Studies on the Bryoflora of Tanumah mountains, south-west Saudi Arabia

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Eight mosses are reported from Tanumah Mountains, south-west Saudi Arabia. Two of them: *Bryum pseudotriquetrum* (Hedw.) Gaertn., Meyer & Scherb. and *Hypnum cupressiforme* Hedw. are described**.** The reported mosses represent three floristic elements (sub) Cosmopolitan, Northern and circum-Tethyan.

Key words : Bryoflora, Mosses, *Hypnum cupressiforme*, *Bryum pseudotriquetrum*, Tanumah, Saudi Arabia.

Introduction

Saudi Arabia is a vast country with an area of more than 2 million square kilometers. It exhibits a complex of landscapes, landforms and habitats, which occasionally provide unique niches for the growth of bryophytes.

Two finds of mosses were recorded by Forsskäl (1775) during his expedition to "*Arabia Felix*". During the major part of the last two centuries, many botanists, geographers and collectors visited Saudi Arabia but bryophytes have been obviously ignored and neglected.

El-Saadawi (1976) published his first paper on the bryoflora of Kuwait (northeast of Saudi Arabia) and emphasized the need for information pertaining to distribution of mosses in the world. He pointed out that "nothing is known of the moss flora of Saudi Arabia". Following this, there has been an extensive increase in collection activities and interest in the bryoflora of Saudi Arabia. In this regard Frey & Kürschner (1982), Kürschner (1984), Pursell & Kürschner (1987) and Kürschner (1989) focused on studying bryoflora of southwest Saudi Arabia. Al-Shehri (1992), studied the ecophysiology of the moss *Hydrogonium fontanum* (C. Müll.) Jaeg. from the Aseer mountains. Kürschner (2000) referred to a total of 224 bryophyte species from the Arabian peninsula and Socotora. To this, Refai (2001) added three species and one species to Saudi Arabia and the Arabian Peninsula respectively.

The present study aims to survey the bryoflora and its combined floristic elements in Tanumah Mountains.

Study area

The study area includes the seasonal water flows along the Dahna Dam at Tanumah mountains (1900 m above see level). This area forms a crucial component of the unbroken chain of the western Aseer mountains of Saudi Arabia (Fig. 1).

The vegetation of Aseer Mountains includes remnants of forests, dense woodlands (Hosni & Hegazi 1996) and related formations harboring a relatively rich bryophyte flora of mosses and liverworts (Kürschner, 1998).

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Available climatic data from Abha (17° 80' N, 42° 46' E) meteorological station show that the mean annual temperature is 16.8°C and the rainfall averaged about 655.2mm/year (Anonymous, 1984). Fog and dew can often be observed in the early morning. Such wet climatic conditions secure continuous water supply to the bryophytes.

