

Synopsis of the genus *Cystopteris* Bernh. (Cystopteridaceae)

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The synopsis of the genus *Cystopteris* Bernh., consisting of 32 species and 5 hybrids, is given in the article. An information on the type material, its localization and the general distribution of species is presented for all taxa. Two new combinations are designated: *Cystopteris huteri* (Hausm. ex Milde) Shmakov, comb. et stat. nov. and sect. *Khokhrjakovia* (Tzvel.) Shmakov, comb. et stat. nov.

Keywords: *Cystopteris*; Cystopteridaceae; distribution; hybrids; Rhizomatopteris; type

As an independent family Cystopteridaceae (Payer) Shmakov was separated recently (Shmakov, 2001), and then recognized by several pteridologists (Christenhusz et al., 2011; Rothfels et al., 2012, 2013) and in different floras (Kim, Sun, 2015). Currently, the family includes 4 genera: *Acystopteris* Nakai, *Cystoathyrium* Ching, *Cystopteris* Bernh. (including *Rhizomatopteris* A.Khokhr.), *Gymnocarpium* Newman. (including *Currania* Copel.) (Christenhusz et al., 2011; Rothfels et al., 2012), – with about 30 species (PPG1, 2016; Rothfels et al., 2012, 2013). The systematic position of the family is complicated, in some treatments it was included in well-known families – Athyriaceae (Bobrov, 1974; Jones, 1998; Prada, 1986; Shmakov, 1999; Tzvelev, 1991), Woodsiaceae (Fraser-Jenkins, 2015; Kato, 1995, Roux, 2009; Smith, 2006; Verdcourt, 2003) or Dryopteridaceae (Smith, 1993; Tryon, Stolze, 1991).

R. F. Blasdel (1963) interpreted the genus *Cystopteris* widely and included in it *Acystopteris* Nakai as subgenus. He divided the subgenus *Cystopteris* into two sections – *Cystopteris* and *Emarginatae* Blasdel. In 1985, on the basis of the morphology of fronds and rhizomes, A. P. Khokhryakov separated genus *Rhizomatopteris* Khokhr. with two species (*Cystopteris montana*, *C. sudetica*) (Khokhryakov, 1985). N. N. Tzvelev (2005), recognizing the genus *Rhizomatopteris*, divided it into two sections: typical and *Khokhrjakovia* Tzvel. We recognise the genus *Cystopteris* (incl. *Rhizomatopteris* Khokhr.) *sensu stricto*, and divide it into two subgenera – the typical and *Emarginatae* (Blasdel) Shmakov (Shmakov, 2001).

Cystopteris Bernh. is the most difficult genus in the family Cystopteridaceae, not only in terms of species diversity, namely, the species capacity, but also in terms of their genesis. Not only the degree of dissection of the frond plate and its shape, but also the location of the fronds on the rhizome, the pubescence of the frond and petioles (hairs, glands, scales), spore morphology have systematic importance in distinguishing species in the genus (Gureyeva, Kuznetsov, 2015; Jermy, Harper, 1971; Ulko et al., 2017). Herewith, a number of *Cystopteris* species is understood by some authors very broadly (Fraser-Jenkins, 1997, 2015; Prada, 1986; Prada, Salvo, 1985; Smith, Kessler, 2018; Wang et al., 2013), and along with this many researchers recognize subspecific taxa or geographically isolated races as separate species (Arana et al., 2015; Grubov, 1958; Gureyeva, 1985; Haufler, 1993; Khokhrjakov, 1985; Kotukhov, 1966; Mickel, 1972; Mickel, Smith, 2004; Murphy, Rumsey, 2005; Shmakov, 2001; Stepanov, 1993, 2015; Tennat, 2010; Vernon, Ranker, 2013; Wang, 1983; Wang et al., 1997).

Materials and methods

In compiling the synopsis, we used not only the main floristic reports, but also individual publications about the distribution of certain *Cystopteris* species (both listed above and: Bir, 1979; Denk, 1998; Fraser-Jenkins, 1986, 1991, 1992; etc.). In addition, we used materials from leading herbaria (including available online collections) of the world (B, K, P, G, C, W, BM, L, E, CH, PE, US, Z, JE, PR, UC, KUN, JEPS, TNS, KYO, FR, NY, LE, AA, TK, MW, MHA, VLA, NS, NSK, TASH, etc.), as well as our own collection, stored in the herbarium of South-Siberian botanical Garden of Altai State University (ALTB, Barnaul).

Taxonomic treatment

Cystopteris Bernh. 1805, in Schrad., Neues J. Bot. 1(2) : 26, nom. cons. – *Cyste* Dulac, 1867, Fl. Haute-Pyrenees: 33, nom. superfl. – *Cyseta* Sm. 1828, Engl. Fl. 4 : 275, 297, nom. superfl. – *Filicula* Ség. 1754, Pl. Veron. 3: 54. – *Filix* Adans., Fam. Pl. 2: 20. 1763, nom. illeg. hom., non Ség. (1754) nec Ludw. (1757). – *Rhizomatopteris* A. Khokhr. 1985, Fl. Magadan. Obl. : 347. –

Cyclopteris Schrad. ex Gray, 1821, Nat. Arr. Brit. Pl. 2: 9, nom. rej. vs. *Cyclopteris* A. T. Brongniart 1828, nom. cons. (Cycadiidae).

