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New distribution data on *Didymodon anserinocapitatus* (X. J. Li) R. H. Zander, *D. maschalogena* (Renauld & Cardot) Broth. and *D. sicculus* M. J. Cano *et al.* (Bryophyta, Pottiaceae)

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Abstract – *Didymodon anserinocapitatus* (X. J. Li) R. H. Zander and *D. maschalogena* (Renauld & Cardot) Broth. are reported as new to Central Asia and SW Asia, respectively. The distribution area of *D. sicculus* M. J. Cano *et al.* is extended to Algeria, The Azores, The Canary Islands, Israel, Turkey and Yemen. The current worldwide range is mapped.

***Didymodon* / Pottiaceae / Distribution / Mediterranean Region / Asia / Macaronesia**

Resumen – Se citan por primera vez *Didymodon anserinocapitatus* (X. J. Li) R. H. Zander y *D. maschalogena* (Renauld & Cardot) Broth. en Asia Central y el SO asiático respectivamente. El área de distribución de *D. sicculus* M. J. Cano *et al.* es ampliada, ya que se cita por primera vez en Argelia, Islas Azores, Islas Canarias, Israel, Turquía y Yemen. Se presentan los mapas de distribución mundial conocida de cada una de las tres especies.

***Didymodon* / Pottiaceae / Distribución / Región Mediterránea / Asia / Macaronesia**

INTRODUCTION

The genus *Didymodon* belongs to the family Pottiaceae, subfamily Merceyoideae, tribe Barbuleae and is represented by approximately 122 species (Zander, 1993), which are distributed throughout the world.

While studying the material of the genus *Didymodon* for a taxonomical revision of this genus in the Mediterranean Region, Macaronesia, Central and Southwestern Asia, we have identified a specimen of *D. anserinocapitatus* and another of *D. maschalogena*.

Didymodon anserinocapitatus is an extremely rare taxon, which is only known from nine localities worldwide. *Didymodon maschalogena*, although collected in several continents, it is only known from very few localities.

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In addition, several samples from different countries of the study area were identified as *D. sicculus*, which was only known from some dry areas of the Mediterranean Region.

MATHERIAL AND METHODS

To confirm the identification of the taxa we studied the type material of each of them. Also all available collections of the genus *Didymodon* deposited in the following institutional and personal herbaria have been revised: B, BC, BCB, BM, BP, C, CAIA, CANM, CLU, COI, E, FCO, FH, FI, G, GB, GDA, GJO, GZU, H, HBG, IRAN, JE, L, LE, LISU, M, MA, MGC, MO, MUB, NMW, NY, O, PAMP, PC, PO, RO, S, SALA, SANT, SINU, SOM, TFC, VAL, VIT, W, WU, Z, herbarium T. L. Blockeel, herbarium P. Boudier, herbarium A. Cogoni, herbarium W. Frey, herbarium J. Martínez-Abaigar, herbarium R. Oliva, herbarium R. B. Pierrot, herbarium R. Düll, herbarium M. Sabovljevic, herbarium R. Skrzypczak, herbarium C. C. Townsend.

RESULTS

Didymodon anserinocapitatus (X. J. Li) R. H. Zander, *Bull. Buffalo Soc. Nat. Sci.* 32: 162. 1993.
Barbula anserinocapitata X. J. Li, *Acta Bot. Yunnan* 3: 103. 1981.
Type: [China] "Tibet, Nan Xian, in riparis, 3200 m" 25.07.1975, *M. Zang 1704* (holotype: KUN; isotype: NY!).

New locality. – KAZAKHSTAN: Inter deversoria Belyye Vody et Antonovka inter Chimkent et Aulie Ata [Taraz], 18.05.1896, *V. F. Brotherus s.n.* (H).
Diagnostic characters and differentiation. – This species is mainly characterized by unistratose lamina, green-yellowish with KOH; apex strongly thickened in an elliptic point, multistratose, very fragile, absent in the mature leaves; costa excurrent, swollen as a propagulum in the excurrency, ventral cells of the costa in the upper middle of the leaf quadrate, smooth or papillose; in transverse section at leaf base with two layers of guide cells; upper and middle laminal cells quadrate to shortly rectangular, 4-8 μm wide, with 1-2 simple, low papillae per cell, sometimes these apparently absent. A complete description and illustrations are provided in Zander & Weber (1997).

