A SURVEY TO THE MOSS FLORA OF ALVAND MOUNTAINS IN HAMEDAN PROVINCE, W IRAN

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Alvand Mt. (Hamedan province, W Iran) is one of the highest mountains in Iran. The present research paper is a survey on the moss flora of the area. Based on this study, totally, 22 mosses species are being reported from the area, out of which 14 of them are new for the province, while, two species are new records for Iran. These are belonging to the family *Pottiaceae*, *Syntrichia norvegica* and *Tortula solmsii.* A list of Alvand moss flora based on the present work is also presented. In addition, a list of the Hamedan moss flora on the basis of the recent published papers and our survey is also added. Totally based on the collected specimens in this research and the published literatures, there are 32 moss species in Hamedan province.

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بررسی و مطالعه فلور خزه‌ای ارتفاعات الوند همدان، غرب ایران

سوگل فریدونفر، دانشجوی کارشناسی ارشد گروه زیست شناسی دانشگاه تربیت معلم.

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کوهستان الوند واقع در شهرستان همدان، غرب ایران، یکی از بلندترین رشته کوه‌های ایران است. مقاله حاضر به تحقیقاتی در زمینه بررسی فلورستیک خزه‌های این منطقه پرداخته است. براساس این مطالعه، تعداد ۲۲ گونه خزه از این منطقه جمع‌آوری و گزارش شد که از این تعداد، ۱٤ گونه برای منطقه مورد بررسی و در نتیجه برای استان گزارش‌های جدید محسوب می‌شوند. همچنین دو گونه *Syntrichia norvegica* و *Tortula solmsii* از خانواده *Pottiaceae* نیز برای ایران جدید هستند. فهرستی از فلور خزه‌های الوند نیز بر اساس نمونه‌های مورد بررسی ارایه شده و همچنین فهرستی از فلور خزه‌های استان بر مبنای آخرین مقالات چاپ شده و نمونه های مورد بررسی نیز اضافه شده است. در مجموع بر اساس نمونه‌های جمع آوری شده در این تحقیق و منابع منتشر شده، استان همدان دارای ۳۲ گونه خزه می‌باشد.

INTRODUCTION

There are few taxonomic researches on the bryophytes of Iran, due to the vast arid and semiarid zones in the country. Thus, there left only some limited but rich habitats for bryophytes which are confined to Caspian Sea shores and Hyrcanian forests in N. Iran, and with less concentration on Zagros chain range in the west. The first study of Iranian mosses was made by Buhse (1860), who recorded 43 species in 16 genera and 13 families. This study was continued by several European investigators (Juratzka & Milde, 1870; Brotherus, 1888, 1892, 1906; Schiffner, 1897, 1901, 1908, 1913; Bornmüller, 1908, 1910, 1911, 1915; Nicholson, 1920; Baumgartner, 1939; Gilli, 1941; Frohlich, 1950, 1952-

53, 1959; Jovet-Ast, 1960; Störmer, 1963). During the seventies, Frey, Kürschner and Probst carried out several collection trips mostly concentrated on the collection and field study of bryophytes and vegetation of Iran (Frey & Kürschner, 1977, 1979, 1981, 1983a & 2010; Kürschner, 1996, 2006, 2007, 2008). Frey & Kürschner (1991) reported 363 taxa for the Iranian Bryoflora. Some recent investigations which have been made on Iran bryoflora are mentioned: Shirzadian, 1989; Shirzadian & Kumar, 1994; Shirzadian et al., 2000; Ahmadi et al., 2004; Faridi, 2006, Tavili et al., 2006; Ghahreman et al., 2007; and Amiri, 2011. In the latest published checklist (Akhani & Kürschner 2004) this number is increased to 437, while with Ghahreman et al. (2007) the number increased to 441.

