# Contributions to the moss flora of the Isthmic Desert, Sinai; Egypt

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Sixteen moss species are reported as new records from Gebel Dalfa and Ain Qadies of the Isthmic Desert in Northern Sinai, among these seven species are new records to the Isthmic Desert while *Trichostomum brachydontium*, is a new record to the flora of Egypt. This brings the total number of fully identified mosses known from Isthmic Desert to 32 taxa. Notes on habitats, fruiting, sex organs and gemmae are given.

***Key words:*** Bryoflora, Egypt, Isthmic Desert, moss flora, northern Sinai.

## *Introduction*

The survey of the bryoflora of the Isthmic Desert in Northern Sinai has, so far, been limited to four localities: 1- Arif El-Naga, 2- Gebel Halal, 3- Gebel Libni and 4- Gebel El-Godyrat (Table 1, Fig. 1). From these localities, Bilewsky (1974), Shabbara (1999) and Abou-Salama & El-Saadawi (2000) reported 33 mosses of which the following 25 species (Table 1) were fully identified.

**Table (1):** Fully identified moss species from Isthmic Desert.

| Taxon | Locality number | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| **Fissidentaceae** | | | | |
| 1. *Fissidens arnoldii* | | | | + |
| **Pottiaceae** | | | | |
| 2. *Tortella humilis* | | | + | |
| 3. *Trichostomum crispulum* | | | + | + |
| 4. *Didymodon aaronis* | | | | + |
| 5. *D. rigidulus* var. *rigidulus* | | | + | + |
| 6. *D. vinealis* | | + | | + |
| 7. *Gymnostomum viridulum* | | | + | + |

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**Table (1):** continued.

| Taxon | Locality number | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| * 8. *Aloina aloides* var. *ambigua* | | | | + |
| * 9. *A. bifrons* | | | | + |
| 10. *Crossidium aberrans* | | + | | |
| * 11. *C. squamiferum* | + | | | + |
| * 12. *Microbryum starckeanum* | | | | + |
| 13. *Pterygoneurum subsessile* | + | | | |
| * 14. *Tortula atrovirens* | | | | + |
| * 15. *T. muralis* | | | | + |
| **Funariaceae** | | | | |
| * 16. *Entosthodon attenuatus* | | | + | + |
| * 17. *E. plano-convexus* | | + | | |
| * 18. *F. hygrometrica* | | + | | |
| * 19. *F. hygrometrica* var. *calvescens* | | + | | |
| * 20. *F. pulchella* | | | | + |
| * 21. *Physcomitrium immersum* | | + | | |
| **Bryaceae** | | | | |
| 22. *B. argenteum* | | | | + |
| 23. *B. bicolor* | | | + | + |
| 24. *B. caespiticium* | | | | + |
| 25. *B. capillare* | | | | + |

* Fruiting plants.

Abou-Salama & El-Saadawi (2000) referred, in some detail, to climatic conditions and geomorphological features of the Isthmic Desert especially its hilly district which apparently favour luxuriant growth of mosses with 17 new records.

The present paper reports other new records to the moss flora of the Isthmic Desert based on collections made from two localities in the hilly district that were not surveyed bryofloristically before.

## *Localities and Materials*

The two new localities studied were Gebel Dalfa and Ain Qadies area, which are situated in the northeastern part of the Isthmic Desert (Fig. 1).

Gebel Dalfa is about 405 m. above sea level. Growth of mosses was more opulent on the much cooler north-facing slopes of Gebel Dalfa than on its south-facing ones. The mean monthy maximum and minimum temperatures of Gebel Dalfa, as measured by Khalil (1995), were found to be 26.8 ºC and 5.9 ºC for north-facing slopes and 43.3 ºC and 7.6 ºC for south-facing ones respectively. Moss populations were found

to grow mainly on fine sediments between or below rock boulders, in water runnels and in rock crevices.