Compared to other species of *Didymodon*, only *Didymodon johansenii* (R. S. Williams) H. A. Crum has very fragile and strongly thickened leaf apices. However, this species is distinguished mainly by the size of the upper laminal cells (13-15 μm wide) and guide cells in only a single layer (Zander & Weber, 1997).
Distribution. – *Didymodon anserinocapitatus* was described by Li (1981) from Tibet province, China, and until now it has only been collected outside this area in the Rocky Mountains, in the states of New Mexico and Colorado (U.S.A.) (Zander & Weber, 1997), Yenisey River, in the South Siberia (Russia) (Otnyukova & Zander, 1998) and from Mongol Altai (Mongolia) (Tsegmed, 2001) (Fig. 1).

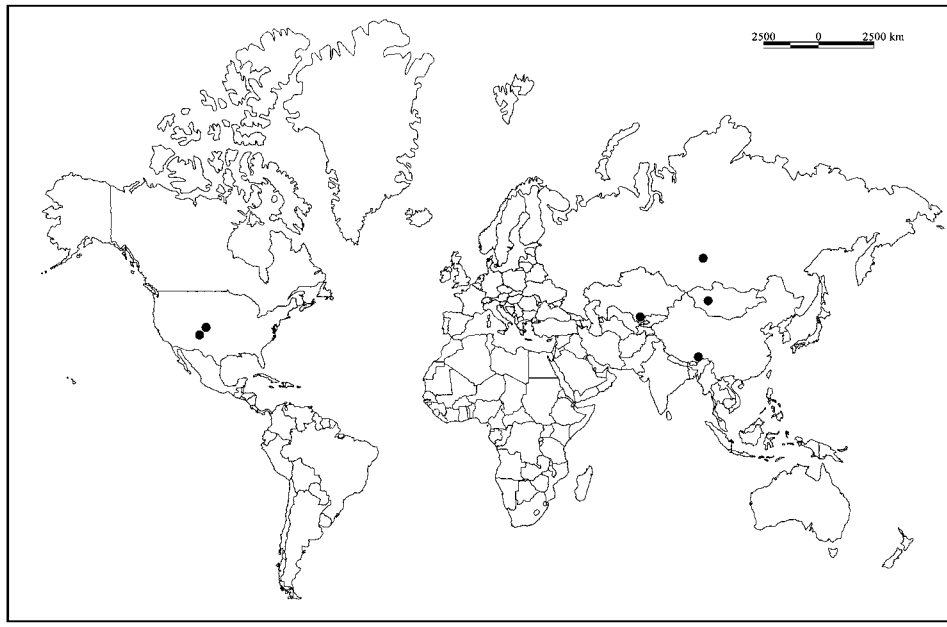

Fig. 1. Present known distribution of *Didymodon anserinocapitatus* in the world.

Didymodon maschalogena (Renauld & Cardot) Broth., *Nat. Pflanzenfam*. I(3): 1192. 1909.
Barbula maschalogena Renauld & Cardot, *Bull. Soc. R. Bot. Belg*. 41(1): 53. 1905.
Type: [India] "Sikkim, Darjeeling" 1901, *G. A. Miller s.n.* (lectotype: PC!, designated by Frahm *et al.* (1996).

New locality. – IRAN: Mounts Elburz (IRAN 4308).
Diagnostic characters and differentiation. – This species is mainly characterized by catenulate leaves, incurved when dry, keeled in the upper part, decurrent at base; lamina unistratose, yellow with KOH; ventral cells of the costa in the upper middle of the leaf elongated, smooth or papillose; upper and middle laminal cells rounded, ovoid or oblong, arranged in longitudinal rows, with one low, simple papillae or, more rarely, smooth; gemmae multicellular, of 2-8 cells, borne in the axils of the leaves, abundant, generally spherical, sometimes elliptical, 20-35(45) µm in diameter, brown, smooth. A complete description and illustrations are provided in Zander (1994).

