

SPECIES IDENTIFICATION IN THE BRYACEAE

by David Holyoak



CONTENT:

- EVOLUTION OF LIFE-HISTORY STRATEGIES AND MORPHOLOGY IN BRYACEAE
- REVIEW OF IDENTIFICATION CHARACTERS
- COMMENTS ON SOME IDENTIFICATION PROBLEMS AND THEIR CAUSES

EVOLUTION OF LIFE-HISTORY STRATEGIES AND MORPHOLOGY

Species of Bryaceae can be placed in several ecological groups:

- **(A) LONG-LIVED SPECIES (e.g. *Rhodobryum roseum*)**
– large size; reproduction mainly from spores
- **(B) SPECIES LIVING 1-2 YEARS (e.g. *Bryum algovicum*, *B. capillare*, *B. warneum*)**
– medium-size; reproduction from spores, some with tubers
- **(C) SPECIES LIVING <1 YEAR (e.g. *Bryum violaceum*, *B. dichotomum*)**
– small size; reproduction from tubers or bulbils (so mainly clonal),
some also producing spores
- **(D) SPECIES/POPULATIONS LIVING ONLY A FEW MONTHS (e.g. some forms of *Bryum argenteum*, *B. gemmilucens*)**
– very small size (paedomorphic); reproduction by bulbils developing on “immature”
plants or even direct from protonemata (so plants clonal); spores not produced

