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Host preference of bryophytes composition from Northern Nigeria

B.Y. Abubakar & S. Abdullahi

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Abstract: The epiphytic bryoflora from northern Nigeria has been reported. Host specificity was shown by the recorded species in which pH value accounted for the marked variation in composition. *Erpodium coronatum* (Hook f. Wilson) Mitt. is the most abundant epiphyllous moss while *Fissidens glauculus* C.Mfill. was noted to be growing on a particular tank wall substrate. Other common bryoflora encountered include *Brachymenium leptophyllum* Bruch & Schimp ex Mull. Hal, *Fabronia angolensis* Welw. & Duby, *Bryum coronatum* Schwaegr. and *Hyophila crenulata* Guim. *Senna siamea* showed the highest species richness of three bryophyte species whereas the remaining tree species supported less. Generally the studied bryophytes showed a considerable preference to different host trees. This therefore suggests the need for careful management of the tree species growing in the University campus which will help in conserving the local epiphytic bryophyte community for enhanced biodiversity richness.

Key words: Bryophytes, Moss, Trees, pH, DBH, Nigeria, Epiphytes, Bark characteristics

Introduction

The bryophytes occupy a special position within the plant kingdom since they are the first group to be successful on land and are a good educational resource in biodiversity studies. The cryptogamic bryophyte vegetation component is often ignored in biodiversity and ecological studies despite their contributions in the ecosystems as well our present day changing environment. Epiphytic mosses are the most commonly sighted groups inhabiting tree bark, gutters and dilapidated walls and contributing to the rich vegetation cover in the main campus of Ahmadu Bello University, Zaria-Nigeria. They are also important as moisture absorbers and retainers in the form of mats serving as seed beds for vascular epiphytes (Salam and Ogunyomi, 2007). A high portion of floristic diversity may exist at a much smaller scale, selecting and partitioning microhabitats according to substrate and microclimate (Roberts *et al*., 2005). The ecology of the epiphytic bryoflora is defined by combination of both physical and chemical characteristics of the host tree (or otherwise) as well as environmental factors (Vanderpoorten *et al*, 2004). Kiraly and Odor (2010) observed that diameter at breast height (DBH) has a differential effect on epiphytic bryophyte richness. They showed that in hornbeam trees (*Carpinus betulus*), DBH had a more important effect than on other tree species commonly found in the mixed deciduous-coniferous forests of western Hungary.

Rich epiphytic bryoflora species distribution in Laurisilva, Madeire Island was found to be strongly shaped by the nature of the tree species as a result of bark and crown characteristics (Sim-Sim *et al*, 2011). Equally, Stradzina (2010) opined that light-loving pioneer bryophytes are more common at the forest edge of Ozolu Island, Latvia, due to significant environmental variables of tree age, soil moisture, tree species and substrate pH. Up to 81 bryophyte species were commonly found on *Dicksonia antarctica*, representing exceptionally high species richness for a single host species in the Tasmanian forest of South Eastern Australia. In an investigation of the pattern of corticolous bryophyte communities of Northern Carolina Piedmont, Palmer (1986) confirms that few moss species are restricted to a given tree species of the forest, but different species of trees do tend to bear different bryophyte communities according to site. Similarly, Roberts *et al.* (2005) reported that two species of mosses (*Rhizogonium novae-hollandiae* and *Plagiothecium lamprostachys*) showed a significant host preference to *Dicksonia antarctica* trunks compared to *Cyathea cunninghamii*. Similarly, Draper *et al.* (2005) observed that a variety of climatic conditions and forest types favours the presence of several types of bryophytic communities in Tazzeka Mountains of northern Morocco. Up to 62 liverwort species were recorded (Pocs, 1996) from West Africa in Guinea to Congo, and this diversity and other parts of the world have been correlated with the diversity of rainforest communities. The present-day changing environment due to human activities of logging for forest resources and in our traditional African practices of firewood harvesting is a major limitation to the conservation of our natural bryoflora diversity.