Type: *C. fragilis* (L.) Bernh. (= *Polypodium fragile* L.).

32 species and 5 hybrids distributed in the Northern and Southern hemispheres.

Subgenus *Cystopteris*

Type: *C. fragilis* (L.) Bernh.

24 species and 5 hybrids distributed on almost all continents.

Cystopteris almaatensis Kotukhov, 1966, Bot. Mater. Gerb. Bot. Inst. Bot. Acad. Nauk Kazakhsk. S.S.R. 4: 27, f. 1.

Described from Kazakhstan (Tien Shan).

Holotype: «Zailiisky Alatau, Chimbulak, on the open places near stones and in rock crevices in the belt of the fir forest, 17 VIII 1964, Yu. Kotukhov» (AA).

Distribution: Kazakhstan, Russia (East Siberia – Altai).

Cystopteris alpina (Lam.) Desv. 1827, Mém. Soc. Linn. Paris, 6(3): 264. – *Polypodium alpinum* Lam. 1778, Fl. Franç. 1: 22. – *Cystopteris fragilis* subsp. *alpina* (Lam.) Hartm. 1846, Sv. Norsk Exc.-Fl.: 152. – *Polypodium alpinum* Jacq. 1788, Collectanea, 2: 171. – *Cystopteris alpina* f. *latilobum* (Milde) Diklić & V.Nikolić, 1986, Fl. SR Srbije, 10: 7. – *Cystopteris taygetensis* Heldr. & Sart. 1883, in Heldr., Herb. norm. n. 35, Salom Nom. 147. – *Cystopteris regia* Desv. 1827, Mém. Soc. Linn. Paris, 6(3): 264. – *Cystopteris atrovirens* C.Presl, 1851, Abh. Königl. Böhm. Ges. Wiss., ser. 5, 6: 426. – *Cystopteris atrovirescens* Presl, 1836, Tent. Pterid.: 93.

Described from France: “Cette plante croît dans les montagnes du Dauphiné...”

Distribution: Abkhazia, Albania, Algeria, Andorra, Armenia, Austria, Bosnia-Herzegovina, Bulgaria, Croatia, France, Georgia, Germany, Greece, Iran, Italy, Macedonia, Montenegro, Morocco, Norway, Poland, Romania, Russia (Caucasus), Serbia, Slovakia, Slovenia, Spain, Sweden, Turkey, Ukraine.

Cystopteris altajensis Gureeva, 1985, Sist. Zаметki Mater. Gerb. Krylova Tomsk. Gosud. Univ. Kuybysheva 87: 5. – *Cystopteris fragilis* (L.) Bernh. var. *altajensis* (Gureeva) Stepanov, 1993, Sibir. Biol. Zhurn. 1993(1): 50.

Described from Western Siberia (Altai).

Holotype: «Altayskiy krai, Turochaksky district, lower reaches of the river Bolshiye Chili, in the niches of the shadow rocks, near Teletskoye lake, 13 VII 1981, I. Gureeva, V. Goncharova» (TK).

Distribution: Kazakhstan (Altai), Russia (West Siberia).

Cystopteris apiiformis Gand. 1913, Bull. Soc. Bot. France 60: 28. – *Cystopteris fragilis* var. *apiiformis* (Gand.) C. Chr. 1917, Index Fil. Suppl. 1913-16: 11.

Described from South America.

Lectotype (Arana, Mynssen, 2015): «Argentina. Tierra del Fuego, Antártida e Islas del Atlántico Sur, Islas Malvinas, Isla Gran Malvina, Ensenada Cove (Roy Cove), 3-XII-1907, C. Skottsberg 61» (S-1391).

Distribution: Argentina, Chile.

Cystopteris bulbifera (L.) Bernh. 1806, in Schrad. Neues Journ. Bot. 1(2): 10. – *Polypodium bulbiferum* L. 1753, Sp. Pl. 2: 1091. – *Cystopteris atomaria* C.Presl, 1836, Tent. Pterid. 93. – *Cystopteris bulbifera* f. *crispa* H.L.Foster, 1954, Amer. Fern J. 44: 116, tab. 13. – *Cystopteris bulbifera* f. *flagelliformis* (G.Lawson) M.Broun, 1938, Index No. Amer. Ferns 55. – *Cystopteris bulbifera* var. *horizontalis* (G.Lawson) Farw. 1931, Amer. Midl. Naturalist, 12: 251. – *Filix bulbifera* (L.) Underw. 1900, Our nat. Ferns ed. IV: 119.

Described from North America: “Habitat in Canada”.

Lectotype (Reveal & Jarvis, 2009): «Herb. Linn. No. 1251.50» (LINN).

Distribution: Canada (New Brunswick, Newfoundland, Nova Scotia, Ontario, Quebec), USA (Alabama, Arkansas, Arizona, Connecticut, Georgia, Iowa, Illinois, Indiana, Kentucky, Massachusetts, Maryland, Maine, Michigan, Minnesota, Missouri, North Carolina, Nebraska, New Hampshire, New Jersey, New Mexico, New York, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Vermont, Wisconsin, West Virginia).