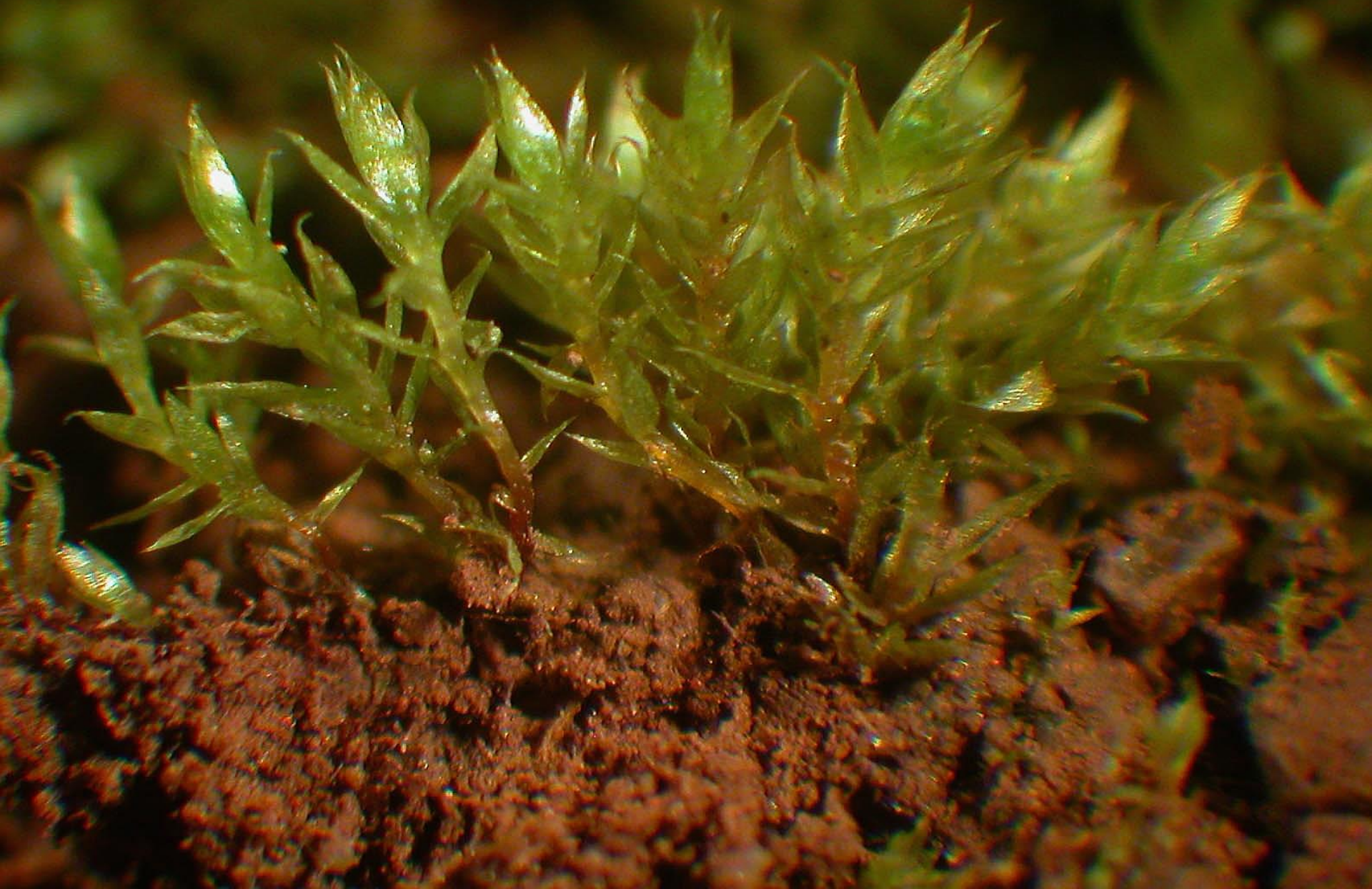
Rhodobryum roseum



Bryum algovicum



Bryum violaceum



Bryum argenteum & *B. dichotomum*

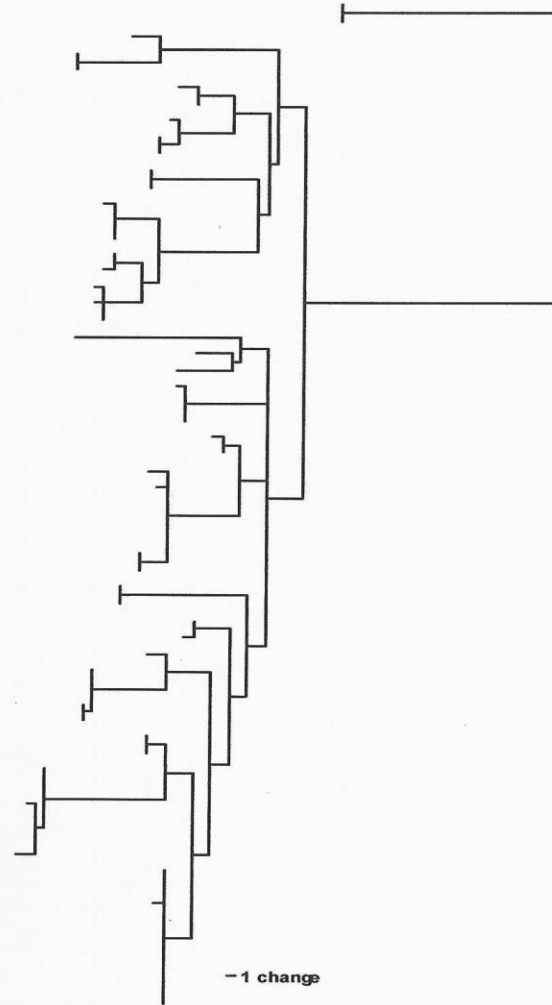
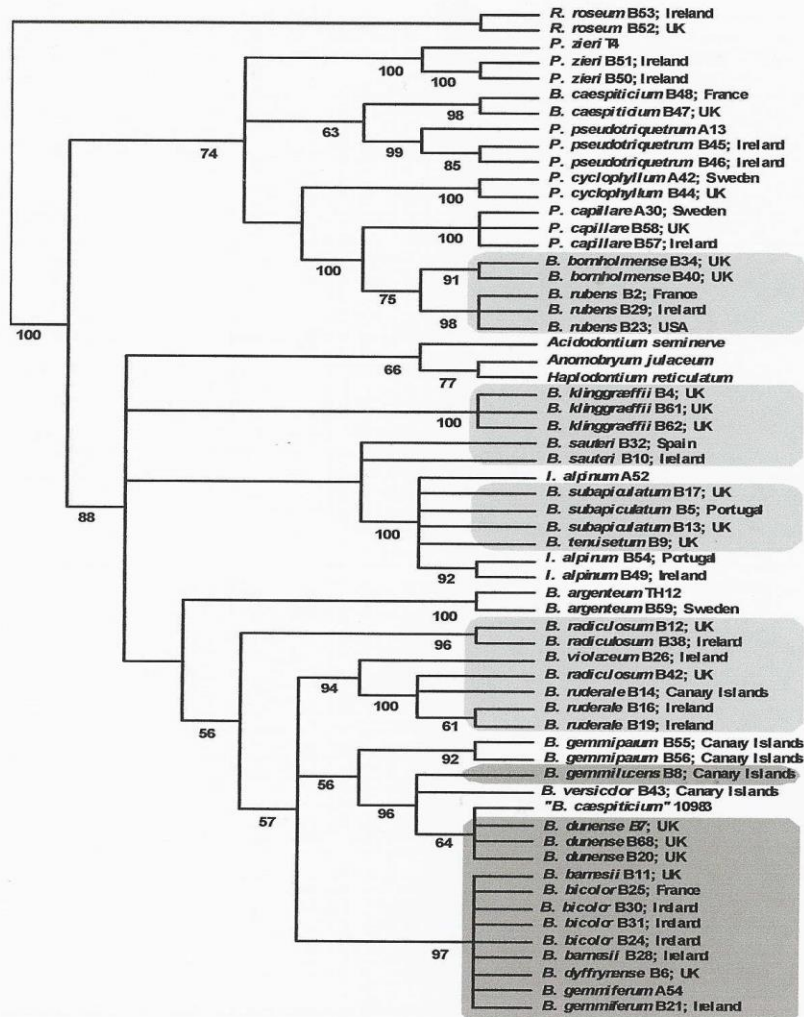


MULTIPLE ORIGINS OF:

(A) SMALL *BRYUM* WITH RHIZOIDAL TUBERS ("*Erythrocarpa*")

(B) SMALL *BRYUM* WITH AXILLARY BULBILS (*B. dichotomum* group)

NOTE CONVERGENT EVOLUTION e.g. with *B. caespiticium* & *B. versicolor*



■ *Bryum* section *Erythrocarpa*

■ *Bryum dichotomum* group

Data and its interpretation from Niklas Pedersen

REVIEW OF IDENTIFICATION CHARACTERS

LEAVES: arrangement on stem; shape; border; length of costa; decurrent or not; red cells at base or not; colour often unhelpful!