Management practices for the conservation of the bryophytes should first of all consider the study of the species richness as well as favorable ecological variables that would ensure their survival for future references. Hallingback and Tan (2010) recently observed that compared to vascular plants, our knowledge about bryophyte biology, ecology and distribution is relatively little. This shortage of knowledge, as they opined, is a serious problem when evaluating what appropriate actions to take, including prioritizing the actions to be taken. Specifically, Frahm (2002) concluded that the reason for the bryophytes serving as excellent indicators for climate, especially humidity, is dependent on atmospheric nutrient and water supply. Hietz (1999) observed that both vascular and cryptogamic epiphytes are highly sensitive to climatic conditions and often of slow growth, appearing in many cases to be more vulnerable than other plants. Thus, this makes them suitable indicators of changes in local climate, forest structure and ecosystem health, which may also affect other species or ecosystem processes. The aim of this study is to report the common epiphytic bryophytes on tree bark and wall materials as well as some of the conditions that favor their habitation.

Materials and methods

Study area

The study was carried out in the main campus of Ahmadu Bello University, Zaria (11º09'N 7º39'E), which covers a land area of 7000 hectares. The mean annual rainfall is 1000mm within duration of not less than 5-6 months. This campus supports a good population of tree species, some of which were planted or form part of the natural stands since the establishment of the University in 1962. Site 1 is the Area A staff residential quarters whereas Site 2 is the main Botanical Gardens of the Department of Biological Sciences (Fig. 1). Both sites represent a typical savanna vegetation zone, but with controlled logging by the University administration.

Sampling design

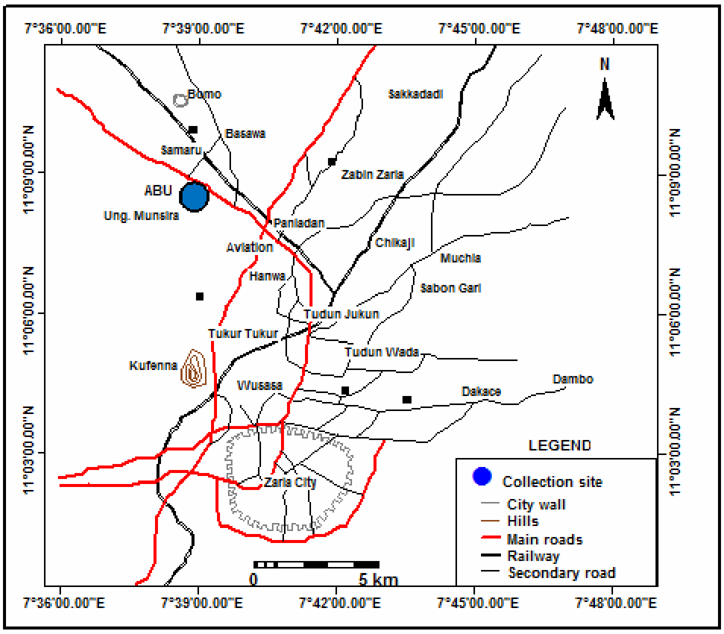
Five plots of 30 x 30m^2 were demarcated and common moss species were randomly collected from tree bark up to 1.5m above the ground surface within these plots. The diameter at breast height (DBH) was also measured using a tape. For mosses on gutter walls and dilapidated buildings, random collection of the commonly occurring epiphytic bryophytes was also made in August, 2011 to January, 2012. A total of 91 living trees contained in seven species and dilapidated/gutter walls were used for the collection. Soil samples were also scraped out and placed in polythene for subsequent analysis. Voucher specimens are deposited at the herbarium (Appendix I), Department of Biological Sciences, Ahmadu Bello University, Zaria-Nigeria.