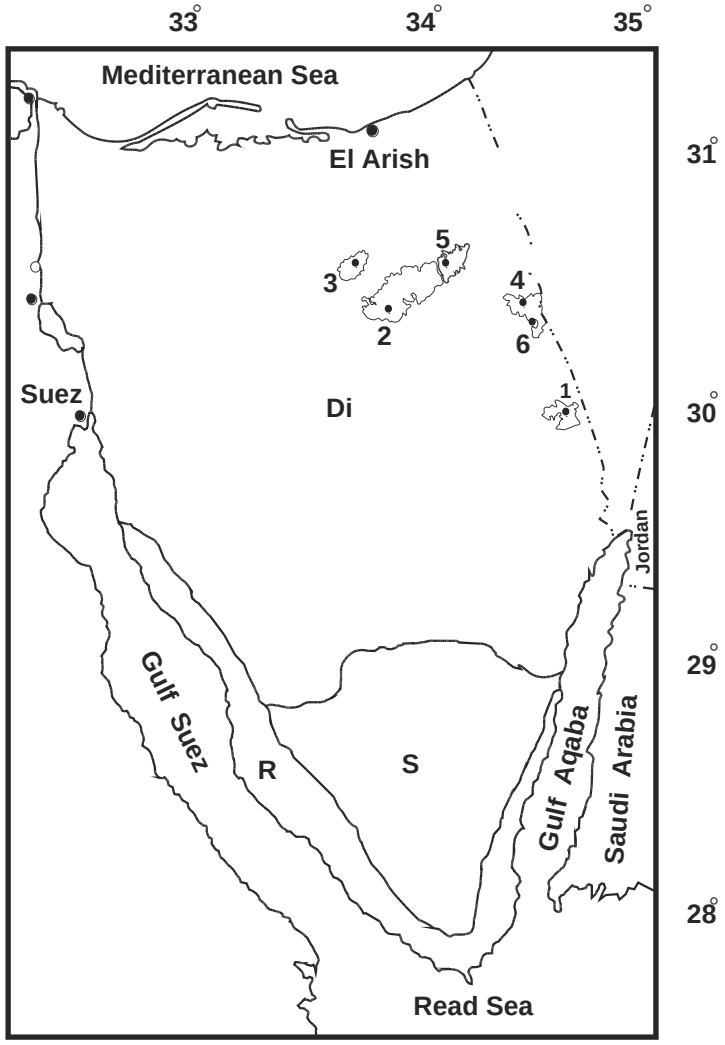


**Fig. (1):** Phytogeographical territories (after Täckholm, 1974; El-Hadidi & Fayed, 1994/95) and the localities studied in North Sinai. **Di**: Isthmic Desert, **R**: Red Sea Costal Plains, **S**: Southern Sinai Massif, 1: Areif El-Naqa (Arif El-Naga), 2: Gebel Halal, 3: Gebel Libni, 4: Gebel El-Qideirat (El-Godyrat), 5: Gebel Dalfa, 6: Ain Qadies.

Ain Qadies is one of the numerous natural springs in the hilly district, originating from accumulation of waters gathering and percolating through rocks and springing

through fissures, usually in wadi beds, forming shallow extended pools. Limestone rocks dominate the surface area in which Ain Qadies spring is located. Moss populations grow on alluvium and on fine sediments derived from withered limestone rocks.

A total of 43 moss samples were collected in April 1995, among which 25 samples were from Gebel Dalfa and 18 samples from Ain Qadies area. All samples are numbered and housed in CAIA.

Identification was carried out by comparing with authentic specimens and by using keys and descriptions and illustrations available in recent reference works which were consulted for classification, synonymy and authority of plant names as appeared in the recently published updated list of Egyptian mosses (El-Saadawi *et al.*, 1999).

## *Results*

Intensive microscopic examinations of the 43 samples showed that they included 20 moss entities. Sixteen of them are fully identified while four are identified to generic level (*Trichostomum, Barbula, Gymnostomum* & *Bryum*).

Seven out of the 16 fully identified mosses are new to Isthmic Desert while *Trichostomum brachydontium* Bruch is a new record to the flora Egypt. These seven new records are: *Trichostomum brachydontium, Didymodon rigidulus* var. *gracilis, Gymnostomum mosis, Aloina aloides* var. *aloides, Crossidium laevipilum, Entosthodon ? fascicularis* , and *Bryum funkii* (vide the list of Egyptian mosses; El-Saadawi *et al.,* 1999).