Cystopteris diaphana (Bory) Blasdell, 1963, Mem. Torrey Bot. Club 21(4): 47. – *Polypodium diaphanum* Bory, 1804, Voy. Îles Afrique 1: 328. – *Asplenium diaphanum* (Bory) Lojac. 1909, Fl. Sicul. (Lojacono) 3: 402, t. 6 f. 4. – *Cystopteris fragilis* var. *diaphana* (Bory) Rosenst. 1910, in Buchtien, Contr. Fl. Bolivia 1: 9. – *Cystopteris fragilis* (L.) Bernh. subsp. *diaphana* (Bory) Li-tard, 1912, Bull. Soc. Bot. Deux-Sevres 23: 88. – *Athyrium fumarioides* C. Presl, 1825, Reliq. Haenk. 1(1): 39, t. 6, f. 2. – *Cystopteris fumarioides* (C. Presl) Kunze, 1834, Linnaea 9(1): 97. – *Cystopteris emarginulata* C. Presl, 1836, Tent. Pterid.: 93. – *Cystopteris viridula* (Desv.) Desv. 1827, Mém. Soc. Linn. Paris, 6(3): 264. – *Aspidium viridulum* Desv. 1811, Ges. Naturf. Freunde Berlin Mag. Neuesten Entdeck. Gesammten Naturk. 5: 321. – *Cystopteris canariensis* C.Presl, 1836, Tent. Pterid.: 93. – *Cystopteris azorica* Fée, 1850-52, Gen. Filic.: 300. – *Cystopteris acuta* Fée, 1850-52, Gen. Filic.: 300. – *Cystopteris fragilis* var.

platychnaena T. Moore, 1861, Index Fil. (T. Moore) 282. – *Cystopteris chilensis* Fée, 1850-52, Gen. Filic.: 300. – *Cystopteris nivalis* (Pirota) Pic. Serm. 1968i, Webbia, 23,1: 173.

Described from the Mascarene Islands.

Lectotype (Arana, Mynssen, 2015): «Francia. Isla Reunión, Ile de Mascareigne, N. Caverne de la plaine des chicots à 8 ou 900 toises, J. B. G. M. Bory de St-Vincent, Fougères catal. 53, 37» (P – P00483050).

Distribution: Algeria, Argentina, Brazil, Bolivia, Cameroon, Colombia, Democratic Republic of the Congo, France, Ethiopia, Honduras, Italy, Kenya, Lesotho, Mexico, Morocco, Panama, Peru, Portugal, Republic of the Congo, Spain, Tanzania, Uganda, Uruguay, South Africa, Sudan, Venezuela, Azores Isl. (Santa Maria, Sao Miguel, Terceira, Graciosa, Sao Jorge, Pico, Faial, Flores, Corvo), Madeira Isl., Canary Isl. (Gran Canaria, Teneriffa, La Gomera, Hierro, La Palma), Comoro Isl., Réunion Isl.

Cystopteris dickieana R. Sim, 1848, Gard. Farmers' J. ser. 2. 2: 308. – *Cystopteris baenitzii* Dörf. 1891, in Baenitz, Herb. Eur. n. 6510, Prospect. 4. – *C. fragilis* var. *baenitzii* (Dörf.) Warnst. 1896, in Asch. & Graebn., Syn. Mitteleur. Fl. 1: 17. – *C. fragilis* (L.) Bernh. subsp. *dickieana* (R. Sim) Hyl. 1945, Uppsala Univ. Årsskr. 1945(7): 59. – *C. fragilis* (L.) Bernh. var. *dickieana* (R. Sim) T. Moore, 1849, Handbook of British ferns: 81. – *Cystopteris fragilis* (L.) Bernh. f. *dickeana* (R. Sim) B. Boivin, 1967, Phytologia 15: 149. – *Cystopteris fragilis* f. *granulosa* Bir & K. Trikha, 1976, Amer. Fern J. 66(3): 109.

Described from Scotland.

Lectotype (C. R. Fraser-Jenkins, 1978): «Aberdeen, sea cave at Cove, Scotland, 1842, G. Dickie s.n.» (BM – BM001066215).

Distribution: Afghanistan, Armenia, Austria, China (Gansu, Hebei, Qinghai, Shaanxi, Sichuan, Xinjiang, Xizang, Yunnan), Czech Republic, England, Finland, France, Germany, Greece, Iceland, Iran, Italy, Kazakhstan, Morocco, Nepal, Norway, Pakistan, Portugal, Russia (European Part, Caucasus, West Siberia, East Siberia, Far East), Slovakia, Spain, Sweden, Switzerland, Tajikistan, Turkey.

Cystopteris douglasii Hook. 1846, Sp. Fil. 1. 200.

Holotype: «Sandwich Islands. D. Douglas n. 51» (K – K001089184).

Distribution: Hawaii (Maui, Hawaii Isl.).