Bark pattern and pH

The bark pattern of each host tree was determined based on its smoothness or roughness by observation. The pH values were determined following the procedures of Strazdina (2010). Ten dry samples of the tree bark (0.5g) were randomly collected into flasks and shaken in 20mL 1M KCl for 1hr. The pH value of the solution was determined with an electronic pH meter (Combo Hanna® Model 98129). A similar procedure was adopted in determining the pH values of the soils from gutter and dilapidated walls. However, ddwater was used in place of the 1M KCl.

Data analysis

Average values and standard deviations of pH and DBH were calculated for each sample.



Source : Adapted and Modified from Zaria Topographic Map, Sheet 102 SW,2012

FIGURE 1 : COLLECTION SITE

Fig 1: View on the collection site (Northern Nigeria)

Results and discussion

From the present study, 91 living trees contained in seven species and five dilapidated/gutter walls gave a record of six moss species (Table 1). A total of 48 living trees support 3 distinct bryophyte species of *Brachymenium leptophyllum*, *Fabronia angolensis* and *Erpodium coronatum* (Table 2). The most abundant epiphytic species of bryophyte in the study area was *E. coronatum* followed by *B. leptophyllum* and the least was *F. angolensis*. This is in contrast to another three bryophyte species of *Bryum coronatum*, *Hyophila crenulata* and *Fissidens glauculus* supported by dilapidated/gutter walls. With the exception of *Diospyros miliformis* bearing only *F. angolensis*, all the other six tree species support two species each while *Senna siamea* represents the highest species richness of three bryophyte species (Table 2). The differences in the number of epiphytic bryophytes may be attributed to the genetic makeup of the tree species such that genetically based traits within this tree species determine which epiphyte species can grow on different host tree individuals (Zytynska *et al*., 2011). Thirty-three trees with rough bark are host to the epiphytic mosses compared to fifteen smooth-barked trees. The roughness provided miniature retaining fissures to accumulate more moisture to facilitate dense bryophyte colonization.

The pH range of the tree species is 3.66-4.85 while the dilapidated/gutter walls had a high pH of 9.03 (Table 1). The high pH values of the latter support an entirely different bryophyte composition compared with the tree bark. These species include *B. coronatum*, *H. crenulata* and *F. glauculus*. It is worth noting that the tree and wall substrates support entirely different bryophytes. Lobel *et al*. (2006) opined that pH showed the best relationship with distribution of epiphytic bryophyte species. In conclusion, moss attachment on tree and wall substrata are largely controlled by the physico-chemical characteristics the host as found in the University campus. The dependence on these characteristics is such that it is species specific and may contribute to the conservation of our rich bryoflora for a balanced ecosystem.

Tab 1: Mean parameters and standard deviation for studied living tree species and wall substrate.

Tree species with epiphytic moss	DBH (m)	Bark/Wall pH	Bark morphology	No. of tress
Senna siamea (n=22)	1.85±0.58	4.74±0.92	rough	19
Diospyros miliformis (n=5)	2.21±0.27	3.85±0.40	rough	1
Khaya senegalensis (n=9)	1.84±0.09	4.35±0.26	rough	8
Plumeria rubra (n=5)	0.98±0.11	6.94±1.43	rough	2
Azadirachta indica (n=16)	1.31±0.38	3.66±0.98	rough	3
Delonix regia (n=6)	1.75±0.31	4.85±0.18	smooth	4
Gmelina arborea (n=28)	1.30±0.65	3.78±0.24	smooth	11
Dilapidated/gutter walls		9.03±0.27	**NA**	**NA**

NA: not applicable

Tab 2: Diversity of the bryophyte epiphytic communities from Zaria-Nigeria

Host tree species	Moss communities		
	Brachymenium leptophyllum	***Fabronia angolensis***	***Erpodium coronatum***
Senna siamea	yes	yes	yes
Diospyros miliformis	no	yes	no
Khaya senegalensis	yes	no	yes
Plumeria rubra	yes	no	yes
Azadirachta indica	no	yes	yes
Delonix regia	yes	no	yes
Gmelina arborea	yes	yes	yes
Dilapidated/gutter walls	*Bryum coronatum*	*Hyophila crenulata*	*Fissidens glauculus*