The present work, therefore, covers a part of Iran located around Alvand Mts. in Hamedan province which is not yet studied bryologically. Mt. Alvand, one of the highest peaks of the Zagros Mountains reaching a maximum altitude of 3570 m, is located in Hamedan province. This province has an area of 19,493 km2 and is located in the W. of Iran, centered on Hamedan city. This province is located between 34° 47 ´ and 53° 52″ N (latitude), 48° 30 ´ and 52° 56″ E longitude).

According to reports by the World Weather Information Service, in the 12 months of the year, relative rainfall in the region of highest value in the months of March to April is 49.6 mm to the lowest value in September, that is 0.8 mm and the average annual rainfall is 323.7 mm. The mean temperature in the coldest month of the year is January, and the warmest month, July, is variable between -10.5° C. to 34.9° C.

MATERIALS AND METHODS

This study was done during the spring and summer of 2010. The study has been based on specimens collected from the field by the first author and herbarium specimens from BASU (Buali-Sina University Herbarium, Hamedan, Iran) which were collected by the third author. For determination of the specimens and preparing a complete list for the province the following literature was used: Smith (2004), Akhani & Kürschner (2004), Frey & Kürschner (1991), Kürschner (2006, 2007 & 2008). All the collected specimens are deposited in Ministry of Jihad-e-Agriculture (IRAN) and Tarbiat Moallem University (FAR) herbaria.

RESULTS

Based on Akhani & Kürschner (2004), there are 11 bryophyte taxa recorded from Hamedan province. Alvand, a range mountain in W Iran, is located close to the Hamedan city with a peak of 3570 m, and mainly consists of intrusive rocks.

During the investigation on moss flora of Alvand Range Mountains, it appears that, 22 species are found in the humid patches. These mosses belong to 19 genera and 11 families; among them two species are considered as new records for Iran.

Totally based on the collected specimens in this research and the published literatures, there are 32 moss species in Hamedan province.

List of taxa

This list is based on the present study.

NEW RECORDS

During the present study, two new records are found both belonging to the family *Pottiaceae*, follows with a short description based on the present collections.

Syntrichia norvegica F. Web. (Fig. 1)

Dioicous. Plants mainly yellowish green, reddish brown when dry. Lax cushions, 80 mm high; leaves appressed, ± twisted when dry, squarrose when moist, oblong-spathulate, 1-1.5 mm long, not or hardly constricted at or below the middle, apex obtuse; margins recurved 2/3-3/4 way up leaf; hair-point denticulate, reddish throughout or hyaline only at apex; cells in basal part rectangular, hyaline, upper cells hexagonal, strongly papillose, opaque, 12-16 (-20) µm wide at widest part of leaf. Setae 24 mm long; capsules cylindrical, often slightly curved; peristome teeth filiform, papillose, spirally coiled; operculum long rostrate; calyptrae cucullate, smooth; spores 12-14 µm.

Specimen examined. Hamedan prov., Asadabad, *ca*. 2400 m, 15.05.2010, on rock, Fereidounfar (IRAN 0307 B).

Distribution. N America, N Africa, N Europe, Turkey, Cyprus and Iran.

Tortula solmsii (Schimp.) Limpr. (Fig. 2)

Dioicous. Dense low tufts or scattered plants, 10-18 mm high; Leaves erect, slightly twisted when dry, erect-patent when moist, lingulate, spathulate or ovate, 1-1.5 mm long; apex rounded to obtuse or acute and mucronate; margins plane or narrowly recurved at middle of leaf, papillose-crenulate; costa ending below apex to excurrent, yellowish to greenish hair-point; basal cells thin-walled, hyaline, lax, narrowly rectangular, shorter and narrower toward the margins; upper cells variable in shape, quadrate to rectangular or hexagonal, densely papillose, opaque, 12-16 (-18) µm wide in mid-leaf, 2-5 (-8) marginal rows rectangular and/orquadrate, ± smooth, less well or hardly

differentiated in shade forms, usually unistratose. Setae yellowish when young, brown with age, 8-15 mm long; capsules erect, shortly cylindrical, 2-2.5 mm long; operculum straight or slightly oblique; peristome teeth *c*. 600 μm long, spirally coiled; spores 10-15 μm.
Specimen examined. Hamedan prov., Moradbeig valley, *ca.* 2300 m, 01.05.2010, on soil, Fereidounfar (IRAN 0308 B).
Distribution. Mediterranean and Atlantic Europe, Turkey, Macaronesia, Algeria, Morocco, and Iran.

