

## FIRST RELIABLE RECORD OF *DIPHASIASTRUM ISSLERI* (LYCOPODIACEAE) IN SIBERIA

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*Diphasiastrum issleri* (Lycopodiaceae) is a species of hybrid origin, and also considered to be an interspecific hybrid. *D. issleri* originated by hybridisation between two species widespread in the temperate regions of Eurasia and North America: *D. alpinum* and *D. complanatum*. Despite the significant overlap of the distributional ranges and partial overlap of ecological niches of the parental species, *D. issleri* has been so far reported mainly from the mountains of Central Europe. A few records from Siberia were based on incorrect identifications of herbarium collections of *D. alpinum* and *D. complanatum* s.lat. Here I describe a specimen of *D. issleri* from the Herbarium of the Botanical Museum of the University of Helsinki (H), collected in 1985 from the Altai Mountains and show that this is the first and only reliable record of this species from Siberia. A Table with a comparison of selected characters of three similar and often confused taxa – *D. alpinum*, *D. issleri*, and *D. complanatum* subsp. *hasulatum* – is presented.

**Keywords:** Lycopodiaceae, *Diphasiastrum*, hybridogeneous species, floristic novelty, Altai, Siberia

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The genus *Diphasiastrum* Holub (Lycopodiaceae P. Beauv. ex Mirb.) contains 20–25 species distributed in the temperate zone of the Northern Hemisphere and in the mountain regions of the tropics and subtropics (Holub, 1975a; Bennert et al., 2011; PPG, 2016). *Diphasiastrum* is recognized by many modern plant taxonomists and other botanists (Ching, 1981; Jermy, 1993; Wagner, Beitel, 1993; Horn, 1997, 2006; Kukkonen, 2000; Zhang, Kung, 2000; Haines, Vining, 2003; Ivanenko, Tzvelev, 2004; Tikhomirov, 2004; Tzvelev, 2005; Pacyna, 2006; PPG, 2016), although some authors still include it in *Lycopodium* s.lat. (Øllgaard, 1987; Christenhusz, Zhang, Schneider, 2011; Christenhusz, Chase, 2014; Christenhusz, Byng, 2016; Criado et al., 2017). The recognition of *Diphasiastrum* as a separate clade within *Lycopodium* s.l. is supported by molecular data (Wikström, Kenrick, 2001).

Interspecific hybridization played an important role in the evolution of *Diphasiastrum*; hybrid origin has been proved or suggested for eight taxa (Wilce, 1965; Øllgaard, 1985; Aagaard et al., 2009a; Schnittler et al., 2019). The hybrid taxa are mostly homoploid, that is, they have the same diploid number of chromosomes as their parent species (Bennert et al., 2011), and this enables backcrossing and introgression gradually erasing the boundaries between parent and hybrid taxa. The presence of backcrossing and introgression

in the genus *Diphasiastrum* was identified in some studies (Aagaard et al., 2009b; Hanušová et al., 2014). This contradicts the findings of M. Schnittler et al. (2019), which analyzed chloroplast microsatellites, two nuclear markers and AFLP of six *Diphasiastrum* taxa from Central Europe – three species (*D. alpinum* (L.) Holub, *D. complanatum* (L.) Holub, *D. tristachyum* (Pursh) Holub) and three hybrids (*D. × issleri* (Rouy) Holub, *D. × oellgaardii* Stoor, Boudrie, Jérôme, K. Horn et Bennert, *D. × zeileri* (Rouy) Holub). Schnittler et al. (2019) concluded that these *Diphasiastrum* hybrid taxa arise as a result of independent acts of crossing of parental species and subsequently do not reproduce sexually and asexually and do not form recent backcrosses, although ancient backcrosses of *D. alpinum* and *D. complanatum* were found. Such individuals are well distinguished from their parental species, reproduce vegetatively and occasionally by aposporia, but are interspecific hybrids, rather than species (Schnittler et al., 2019). Nevertheless, the sporophytes of *Diphasiastrum* hybrids are long-lived; these plants are common in nature and their relationship with the environment is the same as that of reproductively independent species. Here we treat hybrid taxa of the genus *Diphasiastrum* rather as species, not hybrids (cf., Damboldt, 1963; Holub, 1975a; Stoor et al., 1996; Horn, 1997, 2006; Ivanenko, Tzvelev, 2004; Criado et al., 2017).

