

# Contributions to the moss flora of the Egyptian Oases. 1. Farafra Oasis.

Usama, Y. Abou-Salama

and

Wagieh El-Saadawi  
Botany Department, Faculty of Science,  
Ain Shams University, Cairo-Egypt.  
E-mail: elsaadawy@link.net

Abou-Salama U.Y. & El-Saadawi W. 2001. Contributions to the moss flora of the Egyptian Oases. 1. Farafra Oasis. *Taeckholmia*. 21(2):283-290.

Twelve moss species are reported for the first time from Farafra Oasis (Western Desert of Egypt). Eight of them belong to *Bryum* of which *Bryum inclinatum* is a new record to Egypt. The number of mosses known from the Oases territory is raised from 15 to 23 species. Floristic comparisons show more elements in common with Northern Africa and Sinai than with the Nile Region.

**Key words:** Bryoflora, Egypt, Farafra Oasis, mosses.

## Introduction

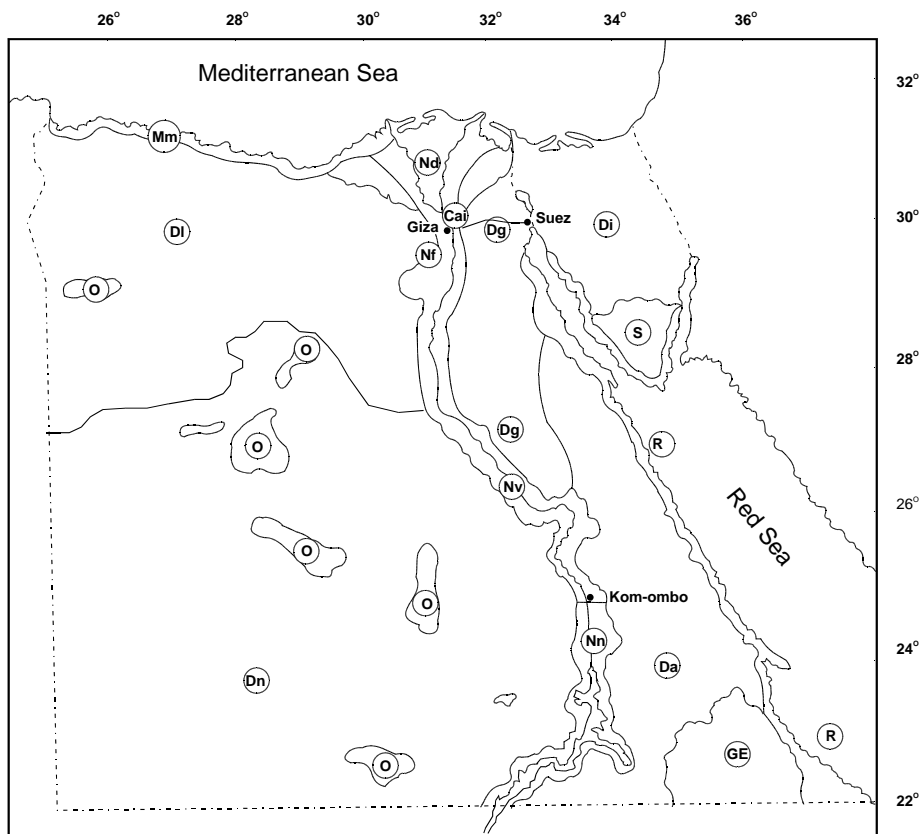
The Egyptian Oases are closed depressions in the Western Desert receiving very little or almost no rain, yet from green patches within the surrounding sterile desert (cf. Migahid *et al.*, 1960; El—Hadidi, 2000). They owe their greenness to a huge underground artesian basin; waters of which appear at the soil surface in the form of springs, or is pumped from wells. Some of the Oases are quite small in area being less than a square kilometer while others are hundreds or even thousands of square kilometers. Inhabitants of the Oases depend on agriculture for their living.

