



Toward A Red List of Bryophytes of Egypt. I. Hepatics

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ABSTRACT

About 200 species of bryophytes are currently known from Egypt. The majority are mosses, only 13 species belong to the liverworts while no hornworts exist. Regarding the liverworts, and following simplified methods used by previous workers, 11 out of the 13 species are listed under threatened categories; 6 of them are in the CR category, 4 in the EN category, 1 in the VU category and 2 are considered not threatened. This evaluation documents the situation at the time of collection, i.e. from 1958 to 1999, which is quite a long time, however, it is basic for any future Red Listing of bryophytes in the country.

INTRODUCTION

Just over 200 bryophytes are, hitherto, known from Egypt (El-Saadawi and Shabbara, 2007; El-Saadawi *et al.*, 2015; El-Sakaty *et al.*, 2018; Khalil and Farag, 2018; Hassan *et al.*, 2019; Taha and Holyoak in Ellis *et al.*, 2019; Taha, 2020). The majority (188 taxa) are mosses while only 13 species belong to the liverworts. Anthocerotales are, at present, extinct in Egypt, weather conditions became drier than in the Holocene (started 11700 yr b.p.) and many genera of bryophytes (e.g. *Phaeoceros*, *Sphagnum*) and of pteridophytes (e.g. *Azolla*, *Lycopodium*, *Selaginella*etc.) that flourished then in Egypt (Leroy, 1992; Kholeif, 2004; Ziada *et al.*, 2018) became at present extinct in this country. The documentation and conservation of the remaining extant amphibians (i.e. bryophytes and pteridophytes) of the plant kingdom and plants in general and their diversity are, therefore, priority objectives.

A list of threatened bryophytes in Egypt is, therefore, much needed. It would serve; together with similar lists for all other African countries as data essential for determining the First Top 10 list of the IUCN Bryophyte Specialist Group (see Van Rooy *et al.*, 2019).

Although the data to be presented here represent the situation of threatened hepatics in Egypt a long time ago (at the dates of collection between 1958 and 1999) yet the basic information given is indispensable for evaluating any future collection of hepatics from Egypt as an African country and is also necessary together with relevant information from all other African countries, in the preparation of a list of "The Top 10 Initiative" for the whole African Continent.

It is worth mentioning that, the recommendations given by Bergamini *et al.* (2019) for using the critical terms when applying IUCN red-listing criteria to bryophytes depend mainly on: generation length, mature individual and severe fragmentation which are quite

difficult to apply here due to severe data deficiency (e.g. no data available on: population size, range, and trend, the ability of individuals to reproduce, life-spans,etc.). Moreover, the growth of hepatics in Egypt is quite poor and the cover areas are usually small and sometimes only a few plants are found in a reported site (El-Saadawi and Shabbara, 2007).

MATERIALS AND METHODS

The present study is based on the floristic information pertaining to the 13 hepatics of Egypt given by El-Saadawi and Shabbara (2007) and other references therein included particularly Arnell (1963), Jovet-Ast and Bischler (1970), Bischler (1993) and Ros *et al.* (2007), which included details of collection data and distribution.

In this article the authors try to assign the 13 hepatics known from Egypt to the conservation categories of threatened species following the methods used by Martinčič (2016) in which species were classified under the Red List categories taking in consideration the only realistic threat assessment criterion, which is expressed in the number of currently known localities: 1 (Critically Endangered "CR"), 2-5 (Endangered "EN"), 6-10 (Vulnerable "VU")....etc.

RESULTS AND DISCUSSION

The hepatics of Egypt can, according to the above information, be evaluated or assigned to threat categories as follows in Table 1. It is clear that quite a small number of hepatics are recorded in Egypt; all are Marchantiales except *Riella* (Sphaerocarpaceae); all are rare and classified under threat categories (6 CR, 4 EN, 1 VU) except *Riccia cavernosa* and *Riccia frostii* which are considered not threatened being reported repeatedly from many localities in at least five of the phytogeographical territories of the country (El-Saadawi and Shabbara, 2007). The rarity and small population size of hepatics in Egypt are quite expected since these plants (known as amphibians of the plant kingdom) are water and shade-loving while Egypt is perhaps the aridest country in North Africa (Wickens, 1992). Furthermore, climate change (drying-up of fresh-water swamps; see Leroy, 1992; Kholeif, 2004; Ziada *et al.*, 2018) and human activities and their impact (Roberts *et al.*, 2004; Shaltout *et al.*, 2018) have become increasingly important agents in the modification of natural environments leading to loss of habitats suitable for bryophytes in general and hepatophytes in particular. As a result of these two main types of threat (climate change and human activities) and taking into consideration that the collection dates of most of the hepatics recorded in Egypt go back to more than 50 years ago it is highly expected that these species are now most probably extinct in Egypt and therefore become assigned under threat category "RE" (Regionally Extinct). Contemporary collection activities of hepatics in Egypt are evidently indispensable to update our knowledge and to be able to apply criterion B of the IUCN (International Union for Conservation of Nature) in order to estimate the AOO (Area of Occupancy) and prepare an up-to-date actual Red List. The need for Red Lists has been emphasized by many authors (e.g. Hallingbäck and Tan, 2010). Data presented in Table 1 showed also that hepatics of Egypt have more in common with Mediterranean countries (Afr1 and south of Europe of the Index Muscorum; Wijk *et al.*, 1959) than with countries in the southern half of the African Continent (i.e. Afr2, 3 and 4 of the Index Muscorum). An article about threatened mosses in Egypt is probably worthwhile to complete our knowledge about bryophytes in the country in this regard, particularly that recent collection activities of mosses are taking place.

