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## Contributions to the moss flora of the Al-Ghab plain (north-west Syria)

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**Abstract:** Sixty mosses belonging to 12 families and 31 genera are presented from Al-Ghab plain in north-west Syria. Among these, 29 species are recorded for the first time for the bryophyte flora of Syria.

**Key words:** Mosses, taxonomy, Al-Ghab plain, Syria

### 1. Introduction

Lorentz (1868), Geheeb (1902), Schiffner (1913), and Rungby (1959) presented early bryofloristical studies on the study area. Relatively recent interest from native bryologists, such as Al-Aaraj and Nizam (1996), and Tizini (1999, 2008), has created important contributions regarding the bryoflora of Syria but it is still bryologically poorly known in spite of several recent studies performed in Turkey, Syria's northern neighbour (e.g., Erdağ & Kürschner, 2011; Kirmacı et al., 2012; Ören et al., 2012). According to Kürschner and Frey (2011), the Syrian bryoflora is represented by 142 bryophyte taxa (18 liverwort and 124 mosses) with 3 endemics: *Fontinalis mesopotamica* Schiffn., *Philonotis fontana* (Hedw.) Brid. var. *syriaca* (Lorentz) Paris, and *Polytrichum commune* Hedw. var. *ehrenbergii* Lorentz.

The study area, Al-Ghab plain, is situated in north-west Syria. It is surrounded by Hamah to the south, Idlip to the north, and Latakia to the west (Figure). Water sources from the mountainous western part make the plain useful for agricultural activities. Annual precipitation in the area varies between 300 and 1000 mm/year depending on altitude. A typical Mediterranean climate affects major parts of the area and the average temperature is 16 °C in the area (Al-Ghab Research Center, 2010).

### 2. Materials and methods

Two hundred moss specimens were collected from different localities during field trips between 2009 and 2011 and the relevant floras and monographs, e.g., Agnew and Vondráček (1975), Cano et al. (2005), Greven (1995), Heyn and Herrstadt (2004), Hofmann (1998), Jimenez et

al. (2005), Kürschner and Frey (2011), Muñoz (1999), Smith (2004), and Zander (1993), were used for identification of the specimens.

Moss taxa are listed to generic level by adopting the taxonomy and nomenclature of the checklist reported by Hill et al. (2006), which in respect of higher taxonomical ranks is based on the system by Goffinet and Buck (2004). The recorded specific and subspecific taxa are listed alphabetically. All specimens are deposited in the personal herbarium of Badeea Charaf Addine and some of them are deposited in AYDN (Herbarium of Adnan Menderes University).

In the list, asterisks show new records for the Syrian bryoflora and Addine refers to the herbarium number of Badeea Charaf Addine.

### 3. Results

#### Bryophyta

#### Encalyptaceae

#### *Encalypta* Hedw.

#### *E. vulgaris* Hedw.

Syria: Al-Ghab plain, Ain El Kroum, Rashe, Fakro, on soil, 1300 m, 28.09.2009, AYDN 3348.

#### Funariaceae

#### *Entosthodon* Schwägr.

#### \**E. attenuatus* (Dicks.) Bryhn

Syria: Al-Ghab plain, Al-Asharneh, Ammorine, on soil, near road, 200 m, 22.02.2011, AYDN 3346.

#### *Funaria* Hedw.

#### *F. hygrometrica* Hedw.

Syria: Al-Ghab plain, Al-Asharneh, Ammorine, on soil, near road, 260 m, 22.04.2011, AYDN 3347.