INFLORESCENCES: often critical to determine whether dioicous/autoicous/synoiuous, variability, problems;

CAPSULES: shape when maturing useful; colour often unhelpful;

PERISTOMES: development of cilia closely linked to spore size – (perfect peristome when mean spore size $<20 \mu\text{m}$, cilia reduced when spores $>25 \mu\text{m}$);

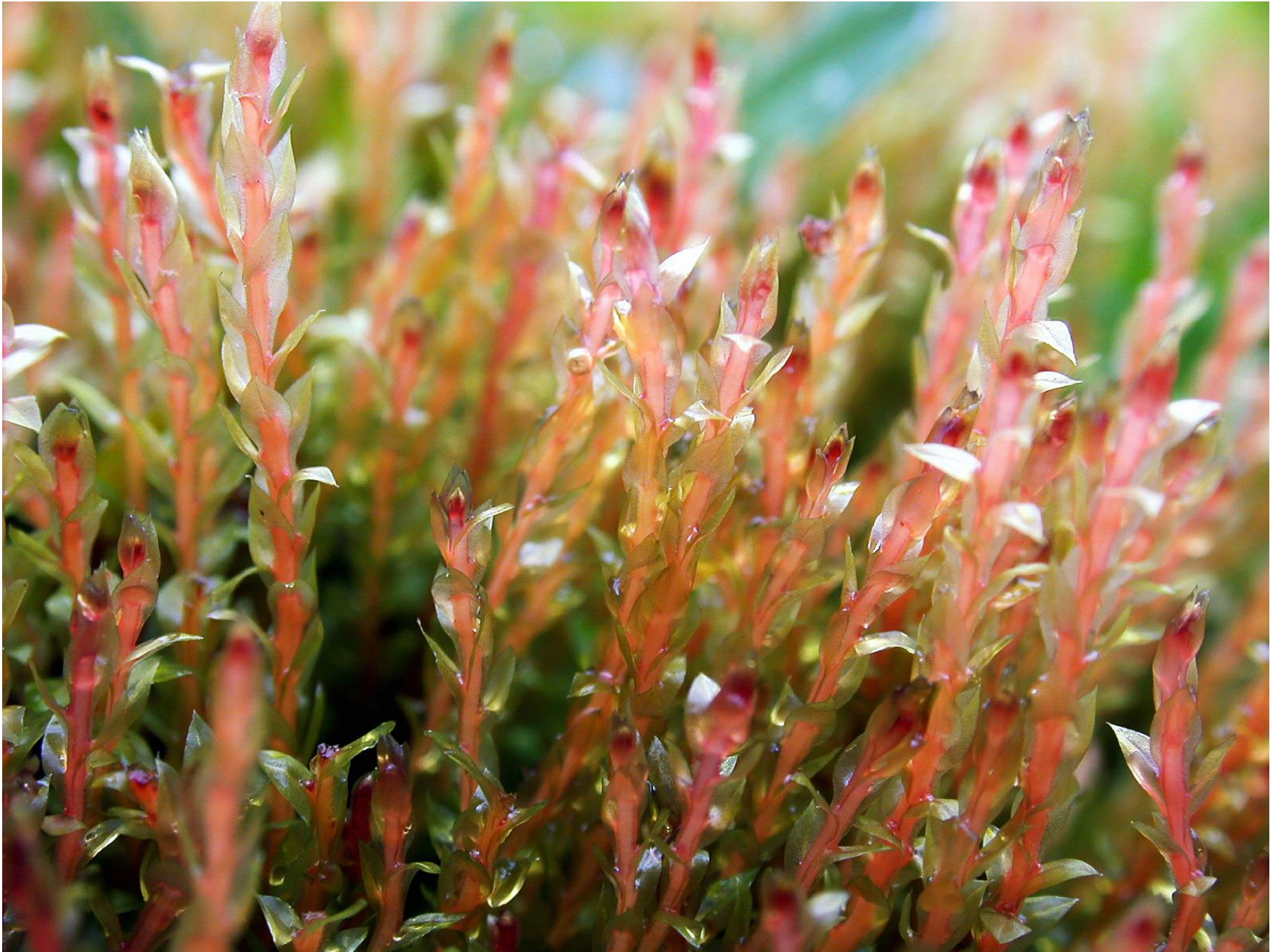
BULBILS & FILAMENTOUS AXILLARY GEMMAE

RHIZOIDAL TUBERS

ROSULATE LEAF ARRANGEMENT – *Rhodobryum roseum*



EQUIDISTANT LEAF ARRANGEMENT – *Bryum weigellii* (note decurrent leaf bases)



