

NEW DATA TO DISTRIBUTION OF FERNS IN TAJIKISTAN (MIDDLE ASIA)

ARKADIUSZ NOWAK¹, MARCIN NOBIS², SYLWIA NOWAK³, AGNIESZKA NOBIS²

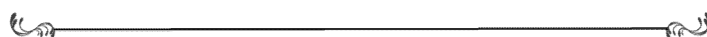
¹Center for Biodiversity Studies, Department of Biosystematics, Opole University, Oleska 48, PL-45-022 Opole; anowak@uni.opole.pl

²Institute of Botany, Jagiellonian University, Kopernika 27, PL-31-501 Kraków; m.nobis@uj.edu.pl

³Laboratory of Geobotany and Plant Conservation, Department of Biosystematics, Opole University, Oleska 48, PL-45-022 Opole; anowak@uni.opole.pl

ABSTRACT: The paper presents new chorological data of eleven fern species (*Ophioglossum bucharicum*, *Azolla filiculoides*, *Botrychium lunaria*, *Gymnocarpium robertianum*, *Cryptogramma stelleri*, *Polystichum aculeatum*, *Asplenium trichomanes*, *Asplenium viride*, *Asplenium ruta-muraria*, *Adiantum capillus-veneris* and *Salvinia natans*) in central Pamir Alai Mts in Tajikistan. Except *Azolla filiculoides* all of them are native to the flora of Tajikistan. The dry and warm climate in lowlands and middle mountains as well as harsh conditions in higher elevation of Pamir are not suitable for Pteridophytes. Thus, many of fern species are rare in Tajikistan, having less than five locations. List of localities of the species in the territory of Tajikistan with distribution map of chosen species is presented.

KEY WORDS: Pamir Alai Mts, biodiversity, chorology, Pteridophytes, new records



Introduction

Tajikistan is a typical mountainous country. Located in the central part of the Pamir Alai and southern Tian-Shan mountain systems. Its vascular plant flora is relatively species-rich, including around 4550 taxa (Nowak et al. 2011). Results of recent studies have shown that this number is not final, as some taxa new to the Tajik flora have been reported (e.g. Nobis et al. 2010, 2011; Nobis 2011a,b, 2013, 2014; Nobis and Nowak 2011a,b; Nobis et al. 2013; Nobis et al. 2014a,b; Ukrainskaja et al. 2013). Approximately 30% of vascular plants species known from Tajikistan are generally accepted as endemics (Nowak et al. 2011). It is worth mentioning that Pamir Alai, belongs to the Central Asian mountain system recognised by Conservation International as one of thirty-four biodiversity hotspots (Mittermeier et al. 2006) and as one of the eleven most important focal point of future plant diversity studies and conservation (Giam et al. 2010). At the same time, with very nearly the lowest adaptive capacity to climate instability, Tajikistan is regarded as one of the most sensitive country to climate change in the world (Fay and Patel 2008), and the high risk of climate change is one of the most critical factors in the degradation of its vegetation (Baettig et al. 2007). Although recently several papers concerning Tajik vegetation have been published (Nowak A. and Nobis 2012, 2013; Nowak A. et al. 2014; Nowak S. et al. 2013 a,b,c, 2014; Nobis et al. 2013), comprehensive research on its vegetation cover is necessary.

Alpine rock communities are considered as most unique and interesting plant formations in the mountainous areas of Holarctic and the Mediterranean provinces. Despite not being species-rich, they have drawn attention of botanists because they often consist of numerous specialists adapted to harsh and extreme environments (Favarger, 1972; Médail and Verlaque 1997;

Agakhanjanz and Breckle 2002). Rocky habitats in Central Asia are a refuge for several ferns, nevertheless, the harsh and xeric conditions of continental and alpine climate is not very suitable for these species. The pteridophytes most frequent in rock crevices and fissures in central Pamir Alai and southern Tian-Shan Mts include among others *Cystopteris fragilis*, *Adiantum capillus-veneris*, *Cryptogramma stelleri*, *Asplenium viride* and *A. ruta-muraria*. It is also worth to notice that majority of Tajik's pteridophytes despite they are regarded as common (eg. *Cystopteris fragilis*, *Ceterach officinarum*, *Cheilanthes persica*), has not been reported from any locations in last years.

Because there were no studies on the chorology and distribution patterns of ferns in Tajikistan for more than 30 years, we conduct a floristic survey to update the current knowledge regarding the most interesting species in this group. In the paper a new data to distribution of eleven rare species in the flora of the country have been presented. Almost all of them are native, the only exception is *Azolla filiculoides* which is an alien taxon recently spreading in this part of Middle Asia.