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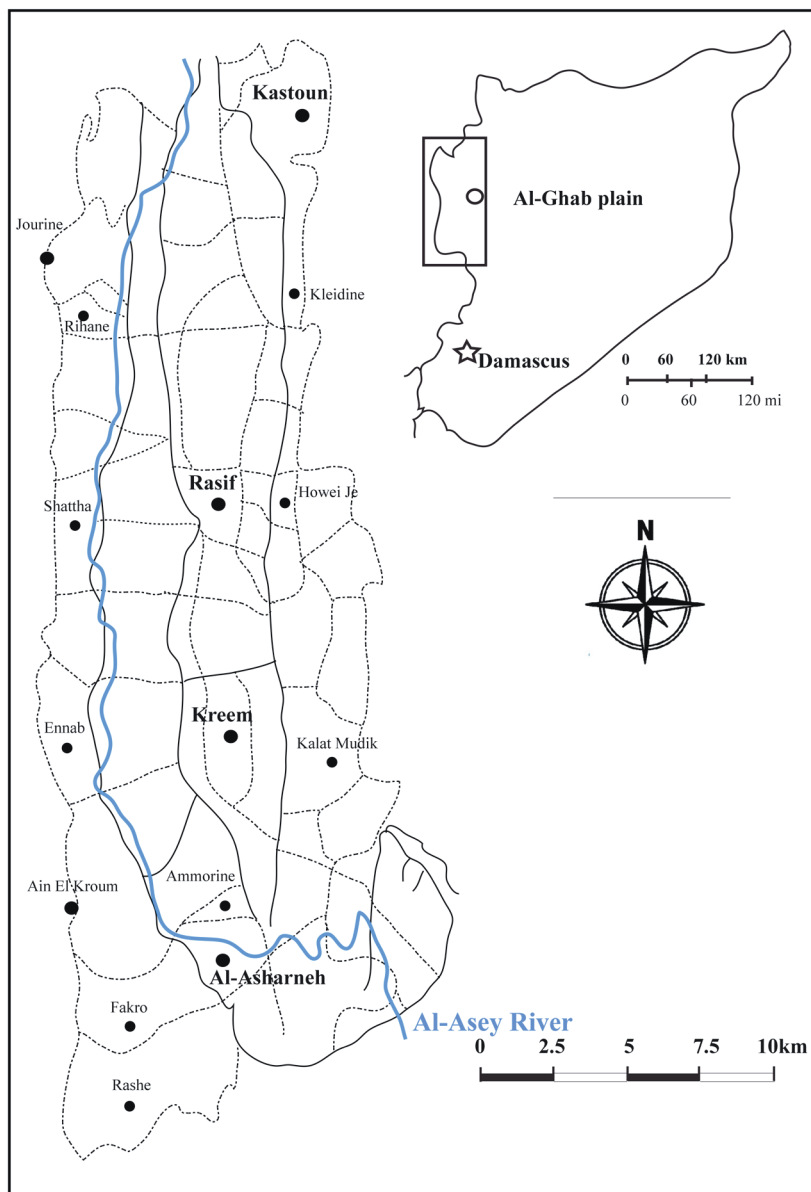


Figure. Map of the study area.

### Grimmiaceae

#### *Grimmia* Hedw.

##### \**G. capillata* De Not.

Syria: Al-Ghab plain, Ain El Kroum, Rashe, on calcareous rocks, 1200 m, 23.03.2011, AYDN 3367; Kastoun, Kleidine, on calcareous rocks, 720 m, 01.03.2011, AYDN 3381.

##### *G. dissimulata* E.Maier.

Syria: Al-Ghab plain, Ain El Kroum, Rashe, 1200 m, 03.05.2011, AYDN 3374; Al-Asharneh, Ammorine, on calcareous rocks, 260 m, 22.05.2009, AYDN 3382; Kastoun, Kleidine, on calcareous rocks, 640 m, 06.06.2010, AYDN 3383; Kreem, Kalat Mudik, on calcareous rocks, 200 m, 30.06.2009, AYDN 3384.

##### \**G. elongata* Kaulf.

Syria: Al-Ghab plain, Ain El Kroum, Rashe, on calcareous rocks, 1200 m, 03.05.2011, AYDN 3378; Al-Asharneh, Ammorine, on calcareous rocks, 260 m, 22.05.2009, AYDN 3385.

##### *G. lisae* De Not.

Syria: Al-Ghab plain, Kastoun, Kleidine, on calcareous rocks, 700 m, 06.05.2010, AYDN 3373; Al-Asharneh, Ammorine, on calcareous rocks, 260 m, 05.05.2009, AYDN 3386.