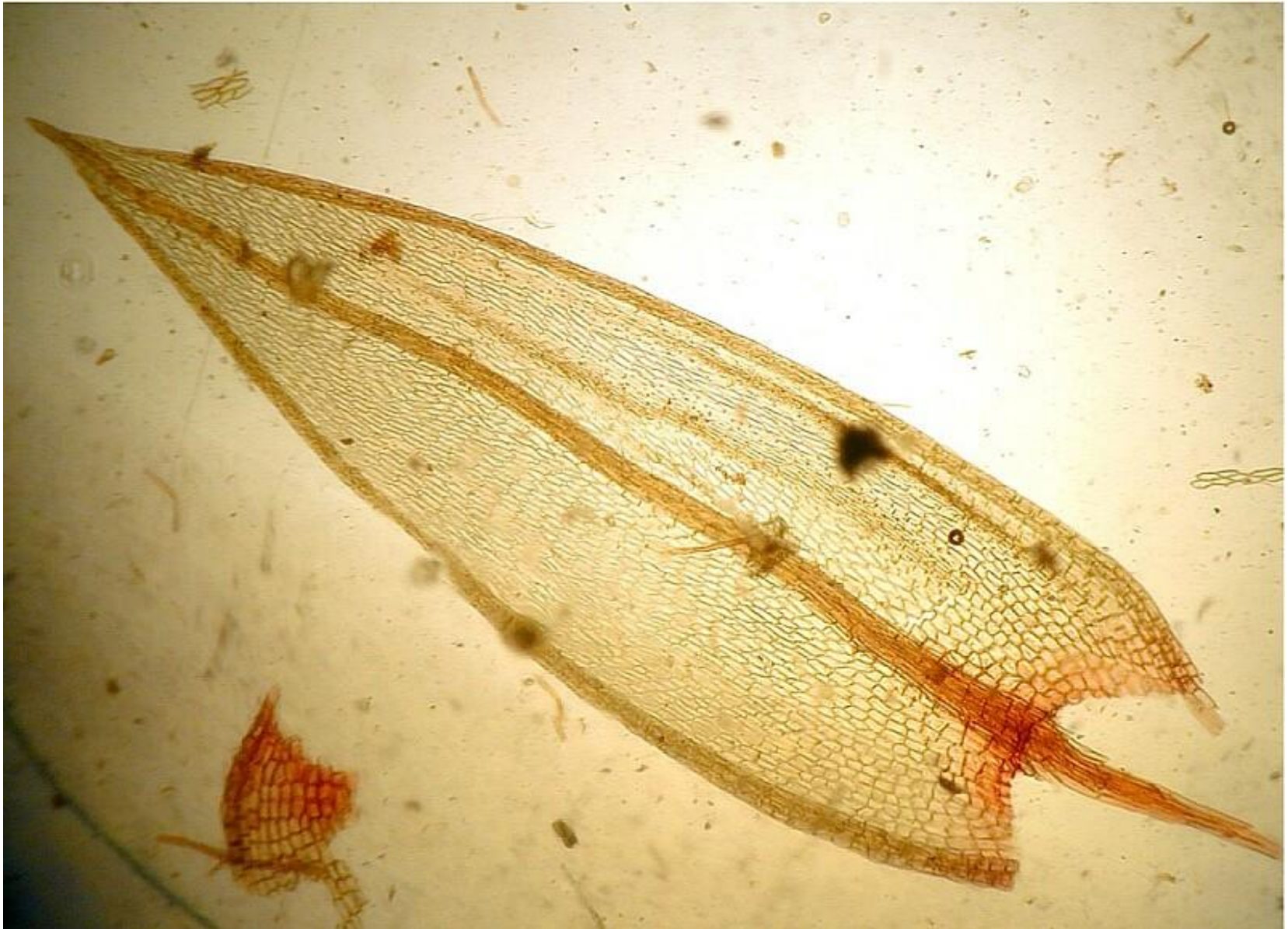
SHORT STEM SO LEAF ARRANGEMENT NOT OBVIOUS – *Bryum caespiticium*



LEAVES WIDEST ABOVE MIDDLE – e.g. *Bryum capillare*



LEAF OVATE-LANCEOLATE, COSTA SHORTLY EXCURRENT, MARGIN NARROWLY RECURVED, INDISTINCT BORDER OF NARROW CELLS, RED BASAL CELLS
– ALL CHARACTERS LIKELY TO VARY (*Bryum mildeanum*)



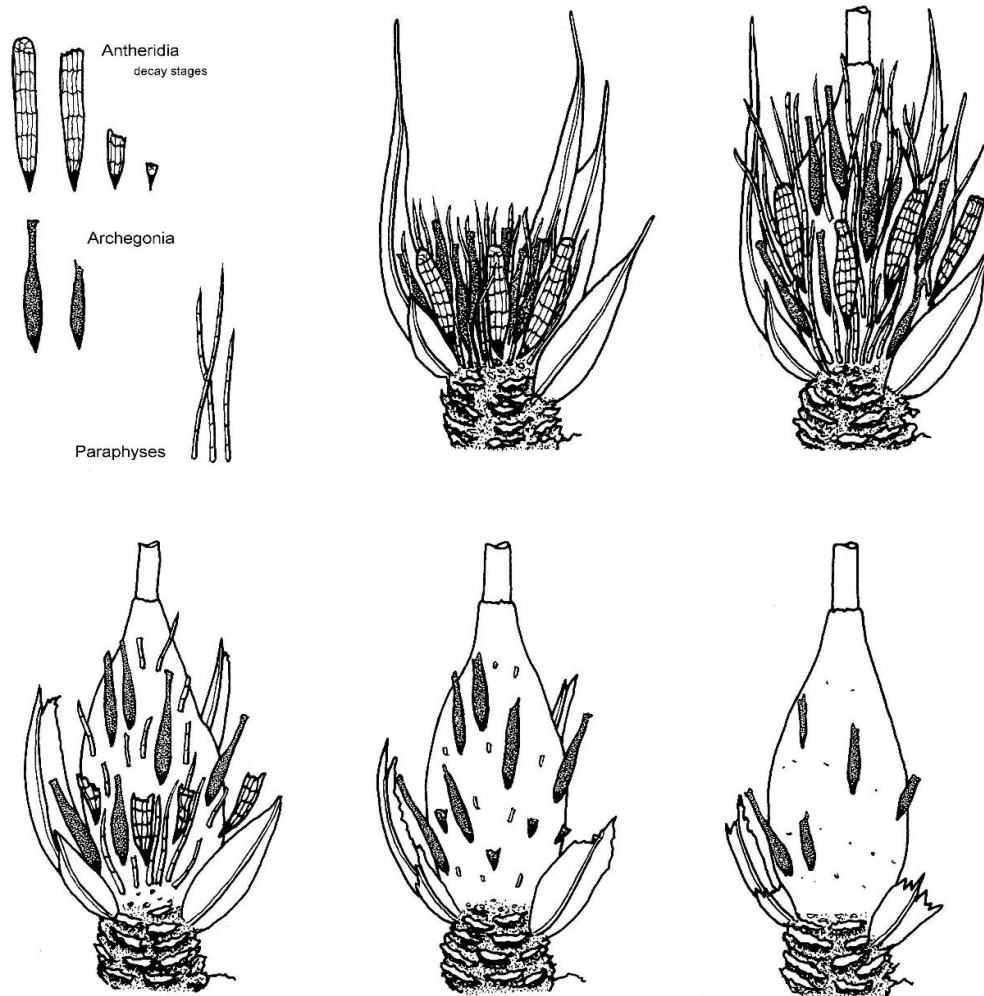
COLOUR PRONE TO VARY – *Bryum alpinum* leaves here red in parts of tuft that are most often dry, green where least often dry



