

## MOSS CONSERVATION IN MEXICO

CLAUDIO DELGADILLO M.\*

### RESUMEN

México cuenta con una flora de musgos bien desarrollada. Como parte del neotrópico es uno de cinco países con más de 900 especies reconocidas, incluyendo 98 taxa endémicos. Sin embargo, su territorio todavía necesita exploración, por lo que se pueden esperar muchas novedades taxonómicas y nuevos registros. La amenaza más importante para los musgos locales, especialmente para las especies endémicas y las de distribución limitada, es la destrucción de su hábitat. Aunque en el sur de México los bosques sufren por la fuerte interferencia humana, en localidades del norte y en las zonas alpinas la flora de musgos está también bajo presión continua. Recientemente se identificaron algunas briofitas que necesitan protección, pero aún no existe legislación que asegure la permanencia de sus hábitats.

Palabras clave: México, musgos, conservación.

### ABSTRACT

A well developed moss flora is found in Mexico. In the Neotropics it is one of five countries with more than 900 recorded species, including about 98 endemic taxa. Much of its territory, however, is yet to be explored thoroughly and many range extensions and taxonomic novelties may be expected when more is known about moss distribution. Habitat destruction is the major threat to local mosses, especially to endemics and species with narrow ranges; this is particularly true in areas of southern Mexico where forests are under continuous human interference, but in northern localities and in the alpine areas the moss flora is also under severe pressure. Only recently have preliminary steps been taken to identify the bryophytes that require protection, but thus far there seems to be no adequate legislation to insure permanence of habitats.

Key words: Mexico, mosses, conservation.

\* Departamento de Botánica, Instituto de Biología, UNAM, Apartado postal 70-233, 04510 México, D.F. Mexico.

## INTRODUCTION

Several years ago, on the occasion of a symposium on the biological diversity of Mexico, in expressing concern over the conservation of bryophytes (Delgadillo, 1993 a, b), I cited many areas that are under pressure from agriculture, industry, population expansion, and other forms of human interference. Today, in reexamining the subject, it is apparent that little has been gained since 1988. The survival of many bryophytes in certain areas may depend on 1) the ability of botanists to obtain scientific information, 2) public awareness, and 3) government control and protecting measures, based on available information. To achieve this it is necessary to review our knowledge on a) diversity of species, b) endangered taxa, and c) the status of protective measures in this country.

## DIVERSITY

Although the recently published Moss Flora of Mexico (Sharp, Crum and Eckel, 1994) contains data for about 943 species and varieties, continued research indicates that the Mexican moss flora harbors at least 959 taxa and that many more species may be present there when further exploration is conducted.

For various reasons, exploration for mosses has not been uniform in Mexico. Several southern states have been visited repeatedly and their moss floras are fairly well known. These include the states of Chiapas, Puebla, Oaxaca and Veracruz whose floras vary between 327 and 479 moss species and varieties (Sharp, Crum and Eckel, 1994). Despite these figures, each of these states encompasses areas that have been visited seldomly or not at all by bryologists, notably the Lacandon forest of Chiapas, the mountain region of southern Oaxaca, the drylands of southern Puebla and adjacent Guerrero, and the residual rainforests of southern Veracruz. Numerous other taxa will be listed in state inventories when these areas are fully explored and extant herbarium records are critically examined and catalogued. On a larger scale, several states are virtually unknown bryologically or are undercollected, as may be inferred from preliminary distributional data given in the Moss Flora of Mexico (Table 1). From

**Table 1.** Mexican states with poor exploration record for mosses

State	Size of moss flora
Aguascalientes	6
Campeche	39
Colima	18
Guanajuato	3
Querétaro	46
Tabasco	39

these data it appears that a large number of species are known from the southern states while the northern states seem comparatively poor; it is important to determine whether the differences are real or represent an artifact due to different collecting histories. In any event, the number of taxa in the Mexican moss flora is expected to increase.

Compared with other neotropical countries, moss diversity in Mexico does not seem exceptionally high. According to LATMOSS, the database of neotropical mosses, Colombia, Peru, Bolivia and Brazil have more than 900 species, but the first three, with a smaller land surface, have more than twice as many moss species per unit area. Yet, the Mexican moss flora is unique because of its diverse origins and relationships (Delgadillo, 1993a); at present, it contains 24 per cent of the known neotropical moss flora.

### ENDANGERED MOSSES

Protection and conservation are novel concepts in Mexican bryology. Except for a questionnaire distributed and answered for the IAB Committee for Endangered Bryophytes (ICEB) in 1991, until late July 1993 there was no major concern for the fate of Mexican mosses. At that time, however, Arturo Gómez-Pompa and Rodolfo Dirzo requested a diagnostic study of the mosses that required protection as part of a project on protected areas in Mexico supported by the federal government and an international agency. A few weeks later the National Institute of Ecology expressed similar concern; six species were recognized as rare or endangered and their names were published in the "Diario Oficial" of May 6, 1994 and are now under official protection.