##### *G. pulvinata* (Hedw.) Sm.

Syria: Al-Ghab plain, Ain El Kroum, Rashe, on calcareous rocks, 1200 m, 03.05.2011, AYDN 3368; Al-Asharneh, Ammorine, on calcareous rocks, 260 m,

22.05.2009, AYDN 3369; Kastoun, Kleidine, on calcareous rocks, 640 m, 06.06.2010, AYDN 3370; Kreem, Kalat Mudik, on calcareous rocks, 200 m, 30.06.2009, AYDN 3371; Rasif, Rasif, Shattha, Howeiye, on calcareous rocks, 186 m, 01.04.2011, AYDN 3372.

\**G. pulvinata* var. *africana* (Hedw.) Wilson.

Syria: Al-Ghab plain, Ain El Kroum, Rashe, on calcareous rocks, 1200 m, 03.05.2011, AYDN 3372; Al-Asharneh, Ammorine, on calcareous rocks, 260 m, 22.05.2009, AYDN 3387; Rasif, Shattha, Howeiye, on calcareous rocks, 186 m, 01.04.2011, AYDN 3388.

\**G. tergestina* Tomm. ex Bruch & Schimp

Syria: Al-Ghab plain, Kastoun, Kleidine, on calcareous rocks, 640 m, 11.07.2010, AYDN 3376; Kreem, Kalat Mudik, 200 m, 30.06.2010; Rasif, Shattha, Howeiye, on calcareous rocks, 186 m, 01.07.2010, AYDN 3389.

#### Fissidentaceae

*Fissidens* Hedw.

*F. viridulus* (Sw.) Wahlenb.

Syria: Al-Ghab plain, Ain El Kroum, Rashe, Fakro, on wet soil in forest, 1300 m, 06.03.2010, AYDN 3342.

\**F. viridulus* var. *incurvus* (Starke ex Röhl.) Waldh.

Syria: Al-Ghab plain, Ain El Kroum, Fakro, on wet soil in forest, 1300 m, 06.03.2010, AYDN 3343.

#### Ditrichaceae

*Pleuridium* Rabenh.

\**P. acuminatum* Lindb.

Syria: Al-Ghab plain, Kastoun, Kleidine, on soil, 450 m, 06.08.2010, AYDN 3350.

#### Pottiaceae

*Timmiella* (De Not.) Limpr.

\**T. barbuloides* (Brid.) Mönk.

Syria: Al-Ghab plain, Ain El Kroum, Rashe, on soil, 1200 m, 03.05.2011, AYDN 3349; Al-Asharneh, Ammorine, on soil, 260 m, 30.05.2009, AYDN 3390.

*Eucladium* Bruch & Schimp.

*E. verticillatum* (With.) Bruch & Schimp

Syria: Al-Ghab plain, Al-Asharneh, Ammorine, on soil, 260 m, 30.09.2009, AYDN 3381.

*Gyroweisia* Schimp.

*G. tenuis* (Hedw.) Schimp.

Syria: Al-Ghab plain, Jourine, Ain Rihane, on rocks, 1440 m, 06.06.2011, AYDN 3380.

*Pleurochaete* Lindb.

*P. squarrosa* (Brid.) Lindb.

Syria: Al-Ghab plain, Ain El Kroum, Rashe, Fakro, on soil in mountains, on rocks, 1200 m, 06.06.2010, AYDN 3317; Kastoun, Kleidine, on rocks, 640 m, 06.06.2010, AYDN 3391.

*Tortella* (Müll.Hal.) Limpr.

\**T. tortuosa* (Hedw.) Limpr.

Syria: Al-Ghab plain, Ain El Kroum, Rashe, Fakro, on soil, 1200 m, 16.08.2010, AYDN 3307; Kastoun, Kleidine, on soil and rocks, 640 m, 12.08.2009, AYDN 3392.

*Barbula* Hedw.

\**B. convoluta* var. *sardoa* Schimp.

Syria: Al-Ghab plain; Kastoun, Kleidine, on soil and rocks, 640 m, 22.07.2010, AYDN 3323.