Cystopteris fragilis (L.) Bernh. 1806, Neues J. Bot. 1(2): 26, plate 2, fig. 9. – *Polypodium fragile* L. 1753, Sp. Pl. 2: 1091. – *Filix fragilis* (L.) Gilib. 1792, Exerc. Phyt. 558. – *Cyathea fragilis* (L.) J. Sm. 1793, Mém. Acad. Roy. Sci. (Turin) 5: 417. – *Aspidium fragile* (L.) Sw. 1801, J. Bot. (Schrader) 1800(2): 40. – *Athyrium fragile* (L.) Spreng. 1804, Anleit. Kenntn. Gew. 3: 136. – *Cyclopteris fragilis* (L.) Gray, 1821, Nat. Arr. Brit. Pl. 2: 9-10. – *Cyste fragilis* (L.) Dulac, 1867, Fl. Hautes-Pyrénées: 33. – *Cystopteris emarginato-denticulata* Fomin, 1911, in Kusn. et al., Fl. Caucas. Crit. 1(1): 19. – *Cystopteris filix-fragilis* (L.) Gilib. 1792, Exerc. Phyt.: 558. – *Cystopteris filix-fragilis* (L.) Borbas, 1900, Balaton Fl. 2: 314, nom. illeg. – *Cystopteris filix-fragilis* Chiov. 1903, Ann. di Bot. 1: 210. – *Cystopteris filix-fragilis* Farw. 1904, Ann. Rep. Mich. Acad. Sci. 6: 200. – *Cystopteris anthriscifolia* Fomin, 1911, in Kusn. et al., Fl. Caucas. Crit. 1(1): 15. – *Cystopteris dentata* (Sw.) Desv. 1827, Mém. Soc. Linn. Paris, 6(3): 263. – *Cystopteris fragilis* f. *himalayensis* Bir & K. Trikha, 1976, Amer. Fern J. 66(3): 110. – *Cystopteris fragilis* var. *aprica* Stepanov, 1993, Sibir. Biol. Zhurn. 1993(1): 49. – *Cystopteris fragilis* var. *angustata* (Hoffm.) Link, 1841, Fil. Spec. 46. – *Cystopteris abyssinica* Fée, 1850-52, Gen. Filic.: 300. – *Cystopteris polymorpha* Bubani, 1901, Fl. Pyren. (Bubani) 4: 431.

Described from Europe: "Habitat in collibus Europae frigidioris."

Lectotype (Copeland, 1929): «Amman 52, Herb. Linn. No. 1251.51» (LINN).

Distribution: Abkhazia, Afghanistan, Algeria, Albania, Andorra, Armenia, Austria, Azerbaijan, Belarus, Bosnia-Herzegovina, Belgium, Bulgaria, Bhutan, Cameroon, Canada (Alberta, British Columbia, Labrador, Manitoba, New Brunswick, Newfoundland, Nova Scotia, Northern Territories, Nunavut, Ontario, Quebec, Saskatchewan, Yukon), China (Anhui, Gansu, Hebei, Heilongjiang, Henan, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Xinjiang, Xizang, Yunnan), Croatia, Czech Republic, Denmark, Great Britain, Equatorial Guinea, Estonia, Finland, France, Germany, Georgia, Greece, Greenland, Hungary, Iceland, India, Iran, Iraq, Ireland, Italy, Japan, Kazakhstan, Kenya, Korea, Kyrgyzstan, Latvia, Lesotho, Libya, Lithuania, Macedonia, Malta, Mongolia, Montenegro, Morocco, Nepal, Netherlands, Norway, Pakistan, Poland, Portugal, Romania, Russia (European Part, Caucasus, West Siberia, East Siberia, Far East), Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Tajikistan, Turkey, Turkmenistan, Ukraine, USA (Alaska, Arizona, California, Colorado, Connecticut, Iowa, Idaho, Illinois, Kansas, Massachusetts, Maine, Michigan, Minnesota, Montana, North Carolina, North Dakota, Nebraska, New Hampshire, New Mexico, Nevada, New York, Ohio, Oregon, Pennsylvania, South Dakota, Texas, Utah, Virginia, Vermont, Washington State, Wisconsin, Wyoming), South Africa, Sudan, Tanzania, Tunisia, Uzbekistan.

Cystopteris guizhouensis X. Y. Wang & P. S. Wang, 1997, Acta Bot. Yunnan. 19(2): 141.

Described from China.

Holotype: «CHINA. Guizhou: Hezhang, Jiucaping, in crevices at opening of a cave under forest, 2800 m, 28 Sept. 1991. P. S. Wang 91163» (HGAS).

Distribution: China (Guizhou).

Cystopteris gureevae Stepanov, 2015, Sist. Zametki Mater. Gerb. Krylova Tomsk. Gosud. Univ. 111: 4. – *Cystopteris fragilis* (L.) Bernh. var. *pseudoathyrium* Stepanov, 1993, Sibir. Biol. Zhurn. 1993(1): 49. – *Cystopteris fragilis* (L.) Bernh. var. *macrosorifera* Stepanov, 1993, Sibir. Biol. Zhurn. 1993(1): 49. Described from the Western Sayan.

Holotype: «Ermakovskiy district, Tanzybei village neighborhood, shady cliff along the Chernyi Tanzybei river. 26 VIII 1987. N.V. Stepanov» (KRSU № 30).

Distribution: Russia (West Siberia – Western Sayan).