TAXA LIST

Pottiaceae

-*Syntrichia fragilis* (Taylor) Ochyra
Ganjnameh, Alvand Mt., on rock, *ca.* 2200 m, 01.05.2010, (IRAN 0309 B).
-*S. ruralis* (Hedw.) F. Web & D. Mohr.
Ganjnameh, Alvand Mt., Tarik-darreh, in river bank, *ca.* 2600 m, 01.05.2010, (IRAN 0311 B).
-*S. norvegica* F. Web.
Alvand Mt., on stone, *ca.*1600 m, 17.05.2010, (IRAN 0307 B).
-*Barbula unguiculata* Hedw.
Meidan Mishan, on soil, *ca.* 2700-2800 m, 14.05.2010, (IRAN 0310 B).
-*Tortula solmsii* (Schimp.) Limpr.
Moradbeig valley, in river bank, *ca.* 2300 m, 01.05.2010, (IRAN 0308 B).
-*Pottia davalliana* (Sm.) C. E. O. Jensen
Meidan Mishan, Takhte Nader, on wet soil, *ca.* 2800 m, 10.05.2010, (IRAN 0312 B).
-*Gymnostomum* sp.
Meidan Mishan, Takhte Nader, in river bank, *ca.* 2800-2900 m, 14.05.2010, (IRAN 0313 B).
-*Tortella* sp.
Ganjnameh, Tarik-darreh, in river bank, *ca.* 2000-2200 m, 01.05.2010, (IRAN 0314 B).

Bryaceae

-*Bryum* sp.
Ganjnameh, Meidan Mishan, on soil, *ca.* 2800-2900 m, 14.05.2010, (IRAN 0315 B).
-*B. argenteum* Hedw.
Moradbeig valley, in river bank, *ca.* 2200-2300 m, 01.05.2010, (IRAN 0316 B).
-*B. capillare* Hedw.
Emamzadeh Kouh, on wet soil, *ca.* 2200-2300 m, 01.05.2010, (IRAN 0317 B).
-*B. exile* (Dozy & Molk.) Bosch & Sande Lac.
Alvand Mt., on rock, *ca.* 2500 m, (BASU [IRAN 0318 B]).
-*B. alpinum* Huds.
Alvand Mt., on rock, *ca.*3000 m, (BASU [IRAN 0319 B]).
-*Ptychostomum schleicheri* (Schwägr.) J. R. Spence
Alvand Mt., on rock, *ca.*2500-3000 m, (BASU [IRAN 0320 B]).

Encalyptaceae

-*Encalypta intermedia* Jur.
Meidan Mishan, Takht-e Nader, on rock, *ca.* 2800-2900 m, 14.05.2010, (IRAN 0321 B).
-*E. vulgaris* Hedw.
Emamzade-Kouh, in river bank, *ca.* 2100-2200 m, 01.05.2010, (IRAN 0322 B).

Funariaceae

-*Funaria hygrometrica* Hedw.
Emamzadeh-Kouh, on wet soil, *ca.* 2100-2200 m, 01.05.2010, (IRAN 0323 B).

Grimmiaceae

-*Grimmia longirostris* Hook.
Ganjnameh fall, in river bank, *ca.* 2200-2300 m, 02.05.2010, (IRAN 0324 B).

Amblystegiaceae

-*Palustriella commutatum* (Hedw.) Roth.
Ganjnameh fall, on rock, *ca.* 2200-2300 m, 02.05.2010, (IRAN 0325 B).
-*Hygroamblystegium tenax* (Hedw.) Jenn.
Ganjnameh, Meidan Mishan, in river bank, *ca.* 2900-3000 m, 10.05.2010, (IRAN 0326 B).