On a world scale, the selection of bryophyte species as endangered, in need of protection, or conservation, is not made by indisputable criteria (Hallingbäck, 1991). Certain conceptual difficulties have been resolved by a recent publication (IUCN Species Survival Commission, 1994), but the lack of familiarity of the terminology used by the conservationists did not allow this author to determine if a distinction could be made between endangered species and those requiring protection. For practical reasons I followed the recommendations of the International Committee for Endangered Bryophytes and tentatively selected certain species as endangered or requiring protection on the basis of habitat and distribution. Although these criteria are imprecise because they do not consider other unique features of the species, I have used them to produce a list of endemic, narrowly distributed taxa that were described before 1966 at the latest, *i.e.*, there has been ample opportunity to learn details of their distribution while this may not be true of recently described taxa. The list includes mosses from such fragile habitats as the alpine meadows and desert areas.

The results show that the moss flora of Mexico contains about 98 endemic species and that 14 of them require protection or are endangered (Table 2). In addi-

**Table 2.** Endemic Mexican mosses that require protection or are endangered

---

☹	<i>Acritodon nephophilus</i> Robins.
	<i>Anomobryum tereticaule</i> (Card.) Shaw
☹	<i>Astomiopsis exserta</i> (Bartr.) Snider
	<i>Brachymenium murale</i> Schimp. ex Besch.
	<i>Brachymenium saint-pierrei</i> Thér.
✧	<i>Bryocephospora mexicana</i> (Bartr.) Crum & Anders.
	<i>Dicranum lophoneuron</i> C.M.
	<i>Fissidens obscurcostatus</i> Pursell
	<i>Floribundaria schenckii</i> Card.
	<i>Hymenolomopsis tolucensis</i> Thér.
✧	<i>Jaffuelobryum arsenei</i> (Thér.) Thér.
	<i>Oreoweisia mexicana</i> Robins.
	<i>Pseudotaxiphyllum richardsii</i> (Bartr.) Irel.
	<i>Synthetodontium pringlei</i> Card.

---

☹ = Officially recognized as endangered; ✧ = Officially recognized as rare

**Table 3.** Endemic Mexican mosses known from the type locality or specimen, only

---

✧	<i>Callicostella mexicana</i> Robins. & Welch.
	<i>Cyclodictyon arsenei</i> Thér.
✧	<i>Hypnodontopsis mexicana</i> (Thér.) Robins.
	<i>Lindbergia ovata</i> Thér.
	<i>Neckera pachycarpa</i> Schimp. ex Besch.
	<i>Trematodon lozanoi</i> Card.

---

✧ = Officially recognized as rare.

tion, six other species need further attention to determine if they have extant populations or have disappeared due to the growth of the cities or to forest alteration (Table 3).

## PROTECTION

For all practical purposes there are no specific Mexican laws protecting mosses, or bryophytes, whose populations have been reduced in number or whose habitats are to be modified or destroyed by natural or artificial agents. The decrees protecting national parks, natural reserves and other such sites may be equally applicable to all groups of plants; similar measures are in operation regarding the collecting and transport of plants, plant parts or specimens. In recent years, the

federal government through the National Institute of Ecology initiated consultations and produced an "Official Mexican Norm", a document that recognizes endangered, rare, or species requiring special protection. The list is the first step toward conservation of plant and animal taxa, but for mosses, it is not yet in any operational form. To attain this goal, the "Norm" must acknowledge the biological singularity of mosses and legislate accordingly. It is not sufficient to establish protected areas or control the collection and distribution of specimens of endangered taxa; we need specific research support in areas of high moss diversity, particularly in southern Mexico and in biogeographically unique areas in the northern states. It is important to promote research that may help restore endangered populations to their original numbers, both as individual taxa and as part of natural communities. Otherwise, we may end up with regulations that impair field and laboratory work and prevent the acquisition of information on the species they seek to protect.

### LITERATURE CITED

- DELGADILLO M., C. 1993a. Floristic diversity in the Mexican bryoflora. In: T.P., Ramamoorthy, R. Bye, A. Lot and J. Fa (eds.), *Biological diversity of Mexico: Origins and distribution*. Oxford University Press, New York, pp. 365-377.
- DELGADILLO M., C. 1993b [1994]. Notas sobre la diversidad briológica de México. *Rev. Soc. Mex. Hist. Nat.*, Vol. Especial 44: 93-97.
- HALLINGBÄCK, T. 1991. What is an endangered bryophyte? *Bryol. Times* 62/63: 9.
- IUCN SPECIES SURVIVAL COMMISSION. 1994. IUCN red list categories. *40th Meeting of the IUCN Council*, Gland, Switzerland.
- SHARP, A.J., H.A. CRUM AND P.M. ECKEL (eds.). 1994. The moss flora of Mexico. *Mem. New York Bot. Gard.* 69: 1-1113+i-xvii.