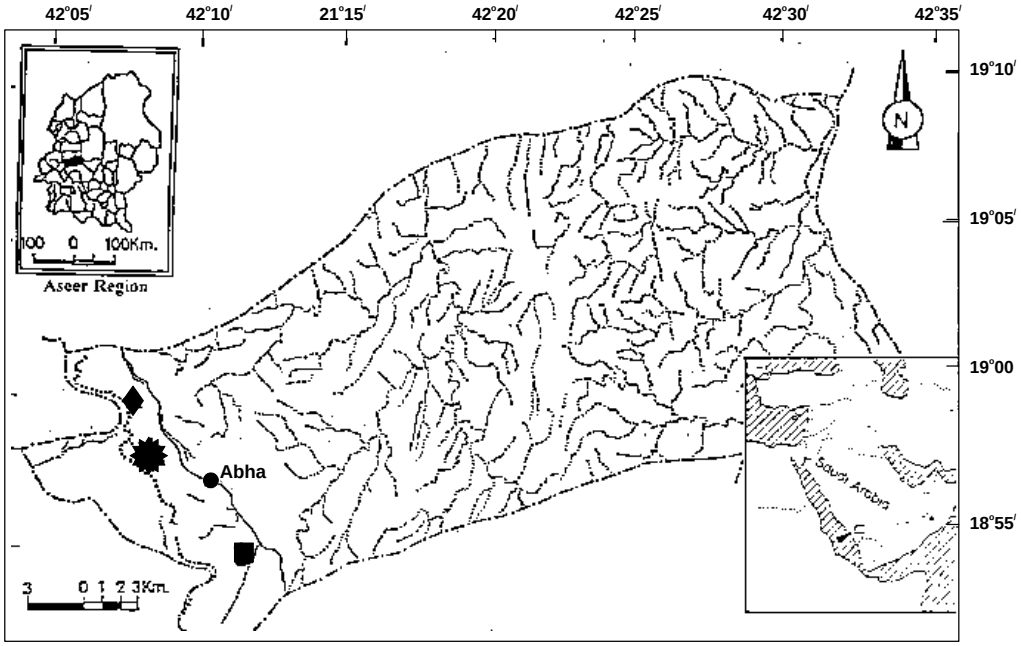

Fig. 1. Map of Tanumah area showing the three locations for plant collection
♦: Al-Mehfar, ✹: Al-Sharaf, ■: Al-Dahna
province boarder
main road
escarpment
valley

Material and methods

The author collected moss samples during the spring of 1999 from the three sites: Al Dahna, Al Sharaf and Al Mehfar escarpment which lie: 118, 110 and 122 km respectively from Abha city (Fig.1).

The Collected mosses were found growing in moist places including rocks of waterfalls and in shade of *Juniperus procera* trees. The moss specimens were kept in moist plastic bags and refrigerated until they were identified using relevant works, particularly Kürschner (2000). The leaves were softened in 30% lactic acid to facilitate microscopic examination of the cells. An "Olympus x 30" microscope has been used to photograph apices, bases, and margins of the leaves. Tanumah moss specimens are kept at College of Science Herbarium, King Khaled University, Abha, Saudi Arabia.

Results

Eight moss species were identified from the area under study, namely: *Bartramia stricta* Brid., *Bryum pseudotriquetrum* (Hedw.) Gaertn., Meyer & Scherb., *Hypnum cupressiforme* Hedw., *Orthotrichum diphanum* Brid. *Pleurochaete squarrossa* (Brid.) Lind., *Tortula muralis* Hedw. *Trichostomum brachydontium* Bruch, and *Trichostomum crispulum* Bruch.

Bryum pseudotriquetrum and *Hypnum cupressiforme* which have not been previously described from the bryoflora of Saudi Arabia (Kürschner, 2000; Kürschner *et al.*, 2001; Kürschner, pers. comm.); their describtion is given below.

Descriptions

Bryum pseudotriquetrum (**Hedw**.) **Schwaeger**, Spec. Musc. Suppl. 1 (1816)

Plant shoots are erect, about 5-6 cm long, green to reddish in colour. Stems matted together at the base. Leaves bright green, less crowded at the stem apex, 0.4-0.6 mm wide and 2.1-2.5 mm long, narrow lanceolate, acuminate with strongly bordered and recurved margins, apex distinctly acuminate. The nerve ending at the apex and occupying 1/10 of the leaf width at the base. Cells large, thin walled 10-20 µm width and 30-50 µm long. Cells become small, longer, hexagonal towards the apex, and narrow, longer towards the margin. Capsule large, slightly constructed near the base, inclined to pendulous shape, lid mamillate (Fig. 2 a, b, c & d).

Note: Recurved margins, acuminate apex and distinctly bordered margins have been used as definite taxonomic features to distinguish our specimen from *Bryum nanoapiculatum* Ochi & Kürschner, which is characterized by plane margins and mucronate apex, and may be confused with *B. pseudotriquetrum.*

Populations of *Bryum pseudotriquetrum* covered an area of ca 60m^2 traced near the water flows of the Dahna Dam.

***Hypnum cupressiforme*. Hedw., Sp. Musc. (1801)**

Plants slender to moderatly robust, with procumbent stems, growing ascending, pinnately branched forming flat carpets on the ground. Leaves falcato-secund, 0.3-0.4 mm width and length 0.8-1.0 mm, ovate to narrow lonceolate, apex acuminate to filiform with two cells in width, margin denticulate to the apex and entire below. Nerve is double and very short, hard to be seen. Basal cells rhomboidal, thick wall, irregular in shape, 8-10 µm. Cells become gradually narrow and linear towards the middle. The Middle cells 7-9 time as long as the wide (4-5 µm wide), while at apex they become gradually short ended with one cell (Fig. 3 a, b, c & d).

