scient. Publishers, Gainesville-Washington-Hamburg-Lima-Taipei-Tokyo.

YANYBAEVA, V.A., 1997. Strekozy Bashkirskogo gosudarstvennogo zapovednika [Dragonflies of the Bashkirian State Reserve]. *Itogi nauch. Issled. biol. Fak. bashkir. Gosuniv.* 1996, pp. 42-43. – [Russ.]

YANYBAEVA, V.A., 1997. Fauna strekoz Bashkirskogo zapovednika i nekotorye voprosy ikh biologii [Dragonfly fauna of Bashkirian State Reserve and some questions of its biology]. *Nauch. Issled. Zapoved. nac. Park. Rossii* 1992/1993: 41 pp. – [Russ.]

YANYBAEVA, V.A., 1999a. K kharakteristike odonatofauny Bashkirskogo zapovednika [Characteristics of the odonate fauna of the Bashkirian State Reserve]. *Izuch. Prir. Zapoved. Bashkortostana* 1: 200-203. – [Russ., with Engl. s.]

YANYBAEVA, V.A., 1999b. O novykh nakhodkakh strekoz Yuzhnogo Urala [New data on dragonflies of South Ural]. *Fauna i flora Respubliki Bashkortostan*, Ufa, pp. 65-69. – [Russ.]

YANYBAEVA, V.A., 2001. Strekozy Bashkirskogo zapovednika [Dragonflies of the Bashkirian State Reserve]. *Sb. nauch. Trudov bashkir. Zapoved.* 2001: 83-93. – [Russ.]

YANYBAEVA, V.A. & M.M. YANYBAEV, 2001. Fauna i ekologiya strekoz Bashkirskogo zapovednika i sopredel'nykh territorii [Fauna and ecology of dragonflies of the Bashkirian state reserve and neighbouring territories]. *Nauch. Issled. Zapoved. nac. Park. Rossii* 2(2): 18-20. [Russ.]

ZAKHAROV, V.D. & N.M. SAMOILOVA, 1994. Ornitofauna Il'menskogo zapovednika i ornitogeograficheskoe raionirovanie Yuzhnogo Urala [Ornithofauna of the Il'menskii Nature Reserve and ornithogeographical subdivision of the South Ural]. *Ekologicheskie issledovaniya v Il'menskom gosudarstvennom zapovednike*, Miass, pp. 83-89. – [Russ.]

ZEI-NECHAEVA, A.N. & M.G. BAYANOV, 1975. Odonatofauna Bashkirii [The odonate fauna of Bashkiria]. *Uchen. Zap. bashkir. Gosuniv.* (Biol.) 76(9): 63-69. – [Russ.]