Eight species of *Diphasiastrum*, including three species of hybrid origin, *D. issleri*, *D. zeileri*, and *D. takedae* Ivanenko, have been recorded from Russia (Ivanenko, Tzvelev, 2004; Ivanenko, 2006). The issue of species taxonomically close to *D. issleri* has been debated: some authors believed that *D. issleri* combined the traits of *D. alpinum* and *D. complanatum* (Lawalrée, 1957) and came from their hybridization (Damboldt, 1962), while others pointed to the fact that *D. issleri* was an intermediate form between *D. alpinum* and *D. tristachyum* (Domin, 1937) and proposed for it the hybrid formula  $D. alpinum \times D. tristachyum$  (Wilce, 1965). J. Holub (1975b) noted that the type material of *D. issleri* collected in the Vosges Mountains (Alsace, France) combined the characteristics of *D. alpinum* and *D. complanatum*, which must be its parental species.

*Diphasiastrum issleri* is found in the mountains of Central Europe (in Austria, Hungary, Germany, Slovakia, the Czech Republic, Switzerland), is known in Western Europe (very rare in Belgium, grows in France in the Vosges, where the locus classicus is located, the Cévennes and the Ardennes), and is distributed in the north of Southern Europe (in northern Italy and Slovenia). In Northern Europe it is reported in the south of Poland (the Sudetenland and the Western Beskids), Norway, Ireland and the United Kingdom, from which it is known by old collections in England and Wales, and old and relatively recent finds in Scotland, and in the Khibiny Mountains of the Kola Peninsula, Russia) (Lawalrée, 1957; Wilce, 1965; Pacyna, 1972; Kramer, 1984; Jermy, 1989; Jessen, 1991; Kukkonen, 2000; Prelli, 2001; Hassler, Schmidt, 2012). In Eastern Europe it is found in the Ukrainian Carpathians (Pacyna, 1972; Protopopova, 1974; Felbaba-Klushina, Votkalchuk, 2015). There is one locality of this species in the Caucasus (Ivanenko, 1991) and one more site in the northeastern United States (Wilce, 1965).

*Diphasiastrum issleri* is the rarest hybrid species of *Diphasiastrum* in Russia. Indications of the presence of *D. issleri* in Kamchatka and on the Kola Peninsula in the vicinity of Lake Imandra (Ivanenko, 1991) were based on the incorrect identification of specimens, respectively of *D. takedae* and the northern form of *D. complanatum*. Until recently, *D. issleri* was reliably known from a single location in the Khibiny Mountains on the Kola Peninsula (Jessen, 1991). Identification of this plant was confirmed by pteridologists Dr. S. Rauschert and K. Horn.

*Diphasiastrum alpinum* and *D. complanatum* are found growing together in mountainous regions of the Asian part of Russia, from the Urals to the Sikhotealin, Dzhugdzhur, the Sredinny and Vostochny Ranges of Kamchatka. *D. alpinum* usually grows in alpine meadows and in the subalpine woodlands and at higher altitudes than *D. complanatum* which grows in the forest belt. However, there are intermediate

heights at which both species can meet and cross. For example, in the Tuva mountains *D. alpinum* grows at 1600–2300 m a.s.l., and *D. complanatum* at altitudes of 800–1800 m a.s.l. (Krasnoborov, 2007), so that both species overlap in the 1600–1800 m belt. Russian botanists noted the presence of *D. issleri* in Siberia, but these sightings were unconfirmed.

V.N. Siplivinsky (1973) described a new species *Diphasium hastulatum* Sipliv. from the Barguzinsky reserve (Republic of Buryatia) which, according to the author, arose as a result of hybridization between *Diphasium alpinum* (L.) Rothm. and *D. complanatum* (L.) Rothm. and combined the characteristics of both parental species. Siplivinsky shared the opinion of J. Wilce (1965) that *Lycopodium alpinum* L. and *L. tristachyum* Pursh were the parents of  $L. \times issleri$  (Rouy) Domin and therefore, he did not consider *D. hastulatum* to be conspecific with *D. issleri* (Rouy) Holub.