INFLORESCENCES OF *BRYUM PSEUDOTRIQUETRUM*: these contain antheridia but lack archegonia, hence plants are dioicous, so it is VAR. *PSEUDOTRIQUETRUM*



STAGES IN DEVELOPMENT AND DECAY OF A SYNOICOUS INFLORESCENCE IN BRYACEAE



INTRASPECIFIC VARIABILITY IN DISTRIBUTION OF INFLORESCENCES IN *BRYUM TORQUESCENS*

HADIUZZAMAN SYED

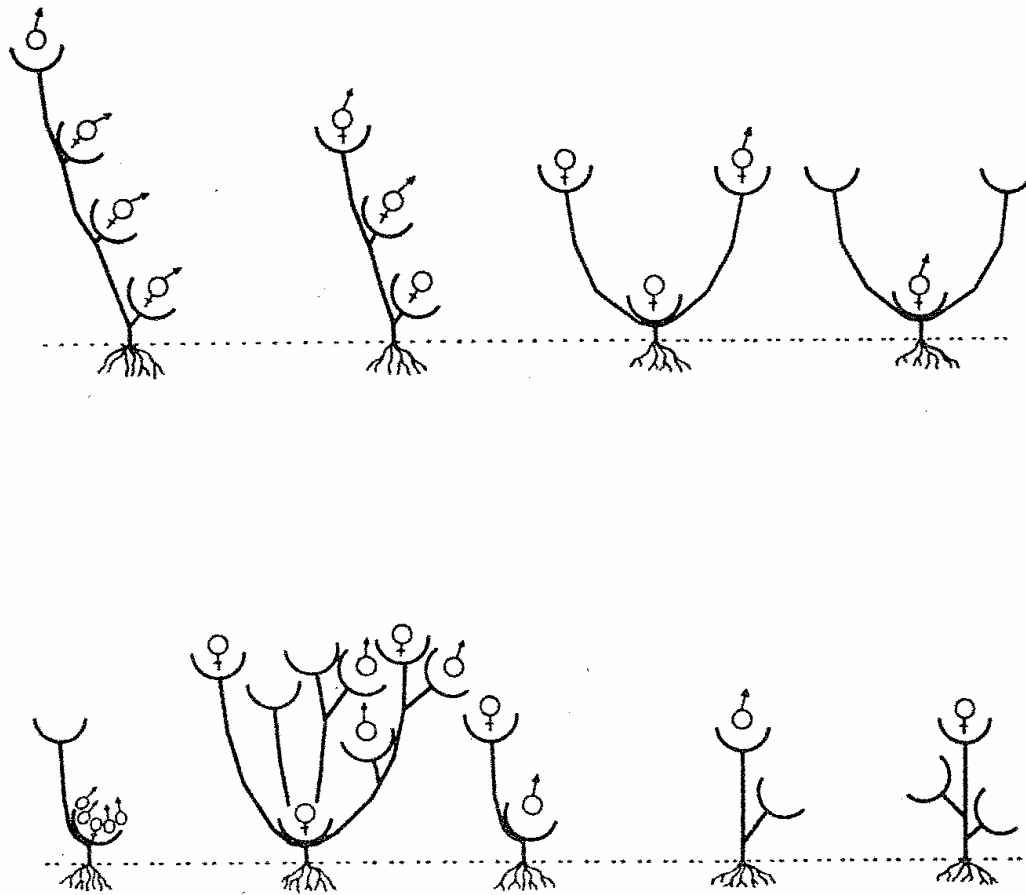


Fig. 25. Diagrammatic presentation of the types and arrangements of inflorescence in *B. torquescens* Bruch.