Note: Greenish stems, curved leaves and narrow lamina cells characterize and differentiate *Hypnum cupressiforme* from *Hypnum vaucheri* Lesq., which is fairly common in the area under study. Populations of *Hypnum cupressiforme* were found sporadically and scattered close to a water fall near to Al-Dahna site.

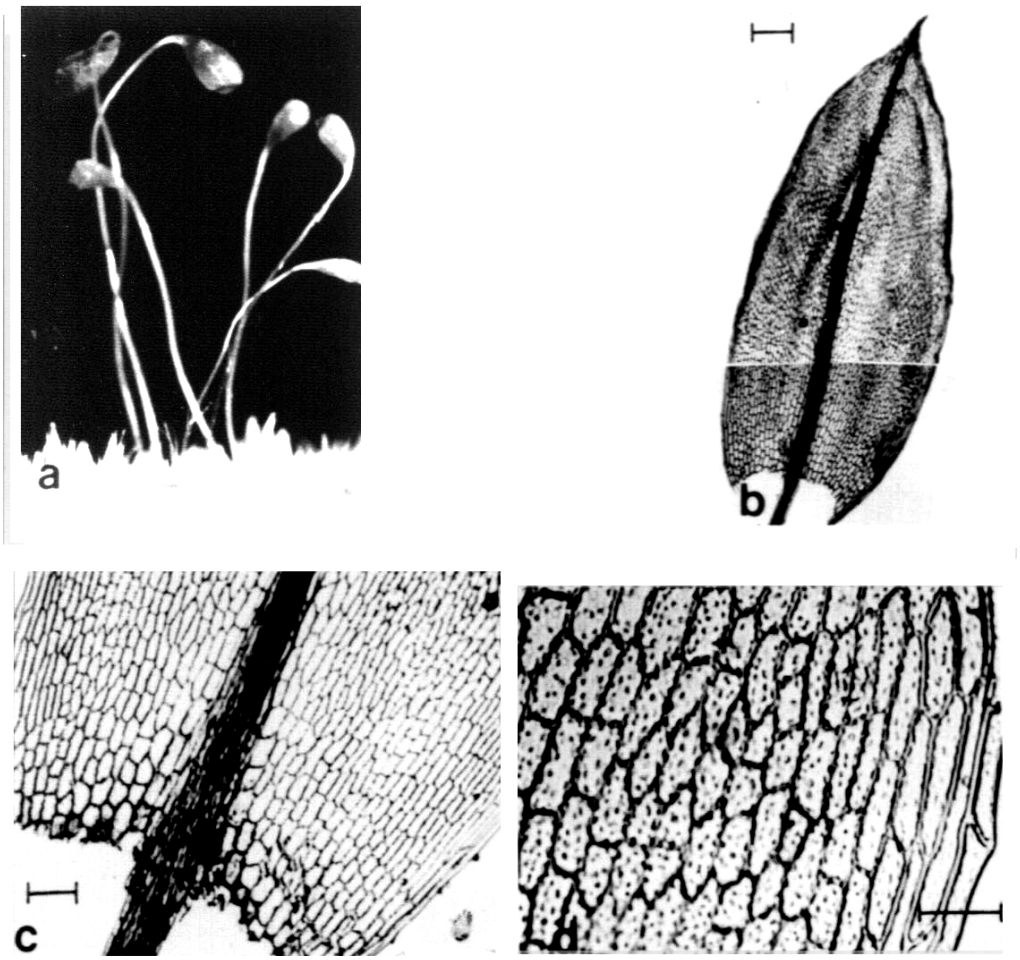

Fig. 2. *Bryum pseudotriquetrum* : a. Capsule (x 8); b. Leaf, c. Basal leaf cells, d. Middle and margin cells. Bar scale for b represents 100 µm, that for c and d represent 50 µm

