

Mosses of Tikehau Atoll (Tuamotu Archipelago, South Pacific)

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Abstract: Six moss species found on Tikehau Atoll in the Tuamotu Archipelago of French Polynesia are discussed in the context of their habitats and distribution. Selected ecological observations and some bryo-geobotanical problems are considered.

Introduction

The moss flora of Pacific atolls is poor in species and documented by a limited number of publications of which the most important are Herzog (1926), Miller et al. (1963, 1971), Merrill and Walker (1947), Sachet et al. (1955) and Sachet and Fosberg (1971) (see also literature cited therein). They treat mainly the taxonomic, general bryo-ecological and phytogeographic problems. Other aspects of atoll bryofloras such as geobotany, relationships with other vegetation types, and paleobryology are fairly unknown.

With the foregoing in mind, Tikehau Atoll in French Polynesia was selected for field research and ten days were spent on site in late January 2003. Air reconnaissance of the atoll was accomplished by means of two low-ceiling flights over the islets. For overland trips, bicycles and motorcycles were used when possible. Travel by sea to more remote islets were achieved via local hotel transport, boats used for monitoring beach signal lights or private boats.

Tikehau Atoll has not been hitherto muscologically studied. It lies in the western part of the Tuamotu Archipelago, just west of Rangiroa, at 15°00'S, 148°20'W, has a perfect short-elliptic shape (36 km long × 31 km wide), composed of numerous flat or nearly so islets (Fig. 1) of which the highest ones rise 4–5 m above sea level. Bare sand, gravel, active boulder beaches, and, rarely, low vertical rock cliffs surround the islets. The largest islets are geologically the oldest, their central areas endowed with uplifted cliffs and other raised coastal land forms, and are currently overgrown by loose palm forests, tall shrubs, liana-like growth, patches of grassland, reed swamps, brackish marshes (especially extensive at the airport) and habitats changed by or the result of human activities. In the middle of some of the largest islets occur bizarre, vertical-walled, usually flat-topped rock outcrops, composed of porous reef limestone. These can be single or in groups and are several meters in height.