CAPSULE MEDIUM-SIZED, STRAIGHT, NECK SHORT – e.g. *Bryum pallescens*



CAPSULE SHORT, STRAIGHT, NECK SHORT, LID ROSTELLATE – *Bryum marratii*



CAPSULE RATHER LONG, SLIGHTLY GIBBOUS, LONG NECK,
MOUTH SLIGHTLY OBLIQUE – *Bryum uliginosum*



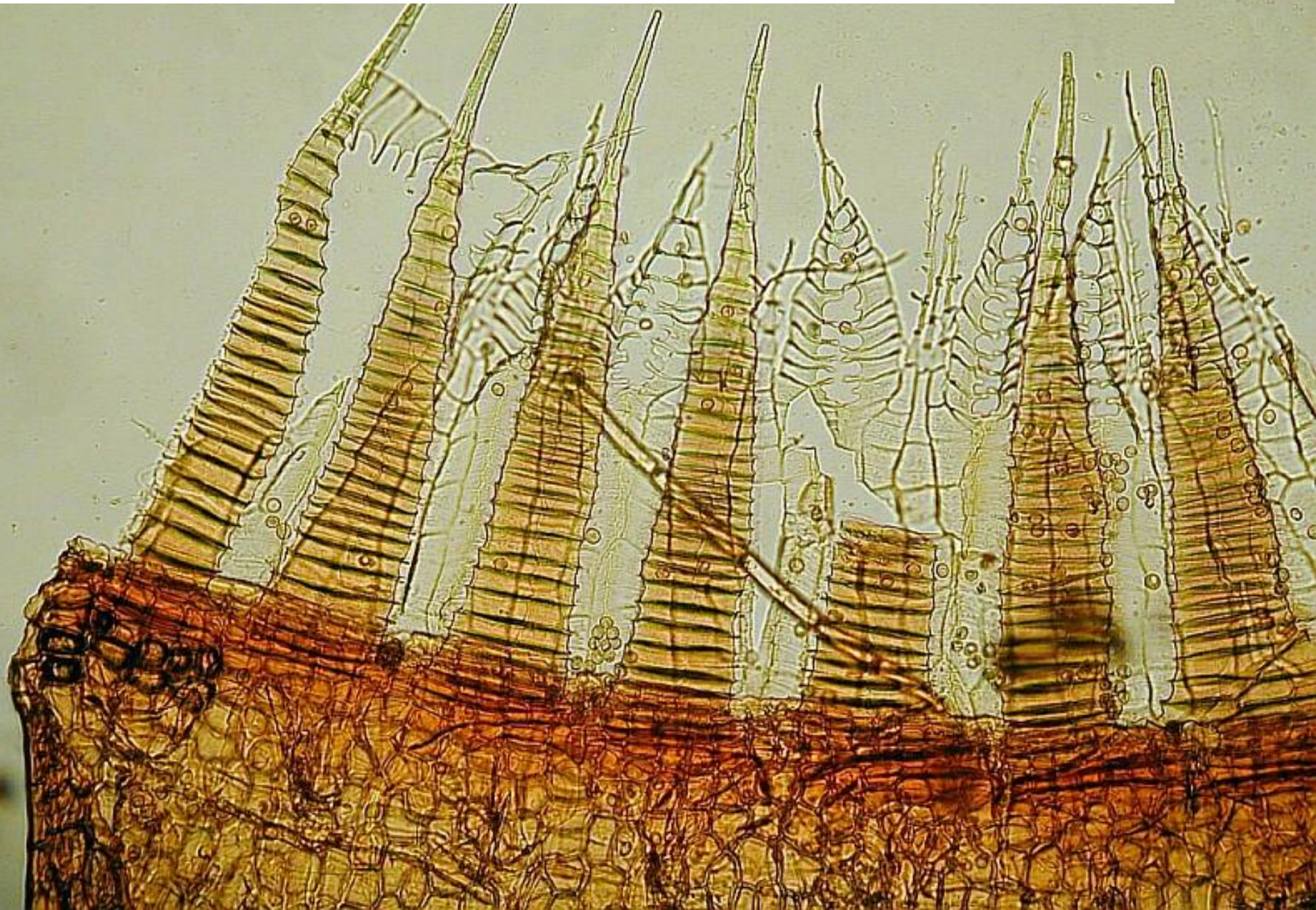
CAPSULE SHORT, STRAIGHT, TURBINATE WHEN RIPE, WITH SHORT NECK AND THIN-WALLED URN – *Bryum dichotomum*



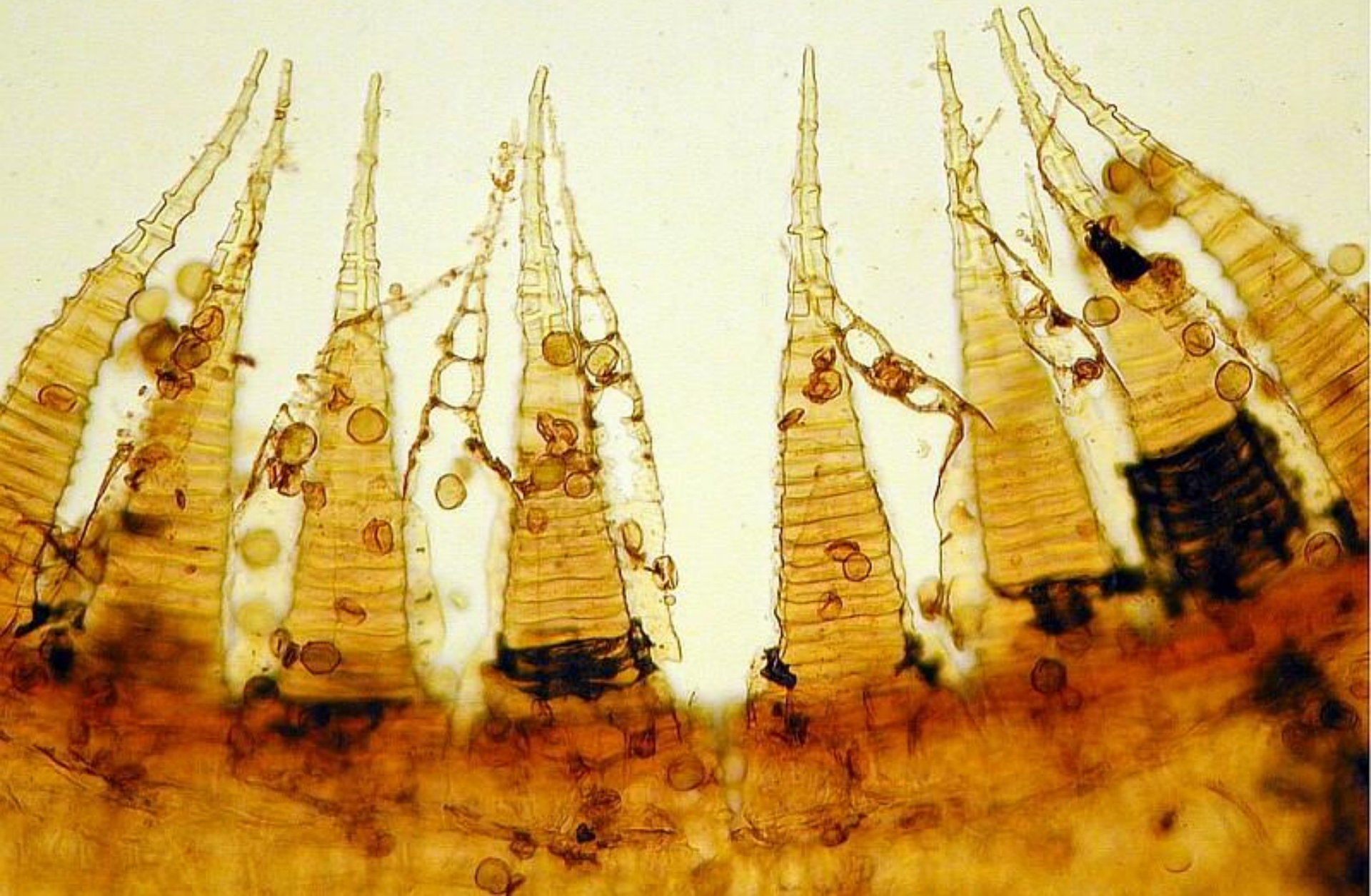
CAPSULE LONG, GIBBOUS, WITH LONG NECK AND OBLIQUE MOUTH,
SETA SHORT – *Ptychostomum demissum* (syn. *Plagiobryum demissum*)