*B. unguiculata* Hedw.

Syria: Al-Ghab plain, Kastoun, Kleidine, on soil and rocks, 640 m, 22.07.2010, AYDN 3336.

*Cinclidotus* P.Beauv.

\**C. fontinaloides* (Hedw.) P.Beauv

Syria: Al-Ghab plain, Jourine, Ain Rihane, on rocks in stream bed, on submerged rocks, 1440 m, 16.08.2010, AYDN 3303.

*C. riparius* (Host ex Brid.) Arnott

Syria: Al-Ghab plain, Jourine, Ain Rihane, on rocks in stream bed, on submerged rocks, 1400 m, 16.08.2010, AYDN 3304.

*Syntrichia* Brid.

*S. calcicola* J.J.Amman

Syria: Al-Ghab plain, Al-Asharneh, Ammorine, on rocks, 260 m, 30.09.2009, AYDN 3319; Kreem, Kalat Mudik, 200 m, 30.10.2009, AYDN 3393.

*S. handelii* (Schiffn.) S.Agnew & Vondr.

Syria: Al-Ghab plain, Kastoun, Kleidine, on rocks, 640 m, 06.08.2010, AYDN 3321.

*S. laevipila* Brid.

Syria: Al-Ghab plain, Al-Asharneh, Ammorine, on rocks, 260 m, 30.09.2009, AYDN 3324; Kreem, Kalat Mudik, on rocks, 200 m, 30.10.2009, AYDN 3394.

*S. ruralis* (Hedw.) F.Weber & D.Mohr

Syria: Al-Ghab plain, Al-Asharneh, Ammorine, on rocks, 260 m, 30.09.2009, AYDN 3322; Kreem, Kalat Mudik, on rocks, 200 m, 30.10.2009, AYDN 3335.

\**S. subpapillosissima* (Bizot & R.B.Pierrot ex W.A.Kramer) M.T.Gallego & J.Guerra

Syria: Al-Ghab plain, Al-Asharneh, Ammorine, on rocks, 260 m, 30.09.2009, AYDN 3320; Kreem, Kalat Mudik, on rocks, 200 m, 30.10.2009, AYDN 3395.

*Tortula* Hedw.

*T. brevissima* Schiffn.

Syria: Al-Ghab plain, Al-Asharneh, Ammorine, on soil and rocks, 260 m, 30.09.2009, AYDN 3340.

*T. cuneifolia* (Dicks.) Turner.

Syria: Al-Ghab plain, Kastoun, Kleidine, on soil and rocks, 640 m, 22.07.2010, AYDN 3338.

*T. inermis* (Brid.) Mont.

Syria: Al-Ghab plain, Kastoun, Kleidine, on soil and rocks, 640 m, 30.09.2009, AYDN 3305.

*T. muralis* Hedw.

Syria: Al-Ghab plain, Al-Asharneh, Ammorine, on soil and partially on rock, 260 m, 30.12.2009, AYDN 3330; Kreem, Kalat Mudik, on soil and partially on rock, 200 m, 30.12.2009, AYDN 3331.

**\*T. subulata** Hedw.

Syria: Al-Ghab plain, Rasif, Howeiye, on rock, 170 m, 14.07.2010, AYDN 3306; Kreem, Sheriya, Kalat Mudik, on rock, 190 m, 24.09.2010, AYDN 3333.

**Orthotrichaceae****Orthotrichum** Hedw.**O. cupulatum** var. **bistratosum** Schiffn.

Syria: Al-Ghab plain, Ain El Kroum, Rashe, on calcareous rocks, 1200 m, 03.10.2009, AYDN 3363; Kastoun, Kleidine, on calcareous rocks, 700 m, 11.09.2010, AYDN 3365.

**\*O. diaphanum** Schrad. ex Brid.

Syria: Al-Ghab plain, Ain El Kroum, Rashe, on decayed tree root, 1200 m, 08.09.2009, AYDN 3364; Kastoun, Kleidine, on decayed tree root, 700 m, 11.09.2010, AYDN 3366.