Bartramiaceae

-*Philonotis fontana* (Hedw.) Brid.
Ganjnameh, Meidan Mishan, on wet soil, *ca.* 2800-3000 m, 14.05.2010, (IRAN 0327 B).

Brachytheciaceae

-*Brachythecium* sp.
Ganjnameh fall, in river bank, *ca.* 2200-2300 m, 01.05.2010, (IRAN 0328 B).
-*Scorpiurium circinatum* (Brid.) M. Fleisch. & Loeske
Ganjnameh, Meidan Mishan, on rock, *ca.* 2900-3000 m, (BASU [IRAN 0329 B]).

Campyliaceae

-*Hygrohypum luridum* (Hedw.) Jenn.
Ganjnameh, Tarik-darreh, in river bank, *ca.*2500-2600 m, 01.05.2010, (IRAN 0330 B).

Plagiomniaceae

-*Plagiomnium undulatum* (Hedw.) T. Kop.
Alvand Mt., on rock, *ca.*2000-3000 m, (BASU [IRAN 0331 B]).

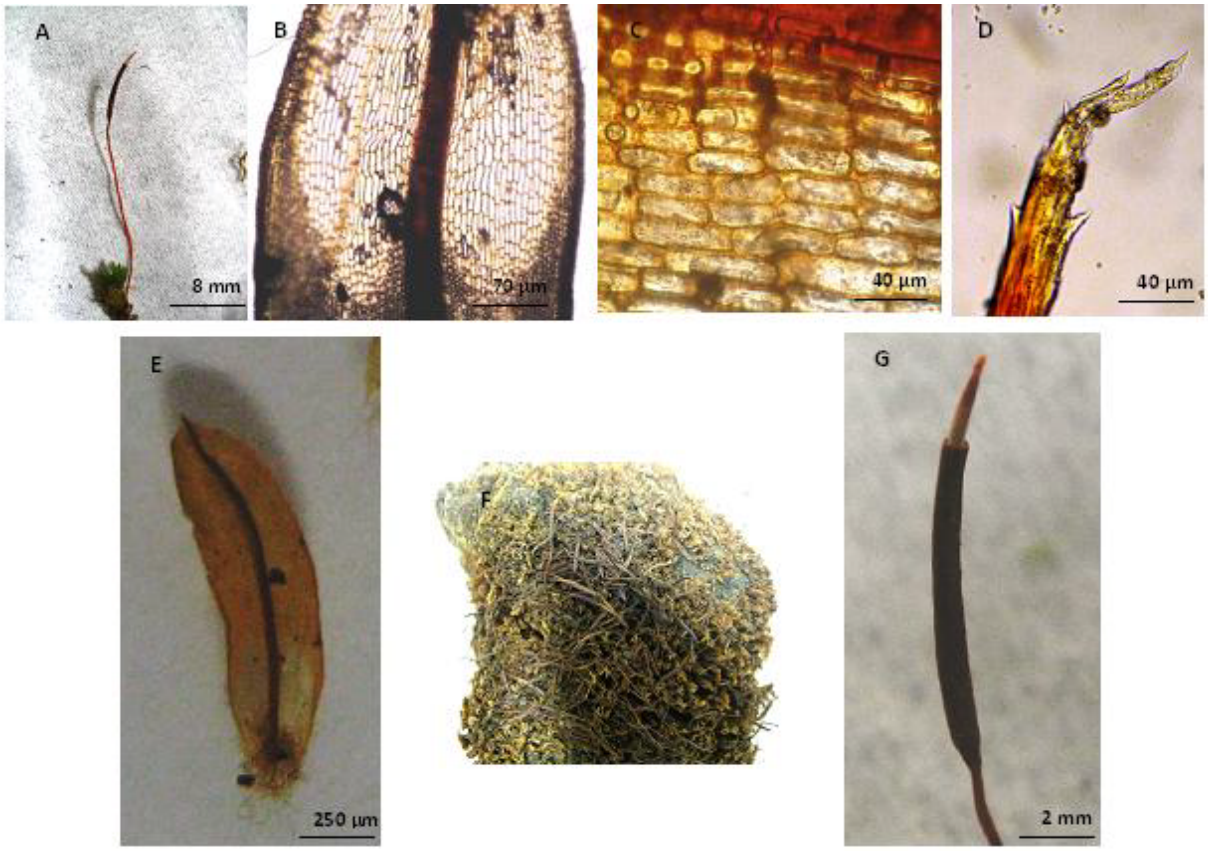

Fig. 1. *Syntrichia norvegica*: A. plant, B. leaf cells, C. leaf cells at the middle & basal parts, D. leaf cells at the apex, E. leaf, F. habit, G. capsule.

Thamnobryaceae

-*Thamnobryum alopecurum* (Hedw.) Gang.
Alvand Mt., on soil, *ca.* 2000-3000 m, (BASU [IRAN 0332 B]).

Mosses checklist of Hamedan province

Amblystegiaceae

- *Hygroamblystegium tenax* (Hedw.) Jenn.
Dist. in Iran: Iran (based on Kürschner 2006), Hamedan province.
-*Palustriella commutatum* (Hedw.) Roth.
Dist. in Iran: Iran (based on Kürschner 2006), Hamedan province.

Bartamniaceae

-*Philonotis caespitosa* Jur.
Dist. in Iran: Hamedan province.
We could not collect any specimen from this species.

-*Philonotis fontana* (Hedw.) Brid.
Dist. in Iran: Hamedan, Kermanshah, Mazandaran & Tehran provinces.

Brachytheciaceae

-*Scorpiurium circinatum* (Brid.) M. Fleisch. & Loeske
Dist. in Iran: Gilan & Hamedan provinces.
This species is only recorded from N Iran (Hyrcanian forests); thus it is a new record for W Iran.

Bryaceae

-*Bryum alpinum* Huds. ex With.
Dist. in Iran: Golestan, Mazandaran, Markazi & Hamedan provinces.
This species is already recorded from N Iran (central and eastern part of Hyrcanian province) and C Iran; thus it is a new record for W Iran.