According to Said (1990) and El-Hadidi (2000) the oases of the Western Desert belong to structurally related groups, different geomorphologic units and different climatic provinces.

Siwa Oasis together with Qattara and Fayum Depressions lie in the Libyan Desert. Baharyia and Farafra Oases lie in the Limestone plateau in the northern part of the Nubian Desert, whereas Dakhla, Kharga and the smaller Kurkur, Dungul and Bir Kissieba-Shabb Oases lie in the southern sandstone part of this desert. The Libyan Desert Oases belong to the hyperarid provinces III.1 & III.2, but are under the influence of the arid province II.1, especially the Siwa Oasis (cf. El-Hadidi, 2000). The climate of the Nubian Desert Oases is extremely arid in the South to hyperarid or arid northwards (cf. Migahid *et al.*, 1960; El-Hadidi, 2000). The winter annual rainfall (in the Nubian Desert) ranges between 0-5 mm. The mean winter temperatures are between 17-22°C, while mean summer temperatures are between 27-30°C (maxima of slightly less than 50°C have been recorded in Dakhla and Kharga Oases) (Migahid *et al.*, 1960; El-Hadidi, 2000).

Farafra Oasis is situated between latitudes 26° 45' and 27° 30' N and between longitudes 27° 10' and 28° 25' E. Its general level is about 130 m asl. (Issawi, *et al.*, 1999). It is irregularly, triangular in shape with its apex towards the north (Fig.1). It is bounded by two bold and with great height east and west cliffs and a less in height north cliff. To the south the floor of the Farafra depression rises imperceptibly (Said, 1990).

Similar to Dakhla and Kharga Oases, the prevailing habitats (sand plains, dunes, saline lands ..... etc) are not suitable for inhabitation by bryophytes (cf. Abou-Salama and El-Saadawi, 2001 b). The only sites suitable for the growth of bryophytes in Farafra are like in Dakhla and Kharga Oases, on moist walls lining sides of artesian wells, water basins, irrigation canals and their muddy banks, especially in shade of cultivated crop plants; date palms, orchards of olive trees and other fruit trees.



**Figure 1.** Phytogeographical territories in Egypt (After Täckholm, 1974; El-Hadidi & Fayed 1994/95). **Cai:** Cairo area; **Da:** Arabian Desert; **Dg:** Galala Desert; **Di:** Isthmic Desert; **Dl:** Libyan Desert; **Dn:** Nubian Desert; **GE:** Gebel Elba; **Mma:** Western Mediterranean coastal land; **Nd:** Nile Delta; **Nf:** Nile Faiyum; **Nn:** Nile Nubia, from Kom-Ombo southwards to Egyptian boundaries with the Sudan including the areas now inundated by the waters of Lake Naser since 1965; **Nv:** Nile Valley, from Cairo-Giza to Kom-Ombo; **O:** Oases of Western Desert; **R:** Red Sea coastal plains; **S:** Southern Sinai massive (Sinai proper i.e. relatively high mountains, south of Isthmic desert)

At present, few records are known from the Egyptian Oases including nine mosses from Kharga Oasis, five from Dakhla Oasis; and one from Bahariya Oasis. This account, therefore, reports on the bryophytes of Farafra Oasis.

### ***Materials***

Twenty-eight moss samples were collected, on the last day of February, and the first day of March 1997, from different sites (moist walls, muddy canal sides, in shade) in four main localities in Farafra; Ain Horrah (Horrah spring) (7 samples), Aisha Abd-el-Rahman village (7 samples), Ain Galow (5 samples) and Ain Beshowy (9 samples). All samples were numbered and kept in CAIA.

### ***Results***

The examination of the collected 28 samples resulted in the recognition of 12 taxa, 10 of which were identified to the specific level and two to generic (*Bryum*) level. The 12 taxa belong to four genera in three families.

All are first records from Farafra Oasis; *Bryum inclinatum* (Brid.) Bland. is a new record to Egypt.