Methods

Research have been conducted in all geobotanical regions of Tajikistan since 2007. The distribution of selected species in Tajikistan is presented on Figure 1 and 2.

The specimens of below listed taxa, are deposited in herbariums of KRA and OPUN.

List of taxa

Ophioglossum bucharicum O. A. & B. Fedtsch. (Ophioglossaceae)

SYNONYMS: *O. vulgatum* L. var. *bucharicum* O. A. & B. Fedtsch.; *Ophioglossum thermale* Komarov var. *bucharicum* (O. Fedtsch. & B. Fedtsch.) H.P. Fuchs.

GENERAL DISTRIBUTION: Tajikistan, Uzbekistan, Turkmenistan (Vvedenskii and Puchkova 1968; Nikitin and Geldikhanov 1988; Kamelin and Ryabkova 1988).

OCCURRENCE IN TAJIKISTAN: *Ophioglossum bucharicum* was noted from three localities in Tajikistan: Myten-Tugai, Khaty-Rabat and Sardaimiena river (Maslennikova 1957; Kamelin and Ryabkova 1988).

NOTE: During revision of the herbarium materials in TAD, we find also a herbarium

sheet with specimens of *O. bucharicum* collected in Hissar Mts. A specimens collected in Kevron [Kivron] in 1947 by Zapryagaeva (Maslennikova 1957) as well as reported by Nowak et al. (2011), belongs to *Ophioglossum vulgatum* (Nobis et al. in prep.).

List of localities:

Hissar-Darvasian region: southern slope of Hissar Mts, Romit reserve, Sardai-Miena riverbank, alt. 1200 m, 15 Jun 1960, *Anulshina* (TAD 92758).