Table 1. Collection and distribution data of the 13 hepatic species known from Egypt and their threat categories based on El-Saadawi and Shabbara (2007); Ros *et al.* (2007); Youssef (2017) and <https://www.tropicos.org/> (2019). Abbreviations of Egyptian territories names: Cai= Cairo area, Dg= Galala Desert, GE= Gebel Elba, Mm= western Mediterranean coastal land, Nd= Nile Delta, Nf= Nile Fayoum, Nv= Nile Valley, S=Southern Sinai massive. Abbreviations of threat categories names: CR= Critically Endangered, EN= Endangered, VU= Vulnerable. Other abbreviations: Afr= Africa, As= Asia, Am= America, Aust= Australia, Eur= Europe, N= North, C= Central, S= South, W= west, E= East. *= No collection data are available in the original publication (Schuster, 1992).

Taxon	Collection Date	No. of localities	No. of countries			World Distribution	Threat Category
			Medit.	African -Medit.	African		
Marchantiales 1. <i>Mannia androgyna</i> (L.) A. Evans	1962	1 in GE	25	4	5	N & S Afr, S.w. As, Eur	CR
2. <i>Marchantia debilis</i> Goegel	1967,1987	2 in Nf, 2 in Nv, 3 in Nd	1	1	5	N, C & S Afr, Eur	VU
3. <i>Marchantia polymorpha</i> L.	1961	1 in Nv	10	2	3	N & C Afr, N, C & S Am, E As, Eur	CR
4. <i>Plagiochasma rupestre</i> (J. R. Forst. & G. Forst.) Steph.	1962	4 in GE	24	5	5	N Afr, E As, N, C & S Am, Eur	EN
5. <i>Riccia atromarginata</i> Levier	1961	1 in Mma	18	6	6	N Afr., N Am, S.w. As., Eur.	CR
6. <i>Riccia cavernosa</i> Hoffm.	1961, 1962, 1963, 1967, 1999	Scores in in Nd, Nv, Cai, Dg, S, GE	12	5	7	N & S Afr, S Am, E As, Aust, Eur	-
7. <i>Riccia congoana</i> Steph.	1962	4 in GE	0	0	2	N & C Afr, S.w. As	EN
8. <i>Riccia crustata</i> Trab.	1961	2 in Mma	12	4	4	N Afr, Eur	EN
9. <i>Riccia frostii</i> Austin	1961, 1962, 1964, 1967, 1999	Scores in Nd, Nv, Cai, Dg, GE	9	2	2	N Afr, N Am, E As, Eur	-
10. <i>Riccia lamellosa</i> Raddi	1961	1 in Mma	24	6	6	N Afr, N & S Am, Eur	CR
11. <i>Riccia sorocarpa</i> var. <i>sorocarpa</i> Bisch.	1961	2 in Mma	29	6	6	N Afr, N & S Am, E As, Eur	EN
12. * <i>Targionia hypophylla</i> L.	?	?	30	6	9	N, C & S Afr, N Am, S.w. & E As, Eur	CR
Sphaerocarpaceae 13. <i>Riella helicophylla</i> (Bory & Mont.) Mont.	1958	1 in Cai	11	3	3	N Afr, Eur	CR

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ARABIC SUMMARY

نحو قائمة حمراء للنباتات الحزازية في مصر. I. الحزازيات الكبدية

وجيه السعداوي ومي أحمد طه

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هناك حوالي ٢٠٠ نوع من النباتات الحزازية معروفة حاليًا من مصر. معظمها حزازيات قائمة، وأقلها (١٣ نوعًا فقط) حزازيات كبدية؛ ليس بينها حزازيات قرناء. وابتاع الطرق المبسطة التي استخدمها دارسون سابقون، تم إدراج ١١ نوعًا من أصل ١٣ نوعًا ضمن الفئات المهددة بالانقراض؛ منها نوع واحد "معرض" و٤ أنواع "مهددة" و٦ أنواع "حرجة التهديد"، وبذلك يبقى نوعان فقط "غير مهددين". ويوثق هذا التقييم الوضع في وقت جمع النباتات، من سنة ١٩٥٨ إلى سنة ١٩٩٩، أي منذ زمن بعيد جدًا، ولذلك، يعد هذا البحث أمرًا أساسيًا لأي دراسة مستقبلية تخص ادراج حزازيات مصر في قوائم حمراء.