Information pertaining to localities, habitats, number of gatherings and sterility or fertility conditions of the 12 collected mosses is given below.

#### **Order 1: Pottiales**

##### **Family: Pottiaceae**

##### **Subfamily: Merceyoideae**

##### **1- *Didymodon fallax* (Hedw.) R. H. Zander**

Farafra Oasis; Ain Horrah, on a sandy-brick wall of a spring, three gatherings, female plants.

##### **2- *Didymodon tophaceus* (Brid.) Lisa**

Farafra Oasis; Ain Beshowy, on wet shaded irrigation channel margin, nine gatherings, female plants.

#### **Order 2: Funariales**

##### **Family: Funariaceae**

##### **3- *Funaria hygrometrica* Hedw.**

Farafra Oasis; Ain Horrah, on a sandy-brick wall of a spring, two gatherings, fruiting plants.

#### **Order 3: Bryales**

##### **Family: Bryaceae**

##### **4- *Brachymerium exile* (Dozy. & Molk.) Bosch & Sande Lac.**

Farafra Oasis; Ain Galow, on wet shaded irrigation channel margin just above water level, two gatherings, sterile plants.

**5- *Bryum bicolor* Dicks.**

Farafra Oasis; Aisha Abd-el-Rahman village, on a wall of a hot water basin, one gathering, plants with axillary bulbils.

**6- *Bryum caespitium* Hedw.**

Farafra Oasis; Ain Horrah, on a sandy-brick wall of a spring, one gathering, sterile plants.

**7- *Bryum inclinatum* (Brid.) Bland.** (Figure 2).

Plants unisetous, median-sized, up to 1.5 cm (excluding sporophyte). Stem branched, radiculose, with central strand, pentagonal in T.S. Leaves lanceolate and long ovate, crowded, equidistant, imbricate, appressed, erect, up to 1.2 mm long, usually straight when dry; subapical leaves short, less than 1 mm, ovate, concave; leaf innovations long ovate, concave, small, distant but more crowded at branch apex, patent and spreading; perichaetial leaves large, up to 1.7 mm, usually triangular or triangular-ovate, with stout costa, recurved margin and thickened cell walls; lamina margin unbordered or with indistinct border of long cells, slightly serrulate at leaf apex but entire below, plane but faintly recurved towards leaf base, unistratose; apex acute; costa excurrent to smoothly serrulate point, tapering gradually towards leaf apex, with ventral guides and a dorsal band with slightly larger dorsal superficial cells; cells pentagonal, hexagonal and  $\pm$  prosenchymatous at apical and mid-leaf parts but wide rectangular and sometimes thin walled at leaf base, more wide near costa, with size about 75 (60) x 8 (10)  $\mu\text{m}$  at leaf apex and 60 (50) x 12 (15)  $\mu\text{m}$  at leaf base. Seta  $\pm$  cygenous, brown, up to 1.7 cm; capsule pyriform, brown when mature, crenuous to pendulous, straight, pachydermous, up to 1 mm long (omitting operculum); peristome double; exostome long triangular, articulate, golden brown with hyaline scarious tips, up to 350  $\mu\text{m}$ ; endostome membranous; annulus of 4 rows, operculum mamillate; exothecial cells incrassate especially towards mouth; stomata phaneropore, numerous; spores  $\pm$  spheroidal, with diameter 12-16  $\mu\text{m}$ .

Farafra Oasis; Aisha Abd-el-Rahman village, on a wall of a hot water basin, three gatherings, fruiting plants.