The 16 fully identified mosses belong to 10 genera in four families of four orders. Details pertaining to number of gatherings, locality, habitat, altitude relative to sea level and sterility or fertility are provided.

### I. Fissidentales
### 1. Fissidentaceae

**1. *Fissidens arnoldii***

**Gebel Dalfa**; in the shade below rock boulders in a water runnel; 120-145 m; WE 69, WE 70. Sporophytes recorded in the two gatherings.

The two samples of *F. arnoldii* dated March 1994 from Gebel El-Godyrat collected by Abou-Salama & El-Saadawi (2000), were entirely sterile.

### II. Pottiales
### 2. Pottiaceae
### a. Trichostomoideae

**2. *Trichostomum brachydontium***

**Gebel Dalfa**; in the shade below rock boulders in a water runnel, on fine sediments between smooth rocks, in rock crevices; 95-160 m ; WE 69, WE 76, WE 78, RE 8, RE 12. Sporophytes recorded in one gathering.

**b. Merceyoideae**

**3. *Didymodon rigidulus* var. *rigidulus***

**Gebel Dalfa**; in the shade below rock boulders in a water runnel, on fine sediments between smooth rocks, in rock crevices; 95-130 m; WE 69, WE 76, WE 77, RE 14. Sterile plants.

**4. *D. rigidulus var. gracilis***

**Gebel Dalfa**; in the shade below rock boulders in a water runnel, on fine sediments between smooth rocks, in rock crevices; 100-130 m; WE 69, WE 70, WE 71, WE 72, WE 74, WE 75, WE 76, RE 1, RE 3, RE 6, RE 7, RE 8, RE 10, RE 11, RE 13, RE 14.

**Ain Qadies**, in the shade below rock boulders in a water runnel, on fine sediments between smooth rocks, on fine alluvium behind water pool, in rock crevices, on wadi bed; 100-150 m; WE 79, WE 81, WE 84, RE 19, RE 20, RE 21, RE 23, RE 24. Sterile plants.

**5. *Gymnostomum mosis***

**Gebel Dalfa**, in the shade below rock boulders in a water runnel, on fine sediments between smooth rocks, in rock crevices; 100-145 m; WE 70, WE 71, WE 72, WE 77, RE 2, RE 5, RE 6, RE 7, RE 8, RE 9, RE 10, RE 12, RE 13, RE 14, RE 15.

**Ain Qadies**, in the shade below rock boulders in a water runnel, on fine sediments between smooth rocks, in rock crevices, on fine alluvium behind water pool, on wadi bed; 95-130 m; RE 17, RE 19, RE 22, RE 23, RE 24, WE 79, WE 80, WE 81, WE 82, WE 83, WE 86. Sterile plants.

**c. Pottioideae**

**6. *Aloina aloides* var. *aloides***

**Ain Qadies**, in rock crevices; 130 m; WE 82. Fruiting plants.

**7. *A. aloides* var. *ambigua***

**Gebel Dalfa**, in the shade below rock boulders in a water runnel, on fine sediments between smooth rocks; 95-160 m; RE 3, RE 8, RE 12, RE 14, WE 73, WE 74. Sporophytes recorded in all gatherings.

**8. *A. bifrons***

**Gebel Dalfa**, in the shade below rock boulders in a water runnel, on fine sediments between smooth rocks, in rock crevices; 100-245 m; RE 1, RE 2, RE 3.

**Ain Qadies**, in the shade below rock boulders in a water runnel, on wadi bed, on fine alluvium behind water pool, on fine sediments in rock crevices; 100-145 m; RE 19, RE 21, WE 80, WE 81. Sporophytes recorded in one gathering.

**9. *Crossidium laevipilum***

**Gebel Dalfa**, on fine sediments between smooth rocks; 145 m; WE 73.

**Ain Qadies**, in the shade below rock boulders in a water runnel, on fine alluvium behind water pool, on wadi bed; 100-150 m; Re 1, Re 21. Sporophytes recorded in all gatherings.

**10. *C. squamiferum***

**Gebel Dalfa**, in the shade below rock boulders in a water runnel, in rock crevices; 100-210 m; RE 7, WE 72, WE 74, WE 76.