Considering the facts and arguments in favor of the origin of *Diphasiastrum issleri* by means of hybridization between  $D. alpinum \times D. complanatum$  some authors suggested that *Diphasium hastulatum* is conspecific with *Diphasiastrum issleri* (Holub, 1975b; Shmakov, Tikhonov, 2005; Dvořáková, 2012). However, a study of the type material of *Diphasium hastulatum* at the Komarov Botanical institute (LE) and its comparison with typical *Diphasiastrum issleri* specimens from Central Europe revealed that the taxon described by Siplivinsky is a deviating form of *D. complanatum*, morphologically transitional between *D. complanatum* subsp. *complanatum* and *D. complanatum* subsp. *montellii* (Kukkonen) Kukkonen (Ivanenko, 1991; Ivanenko, Tzvelev, 2004). It was therefore transferred to *D. complanatum* subsp. *hastulatum* (Sipliv.) Ivanenko et Tzvel. (Ivanenko, Tzvelev, 2004).

D.N. Shauro was the first to report *Diphasiastrum \times issleri* from the Northern Baikal floristic region of Buryatia in the “Flora of Siberia” (Shauro, 1988: 37). No synonym was given in the nomenclature quotation of  $D. \times issleri$ , but, given the data on the distribution of this hybrid, we can safely assume that Shauro had in mind the location of *D. hastulatum*, considering this species and  $D. \times issleri$  to be the same taxon.

I.M. Krasnoborov (2007) cited  $D. \times issleri$  in the “Key to Plants of the Republic of Tyva” for the Todzhinsky meadow-taiga and East Tuva natural regions. Unfortunately, no images of  $D. \times issleri$  and its morphological and locality details were provided.

A.I. Shmakov and D.V. Tikhonov (2005) mentioned *D. issleri* from the northern part of the Altai Mountains, but did not provide a map of its distribution in this region.

Later Krasnoborov (2012) included  $D. \times issleri$  in his treatment of *Lycopodiaceae* for the “Key to plants of the Altai Republic” (Krasnoborov, 2012) presumably taking into account the data of Shmakov and Tikhonov (2005), but only indicating possibility of find-

ing this taxon in the botanical and geographical region of Northern Altai.

A.L. Ebel (2012) cited *D. × issleri* with a question mark in the “Synopsis of Flora of the North-West Part of the Altai-Sayan Province<sup>1</sup>” following Shmakov and Tikhonov (2005), but suggested it might be *D. complanatum* subsp. *hastulatum*.

M.M. Silantyeva (2013: 23) cited *D. × issleri* in the “Synopsis of the flora of the Altai Territory” (2013) also following Shmakov and Tikhonov (2005), which is obvious from the nomenclature quotation of this taxon. This publication by Silantyeva exhausts, as far as we know, reports about the presence of *D. issleri* in Siberia.

The aim of our research is to clarify the distribution of *D. issleri* in Russia and describe reliable record of this species from Siberia.

## MATERIALS AND METHODS

Collections of *Diphasiastrum* were studied in the Herbaria of the Komarov Botanical Institute, St. Petersburg, Russia (LE), the Botanical Museum of the University of Helsinki, Finland (H), the Natural History Museum at the University of Oslo, Norway (O), the I.M. Krasnoborov Herbarium of the Central Siberian Botanical Garden, Novosibirsk, Russia (NS), as well as collections of Dr. A.I. Shmakov (Barnaul, Russia) from Altai and our own collections of *D. issleri* made during botanical excursions in Austria in 2003 and Bavaria in 2016. Some specimens were measured and described.

Wilce (1965) concluded that the growth habit of the aerial shoot system, the height of the aerial shoot system, the width of the branchlets, the size and shape of the leaves and, to a lesser extent, the peduncle length are of taxonomic and diagnostic importance for the genus. Large parts of plants, such as whole aerial shoot systems, peduncles and strobili, were measured with millimeter ruler. All measurements of leaves and branchlets width were taken under different types of stereo microscope by dint of an ocular micrometer.