Didymodon maschalogena belongs to section *Fallaces* (De Not.) R. H. Zander of the genus *Didymodon*, which is distinguished mainly by having elongated adaxial superficial cells of the costa in the upper half of the leaf. This species is hardly confused with other species of this section, since it is the only taxon that has gemmae in the leaf axils. In the literature it is commonly cited as *D. michiganensis* (Steere) K. Saito.
Distribution. – This species is known from different areas of the world, although it has been reported from a very few scattered localities in North America, Africa

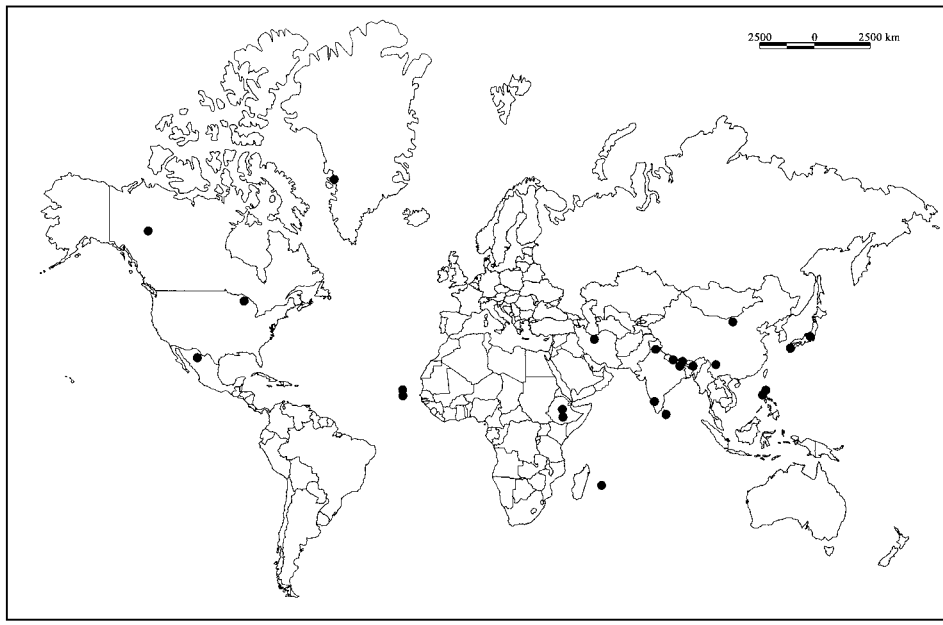

Fig. 2. Present known distribution of *Didymodon maschalogena* in the world.

and Asia. In North America it has been cited from Canada, Greenland, Mexico and U.S.A. (Mogensen & Zander, 1999), in Africa, from the Cape Verde Islands (Frahm *et al.,* 1996), Ethiopia and Reunion Islands (O'Shea, 1999) and in Asia, from Philippines (Sollman, 2000), Japan (Saito, 1975), India (Robinson, 1968; Townsend, 1994), Sri Lanka (O'Shea, 2002), China and Nepal (Townsend, 1994; Redfearn *et al.,* 1996). The specimen studied were collected from northern Iran (Mounts Elburz) and represent the first record of this species in the southwestern Asia (Fig. 2).

Didymodon sicculus M. J. Cano, Ros, García-Zamora & J. Guerra, *The Bryologist* 99: 401. 1996.
Type: "Spain, Alicante, Calpe, salinas El Saladar, UTM: BC 4481" 15.03.1993, *M. J. Cano & R. M. Ros s.n.* (holotype: MUB 5510!).