**Bryaceae****Bryum** Hedw.**\*B. archangelicum** Bruch & Schimp.

Syria: Al-Ghab plain, Al-Asharneh, Ammorine, on wet soil, 260 m, 23.04.2011, AYDN 3351.

**B. argenteum** Hedw.

Syria: Al-Ghab plain, Kastoun, Kleidine, on rocks, near road, 720 m, 01.03.2011, AYDN 3359.

**B. caespiticium** Hedw.

Syria: Al-Ghab plain, Ain El Kroum, Rashe, on soil and rocks, 1200 m, 03.05.2011, AYDN 3358; Al-Asharneh, Ammorine, on soil and rocks, 260 m, 22.05.2010, AYDN 3397; Kreem, Kalat Mudik, on soil and rocks, 180 m, 30.04.2011, AYDN 3398.

**\*B. capillare** Hedw.

Syria: Al-Ghab plain, Al-Asharneh, Ammorine, on wet soil, 250 m, 12.03.2011, AYDN 3355.

**B. dichotomum** Hedw.

Syria: Al-Ghab plain, Al-Asharneh, Ammorine, on wet soil, 250 m, 17.03.2009, AYDN 3357.

**B. funckii** Schwägr.

Syria: Al-Ghab plain, Al-Asharneh, Ammorine, on wet soil, 255 m, 22.03.2010, AYDN 3361.

**\*B. marrattii** Hook.f. & Wilson

Syria: Al-Ghab plain, Al-Asharneh, Ammorine, on wet soil, 255 m, 22.03.2010, AYDN 3356.

**B. torquescens** Bruch & Schimp.

Syria: Al-Ghab plain, Al-Asharneh, Ammorine, on wet soil in forest, 260 m, 28.02.2011, AYDN 3352.

**Pohlia** Hedw.**\*P. cruda** (Hedw.) Lindb.

Syria: Al-Ghab plain, Rasif, Howeiye, on soil, 170 m, 15.09.2010, AYDN 3379.

**Amblystegiaceae****Hygroamblystegium** Loeske

**\*H. fluviatile** subsp. **noterophilum** (Sull. & Loeske) Grout.

Syria: Al-Ghab plain, Jourine, Ain Rihane, on rocks in stream bed, on submerged rocks, 1440 m, 15.01.2011, AYDN 3295.

**Brachytheciaceae****Scorpiurium** Schimp.**\*S. circinatum** (Brid.) Fleisch. & Loeske

Syria: Al-Ghab plain, Jourine, Ain Rihane, on rocks in stream bed, on submerged rocks, 1440 m, 06.01.2011, AYDN 3296.

**\*S. sendtneri** (Schimp.) M.Fleisch.

Syria: Al-Ghab plain, Jourine, Ain Rihane, on wet soil in forest, 1440 m, 06.01.2011, AYDN 3314.

**Eurhynchium** Schimp.**\*E. striatum** (Hedw.) Schimp.

Syria: Al-Ghab plain, Jourine, Ain Rihane, on rocks near stream, 1440 m, 15.07.2010, AYDN 3328.

**Platyhypnidium** M.Fleisch.**P. riparioides** (Hedw.) Dixon

Syria: Al-Ghab plain, Jourine, Ain Rihane, on rocks in stream bed, on submerged rocks, 1440 m, 15.07.2010, AYDN 3329.

**Rhynchostegium** Schimp.**\*R. confertum** (Dicks.) Schimp.

Syria: Al-Ghab plain, Ain El Kroum, Rashe, Fakro, on wet soil in forest, 1150 m, 06.03.2010, AYDN 3310.

**Oxyrrhynchium** (Schimp.) Warnst.**\*O. speciosum** (Brid.) Warnst.

Syria: Al-Ghab plain, Ain El Kroum, Fakro, on wet soil in forest, 1150 m, 03.04.2010, AYDN 3316.

**Brachythecium** Schimp.**\*B. albicans** (Hedw.) Schimp.

Syria: Al-Ghab plain, Ain El Kroum, Rashe, Fakro, on wet soil in forest, 1200 m, 06.03.2010, AYDN 3313.