## RESULTS AND DISCUSSION

We found the following two herbarium specimens in the I.M. Krasnoborov Herbarium of the Central Siberian Botanical Garden (NS) that were previously identified as *Diphasiastrum × issleri* and collected from the Tuva Republic: specimen NS 46: “Tuva Republic, Todzhinsky District, Azas Nature Reserve, ridge Ulug-Arga, the Kosh-Pesh river valley, northern slope, steepness of 15 degrees, fir-cedar sedge-green-moss forest, a grass-forbs degraded meadow, al. 1650 m a.s.l. 52°28' N, 97°47' E. 17 VII 1997,

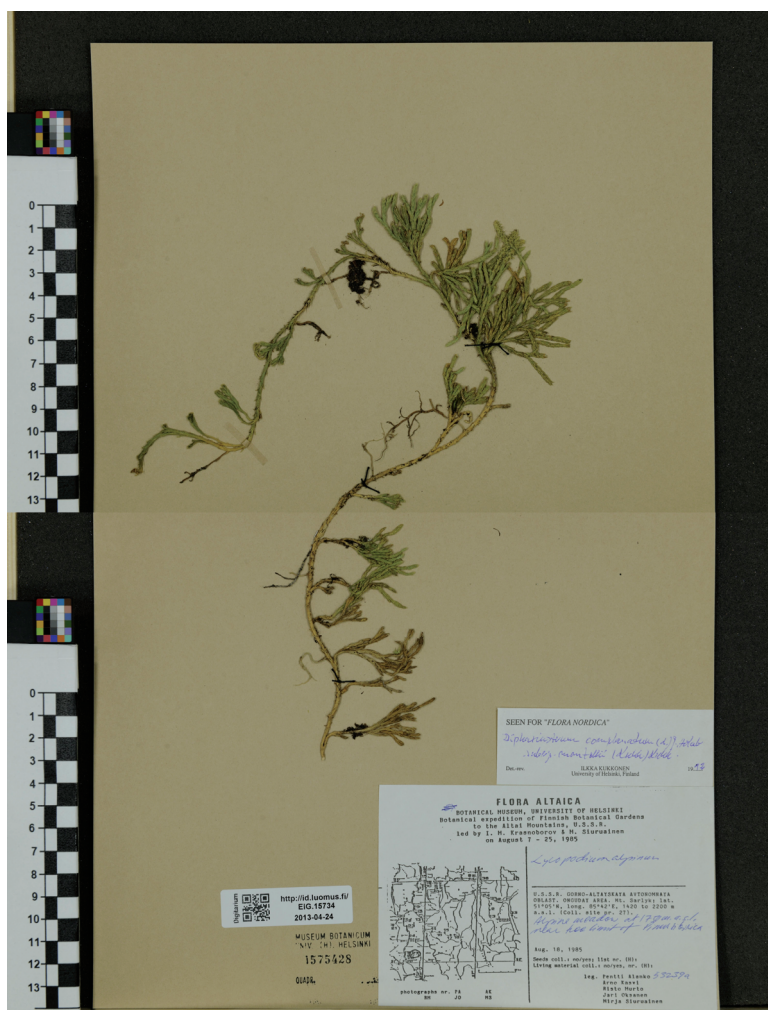
D.N. Shaulo, I.D. Shaulo”, NS! and specimen NS 23: “Tuva Republic, Todzhinsky District, the Biy-Khem river valley, the mouth of the river Haral, a grass-forbs degraded meadow. 52°08' N, 96°41' E. 2 VII 1999, D.N. Shaulo”, NS! Dr. V.M. Doronkin, an employee of the Central Siberian Botanical Garden, confirmed that there are no additional specimens of *D. × issleri* in the I.M. Krasnoborov Herbarium except these two (pers. comm., February 25, 2020).

We identified specimen NS 46 as *D. alpinum* and specimen NS 23 as *D. complanatum*. We believe that the *D. × issleri* designation for the Tuva Republic was based on an incorrect identification of these two collections. The specimen “NS 23”, collected in the Todzhinsky administrative district was cited by Krasnoborov (2007) as found in Eastern Tuva natural region.