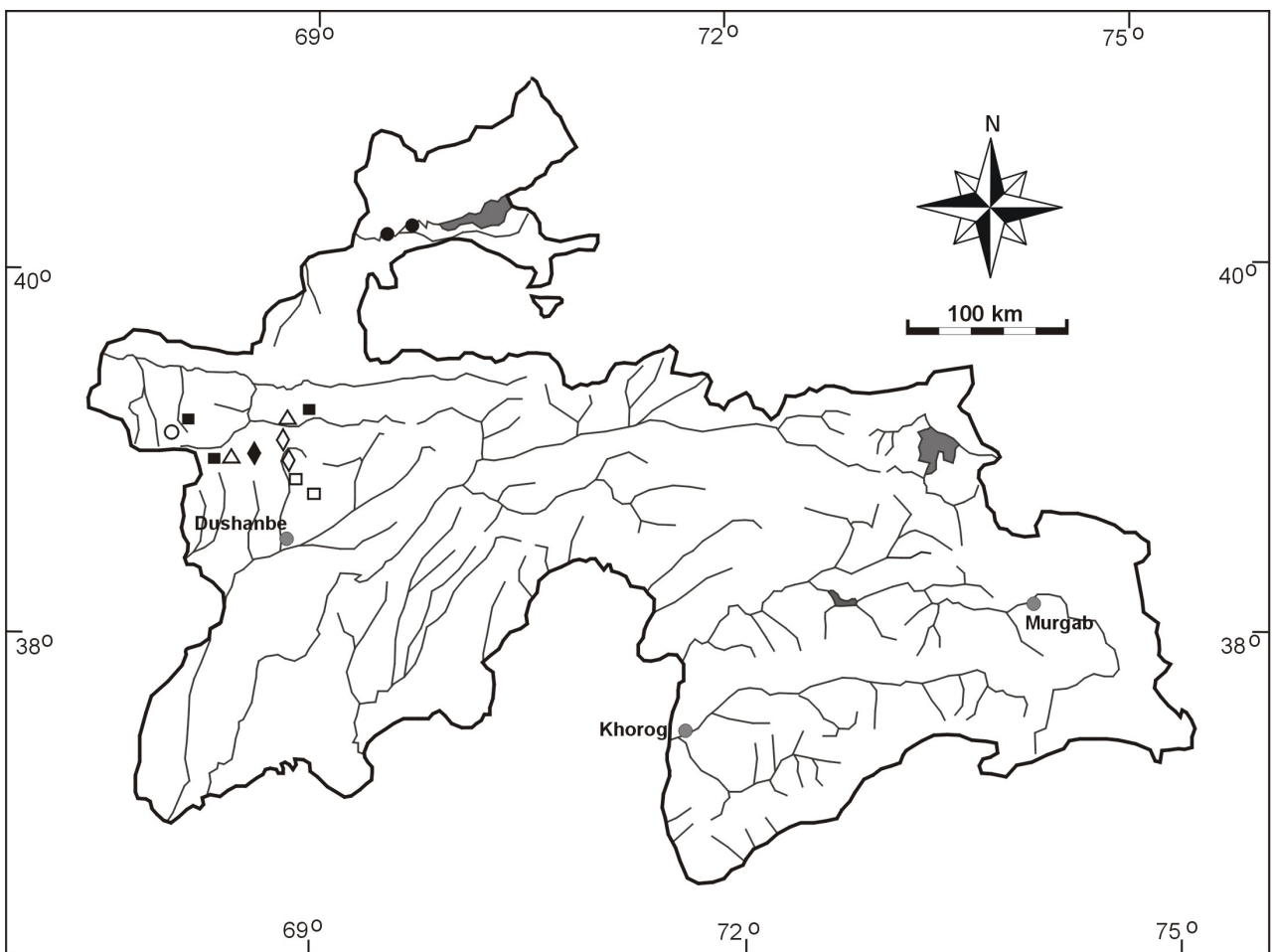


Fig. 1. Distribution map of fern locations in Tajikistan: ● – *Azolla filiculoides*; ○ – *Botrychium lunaria*; Δ - *Gymnocarpium robertianum*; ■ – *Cryptogramma stelleri*; □ – *Polystichum aculeatum*; ◇ - *Asplenium trichomanes*; ◆ - *Asplenium viride*.

***Azolla filiculoides* Lamarck (Azollaceae)**

GENERAL DISTRIBUTION: *Azolla filiculoides* is nowadays cosmopolitan species occurring in South Africa, Asia, Australia, Europe and South-, Central- and North America.

OCCURRENCE IN TAJIKISTAN: *Azolla filiculoides* is an alien species in the flora of Tajikistan known from one location in Syrdaria river valley near Khujand (Nobis and Nowak 2011a; Nobis et al. 2011).

NOTE: *Azolla filiculoides* grows in Middle Asia in great number in anthropogenic habitats, mainly rice paddles in river valleys. It

overgrows water surface inhibiting the development of native aquatic species occurring in rivers and ox-bow lakes.

List of new localities:

Prisyrdarian region: to the east from Qushtegirmon, in the ditch in rice paddles area; alt. 319 m, N 40°12'45.4"/E 69°25'55.1", 13 Aug 2011, A. Nowak & S. Nowak;

Prisyrdarian region: to the north from Proletarsk, in the rice paddles, alt. 316 m, N 40°13'37.1"/E 69°30'24.2", 07 Sep 2011, A. Nowak & S. Nowak.