**New record to the bryoflora of Egypt.**

**8- *Bryum radiculosum* Brid.**

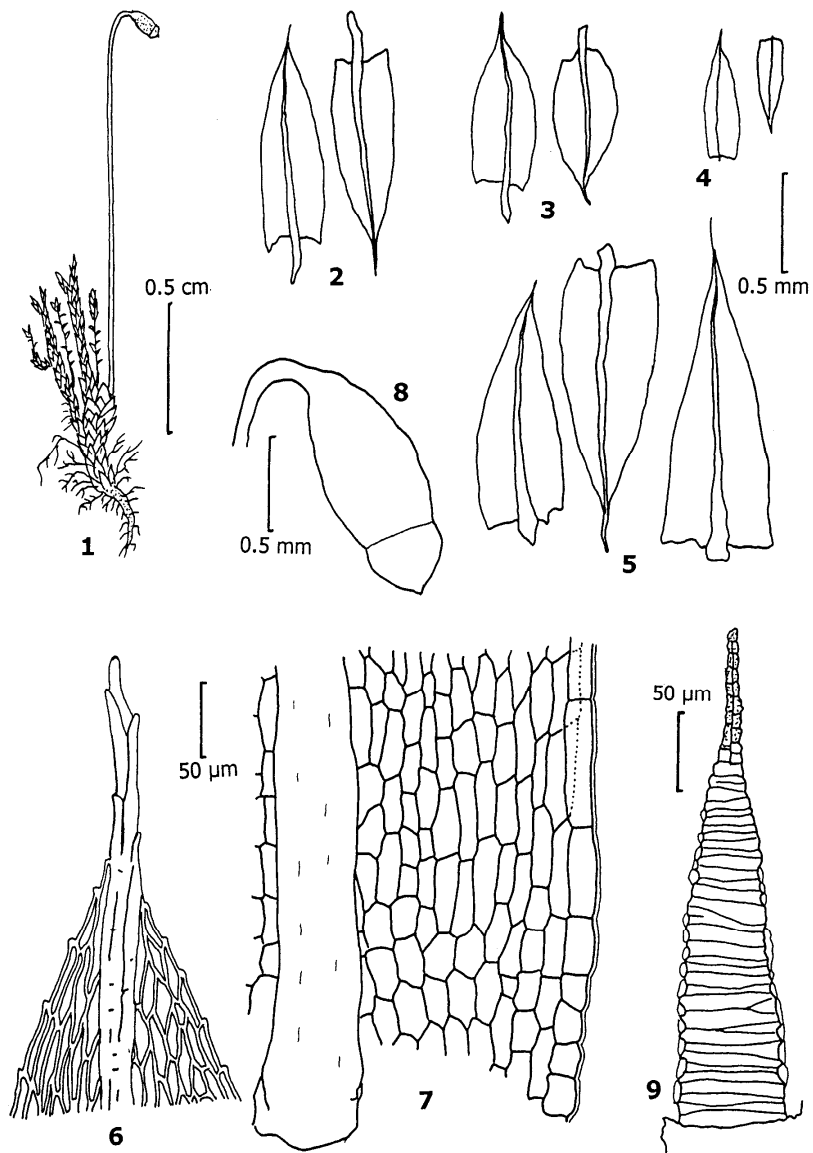
Farafra Oasis; Aisha Abd-el-Rahman village, on a wall of a hot water basin, two gatherings, fruiting plants.

**9- *Bryum torquescens* Bruch ex De Not**

Farafra Oasis; Ain Horrah, on a sandy-brick wall of a spring, one gathering, sterile plants.

**10- *Bryum turbinatum* (Hedw.) Turner**

Farafra Oasis; Aisha Abd-el-Rahman village, on a wall of a hot water basin, one gathering, sterile plants.



**Figure 2.** *Bryum inclinatum* (Brid.) Bland.: 1, fruiting plant; 2, mid-stem-leaves; 3, subapical stem-leaves; 4, innovation leaves; 5, perichaetial leaves; 6, apical cells of lamina; 7, basal cells of lamina; 8, capsule; 9, exostome tooth (outer view).

**11- *Bryum* sp.1**

Farafra Oasis; Ain Galow, on wet shaded irrigation channel margin just above water level, two gatherings, sterile plants.

**12- *Bryum* sp.2**

Farafra Oasis; Ain Galow, on wet shaded irrigation channel margin just above water level, one gathering, sterile plants.