The three specimens provided by A.I. Shmakov and D.V. Tikhonov were labeled as “Russia, Khakassia Republic, Alan range, northeast branch of mts. Babik, slope of a southeast exposition, between boulders at the timberline, al. 1200–1300 m. a.s.l. 52°56' N, 91°23' E. 29 VII 2005, № 1531, A.I. Shmakov, M.G. Kutzev, S.A. Kostjukov, A.V. Vaganov”. The label of the fourth Shmakov’s specimen differs only in the number indicated as “№ 15316”. These four specimens were not identified previously, but it was assumed that they represent *D. issleri*. Our examination showed that these plants belong to *D. complanatum* subsp. *hastulatum*. This subspecies is poorly segregated from both *D. complanatum* subsp. *complanatum* and *D. complanatum* subsp. *montellii* (Ivanenko, Tzvelev, 2004: 108, 112). We confirm that *D. complanatum* subsp. *hastulatum* was indeed mistaken for *D. issleri*. Moreover, Tikhonov while visiting the Komarov Botanical Institute showed us several specimens from the Altai Mountains he believed to be *D. issleri*. In our opinion, all these specimens presented a form of *D. alpinum* with clearly flattened branches and weakly turned down lateral leaves, the alleged shade form of the species; some plants had strobili on short, less than 5 mm long, peduncles, and thus belonged to a quite rare, but well-known for this species, aberration (Wilce, 1965).

We found one specimen of *D. issleri* at the Botanical Museum of the University of Helsinki. It was collected during an expedition of Finnish botanists to the Altai Mountains (Fig. 1) in 1985. Pentti Alanko, a curator of the Botanical Garden of the University of Helsinki, was a member of the expedition; duplicates of specimens collected in Altai were given to him. The herbarium label of the specimen is as follows: “USSR, Gorno-Altayskaya Avtonomnaya Oblast, Onguday Area, Mt. Sarlyk (Coll. site pr. 27), alpine meadow near too limit of *Pinus sibirica*, al. 1750 m. a.s.l. 51°05' N, 85°42' E, 18 VIII 1985, № 53239a, H 1575428, Pentti Alanko, Arno Kasvi, Risto Murto, Jari Oksanen, Mirja Siuruainen”, H!

<sup>1</sup> It means the Altai-Sayan floristic province according to A.L. Takhtajan (1978).



**Fig. 1.** Photo of the herbarium specimen of *Diphasiastrum issleri* from Mt. Sarlyk, Altai Mts., Siberia; courtesy of Dr. A.N. Sennikov (specimen kept in the Herbarium H).

The specimen H 1575428 was originally identified as *Lycopodium alpinum*, presumably by one of the collectors. In 1992 I. Kukkonen, an employee of the Botanical Museum of the University of Helsinki, studying the herbarium collections of Lycopodiaceae in order to treat this family for Flora Nordica, re-identified the sample collected in Altai as *D. complanatum* subsp. *montellii*. Our study of the Altai plant showed that, despite some similarities with *D. alpinum* or *D. complanatum* subsp. *montellii*, its most important diagnostic characters exactly correspond to *D. issleri*: lateral vegetative branchlets flattened, lower (ventral) leaves without petiole, deltoid, large, somewhat convex on abaxial side and appressed; lateral leaves with moderately broad not revolute or only slightly revolute leaf margin, with gradually tapering falcate or almost straight narrow triangle free blade; solitary strobili sessile or short pedunculated; the shape of sporophylls intermediate between “alpinum”-type and “complanatum”-type (see Wilce, 1965: 76–77, Fig. 14), with

cuneal decurrent base and broadly deltoid and gradually tapering or subovoid and abruptly tapering free blade. This specimen confirms the presence of *D. issleri* in Siberia and indicates the possibility of hybridization between *D. alpinum* and *D. complanatum* in a territory far removed from Central Europe, where the main part of the range of *D. issleri* is located.