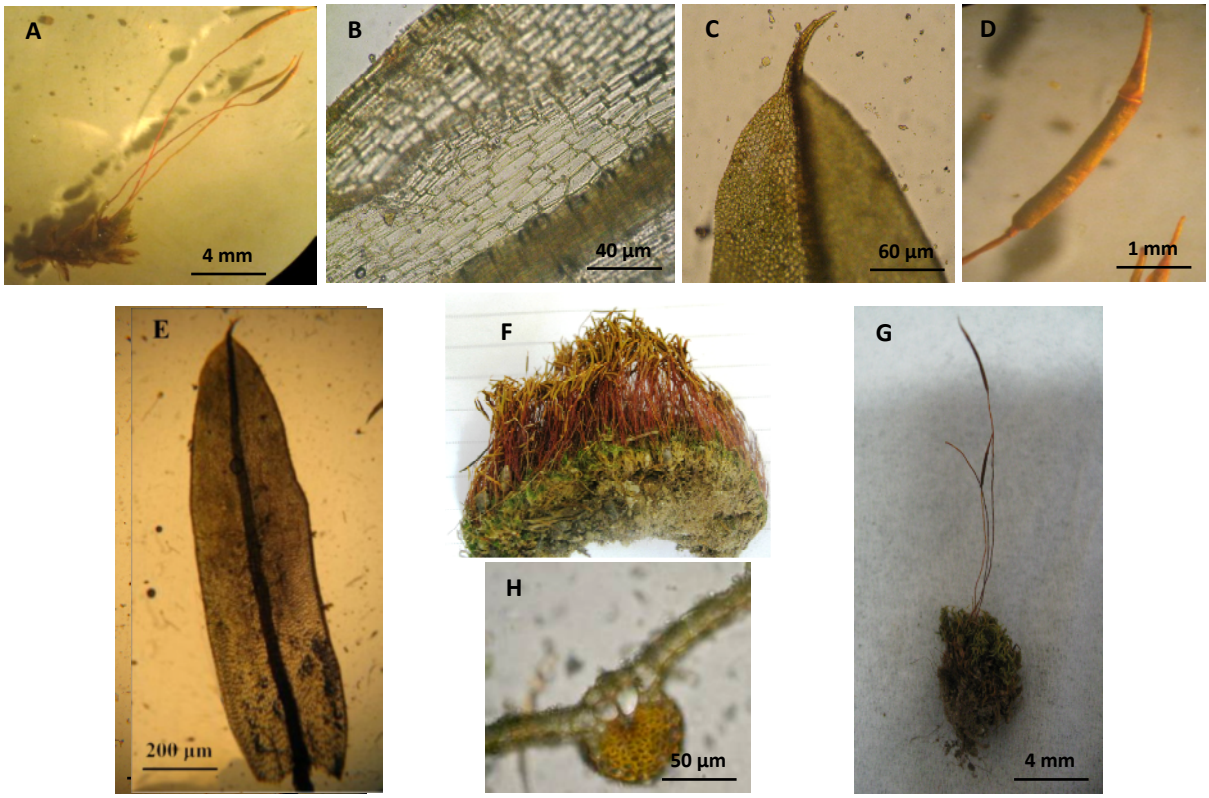

Fig. 2. *Tortula solmsii*: A. plants, B. leaf cells at the middle & basal parts, C. leaf cells at apex, D. capsule, E. leaf, F. habit, G. Dry plants, H. T. S. leaf.

-*B. amblyodon* Müll. Hal.
Dist. in Iran: Hamedan province.
This species was recorded from Iran only from Hamedan province; but we could not collect any specimen from this species.
-*B. argenteum* Hedw.
Dist. in Iran: Gilan, Golestan, Mazandaran, Tehran & Hamedan provinces.
This species was recorded only from N Iran (three provinces in the Hyrcanian province) and Tehran; thus, it is a new record for W Iran.
-*B. capillare* Hedw.
Dist. in Iran: Gilan, Golestan, Lorestan, Tehran & Hamedan provinces.
This species was recorded from Hyrcanian province (N Iran) and W Iran (Lorestan province); thus, it is a new record for the province.
-*B. elwendicum* C. Fehlner
Dist. in Iran: Hamedan, Mazandaran, & Tehran provinces.
The type locality of this species belongs to the studied area, but we could not collect any specimen from this species.
-*B. exile* (Dozy & Molk.) Bosch & Sande
Dist. in Iran: Iran (based on Kürschner 2008), Hamedan province.
-*B. scleicheri* Schwägr
Dist. in Iran: Hamedan, Mazandaran, & Tehran provinces.
We could not collect any specimen of this species in the studied area.
-*B. syriacum* Lorentz
Dist. in Iran: Hamedan, Khorassan, & Tehran provinces.
We could not collect any specimen of this species in the studied area.
-*B. turbinatum* (Hedw.) Turner
Dist. in Iran: Hamedan, Khorassan, Semnan, & Tehran provinces.
We could not collect any specimen of this species in the studied area.
-*Ptychostomum schleicheri* (Schwäegr.) J. R. Spence
This species has not been recorded from west of Iran, thus it is a new record for W Iran.

Campyliaceae

-*Hygrohypnum luridum* (Hedw.) Jenn.

Dist. in Iran: Iran (based on Kürschner2006), Hamedan province.

Cratoneuraceae

-*Palustriella falcate* (Brid.) Hedenas
Dist. in Iran: Hamedan, Golestan, Kermanshah, & Khorassan provinces.
We could not collect any specimen of this species in the studied area.

Encalyptaceae

-*Encalypta intermedia* Jur.
Dist. in Iran: Iran (based on Kürschner 2008), Hamedan province.
-*E. vulgaris* Hedw.
Dist. in Iran: Iran (based on Kürschner 2008), Hamedan province.