***Observations and comparisons***

Features of the moss flora of Farafra Oasis agree with a great excellence with those of Kharga and Dakhla Oases (cf. Abou-Salama & El-Saadawi, 2001 b).

These features are outlined as follows:

1. The flora is generally poor; a small number of moss species is recorded.
2. Recorded taxa may be frequent in the locality where they exist and are absent from other localities. This is for instance the case of *Didymodon tophaceus*, which was collected from nine sites in Ain Beshowy but was not met with elsewhere in Farafra. In fact, not any of the 12 taxa collected in this work was met with in more than one locality. This means that each of the four localities in Farafra has its own species assemblage which was not found in the three other localities (Table 1).
3. The Bryoflora of the surveyed Oases shows that each has a small but more or less distinct assemblage of species (see Table 1 for Farafra Oasis). At present, only two mosses (*Didymodon fallax* and *Funaria hygrometrica*) out of a total of 23 species, recorded in the three surveyed oases, were found in more than one oasis (Kharga and Farafra). Furthermore, *Philonotis hastata* the only moss, hitherto, reported from Bahariya Oasis, was not recorded in Dakhla, Kharga or Farafra.

**Table 1.** Localities and number of samples of the 12 mosses collected from Farafra Oasis.

	Taxa	Ain Beshowy	Ain Galow	Aisha Abd-el-Rahmaan	Ain Horrah	No. of samples
	<b>Pottiaceae</b>					
1	<i>Didymodon fallax</i>				+	3
2	<i>Didymodon tophaceus</i>	+				9
	<b>Funariaceae</b>					
3	<i>Funaria hygrometrica</i>				+	2
	<b>Bryaceae</b>					
4	<i>Brachymenium exile</i>		+			2
5	<i>Bryum bicolor</i>			+		1
6	<i>Bryum caespiticium</i>				+	1
7	<i>Bryum inclinatum</i>			+		3
8	<i>Bryum radiculosum</i>			+		2
9	<i>Bryum torquescens</i>				+	1
10	<i>Bryum turbinatum</i>			+		1
11	<i>Bryum</i> sp1		+			2
12	<i>Bryum</i> sp2		+			1
		1	3	4	4	28

4. *Bryum* is the largest genus (as in many other territories in Egypt) being represented in Farafra by eight out of 12 reported taxa (Table 1). It is also the most common genus being present in 12 out of 28 samples.
5. The most frequent species in Farafra is *Didymodon tophaceus* (nine gatherings) which is in agreement with the findings in the Nile Valley (Nv) where *D. tophaceus* is among the most common taxa (Shabbara, *et al.* 2000). It is also worth mentioning that nine of the recorded mosses in Farafra had been reported earlier from other territories in Egypt. (cf. El-Saadawi, *et al.*, 1999; Shabbara, *et al.*, 2000). *Bryum inclinatum* represents a new record to the country. The latter is of wide distribution and is known from Afr1 (ALG & MOR), As1, 2, 5, Eur, Am1, Aust1 (Ros, *et al.* 1999; Wijk, *et al.*, 1959).
6. Farafra Oasis appears to have more ties with Northern Africa (see Ros, *et al.* 1999; Shabbara, *et al.* 2000) even more than Dakhla and Kharga Oases (cf. Abou-Salama and El-Saadawi, 2001 b). All of the 10 fully identified mosses reported from this oasis occur in Northern Africa, eight out of these 10 are known from Sinai and six are known from Mma (Westren Mediterranean Coastal Plains territory) whereas a much smaller number is common with Nile land territories and those irrigated by Nile waters (Nn, Nv, Nd, Cai, Nf and Dg) (cf Shabbara, *et al.* 2000 & Fig. 1 for abbreviations). This puts further emphasis on the presumption made by Abou-Salama & El-Saadwi (2001 b) that "Nile waters introduced many new floral elements in the Nile Basin and territories irrigated mainly by Nile waters resulting in the interruption of the once continuous and more or less homogenous floral assemblage occupying this part of Northern Africa". It is to be mentioned that more than 80% of the Sinai mosses occur also in Northern Africa (cf. Ros, *et al.* 1999; Shabbara, *et al.* 2000; Abou-Salama & El-Saadawi 2001 a).
7. Regarding reproduction, the obtained data showed that three mosses (*Funaria hygrometrica*, *Bryum inclinatum* and *B. radiculosum*) bore sporophytes in abundance, two mosses (*Didymodon fallax* and *D. tophaceus*) had archegonia, *Bryum bicolor* carried axillary bulbils whereas the remaining six taxa (all Bryaceae) were entirely sterile at the time of collection. It is worth mentioning that plants of the three gatherings of *Didymodon fallax* from Farafra had archegonia whereas plants of this species gathered in the same week (early March, 1997) from Kharga Oasis were entirely sterile (cf. Abou-Salama & El-Saadawi, 2001 b).