New localities. – ALGERIA: El Kantara, 36º22'N 6º37'E, 06.04.1985, *R. M. Ros s.n.* (MUB 13143). GREECE: East Macedonia, Strymon river delta at Nea Kerdylia village, 0-20 m, 31.03.2001, *B. Papp s.n.* (BP 168085). East Macedonia, Strymon river delta at Touzla village, 0-20 m, 31.03.2001, *B. Papp s.n.* (BP 168087). ISRAEL: Caesaria, 1970, *Blank s.n.* (CANM 291975). Ramat Gan, Yarhon bank, 03.1953, *F. Bilewsky 256a* (E). MOROCCO: Proximidad a Mohammedia, 16.04.1984, *R. M. Ros s.n.* (MUB 13462). Nador, 12.04.1985, *R. M. Ros s.n.* (MUB 13460). PORTUGAL: The Azores: Santa Maria, roadside near the airport, 23.03.1980, *A. C. Crundwell 526* (Herb. A. C. Crundwell in E). SPAIN: Ciudad Real, Alcázar de San Juan, Laguna de las Yeguas, 39º25'26''N 3º16'48''W,

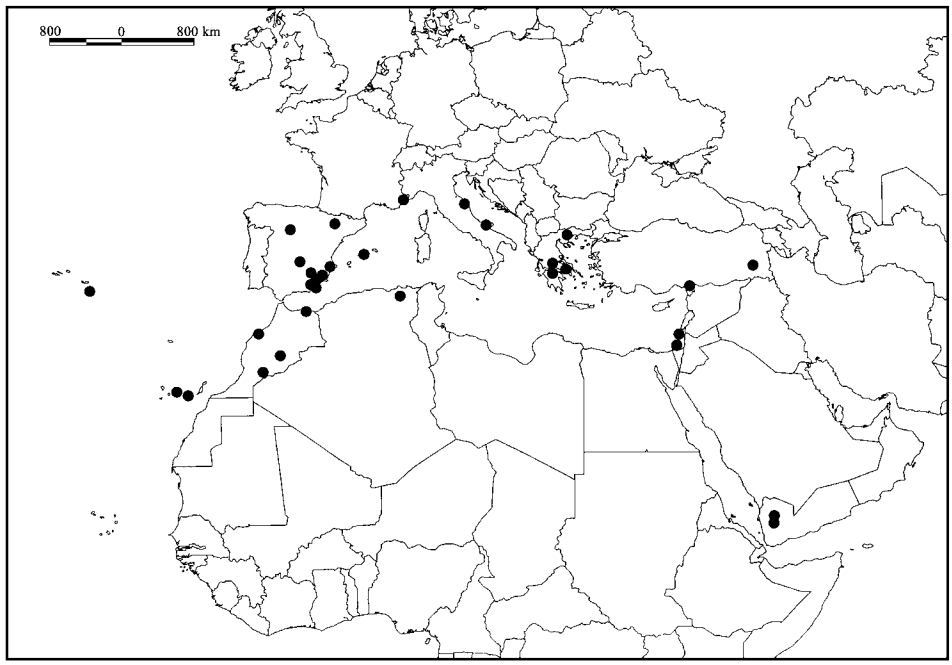

Fig. 3. Present known distribution of *Didymodon sicculus* in the world.

22.03.2003, *M. J. Cano 1098* (MUB 14970). Huesca, pr. Albalate de Cinca, 200 m, 41º43'34''N, 0º08'12''E, 18.04.2003, *M. J. Cano 1147* (MUB 15137). Valladolid, Laguna de Portillo, 26.03.1985, *E. Fuertes-Lasala s.n.* (MA 9343). The Canary Islands: Tenerife, San Cristóbal de la Laguna, 28.05.1997, *M. Abella & L. M. Alonso s.n.* (TFC 13577); Gran Canaria, Jardín Botánico Canario Viera y Clavijo, Tarifa Alta, *ca* 7 km SW of Las Palmas, 20.03.1978, *C. C. Townsend 78/10* (E). TURKEY: Prope oppidum Iskerderum (Alexandrette) versus Beilan, 10.03.1910, *H. F. v. Handel-Mazzetti s.n.* (S). Akdamar island in Van lake at Van city, 26.07.2001, *B. Papp s.n.* (BP). YEMEN: Hadda 4 km of Sana´a by irrigation channels, 13.10.1978, *A. G. Miller 671* (E). Wadi Dahr, 12 km NW of Sana´a, 06.04.1981, *D. G. Long & A. G. Miller 10228* (E). Wadi Dahr, 20 km NW of Sana´a, 11.11.1982, *R. A. King 53b* (E).