Cystopteris huteri (Hausm. ex Milde) Shmakov, comb. et stat. nov. – *Cystopteris fragilis* (L.) Bernh. var. *huteri* Hausm. ex Milde, 1867, Fil. Eur. 149. – *Cystopteris fragilis* subsp. *huteri* (Hausm. ex Milde) C. Prada & Salvo, 1985, Anales Jard. Bot. Madrid 41(2): 466, nom. superfl. – *Cystopteris fragilis* subsp. *huteri* (Hausm. ex Milde) Grint. 1952, in Savul., Fl. Rep. Pop. Rom., 1: 89.

Described from South Tirol (Italy).

Type (Blasdel, 1963): AUSTRIA? «Tirol, Pusterthal. In rup. Dolomit. (Huter)» (HT: ?).

Distribution: Andorra, Austria, France, Italy, Romania, Spain,

The presence of significant glandular pubescence on the edge of the lobes and on the whole plate, as well as confinement to dolomites, indicate a species independence, since in other species of the *Cystopteris fragilis* group, this character is absent or there are single glands (*Cystopteris alpina*).

Cystopteris kansuana C. Chr. 1927, J. Wash. Acad. Sci. 17: 499. – *Cystopteris fragilis* subsp. *kansuana* (C. Chr.) Fraser-Jenkins, 2015, Ferns and Fern-allies of Nepal, 1: 24. – *Cystopteris* × *kansuana* (C. Chr.) Blasdel, 1963, Mem. Torrey Bot. Club 21(4): 53, pl. 19, f. b.

Described from the Chinese province of Gansu.

Type: «China. Kansu. La Chang K'ou, near Sining,; alt. 3300 m. VII 1923. R.C. Ching 631» (BM – BM001067990).

Distribution: Bhutan, China (Gansu, Qinghai, Sichuan, Xizang, Yunnan), India (Sikkim), Nepal.

Cystopteris membranifolia Mickel, 1972, Amer. Fern J. 62: 93.

Described from Mexico.

Holotype: «Mexico. Oaxaca: Dto Teotitlán. Ca. 33 km NE of Teotitlán del Camino on road to Huautla. By waterfall in cut-over woods. Elev. ca. 7000 ft alt. 15 IX 1970, Mickel J. T., Leonard S. W., 4544» (NY – NY149412).

Distribution: Mexico (Oaxaca, Puebla, Queretaro, San Luis Potosi, Veracruz), Guatemala.

Cystopteris millefolia Mickel & Tejero, 2004, Brittonia 56 (2): 115.

Described from Mexico.

Holotype: «Mexico. Ocuilán, km 18, Ocuilán-Cuernavaca, Mor. Hemigeofita escasa, frec. en bordes de avenidas. Bos. Mesófilo en cañada. Alt. 2310 m. 09 XI 1985, J. D. Tejero Díez 2234» (NY: NY-00688050).

Distribution: Mexico (Mexico State, Michoacan, Morelos).

Cystopteris protrusa (Weath.) Blasdel, 1963, Mem. Torrey Bot. Club 21: 41. – *Cystopteris fragilis* var. *protrusa* Weath. 1935, Rhodora, 37: 373, pl. 383. – *Cystopteris fragilis* f. *protrusa* (Weath.) Clute, 1938, Ferns in Their Haunts 263.

Described from North America (USA).

Holotype: «Tennessee. Knox County. Knoxville, along Tennessee river. 5 VI 1898. A. Ruth 564» (GH – GH00020947).

Distribution: Canada (Ontario), USA (Alabama, Arkansas, Connecticut, District of Columbia, Delaware, Florida, Georgia, Iowa, Illinois, Indiana, Kansas, Kentucky, Louisiana, Massachusetts, Maryland, Michigan, Minnesota, Missouri, Mississippi, North Carolina, Nebraska, New Hampshire, New Jersey, New York, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Virginia, Wisconsin, West Virginia).

Cystopteris pseudoregia (Rivas Mart., T.E. Díaz, Fern. Prieto, Loidi & Penas) Rivas Mart. 2002, Itinera Geobot. 15(2): 700. – *Cystopteris fragilis* (L.) Bernh. subsp. *pseudoregia* Rivas Mart., T.E. Díaz, Fern. Prieto, Loidi & Penas, 1984, Vegetacion Picos de Europa: 263.

Described from Spain.

Holotype: «Santander: Picos de Europa, Pefia Vieja 1850 m. ad rupes calcareis subalpinis. 15 VII 1976. Ladero & Lopez s.n.» (MAF – MAF96201).

Distribution: Spain.

Most likely it is a hybrid between *Cystopteris fragilis* and *Cystopteris alpina*.

Cystopteris reevesiana Lellinger, 1981, Amer. Fern J. 71(3): 92. – *Cystopteris fragilis* subsp. *tenuifolia* Clute, 1908, Fern Bull. 16: 76. – *Cystopteris fragilis* var. *tenuifolia* (Clute) M. Broun, 1938, Index No. Amer. Ferns 57.

Described from North America (Arizona).

Type: «Carr Canyon. Huachuca Mountains, Cochise Co., Arizona, in rich soil. Nov 1907. J.H. Ferriss» (Type lost or location unknown (Dolan, 1994)).

Distribution: USA (Arizona, Colorado, New Mexico, Texas, Utah), Mexico (Chihuahua, Sonora).