“PERFECT” PERISTOME (CILIA APPENDICULATE), TYPICAL OF SPECIES WITH SPORE SIZE $<20\ \mu\text{m}$ – *Bryum caespiticium*



REDUCED PERISTOME (CILIA RUDIMENTARY), TYPICAL OF SPECIES WITH SPORE SIZE $>20 \mu\text{m}$ – *Bryum archangelicum*



CILIA RUDIMENTARY,
ENDOSTOME ADHERENT,
SPORES LARGE (40 μm)
– *Bryum warneum*

Spore release in this species is xerocastique as in other British Bryaceae, i.e. spores are released in dry weather. In wet weather release of the large spores is stopped by endostome processes curving inwards and closing mouth of capsule



ATYPICAL EXOSTOME, ADHERENT
ENDOSTOME – *Bryum algovicum*



BULBILS MEDIUM-SIZE, 2 TO 8 PER LEAF AXIL (VARIABLE!) – *Bryum dichotomum*



BULBILS LARGE, 1 PER LEAF AXIL – small plants of *Bryum dyffrynense*



BULBILS SMALL, >10 PER LEAF AXIL – *Bryum gemmiferum*



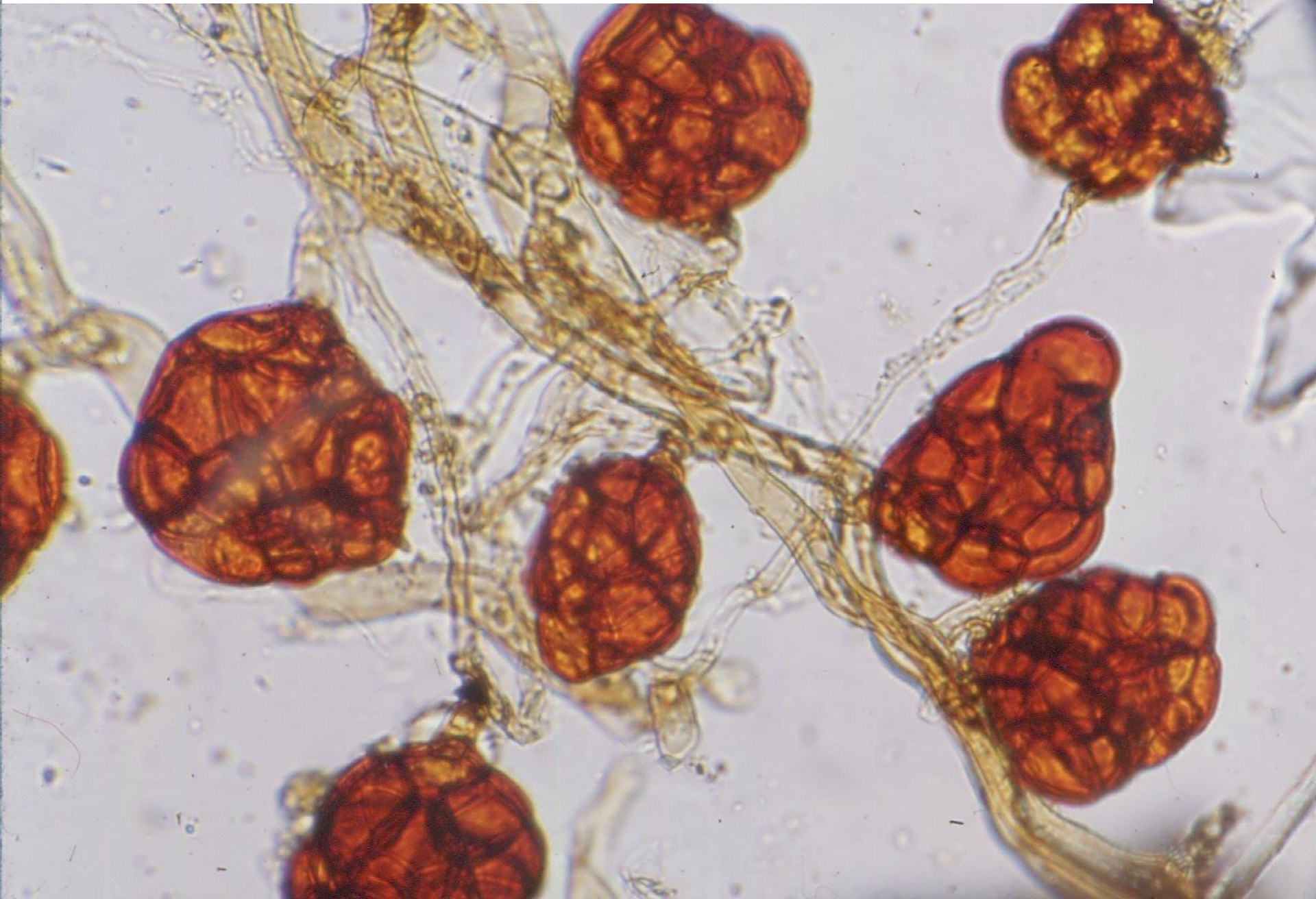
FILAMENTOUS AXILLARY GEMMAE – *Bryum pseudotriquetrum*