**B. rutabulum** (Hedw.) Schimp.

Syria: Al-Ghab plain, Ain El Kroum, Rashe, Fakro, on wet soil in forest, 1200 m, 06.03.2010, AYDN 3308.

**Scleropodium** Bruch & Schimp.**\*S. caespitans** (Wilson ex Mull.) L.F.Koch.

Syria: Al-Ghab plain, Ain El Kroum, Rashe, Fakro, on wet soil in forest, 1150 m, 06.03.2010, AYDN 3312.

**S. touretii** (Brid.) L.F.Koch.

Syria: Al-Ghab plain, Ain El Kroum, Rashe, on wet soil in forest, 1150 m, 16.02.2009, AYDN 3309.

**Homalothecium** Schimp.**H. lutescens** (Hedw.) H.Rob.

Syria: Al-Ghab plain, Ain El Kroum, Fakro, on rocks and soil in forest, 1220 m, 03.09.2009, AYDN 3297.

**H. sericeum** (Hedw.) Schimp.

Syria: Al-Ghab plain, Ain El Kroum, Fakro, on rocks and soil in forest, 1220 m, 03.09.2009, AYDN 3298.

**Plagiotheciaceae****Myurella** Schimp.**M. julacea** (Schwägr.) Schimp.



Syria: Al-Ghab plain, Al-Asharneh, Ammorine, on soil, 250 m, 17.03.2009, AYDN 3318.

#### Leucodontaceae

##### *Antitrichia* Brid.

\**A. curtipendula* (Hedw.) Brid.

Syria: Al-Ghab plain, Ain El Kroum, Fakro, on wet rocks in mountains, 1220 m, 28.12.2010, AYDN 3299.

##### *Leucodon* Schwägr.

\**L. sciuroides* (Hedw.) Schwägr.

Syria: Al-Ghab plain, Ain El Kroum, Rashe, on wet rocks in mountains, 1200 m, 08.12.2009, AYDN 3301.

##### *Pterogonium* Sw.

\**P. gracile* (Hedw.) Sm.

Syria: Al-Ghab plain, Ain El Kroum, Fakro, on wet rocks in mountains, 1220 m, 08.12.2009, AYDN 3302.

#### 4. Discussion

As a result of the identification of approximately 200 specimens, 60 moss taxa belonging to 12 families and 31 genera have been found in the area. Among these mosses, 29 taxa, namely *Entosthodon attenuates*, *Grimmia capillata*, *G. elongate*, *G. pulvinata* var. *africana*, *G. tergestina*, *Fissidens viridulus* var. *incurvus*, *Pleuridium*

*acuminatum*, *Timmia barbuloidea*, *Tortella tortuosa*, *Barbula convoluta* var. *sardoa*, *Cinclidotus fontinaloides*, *Syntrichia subpapillosissima*, *Tortula subulata*, *Orthotrichum diaphanum*, *Bryum archangelicum*, *B. capillare*, *B. marrattii*, *Pohlia cruda*, *Hygroamblystegium fluviatile* subsp. *noterophilum*, *Scorpiurium circinatum*, *S. sendtneri*, *Eurhynchium striatum*, *Rhynchostegium confertum*, *Oxyrrhynchium speciosum*, *Scleropodium cespitans*, *Brachythecium albicans*, *Antitrichia curtipendula*, *Leucodon sciuroides*, and *Pterogonium gracile* are recorded for the first time for the Syrian bryophyte flora. Most of these records are very common species in the Middle Eastern floras and this shows the poorness of the knowledge on the Syrian bryophytes. As easily expected, acrocarpous mosses contribute 76.6% of the flora (46 taxa) because of the climatic features of the area. *Pottiaceae* is the richest family in terms of species number and is now represented in the flora by 71 taxa (Kürschner and Frey, 2011). The present bryofloristical situation of Syria is far from reflecting the real situation due to the lack of research on the topic, but it reflects perfectly the need for further studies to understand comprehensively the Middle East bryologically.

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