Cystopteris sandwicensis Brack. 1854, U.S. Expl. Exped., Filic. 16: 234.

Type: «Kaala Mt., Wainai, Sandwich Islands, Wilkes Exped. 1838-24» (Blasdel, 1963).

Distribution: Hawaii (Kauai, Lanai, Oahu, Maui)

Some researchers consider this species synonym with *Cystopteris douglasii* Hook.

Cystopteris sikkimensis Ching ex Bir, 1964, Nova Hedwigia 7: 504, t. 36, 37.

Described from the Western Himalayas.

Type: «INDIA. Sikkim: Thangu, 13000', 26 VII 1958. S.S. Bir 1068» (HT: PAN 2261, IT: K001089196).

Distribution: India (Jammu and Kashmir, Sikkim), Nepal.

Some authors recognize this species as a synonym of *Cystopteris dickieana* (Fraser-Jenkins, 1997; Wang et al., 2013).

Cystopteris tasmanica Hook. 1846, Species Filicum, 1: 199. – *Cystopteris fragilis* var. *tasmanica* (Hook.) Hook.f. 1858, Flora Tasmaniae, 2: 136, t. 166. – *Cystopteris novae-zealandiae* J.B. Armstr. 1881, Trans. & Proc. New Zealand Inst. 13: 360.

Described from the Island of Tasmania.

Holotype: «Van Diemen's Land, 1838, R.C. Gunn 32» (K – K 001089192).

Distribution: New Zealand (North Island, South Island), Australia (New South Wales, Tasmania, Victoria).

Cystopteris tenuis Desv. 1827, Mém. Soc. Linn. Paris 6(3): 263. – *Nephrodium tenue* Michx. 1803, Fl. Bor.-Amer. 2: 269. – *Athyrium tenue* (Michx.) A.A. Eaton, 1817, Man. Bot. 122. – *Cystopteris fragilis* (L.) Bernh. var. *mackayi* G.Lawson, 1889, Fern Fl. Canada: 233.

Described from Canada.

Distribution: Canada (New Brunswick, Nova Scotia, Ontario, Quebec), USA (Alabama, Arkansas, Arizona, Colorado, Connecticut, District of Columbia, Delaware, Iowa, Illinois, Indiana, Kansas, Kentucky, Louisiana, Massachusetts, Maryland, Maine, Michigan, Minnesota, Missouri, Mississippi, North Carolina, Nebraska, New Hampshire, New Jersey, New Mexico, Nevada, New York, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Dakota, Tennessee, Utah, Virginia, Vermont, Wisconsin, West Virginia).

Hybrid *Cystopteris fragilis* × *Cystopteris tenuis* was noted from Vermont (Paler, Barrington, 1995). In addition, hybrids of this species with *Cystopteris protrusa* and *C. tennesseensis* were described (Moran, 1982, 1983).

Cystopteris thermalis A.P.Khokhr. 1983, Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol. 88(5): 95.

Described from the Far East (Magadan region).

Holotype: «Prov. Magadanensis, distr. Boreo-evenensis, Tavatum, 7 VII 1972, A. P. Khokhrjakov» (MHA – MHA0032801).

Distribution: Russia (Far East).

Cystopteris ulei Christ, 1900, in Schwanke, Pl. Nov. Mineiras 2: 30.

Described from South America.

Lectotype (Arana, Mynssen, 2015): «Brasil. Goiás, Serra Dourada, entre rochedos, I-1893, E. Ule 530» (P – P00642777).

Distribution: Brazil (Goiás).

Cystopteris utahensis Windham & Haufler, 1991, Amer. Fern J. 81(1): 13.

Described from the USA (Utah).

Type: «U.S.A. Utah: Grand Co., base of Morning Glory Arch in tributary of Negro Bill Canyon 3.93 km SE of its confluence with the Colorado River, 4300 ft, 2 VII 1990. Windham 90-282 & Windham» (HT: UT – UT0009552; IT: ASU – ASU0016867, BRY – BRYV0000655, DUKE – DUKE10000943, KANU – KANU365983, MO – MO255786, UC – UC1738634, US – US00610847, UTC – UTC00218793).

Distribution: USA (Arizona, Colorado, New Mexico, Texas, Utah).

Hybrids

Cystopteris* × *illinoensis R.C. Moran, 1982, Amer. Fern J. 72(2): 43.

Described from North America (Illinois).

Type: «U.S.A. Cultivated in the garden of Ralph C. Benedict at Rockford, Illinois, from wild material found once in an old quarry in Winnebago County, Illinois, date uncertain (probably 1960's), R. C. Benedict» (HT: ILL – ILL00010101; IT: ILLS – ILLS00000003, MO – MO256427, MO256428).

Distribution: USA (Illinois, Ohio, Wisconsin)

The sterile hybrid between *Cystopteris protrusa* and *Cystopteris tenuis* (Moran, 1982).

Cystopteris* × *laurentiana (Weath.) Blasdell, 1963, Mem. Torrey Bot. Club 21: 51. – *Cystopteris fragilis* var. *laurentiana* Weath. 1926, Rhodora 28: 129.

Described from Canada.