Diagnostic characters and differentiation. – *Didymodon sicculus* is characterized by unistratose lamina, sometimes irregularly bistratose in the upper third, green-yellowish with KOH; apex acute to rounded; margins entire or papillose-crenulate, recurved, sometimes very lightly, from base to 3/4 of the leaf, unistratose, rarely irregularly bistratose in the upper third; costa ending below the apex, percurrent or shortly excurrent, ventral cells of the costa in the upper middle of the leaf subquadrate to rectangular, smooth or papillose; upper and middle laminal cells rounded, subquadrate or shortly rectangular, with 1-2(3) simple papillae per cell. A complete description and illustrations are provided in Cano *et al.* (1996a).

Didymodon sicculus is often confused with *D. tophaceus* (Brid.) Lisa but the last species can be well distinguished by its elongated adaxial superficial cells

of the costa in the upper half of the leaf. Furthermore, the habitat of both taxa is very different, *D. sicculus* is a terricolous, xerophilous moss, which grows on basic and acid soil (saline, gypsiferous, clayey, sandy, loamy or nitrified) generally open, ledge of rocks with accumulated soil while *D. tophaceus* grows on calcareous rocks with seeping water or in very humid places. *Didymodon luridus* is another species that can also be confused with *D. sicculus*, although the former is differentiated by smooth upper laminal cells and the red colour of the lamina with KOH.

This species was described by Cano *et al.* (1996a) from specimens from southeast Spain and subsequently it has been found in other places from Spain (Cano *et al.,* 1996b; García-Zamora *et al.,* 1998; Sánchez-Moya & Cano, 1999; Rams *et al.,* 2000).

Distribution. – *Didymodon sicculus* has recently been cited from several areas in the Mediterranean basin: Balearic Islands (Cano *et al.,* 2001), Morocco (Cano *et al.,* 2002), Greece (Blockeel *et al.,* 2002), Italy (Aleffi *et al.,* 2003) and south of France (Jiménez & Skrzypczak, in press). It should now be added to the bryofloras of Algeria, The Azores, The Canary Islands, Israel, Turkey and Yemen (Fig. 3).

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REFERENCES

ALEFFI M., SABOVLJEVIC M. & TACCHI R., 2003 — *Didymodon sicculus* M.J. Cano, Ros, García-Zamora & J. Guerra (Pottiaceae, Musci), new to Italy. *Cryptogamie, Bryologie* 24: 49-51.

BLOCKEEL T.L., ROS R.M., SABOVLJEVIC M., CANO M.J., GALLEGO M.T. & MUÑOZ J., 2002 — New and interesting bryophyte records for Greece. *Cryptogamie, Bryologie* 23: 149-155.

CANO M.J., ROS R.M., GARCÍA-ZAMORA P. & GUERRA J., 1996a — *Didymodon sicculus sp. nov*. (Bryopsida, Pottiaceae) from the Iberian Peninsula. *The Bryologist* 99: 401-406.

CANO M.J., ROS R.M. & GUERRA J. 1996b — Flora briofítica de la provincia de Alicante (SE de España). *Cryptogamie, Bryologie-Lichénologie* 17: 251-277.

CANO M.J., GALLEGO M.T., GARILLETI R., JUARISTI R., LARA F., MARTÍNEZ-ABAIGAR J., MAZIMPAKA V., ROSELLÓ J.A., SÁNCHEZ-MOYA M.C. & URDÍROZ A., 2001 — Aportaciones al conocimiento de la flora briológica española. Notula XIII: Hepáticas y musgos de Mallorca (Islas Baleares). *Boletín de la Sociedad Española de Briología* 18/19: 103-110.