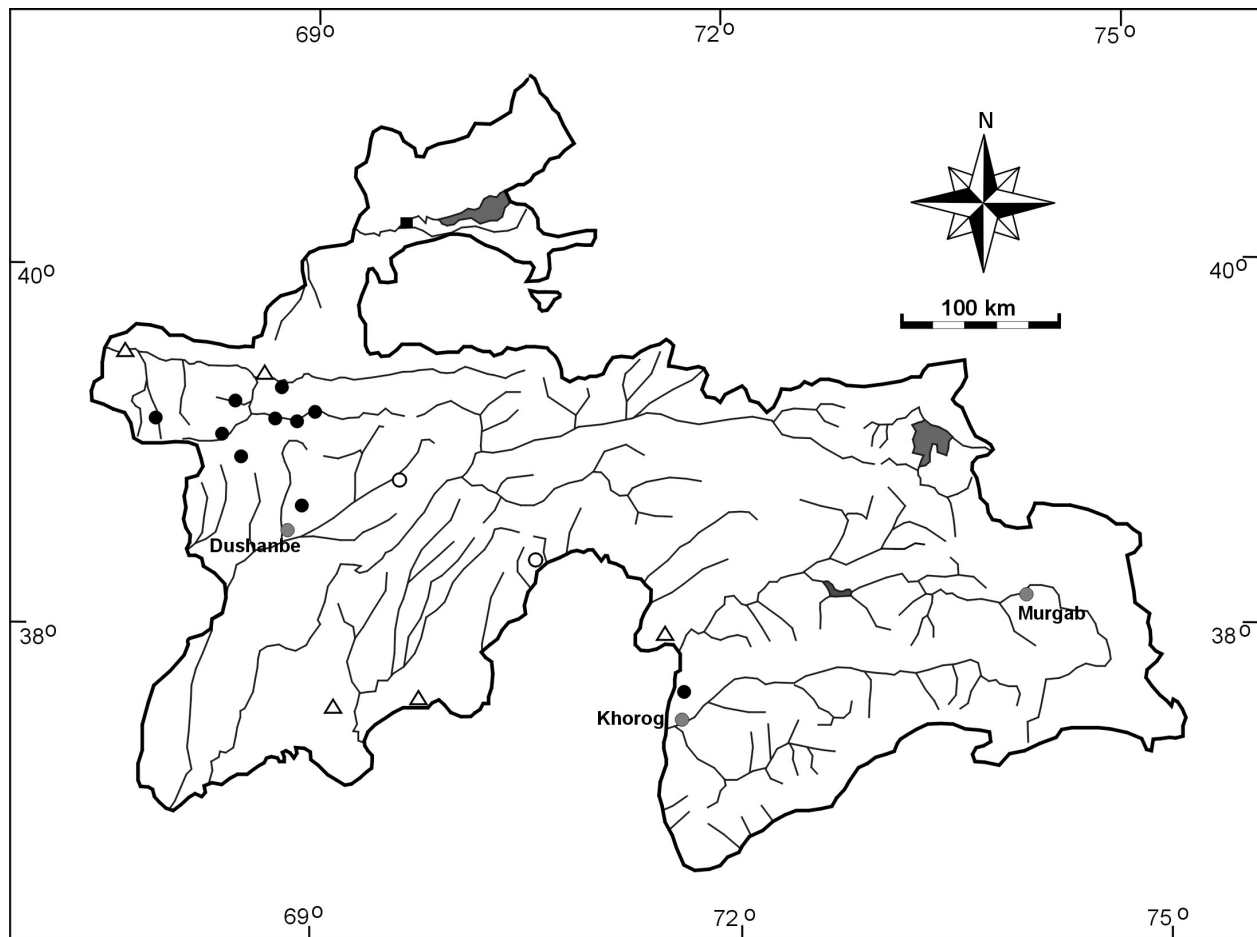


Fig. 2. Distribution of the encountered localities of selected rare pteridophytes in Tajikistan: ● – *Asplenium ruta-muraria*; Δ – *Adiantum capillus-veneris*; ■ – *Salvinia natans*; ○ – *Ophioglossum bucharicum*;

***Botrychium lunaria* (L.) Sw.
(Ophioglossaceae)**

SYNONYMS: *Ophioglossum pennatum* Lam.

GENERAL DISTRIBUTION: *Botrychium lunaria* is a cosmopolite species known from Europe, Asia, North America, South America, Australasia.

OCCURRENCE IN TAJIKISTAN: *Botrychium lunaria* was noted very sporadically in Tajikistan (Maslennikova 1957). It was reported mainly from northwestern part of the country from Turkestan and Zeravshan Mts.

List of new localities:

Zeravshanian region: Zeravshan Mts, near Allowdin Lakes, alpine swards on northern slopes of the Pastrud-Daria valley, alt. 2872 m, N 39°14'30.3"/E 68°16'05.7", 8 Jul 2007, *A. Nowak & M. Nobis*; Zeravshan Mts, Kashkuital-Zambar valley (tributary of Karakul river), wet meadow, alt. 2850 m, N 39°00'40.3"/E 68°15'19.7", 17 Jun 2008, *M. Nobis, M. Kozak, A. Nowak*.

***Gymnocarpium robertianum* (Hoffm.)
Newman (Woodsiaceae)**

SYNONYMS: *Gymnocarpium fedtschenkoanum* Pojark., *Dryopteris robertiana* (Hoffm.) C. Chr., *Phegopteris robertiana* (Hoffm.) A. Braun.

GENERAL DISTRIBUTION: Europe, circumpolar areas in Asia and North America, Siberia, Himalayas.

OCCURRENCE IN TAJIKISTAN: the species is known from several localities in the country, mainly from Zeravshan, Hissar and Pamir Mts (Nikitin and Sidorenko 1957; Kamelin 1971; Ikonnikov 1979).

List of new localities:

Zeravshan region: Jagnob gorge near Margeb, alt. 2226 m, N 39°11'43.5"/E 68°54'25.2", 24 Jun.2011, *M. Nobis & A. Nowak*; Hissar-Darvasian range, north slopes of rocks in Maychura valley; alt. 2090 m, N 39°02'32.8"/E 68°44'17.8", 8 Aug 2013, *A. Nowak*.