### **Concluding remarks**

The present work is the first report on the bryoflora of Farafra Oasis where, 12 taxa (only 10 fully identified) were recorded. This raised the number of mosses known from the Oases territory from 15 to 23 species while that of the whole country totals now 176 taxa.

Based on the results obtained by Abou-Salama & El-Saadawi (2001 b) from Dakhla and Kharga Oases, and on the present results from Farafra; Siwa and Bahariya Oases are expected to have their distinct assemblages of moss species as well.

## References

- Abou-Salama U.Y. & El-Saadawi W.E. 2001 a. A contribution to the moss flora of the Isthmic Desert, Egypt. *Journal of Bryology* **23** (2): 146-148.
- & ----- 2001 b. Mosses of the Egyptian Oases Dakhla and Kharga. *Lindbergia* (submitted for publication).
- El-Hadidi, M.N. 2000. *Flora Aegyptiaca* vol. **1**(1):1-20. The Palm Press, Cairo and Cairo University Herbarium.
- & Fayed, A.A. 1994/95. Materials for excursion flora of Egypt (EFE). *Taeckholmia* **15**:1-233.
- El-Saadawi W.E., Badawi A.A., Shabbara H.M., Abou-Salama U.Y. & Refai M.S. 1999. An updated list of Egyptian mosses. *Taeckholmia* **19** (2): 77-96.
- Friis, I. 1998. Frank White and development of African Chorology. In (eds. C.R. Huxley, et al.) *Chorology, Taxonomy and Ecology of the floras of Africa and Madagascar*. 25-51. Royal Botanic Gardens, Kew-UK.
- Issawi B., El-Hinnawi M., Francis M. & Mazhar A. 1999. The Phanerozoic Geology of Egypt, a geodynamic approach. Special Publication, **76**:1-462. The Egyptian Geological Survey, Cairo.
- Migahid A.M., Ali M. El-Shafei, Abd-el-Rahman A.A. & Hammouda MA. 1960. An ecological study of Kharga and Dakhla Oases. *Bulletin de la Société de Géographie d'Égypte* **33**: 279-309.
- Ros R.M., Cano M.J. & Guerra J. 1999. Bryophyte checklist of Northern Africa. *Journal of Bryology* **21**: 207-244.
- Said R. 1990. *The Geology of Egypt*. Balkema. Rotterdam, Brookfield.
- Shabbara H.M., Abou-Salama U., Refai M. & El-Saadawi W. 2000. Notes on the bryoflora of the different phytogeographical territories of Egypt. *Proceeding of The First International Conference on Biological Sciences, 7-8 May 2000, Tanta Univ., Egypt*. **1**: 366-378.
- Täckholm, V. 1974. *Student's Flora of Egypt*. Cairo Univ.
- Wijk, R., Margadant W.D. & Florschütz P.A. 1959. Index Muscorum, 1, *Regnum vegetabile* **17**. Utrecht - Netherlands.