Table 1 compares selected characters of *D. issleri* specimen from Mount Sarlyk with European *D. issleri* specimens (from Austria, Germany, Norway, Poland, the Czech Republic), European and North American *D. alpinum* plants, and type specimens of *D. complanatum* subsp. *hastulatum* from the Republic of Buryatia (Russia). The taxa for comparison were chosen on the basis of their distribution in the Altai and similarity with *D. issleri*. According to the data presented in Table 1, the plant from Mount Sarlyk has the same characteristics as with other samples of *D. issleri*, but has lower height of above-ground shoot systems with a strobil and the vegetative part of above-ground shoot

Table 1. Comparison of characters of *D. issleri*, *D. alpinum*, and *D. complanatum* subsp. *hastulatum*

Character	<i>D. issleri</i> from Sarlyk Mountain, Altai, Siberia; from 1 to 20 measurements were made, depending on character	<i>D. issleri</i> from Europe; from 26 to 270 measurements were made, depending on character	<i>D. alpinum</i> (according to Wilce, 1965: 130–131); data on “peduncle length” are our original ones	<i>D. complanatum</i> subsp. <i>hastulatum</i> (type collection); from 10 to 100 measurements were made, depending on character
Growth form	densely fasciculate or tufted green, the lower side of lateral vegetative branchlets is lighter than the upper	shrubby or almost arborescent green, the lower side of lateral vegetative branchlets is lighter than the upper	densely fasciculate or tufted bluish green, bluish tint is especially pronounced in young branchlets	densely fasciculate or shrubby green, the lower side of lateral vegetative branchlets is lighter than the upper
Height of aerial shoot systems including strobili (cm)	7.0–7.1	14.3 (9.1–24.0)	8.4 (6.0–14.0)	11.2 (8.0–17.0)
Height of the vegetative parts of the aerial shoot systems (cm)	5.2–5.6	12.3 (5.6–22.5)	6.7 (4.0–14.0)	9.8 (7.4–16.5)
Width of lateral vegetative branchlets (mm)	2.3 (1.7–2.8)	2.3 (1.4–3.7)	2.5 (1.8–4.0)	2.0 (1.4–2.7)
Lower (ventral) leaves of lateral vegetative branchlets free blades length (mm), and width (mm)	sessile, broadest at the base, triangular, somewhat convex on the abaxial side and adpressed; 1.8 (1.2–2.3) long, 0.65 (0.5–0.7) broad	sessile, broadest at the base, triangular, somewhat convex on the abaxial side and adpressed; 1.9 (1.2–3.2) long, 0.6 (0.4–1.3) broad	with petiole-like narrow bases, trowel-shaped with lanceolate free blades; free blades linear lanceolate, arcuate, deflected from the branchlets, but with the apices directed towards them in shade forms; 2.1 (1.3–3.3) long, 1.0 (0.6–1.3) broad	sessile, broadest at the base, triangular, flat on the abaxial side and adpressed; 1.4 (0.8–1.9) long, 0.6 (0.5–0.8) broad
Lateral leaves of lateral vegetative branchlets	the free blades moderately broad, narrowly triangle, directed forward or obliquely forward, the leaf margin not revolute or slightly revolute	the free blades moderately broad, narrowly triangle, directed forward or incurving, tapering towards acute apices, the leaf margin not revolute or slightly revolute	the free blades broad, triangle, with blunt apices directed forward or slightly curved towards the branchlet, the leaf margin usually revolute to rolled, but flat and spreading in shade forms	the free blades moderately broad, narrowly triangle, directed forward or slightly deflected from the branchlet, narrowing abruptly toward acute apices, the leaf margin not revolute or slightly revolute
Peduncles and strobili. Peduncle length (cm), Strobilus length (cm)	strobili solitary, sessile or pedunculated; 0.0–1.4; 1.3–1.4	strobili 1 (2), sessile or pedunculated; 0.2 (0.0–3.1); 2.4 (1.0–3.4)	strobili solitary, sessile, or short-pedunculated; 0.0–0.3; 1.3 (0.5–3.0)	strobili 1–2 (3) per peduncle, pedunculated or sessile; 0.9 (0.0–2.8); 1.8 (0.8–2.7)

systems, approaching *D. alpinum*. This can be explained by the more severe growing conditions of *D. issleri* in Altai in comparison with Europe.