***Cryptogramma stelleri* (S.G. Gmel.) Prantl.
(Adiantaceae)**

GENERAL DISTRIBUTION: Arctic and subarctic Asia, North America.

OCCURRENCE IN TAJIKISTAN: *Cryptogramma stelleri* was known from few locations in western Pamir Mts, from Vamar-Dara River Valley, Yazgulemski Range and Sangovdara river (Ryabkova 1963; Ikonnikov 1979; Kamelin and Ryabkova 1988).

Note: *Cryptogramma stelleri* is one of the rarest pteridophytes in Middle Asia. To date known only from Pamir Mts. During field studies we find three new localities of the species, occurring on wet rocks close to waterfalls.

List of new localities:

Zeravshanian region: Upper section of Pastrud-Daria River valley behind the Allowdin Lakes, on wet rock, near waterfall, slope E, alt. 3285 m, N 39°12'55.6"/E 68°14'34.9", 14 Aug 2012, *A. Nowak*; Jagnob gorge near Margeb, western exposition, wet rocks near waterfall, alt. 2221 m, N 39°12'18.6"/E 68°54'36.7", 29 May 2011, *A. Nowak & M. Nobis*; on wet rocks in Maychura River valley, northern slope, alt. 2594 m, N 39°01'59.9"/E 68°43'56.7", 12 Aug. 2013, *A. Nowak*.

***Polystichum aculeatum* (L.) Roth.
(Dryopteridaceae)**

SYNONYMS: *Polystichum lobatum* (Hudson) Bast, *Dryopteris lobata* (Hudson) Schinz & Thell.

GENERAL DISTRIBUTION: Europe, Asia, North Africa.

OCCURRENCE IN TAJIKISTAN: This is a rare species in the flora of Tajikistan, known mainly from the Hissar Mts (Nikitin and Sidorenko 1957; Kamelin 1971)

List of new localities:

Hissar-Darvasian region: Near Varmanik, alt. 1702 m, N 38°50'03.5"/E 68°55'45.7", 3 Okt

2006, *A. Nowak*; to the north from Tushark; alt. 1856 m, N 38°56'57.8"/E 68°48'27.4", 18 Aug 2013, *A. Nowak*.

***Asplenium trichomanes* L. (Aspleniaceae)**

GENERAL DISTRIBUTION: Worldwide distributed species.

OCCURRENCE IN TAJIKISTAN: This is rare species in the flora of Tajikistan, known from several localities in Hissar Mts (Maslennikova 1957; Kamelin 1971)

List of new localities:

Hissar-Darvasian region: Hissar range, lower section of Maychura valley, exposition NE, slope 85°, alt. 1958 m, N 39°01'50.1"/E 68°46'46.2", 8 Aug 2013, *A. Nowak*; to the north from Tushark, alt. 1856 m, N 38°56'57.8"/E 68°48'27.4", 18 Aug 2013, *A. Nowak*.

***Asplenium viride* Huds. (Aspleniaceae)**

SYNONYMS: *Asplenium intermedium* C.B. Presl

GENERAL DISTRIBUTION: Eurasia, boreal zone, Alps, Caucasus, Asia Minor, Himalayas, Central Asia.

OCCURRENCE IN TAJIKISTAN: *Asplenium viride* was known from few locations in western Tajikistan, mainly from Zeravshan and Hissar Mts (Maslennikova 1957; Kamelin 1971).

List of new localities:

Hissar-Darvasian range, north slopes of rocks in Maychura valley; alt. 2446 m, N 39°02'10.9"/E 68°44'01.9", 8 Aug 2013, *A. Nowak*.

***Asplenium ruta-muraria* L. (Aspleniaceae)**

GENERAL DISTRIBUTION: Europe, North America, Siberia, Central Asia, North Africa, Asia Minor, Afghanistan, Himalayas, Japan.

OCCURRENCE IN TAJIKISTAN: Although *Asplenium ruta-muraria* is regarded as one of the most frequent pteridophytes in Tajikistan, its localities, known from literature are not

numerous (e.g. Maslennikova 1957, Zakirov 1963, Ikonnikov 1979). That is why, we decided to present a list of newly found sites of that species.