**Ain Qadies**, in the shade below rock boulders in a water runnel, on fine sediments between smooth rocks, in rock crevices; 95-120 m; RE 17, RE 19, RE 20, WE 84. Sporophytes recorded in all gatherings.

**11. *Tortula atrovirens***

**Gebel Dalfa**, in the shade below rock boulders in a water runnel, on fine sediments between smooth rocks, in rock crevices; 110-220 m; RE 2, RE 3, RE 4, RE 5, RE 6, RE 8, RE 9, RE 11, RE 12 , RE 14 , WE 69, WE 71, WE 75, WE 76, WE 77, WE 78.

**Ain Qadies**, in the shade below rock boulders in a water runnel, on wadi bed, on fine sediments between smooth rocks, on fine alluvium behind water pool, on fine sediments in rock crevices; 110-200 m; RE 16, RE 18, RE 19, RE 22, WE 82, WE 83, WE 85, WE 86. Sporophytes recorded in all gatherings.

## III. Funariales

### 3. Funariaceae

**12. *Entosthodon ? fascicularis***

**Gebel Dalfa**, in the shade below rock boulders in a water runnel; 145 m; WE 69. Fruiting plants, but with decayed capsules.

**13. *Funaria hygrometrica***

**Gebel Dalfa**, in the shade below rock boulders in a water runnel; 120 m; RE 4. Fruiting plants.

## IV. Bryales

### 4. Bryaceae

**14. *Bryum bicolor***

**Gebel Dalfa**; in the shade below rock boulders in a water runnel, on fine sediments between smooth rocks, in rock crevices; 110-1630 m; RE 4, RE 5, RE 15, WE 72, WE 77.

**Ain Qadies**; on fine sediments between smooth rocks, on fine alluvium behind water pool, 110-130 m; WE 79, WE 80, WE 85, WE 86. Rhizoidal gemmae recorded in three gatherings.

**15. *B. ? caespiticium***

**Gebel Dalfa**; in the shade below rock boulders in a water runnel, on fine sediments between smooth rocks, in rock crevices; 110-160 m; RE 15, WE 75, WE 77. Sterile plants.

**16. *B. funkii***

**Ain Qadies**; on fine sediments between smooth rocks, 130 m; RE 18, RE 20. Sterile plants.

## *Concluding Remarks*:

The above data show that all fully identified taxa were recorded from Gebel Dalfa except *Aloina aloides* var. *aloides* and *Bryum funkii*. Nine of these taxa were recorded in Ain Qadies area. *Trichostomum brachydontium* which is a new record to Egypt is reported from Gebel Dalfa (5 gatherings). This moss is of world wide distribution and is known from Afr 1-4, As 1-5, Am 1-4, 6 (Zander, 1993) .

The most frequent moss in the study area (expressed by no. of samples collected) is *Gymnostomum mosis* (26 samples) followed by *Didymodon rigidulus var. gracilis* and *Tortula atrovirens* (24 samples each), *Bryum bicolor* (9 samples), *Crossidium squamiferum* (8 samples), *Aloina bifrons* (7 samples), *Aloina aloides var. ambigua* (6 samples) and the remaining nine mosses are represented by five samples or less each.

Six out of the 16 fully identified mosses did not bear sporophytes or any kind of sex organs and are apparently sterile at the time of collection, except for the presence of rhizoidal gemmae in *Bryum bicolor*. The ten fruiting samples belonged to Fissidentaceae (one taxon), Pottiaceae (seven taxa) and Funariaceae (two taxa).

As a result of this work the number of fully identified mosses from Isthmic Desert had increased from 25 to 32, with Pottiaceae (19 taxa) as the predominant family. It is followed by Funariaceae (seven taxa) then Bryaceae (five taxa) and Fissidentaceae (one taxon). The number of fruiting taxa had increased from 12 to 17 (9 Pottiaceae, 7 Funariaceae and one Fissidentaceae).

It may be worthy to mention that six out of the 32 fully identified mosses in the Isthmic Desert are not known, up to the present from other parts of Egypt. These are: *Trichostomum brachydontium, Tortella humilis, Pterygoneurum subsessile, Entosthodon plano-convexus, Funaria hygrometrica* var. *calvescens* and *Physcomitrium immersum*.

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