Our results show that *D. issleri* can only be confirmed from a single Altai locality in Siberia. The rarity of this hybrid species in Asian Russia can be explained by the insufficient study of this vast region and its harsh climate. The opportunities for of gametophyte formation and sexual reproduction are likely limited in there, while the partial ecological isolation and comparative rarity of *D. alpinum* and *D. complanatum* in northern Asia reduce the likelihood of their joint occurrence and interspecific crosses. We consider the accidental dispersal of *D. issleri* spores from Europe or from the Caucasus to Altai as highly unlikely. The search for new sites of *D. issleri* in Altai, in other regions of Siberia, and in the Russian Far East should be continued.

Finally, we give the main synonyms of *Diphasiastrum issleri*, taking it at the rank of species:

*Diphasiastrum issleri* (Rouy) Holub, 1975, Preslia, 47, 2 : 108; Jessen, 1991, Farnblätter, 23 : 21. — *Lycopodium alpinum* race *issleri* Rouy, 1914, Fl. France, 14: 489. — *Lycopodium issleri* (Rouy) Domin, 1937, Věda Přír. 18 : 204. — *Lycopodium issleri* (Rouy) Lawalrée, 1957, Bull. Soc. Roy. Bot. Belgique, 90, 1 : 114, isonym. — *Lycopodium alpinum* subsp. *issleri* (Rouy) Chass., 1956, Fl. Auvergne, 1 : 3. — *Lycopodium complanatum* subsp. *issleri* (Rouy) Domin, 1937, Rozpr. Čes. Akad. Věd, Cl. Mat. Natur. 47, 19 : 25. — *Diphasiastrum issleri* (Rouy) Holub, 1960, Preslia, 32 : 432. — *Diphasiastrum complanatum* (L.) Holub subsp. *issleri* (Rouy) Jermy, 1989, Fern Gaz. 13, 5 : 260. — *Lycopodium alpinum* subsp. *kablikianum* Domin, 1937, Rozpr. Čes. Akad. Věd, Cl. Mat. Natur. 47, 19 : 13. — *Diphasiastrum issleri* subsp. *kablikianum* (Domin) T. Wraber, 1962, Bull. Scient. 7, 1–2 : 4. — *Diphasiastrum kablikianum* (Domin) Dostál, 1984, Folia Mus. Rer. Nat. Bohem. Occid., Bot. 21 : 3. — *Diphasiastrum complanatum* subsp. *kablikianum* (Domin) Eb. Fischer et Lobin, 1995, in W. Frey et al. Die Moos- und Farnpflanzen Europas, ed. 6 : 330. — *Diphasiastrum alpinum* (L.) Holub × *D. complanatum* (L.) Holub.

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## ПЕРВОЕ ДОСТОВЕРНОЕ СООБЩЕНИЕ О *DIPHASIASTRUM ISSLERI* (LYCOPODIACEAE) В СИБИРИ

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*Diphasiastrum issleri* (Lycopodiaceae) — это вид гибридного происхождения, который также рассматривается как межвидовой гибрид. *D. issleri* возник вследствие гибридизации между двумя видами, широко распространёнными в умеренных областях Евразии и Северной Америки: *D. alpinum* и *D. complanatum*. Несмотря на значительное перекрытие ареалов и частичное перекрытие экологических ниш родительских видов, *D. issleri* был до сих пор известен главным образом из гор Центральной Европы. Сообщения о наличии этого вида в Сибири были основаны на неверном определении гербарных сборов *D. alpinum* и *D. complanatum* s.lat. Здесь мы описываем гербарный образец *D. issleri* из Гербария Музея естественной истории Университета Хельсинки (H), собранный в 1985 г. в горах Алтая, и объясняем, почему это первая и единственная достоверная находка данного вида из Сибири. Представлена таблица со сравнением по нескольким избранным признакам трёх похожих таксонов, которые нередко путают при определении: *D. alpinum*, *D. issleri* и *D. complanatum* subsp. *hashtulatum*.

**Ключевые слова:** Lycopodiaceae, *Diphasiastrum*, гибридогенные виды, флористические новинки, Алтай, Сибирь