Holotype: «Prov. Quebec, Rimouski Co., Limestone-conglomerate cliffs, headland north of Baptiste Michaud's, Bic 18 VII 1904. J.F. Collins & M.L. Fernald» (GH – GH00020944).

Distribution: Canada (New Brunswick, Newfoundland, Nova Scotia, Ontario, Quebec), USA (Iowa, Illinois, Massachusetts, Michigan, Minnesota, New Hampshire, Pennsylvania, Vermont, Wisconsin).

The fertile hybrid (hexaploid) between *Cystopteris bulbifera* and *Cystopteris fragilis*.

Cystopteris × *montserratii* Prada & Salvo, 1985, Anales Jard. Bot. Madrid 41(2): 466. – *Cystopteris fragilis* nothosubsp. *montserratii* (Prada & Salvo) Fraser-Jenk. 1997, New Sp. Syndr. Indian Pteridol.: 100.

Described from Spain.

Holotype: «Lérida, Artigas de Lin, Valle de Aran. 21 VII 1982. J. Molero s.n.» (MGC – MGC12272).

Distribution: Spain.

The sterile hybrid between *Cystopteris dickieana* and *Cystopteris fragilis* (Prada, Salvo, 1985).

Cystopteris × *tennesseensis* Shaver, 1950, Journ. Tenn. Acad. Sc. 25: 107. f. 172-175. – *Cystopteris fragilis* var. *simulans* (Weath.) McGregor, 1950, Amer. Fern J. 40: 204. – *Cystopteris fragilis* f. *simulans* Weath. 1935, Rhodora, 37: 376.

Described from North America.

Distribution: USA (Alabama, Arkansas, Delaware, Georgia, Iowa, Illinois, Indiana, Kansas, Kentucky, Maryland, Minnesota, Missouri, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Virginia, Wisconsin, West Virginia).

The fertile hybrid (allotetraploid) between *Cystopteris bulbifera* and *Cystopteris protrusa* (Haufler et al., 1990).

Cystopteris × *wagneri* R.C.Moran, 1983, Castanea, 48(3): 224.

Described from North America.

Holotype: «U.S.A. Fairfield County, Ohio. 11 VI 1982. Robbin C. Moran 2372» (MICH – MICH1003426A, MICH1003426B).

Distribution: USA (Ohio).

The sterile hybrid between *C. tennesseensis* and *C. tenuis* (Moran, 1983).

Subgenus *Emarginatae* (Blasdell) Shmakov, 2001, Turczaninowia, 4(1-2): 61. – Sect. *Emarginatae* Blasdell, 1963, Mem. Torrey Bot. Club, 21(4): 43. – *Rhizomatopteris* A. Khokhr. 1985, Fl. Magadan. Obl.: 347.

Type: *C. montana* (Lam.) Bernh. ex Desv.

Eight species distributed mainly in Eurasia.

Sect. *Emarginatae* Blasdell, 1963, Mem. Torrey Bot. Club, 21, 4: 43.

Type: *C. montana* (Lam.) Bernh. ex Desv.

Cystopteris modesta Ching, 1940, Bull. Fan Mem. Inst. Biol., Bot. 10: 5.

Described from China (Yunnan).

Holotype: «Yunnan: Salwin-Chiujiang divide, Tsukuai, on rocks by the side of stream, 5600 m, 19 X 1938. T.T. Yü 20777» (PE – PE00059194).

Distribution: China (Yunnan).

Cystopteris montana (Lam.) Bernh. ex Desv. 1805, in Schrader, Neues J. Bot. 1(2): 26. – *Polypodium montanum* Lam. 1778, Fl. Franç. 1: 23. – *Cyathea montana* (Lam.) J. Sm. 1793, Mém. Acad. Roy. Sci. (Turin) 5: 417. – *Aspidium montanum* (Lam.) Sw. 1801, J. Bot. (Schrader) 1800(2): 42–43. – *Athyrium montanum* (Lam.) Röhl. ex Spreng. 1804, Anleit. Kenntn. Gew. 3: 143–144. – *Cystopteris allionii* Newm. 1851, Phytologist 1851. app. XXV. – *Cystopteris myrrhidifolia* (Vill. ex Gilib.) Newm. 1854, Hist. Brit. Ferns, ed. 3 97. – *Cyste montana* (Lam.) Dulac, 1867, Fl. Hautes-Pyrénées 33. – *Filix montana* (Lam.) Underw. 1900, Native Ferns (ed. 6) 119. – *Filicula montana* (Lam.) Farw. 1931, Amer. Midl. Naturalist, 12(8): 252. – *Rhizomatopteris montana* (Lam.) A.P. Khokhr. 1985, Fl. Magadan. Obl. 347.

Described from France ("Cette plante croît dans les lieux montagneux & couverts").

Distribution: Austria, Belgium, Bosnia & Hercegovina, Canada (Alberta, British Columbia, Labrador, Newfoundland, Nova Scotia, Northern Territories, Ontario, Quebec, Saskatchewan, Yukon), China (Gansu, Hebei, Henan, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shanxi, Sichuan, Xinjiang, Xizang, Yunnan), Croatia, Denmark, England, France, Georgia, Germany, Greenland, Finland, Italy, Kazakhstan, Kyrgyzstan, Norway, Poland, Romania, Russia (European Part, Caucasus, West Siberia, East Siberia, Far East), Turkey, USA (Alaska, Colorado, Montana), Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine.