Funariaceae

-*Entosthodon durieui* Mont.
Dist. in Iran: Hamedan, Ilam, Lorestan, & Mazandaran provinces.
We could not collect any specimen of this species in the studied area.
-*Funaria hygrometrica* Hedw.
Dist. in Iran: Gilan, Mazandaran, Tehran, Khorassan, & Hamedan provinces.
This species was recorded from N Iran (west to east parts of Hyrcanian province), Tehran, and E Iran, thus it is a new record for W Iran.

Grimmiaceae

-*Grimmia longirostris* Hook.
Dist. in Iran: Mazandaran & Hamedan provinces.
This species was recorded from N Iran (Hyrcanian province), thus it is a new record for W Iran.

Plagiomniaceae

-*Plagiomnium undulatum* (Hedw.) T. Kop.
Dist. in Iran: Gilan, Mazandaran, & Hamedan provinces.
This species was recorded from N Iran (Hyrcanian province), thus it is a new record for W Iran.

Pottiaceae

-*Barbula unguiculata* Hedw.
Dist. in Iran: Gilan, Mazandaran, & Hamedan provinces.
This species was recorded from N Iran (Hyrcanian province), thus it is a new record for W Iran.
-*Eucladium verticillatum* (Brid.) Bruch & Schimp.
Dist. in Iran: Hamedan, Golestan, Khorassan, Kordestan, Lorestan, Mazandaran, & Kermanshah provinces.
This species with a vast distribution in Iran was recorded from Hamedan province too, but we could not find any specimens of it from the studied area.
-*Pottia davalliana* (Sm.) C. E. O. Jensen.
Dist. in Iran: Iran (based on Kürschner 2007), Hamedan province.
-*Syntrichia fragilis* (Taylor) Ochyra
Dist. in Iran: E Azarbayejan, Golestan, & Hamedan provinces.
This species was recorded from N Iran (Hyrcanian province) and W Iran, thus it is a new record for Hamedan province.
-*S. norvegica* F. Web.
Dist. in Iran: Hamedan province.
This species is recorded in this paper for the first time from Iran.
-*S. ruralis* (Hedw.) F. Web. & D. Mohr
Dist. in Iran: Gilan, Golestan, Kordestan, Khorassan, & Hamedan provinces.
This species was recorded from N, W, E Iran, but it is a new record for Hamedan province.
-*Tortula inermis* (Brid.) Mont.
Dist. in Iran: Fars, Golestan, Hamedan, Kermanshah, Khorassan, Kordestan, Mazandaran, & Tehran provinces.
This species with a vast distribution in Iran was recorded from Hamedan province too, but we could not find any specimens of it from the studied area.
-*T. solmsii* (Schimp.) Limpr.
Dist. in Iran: Hamedan province.
This species is recorded here for the first time from Iran.

Thamnobryaceae

-*Thamnobryum alopecurum* (Hedw.) Nieuwl.
Dist. in Iran: Gilan, Mazandaran, Golestan, & Hamedan provinces.
This species was recorded from N Iran (eastern to western parts of Hyrcanian province), thus it is a new record for W Iran.

NOTE

In the present study, the determination of four specimens due to the absence of their sporophytes is done just up to generic level. These are discussed as follows:
a) *Gymnostomum* (*Pottiaceae*) with three species in Iran does not have any species in Hamedan province. Our specimen is the first record for the province: IRAN 0313 B; b) *Tortella* (*Pottiaceae*) with five species in

Iran does not have any species in Hamedan province. Our specimen is the first record for the province: IRAN 0314 B; c) *Bryum* (*Bryaceae*) with 23 species in Iran has nine species in Hamedan province. Our specimen: IRAN 0315 B; d) *Brachythecium* (*Brachytheciaceae*) with 14 species in Iran does not have any species in Hamedan province. Our specimen is the first record for the province: IRAN 0328 B.

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