List of new localities:

Zeravshanian region: Zeravshan Mts: Pastrud-daria River valley, boulders on the left side of the valley near Iskander-kul Lake, alt. 2194 m, N 39°04'59.4"/E 68°23'05.1", 5 Jul 2011, *A. Nowak* & *M. Nobis*; Poymazor village, alt. 2893 m, N 39°18'51.8"/E 68°26'26.7", 25 Jun 2011, *A. Nowak* & *M. Nobis*; Jagnob river gorge near Margeb, alt. 2226 m, N 39°11'43.5"/E 68°54'25.2", 1.24 Jun 2011, *M. Nobis* & *A. Nowak*; to the east from Anzob village, alt. 2135 m, N 39°10'28.8"/E 68°47'14.6", 9 Jun 2012, *A. Nowak* & *M. Nobis*; Takfon village; alt. 1825 m, N 39°11'38.2"/E 68°47'14.6", 9 Jun 2012, *A. Nowak* & *M. Nobis*; Seventh Lake in 7-Lake Valley, marble rocks, northern exposition, alt. 2425 m, N 39°06'54.1"/E 67°51'12.6", 12 Jun 2012, *A. Nowak* & *M. Nobis*; near Tamin village, slope S, alt. 1985 m, N 39°22'07.6"/E 68°38'27.9", 13 Jun 2011, *A. Nowak* & *M. Nobis*; Hissar-Darvasian region: near Maychura village, northern exposition, alt. 2115 m, N 39°02'32.8"/E 68°44'18.8", 18 Aug 2013, *A. Nowak*; near Harangon village, alt. 1427 m., N 38°40'50.2"/E 68°52'05.9", 19 Aug.2013, *A. Nowak*; Western Pamirian region: near Huf village, southern slope of shale rocks, alt. 2989 m, N 37°49'29.3"/E 71°39'58.2", 20 Aug 2013, *A. Nowak*.

***Adiantum capillus-veneris* L. (Adiantaceae)**

GENERAL DISTRIBUTION: western and southern Europe, tropical zone in Africa, America and Asia, Japan, areas with Mediterranean-type climate in Europe and North America (Dostál 1984; Tutin et al. 2002).

OCCURRENCE IN TAJIKISTAN: *Adiantum capillus-veneris* is spreaded throughout Tajikistan and occupies wet habitats on rocks

with seeping water. It is known from dozens of locations from the country. Mogol: Mogol-Tau Mts.; Zer B: Kshtut River valley; Zer C: Fandaria River mouth; GD A: Karatag, Takob, Khondara; GD B: near Yavroz village, Yoz valley; GD E: near Poshkharv village, Dashtak, Dzharf, Qualaykhum, Sorbuh river valley; GD F: Zarbuz River valley, Vashpusht River valley, eastern slope of Tityai Mt., Hytham River valley; S Tjk B: near Siyahor village, near Naizabulak village, Tut-kaul, Garab-dara springs; W Pamir A: near Anderob village, Tash-Kurgan village, W Pamir B: Shah-Dara, between Nishusp and Anderob, Khorogh (Ovchinnikov 1957);

List of new localities:

Zer B, to the S from Ayni, shadowed rocky slope, western exposition, coordinates N 39°20'30.7"/E 68°33'13.7", 1490 m a.s.l., 11.06.2012, leg. A. Nowak & M. Nobis; Zer A, to the north-east from Panjikent, shadowed rupicolous slope, southern exposition, coordinates N 39°31'29.2"/E 67°38'27.3", 995 m a.s.l., 14.06.2010, leg. A. Nowak & M. Nobis; S Tjk D, to the east from Vose, shadowed gravelly slope, western exposition, coordinates N 39°48'29.4"/E 69°41'05.6", 673 m a.s.l., 01.06.2011, leg. A. Nowak & M. Nobis; W Pamir: near Barou village; N 38°26'59.1"/E 71°01'59.8", altitude 1395 m a.s.l., leg. A. Nowak 20.08.2013; W Pamir: to the south from Ab Darrah village; N 38°03'19.8"/E 70°21'49.7", altitude 1284 m a.s.l., leg. A. Nowak 18.08.2013.

***Salvinia natans* L. (Salviniaceae)**

GENERAL DISTRIBUTION: Europe, Asia with exception of boreal and circumpolar zones.

OCCURRENCE IN TAJIKISTAN: *Salvinia natans* was recorded till now only in Syr-Daria River Valley in northern Tajikistan. It was known from two locations, in Khojand and in Digmaisk (Maslennikova 1957).

List of new localities:

Prisyrdarski region: to the north from Proletarsk, rice paddle, alt. 316 m, N 40°13'37.2"/E 69°30'24.2", 7 Aug 2011, A. Nowak & S. Nowak.

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