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References

Draper I., Mazimpaka V., Albertos B., Garilleti R. & Lara F. (2005). A survey of the bryophyte flora of the Rif and Tazzeka Mountains (northern Morocco). − Journal of Bryology 27: 23-34

Frahm J.-P. (2002). Ecology of bryophytes along altitudinal and latitudinal gradients in Chile. − Tropical Bryology 21: 6-79

Hallingback T. & Tan B. C. (2010). Past and present strategies and future strategy of bryophyte conservation. − Phytotaxa 9: 266-274

Hietz P. (1999). Diversity and conservation of epiphytes in a changing environment. International Conference on Biodiversity and Bioresources: Conservation and Utilization, 23-27 November, 1997, Phuket, Thailand. www.iupac.org/symposia/proceedings/phuket97/hietz (accessed on December 17, 2011)

Kiraly I. & Odor P. (2010). The effect of stand structure and tree species composition on epiphytic bryophytes in mixed deciduous-coniferous forests of Western Hungary. − Biological Conservation 143: 2063-2069

Löbel S., Snäll T. & Rydin H. (2006). Metapopulation processes in epiphytes inferred from patterns of regional distribution and local abundance in fragmented forest landscapes. − J. Ecol. 94: 856-868

Palmer M.W. (1986). Pattern in corticolous bryophyte communities of the Northern Carolina Piedmont: Do mosses see the forest or the trees? − The Bryologist 89: 59-65

Pócs T. (1996). Epiphyllous liverwort diversity at wordwide level and its threat and conservation. − Anales Inst. Biol. Univ. Nac. Autón México, Ser. Bot. 67: 109-127.

Roberts N.R., Dalton P.J. & Jordan G.J. (2005). Epiphytic ferns and bryophytes of Tasmanian tree-ferns: A comparison of diversity and composition between two host species. − Austral Ecology 30: 146-154

Salam A.M. & Egunyomi A. (2007). An overview of studies on the Nigerian mosses. − Nigerian Journal of Botany 20(1): 219-228

Sim-Sim M., Bergamini A., Luis L., Fontinha S., Martins S., Lobo C. & Stech M. (2011). Epiphytic bryophyte diversity on Madeire Island: Effects of tree species on bryophyte species richness and composition. − The Bryologist 114: 142-154

Strazdina L. (2010). Bryophyte community composition on an island of Lake Cieceres, Latvia: dependence on forest stand and substrate properties. − Environmental and Experimental Biology 8: 49-58

Vanderpoorten A., Engels P. & Sotiaux A. (2004). Trends in diversity and abundance of obligate epiphytic bryophytes in a highly managed landscape. − Ecography 27: 567-576
Zytynska S.E., Fay M.F., Penney D. & Preziosi R.F. (2011). Genetic variation in a tropical tree species influences the associated epiphytic plant and invertebrate communities in a complex forest ecosystem. − Philosophical Transactions of the Royal Society B 366: 1329-1336

Authors' adress: B.Y. Abubakar & S. Abdullahi, Department of Biological Sciences, Ahmadu Bello University, Zaria 810261, byabubakar@abu.edu.ng

Appendix I. Accession numbers of the voucher specimens used

S/no.	Taxon	Accession no.
1.	*Braychymenium leptophyllum*	*7201201*
2.	*Fabronia angolensis*	*7201202*
3.	*Erpodium coronatum*	*7201203*
4.	*Bryum coronatum*	*7201204*
5.	*Hyophila crenulata*	*7201205*
6.	*Fissidens glauculus*	*7201206*

Fig 1: Epiphytic moss on greenhouse wall (*Hyophila crenulara*)

Fig 2: *Brychymenium leptophyllum* on *Senna siamea* bark

Fig 3: Gutter wall hosting *Hyophila crenulara*

Fig 4: Brick wall with *Fissidens glauculus*

Fig 5: Rough bark of *Khaya senegalensis* with *Fabronia angolensis* and *Erpodium coronatum*