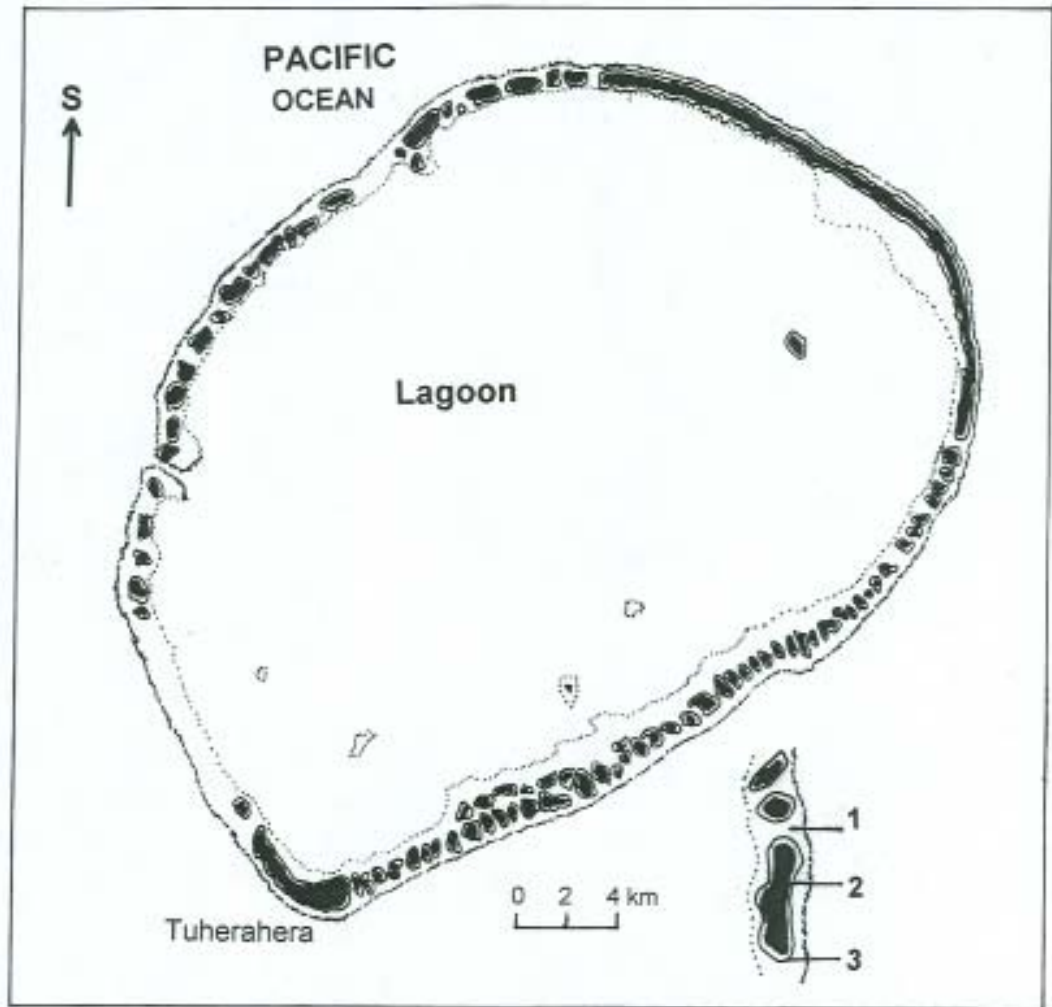


Fig. 1. Tikehau Atoll. 1. Intertidal zone. 2. Shrubby forest vegetation visible on aerial-photographs. 3. Active beaches.

Generally, ecological systems and habitats of Tikehau Atoll are primary and simple.

The moss diversity of Tikehau Atoll is unexpectedly poor. Only six species, listed below, were found. They occupy a very small part of an area overgrown by other plants and are limited to several habitats, namely: tree trunks (where they are most common), shaded branches of shrubs, rotten wood, seasonally moist calcareous flat sandy soils (which are rare), and anthropogenic habitats (often frequented by mosses).

Species Collected (Vouchers deposited in NY)

Brachymerium indicum (Dozy & Molk.) Bosch & Sande Lac. - Frequent on the largest islets, especially in central areas. On moist, flat or slightly depressed (partly flooded during prolonged rains), calcareous sand or fine gravel-fields, especially when these are shaded and invaded by grasses; also on anthropogenic substrates.

An early invader on bare soils. Sterile.

The elongate, thin stems, with loosely arranged short, broadly ovate leaves of this species are difficult to separate from its very close relative *Brachymenium melanothecium* (Müll. Hal.) A. Jaeger. Typical Tikehau specimens of *B. indicum* have sparsely branched, dark green short stems to 1 cm long, forming compact tufts; leaves when wet are erect spreading, when dry stiff and appressed, narrowly lanceolate, gradually tapering; costa thick, long excurrent; upper lamina areolation linear-rhomboidal, in mid-leaf short-rectangular or irregularly rhomboidal, below (especially at leaf base) isodiametric (quadrangle, short-rectangular to hexagonal, reddish); margin curved at apex, distantly but clearly serrate, below entire; excurrent costa firm, denticulate, usually reddish.

All features of this species are stable and agree perfectly with published diagnoses and illustrations (Bartram 1933, Bescherelle 1895, Miller et al. 1963, Ochi 1957, Phillips 1947, Whittier 1976, Whittier & Whittier 1974). The last author considered *B. melanothecium* as a synonym of *B. indicum*. In my opinion, *B. melanothecium* seems to be nothing other than a distinct, elongate growth form. According to Whittier (1976), *B. melanothecium* occurs mainly at the edges of *B. indicum* tufts in shaded meso/hygic habitats.

Bryum weberaceum Besch. - Rather rare. On moist, flat or slightly depressed and sometimes flooded calcareous sand. Often together with *Brachymenium indicum*. Gametangia were seen, though plants were not fertile at this time (probably fertile in another season).

Calymperes quaylei E. B. Bartram - Frequent. On bases of tree trunks, rotten snags and logs in central parts of larger islets. Fertile.

Sterile stems are simple and shorter than fertile ones, with smaller and wider leaves, often with numerous propagula. On all leaves the costa clearly ends below the leaf apex, the most characteristic feature of this taxon.