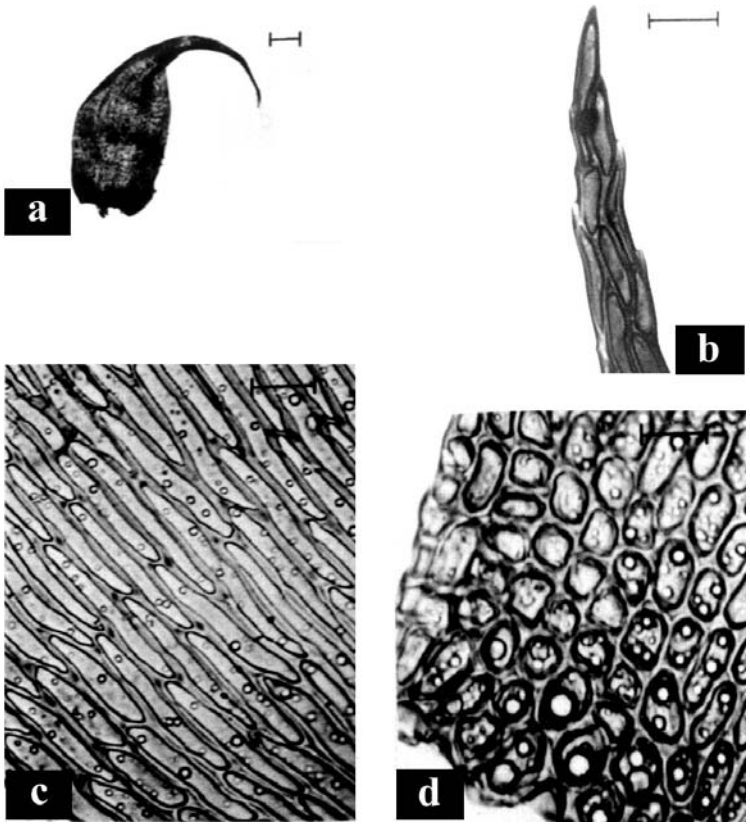

Fig. 3. *Hypnum cupressiforme*: a. leaf; b. leaf apex; c. mid-leaf cells; d. basal leaf cell. Bar scale for a & b represent 100 µm; c. represents 25 µm, that for d. represents 50 µm.

Floristic elements and discussion

The growth of a relatively heterogenous bryoflora in the semiarid area at Tanumah is rather interesting, which is attributed to the presence of seasonal moist microhabitats relevant to the development of moss species. The bryoflora of Arabia and Socotora includes six floristic elements: 1.(sub) Cosmopolitan, 2. Northern, 3. Xerotherm-Pangean, 4. Circum-Tethyan, 5. Tropical and 6. Endemics. These elements belong to different ancestral floral stocks (Kürschner, 2000).

Despite of the small number of moss species recorded from Tanumah, the present study may shed the light on florisitic aspects of the area. Table (1) shows that three floristic elements are known: (sub) Cosmopolitan, Northern and circum-Tethyan. Wide distribution of the (sub) cosmopolitan taxa is attributed to human activities across the world (Kürschner,

2000). This element is represented in Tanumah by four species, viz. *Bartramia stricta, Bryum pseudotriquetrum, Tortula muralis* and *Trichostomum brachdontium.*

Table 1. Floristic analysis of the moss species recorded from Tanumah Mountains, southwest Saudi Arabia. Floristic elements after (Kürschner, 2000)

Species	Floristic Element
Bartramia stricta	Sub-cosmopolitan
Bryum pseudotriquetrum	Sub-cosmopolitan
Hypnum cupressiforme	Northern
Orthotrichum diphanum	Northern
Pleurochaete squarrosa	Circum Tethyan
Tortula muralis	Sub-cosmopolitan
Trichostomum brachdontium	Sub-cosmopolitan
Trichostomum crispulum	Northern

The northern element comprises taxa with a former northern Pangean distribution, which includes arid parts of the Old World and North America (Frey, 1990; Frey & Kürschner, 1988). Tanumah mountains enclave three species of this element: *Hypnum cupressiforme, Orthotrichum diphanum* and *Trichostomum crispulum.*

The circum-Tethyan floral stock was formerly distributed along the northern and southern coasts of the Tethys sea. Today, taxa of this origin dominate arid regions in the Holarctic (Frey & Kürschner, 1983). Hence the presence of *Pleurochaete squarrosa* in the bryoflora of Tanumah mountains could be treated as a relict taxon of the circum-Tethyan element in the region.

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