Sect. *khokhrjakovia* (Tzvel.) Shmakov, comb. et stat. nov. – *Rhizomatopteris* Khokht. sect. *khokhrjakovia* Tzvel. 2005, Novosti Sist. Vyssh. Rast. 37: 28.

Type: *Cystopteris sudetica* A. Braun et Milde.

Cystopteris deqinensis Z. R. Wang, 1994, Acta Phytotax. Sin. 32(1): 84.

Described from China (Yunnan).

Holotype: «China. Yunnan: Dêqên, Yongzhongdadui, in valley on rocks, 2400-2800 m, 22 VIII 1981. Hengduanshan Exped. of Inst. of Bot. 3461» (PE – PE00059191).

Distribution: China (Yunnan).

Cystopteris tibetica Z. R. Wang, 1994, Acta Phytotax. Sin. 32(1): 85.

Described from Tibet.

Holotype: «China. Tibet, Xizang, Mainling, alt. 3100 m, on slopes, by stream, 15 VII 1972. Xizang Chin. Herb. Medic. Exped. 3791» (PE – PE00059200).

Distribution: China (Xizang, Yunnan).

Cystopteris tangutica Grubov, 1958, Acta Phytotaxonomica Sinica 7: 295. t. 60.

Holotype: «China occidentalis, Tangut region, jugum a fl. Tetung S. versus in regione media sylvarum 8.500' supra mare. 23 VII 1880. N. Przewalski s.n.» (LE).

Distribution: China (Qinghai).

In Flora of China (Wang et al., 2013), this species is synonym of *Cystopteris moupinensis*.

Cystopteris moupinensis Franch. 1887, Nouv. Arch. Mus. Hist. Nat., sér. 2, 10: 111. – *Cystopteris mairei* Brause, 1914, Hedwigia, 64: 200, t. 4 A. – *Cystopteris sphaerocarpa* Hayata, 1914, Icon. Pl. Formosan. 4: 144, f. 84. – *Cystopteris sudetica* A. Braun & Milde var. *moupinensis* (Franch.) C. Chr. 1924, Acta Horti Gothob. 1(2): 52. – *Cystopteris sudetica* var. *moupinensis* (Franch.) Blasdell, 1963, Mem. Torrey Bot. Club 21(4): 45.

Described from China.

Holotype: «China (Thibet oriental). Province de Moupin. VIII 1869. A. David» (P – P00301567).

Distribution: China (Gansu, Guizhou, Hebei, Henan, Qinghai, Shaanxi, Sichuan, Taiwan, Xizang, Yunnan), India (Sikkim), Nepal.

Cystopteris pellucida (Franch.) Ching, 1934, in C. Chr., Index Filic., Suppl. 3: 67. – *Aspidium pellucidum* Franch. 1887, Nouv. Arch. Mus. Hist. Nat., sér. 2, 10: 119. – *Cystopteris alata* Ching, 1974, Fl. Tsinling. 2: 211. – *Nephrodium pellucidum* (Franch.) Diels, 1900, Bot. Jahrb. Syst. 29(2): 191. – *Dryopteris pellucida* (Franch.) C. Chr. 1905, Index Filic. 5: 283.

Described from China.

Type: «China (Thibet oriental). Province de Moupin. 1870. A. David» (P – P00301566).

Distribution: China (Gansu, Henan, Shaanxi, Sichuan, Xizang, Yunnan).

Cystopteris sudetica A. Braun & Milde, 1855, Jahresber. Schles. Ges. Vaterl. Cult. 1855: 92. – *Rhizomatopteris sudetica* (A. Braun & Milde) A. P. Khokhr. 1985, Fl. Magadan. Obl. 347. – *Cystopteris leucosoria* Schur, 1858, Oesterr. Bot. Z. 8: 328. – *Cystopteris braunii* Milde, 1865, Hoh. Sporenpfl. Deutschl. 70. – *Cystopteris silesiaca* A. Br. ex Milde, 1865, Hoh. Sporenpfl. Deutschl. 70. – *Cystopteris sudetica* var. *leptophylla* Milde, 1865, Hoh. Sporenpfl. Deutschl. 71. – *Cystopteris sudetica* var. *platyphylla* Milde, 1865, Hoh. Sporenpfl. Deutschl. 71. – *Cystopteris sudetica* var. *vulgaris* Milde, 1865, Hoh. Sporenpfl. Deutschl. 71.

Described from Europe.

Lectotype (Shmakov, 2005): «Czech Republic: Am Wege nach den Hirschwiesen von Waldenburg aus, am Fuße des Altvaters in einem feuchten Buchenwalde in größter Menge, Alt.: 2100', VII 1855, Milde, J. et al. s.n.» (B: B200043618).

Distribution: Austria, Belarus, China (Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol, Shanxi, Xizang, Yunnan), Czech Republic, Estonia, Germany, Georgia, Italy, Japan, North Korea, Norway, Poland, Romania, Russia (European Part, Caucasus, West Siberia, East Siberia, Far East), Ukraine, Slovakia, Switzerland.

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