C. tahitense (Sull.) Mitt. - Rare and only on the largest islets. On trunks and thick branches of

tall shrubs growing in shaded, well-sheltered places between high rock outcrops. Sterile.

Though leaves of average specimens are only 4.5–5.5 mm long, it is rather easy to recognize this taxon with a 5× lens by means of its long excurrent propaguliferous costa and linear-lanceolate leaves slightly wider at bases.

C. tenerum Müll. Hal. - This is the most common moss of the atoll. On old trunks of coconut palms to several meters above ground and on twigs of tall shrubs.

Depauperate specimens (short, dark, twisted) sporadically appear low on the inland-facing sides of palm trees growing just above the high tide mark.

Isopterygium albescens (Hook.) A. Jaeger - Rare. On shaded, sandy, bare soil in loose forests and open eroded place, rarely on bases of old palm trunks. Sterile.

Comments on the Geobotanical aspect of the Bryoflora of Tikehau Atoll

1. **Vacant habitats.** There are many habitats suitable for moss growth on Tikehau Atoll which are not yet occupied by mosses, e.g., reed swamps, brackish marshes, uplifted coastal structures, surfaces and fissures of rocks, loose dry sand, eroded escarpments, soils covered by tall xeromorphic grasses, rotting foliage, damp places and many microhabitats. Why these sites remain uninhabited is difficult to understand. One suggestion points to the presence of salt, which is a well-known inhibitor for moss development, but this was not confirmed by numerous measurements made on Tikehau Atoll with a salinity refractometer (model S-28, measuring salt concentration from 0–28%). Moreover, ecoforms of *Calymperes tenerum* appear on the inland-facing sides of palm trunks within the range of sea water splash. Furthermore, in this ecozone on many South Pacific islands, the author observed quite large isolated clumps of mosses. These facts suggest a more specific nature to this phenomenon, which requires more investigation.

2. Size, shape and age of islets in relation to moss development. Mosses are absent on small young islets, even if they are covered by vegetation (mainly shrubby growth, single low trees or grassland). On the largest and oldest islets, they occur mainly in their interiors from where they radiate towards the sea as single occurrences or small groups. Mosses seem to prefer the islands that are roundish in shape rather than those with narrow elongate shapes.

3. The role of shade and moisture in the development of moss growth on islets. An increasing moisture level is patently positive for the development of mosses. A good example is found in the local nature reserve located at the north coast near the village of Tuherahera. Here, between high rocky cliffs, grow shrubs whose branches extend about 1 m above the cliff tops. Mosses abundantly cover branches and stems of the shrubs to the height of the topmost outcrops, above which they are conspicuously absent. Another good example of this phenomenon are old, dense palm clumps shading the ground. In this environment epiphytic mosses form large dense clumps to several meters above ground and abundantly grow on rotten wood accumulated at the bases of trunks. They are epiphytes and bryochamaephytes spreading over soil rich in wood detritus. In similar habitats, which however are more exposed to sun and wind, mosses do not occur or appear only rarely as poor dwarf life forms.

4. General eco-taxonomic aspect of the Tikehau moss flora. Ecologically, the moss flora is very average and taxonomically represented by several common species. It does not include extreme life forms such as aquatic mosses, ephemeral dwarf invaders of bare substrates, nitrophilous species or distinct xeromorphics, etc.

5. Anthropogenic pressures. Human influence is clearly positive for the invasion of mosses on to this atoll. Mosses occur much more abundantly on cultivated palms than on other trees and along the borders of foot paths they sometimes form narrow discontinuous belts. They are also found in gardens, in sheltered and

fertilized areas in the vicinities of houses, and also on some stone or wood monuments. Mosses were not observed on the extensive refuse heaps on Tikehau.

Summary and conclusions

At a glance, the species-poor moss flora of Tikehau, its limited ecological potential, the vacant habitats, the abbreviated, simple ecosystems and other features help to form a false impression of devastated growth. However, there are no signs of catastrophes on the atoll. Reasons for the great paucity of moss species are, rather, local environmental factors, the length of time needed for moss succession, barriers inhibiting dispersion of both sexual and asexual organs, isolation of the atoll from larger centers of bryofloras and other reasons of a more speculative character.

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