CANO M.J., ROS R.M., GALLEGO M.T., JIMÉNEZ J.A. & GUERRA J., 2002 — Contribution to the bryophyte flora of Morocco: the Anti-Atlas catalogue. *Cryptogamie, Bryologie* 23: 249-262.

FRAHM J.-P., LINDLAR A., SOLLMAN Ph. & FISCHER E., 1996 — Bryophytes from the Cape Verde Islands. *Tropical Bryology* 12: 123-153.

GARCÍA-ZAMORA P., ROS R.M. & GUERRA J., 1998 — Bryophyte flora of the Sierras de Filabres, Cabrera, Alhamilla and Cabo de Gata (Almería, S.E. Spain). *Journal of Bryology* 20: 461-493.

JIMÉNEZ J.A. & SKRZYPCZAK R., 2003 — Présence de *Didymodon sicculus* (Cano *& al.*) (Bryopsida, Pottiaceae) en France. *Bulletin de la Société Botanique du Centre-Ouest* (in press).

LI X.J., 1981 — Some new taxa of Pottiaceae from Xizang (Tibet). *Acta Botanica Yunnanica* 3: 101-112.

MOGENSEN G.S. & ZANDER R.H. 1999 — Four moss species new to Greenland: *Barbula amplexifolia*, *Didymodon brachyphyllus*, *Didymodon michiganensis*, and *Gyroweisia tenuis* (Pottiaceae, Musci). *Lindbergia* 24: 77-83.

O'SHEA B.J., 1999 — Checklist of the mosses of sub-Saharan Africa (version 3, 11/99). *Tropical Bryology Research Reports* 1: 1-133.

O'SHEA B.J., 2002 — Checklist of the mosses of Sri Lanka. *Journal of the Hattori Botanical Laboratory* 92: 125-164.

OTNYUKOVA T.N. & ZANDER R.H., 1998 — *Didymodon anserinocapitatus*, new to Russia from the Yenisey River, South Siberia. *Arctoa* 7: 33-35.

RAMS S., ROS R.M., CANO M.J. & GUERRA J., 2000 — Brioflora urbana de la ciudad de Murcia (SE Península Ibérica). *Boletín de la Sociedad Española de Briología* 17: 9-18.

REDFEARN P.L., Jr., TAN B.C. & HE S., 1996 — A newly updated and annotated checklist of Chinese mosses. *Journal of the Hattori Botanical Laboratory* 79: 163-357.

ROBINSON H., 1968 — Notes on bryophytes from the Himalayas and Assam. *The Bryologist* 71: 82-97.

SAITO K., 1975 — A monograph of Japanese Pottiaceae (Musci). *Journal of the Hattori Botanical Laboratory* 39: 373-537.

SÁNCHEZ-MOYA M.C. & CANO M.J., 1999 — Adiciones a la flora briofítica del sudeste de España. La sierra minera de La Unión (Murcia). *Boletín de la Sociedad Española de Briología* 14: 9-12.

SOLLMAN PH., 2000 — Some mosses (Pottiales) new or rarely collected in tropical Asia. *Tropical Bryology* 19: 25-26.

TOWNSEND C.C., 1994 — A reduction in *Didymodon*, and new records for Asia. *Journal of Bryology* 18: 195-196.

TSEGMED T., 2001 — Checklist and distribution of mosses in Mongolia. *Arctoa* 10: 1-18.

ZANDER R.H., 1993 — Genera of the Pottiaceae: Mosses of harsh environments. *Bulletin of the Buffalo Society of Natural Sciences* 32: 1-378.

ZANDER R.H. 1994 — *Didymodon* Hedw. *In* Sharp A. J., Crum H. & Eckel P. M., (eds.). *The moss flora of Mexico. Part one Sphagnales to Bryales*. Memoirs of the New York Botanical Garden 69: 299-319.

ZANDER R.H. & WEBER W.A., 1997 — *Didymodon anserinocapitatus* (Musci, Pottiaceae) new to the New World. *The Bryologist* 100: 237-238.