FILAMENTOUS AXILLARY GEMMAE – *Bryum moravicum*



SMALL SPHERICAL RED TUBERS, CELLS BULGING, RHIZOIDS BROWN
– *Bryum klinggraeffii*





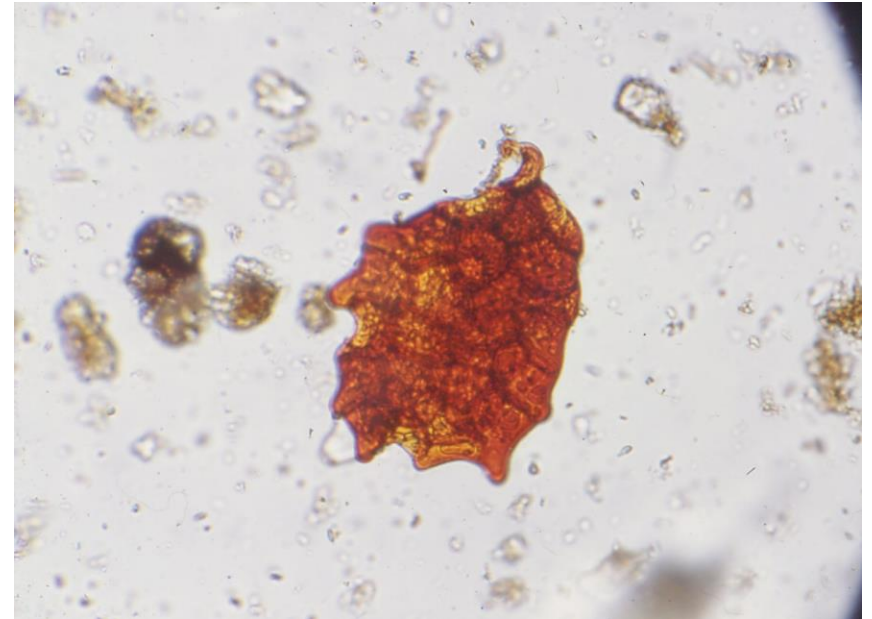
SMALL SPHERICAL RED TUBERS,
CELLS NOT BULGING, RHIZOIDS
PURPLE, SMOOTH – *Bryum violaceum*

SMALL PYRIFORM BROWN TUBERS, CELLS HARDLY BULGING,
RHIZOIDS BROWN – *Bryum sauteri*



LEFT : LARGE, SPHERICAL, RED TUBER WITH CELLS THICK-WALLED AND BULGING – *Bryum rubens*

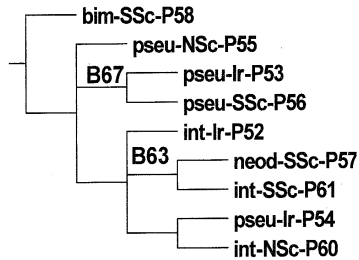
RIGHT : LARGE, FLAT, RED TUBER WITH PROJECTING CELLS -- *Bryum riparium*



IDENTIFICATION PROBLEMS AND THEIR CAUSES

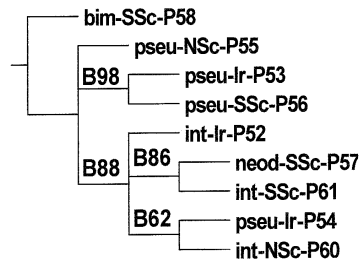
- POOR SPECIMENS (e.g. good sporophytes but decayed gametophytes)
- MISINTERPRETATION OF CHARACTERS (particularly sexuality, peristome morphology, often coupled with undue optimism!)
- MIXTURES OF TWO OR MORE SPECIES
- PLASTICITY OF MORPHOLOGY (e.g. *Bryum dichotomum* plants from same clone producing blunt leaves in winter when wet, acute leaves in summer when dry)
- TAXONOMIC OR NOMENCLATORIAL ISSUES (including: recognition of invalid species, existence of much clonal variation in taxa that mainly reproduce vegetatively (e.g. *B. dichotomum*), genuine diversity due to polyploidy, genuine genetic and morphological diversity within species having global ranges, nomenclatorial problems resulting from loss of types and hundreds of synonyms, occasional interspecific hybridization, sibling species with few stable characters, requirement for perfect fertile material with some species).

PHENOTYPIC PLASTICITY LEADING TO RECOGNITION OF AN INVALID SPECIES:
 Morphologically typical *Bryum pseudotriquetrum* var. *pseudotriquetrum* has been shown to include three lineages in Europe; one of these can give rise to “*Bryum neodamense*” and intermediate plants, another lineage also gives rise to intermediate plants.



3 trees, L 17, Ci 0.88, Ri 0.86

Gaps not coded as informative, incomplete species excluded



3 trees, L 35, Ci 0.91, Ri 0.91

Gaps coded as informative, incomplete species excluded

“*Bryum neodamense*”



Intermediate plants



Above: Summary interpretation
 of DNA sequence data by
 Lars Hedenäs

“*Bryum neodamense*” leaves on innovation produced by shoot of *B. pseudotriquetrum* var. *pseudotriquetrum* after submergence by rising water of lake



PHENOTYPIC PLASTICITY, BUT PROBABLY NOT ANOTHER INVALID SPECIES? :
First gathering of *Bryum muehlenbeckii* reported from Scotland (in DBN Herbarium); **left**,
whole specimen; **top right**, upper leaves from same specimen showing characters of
Bryum muehlenbeckii; **bottom right**, lower leaves from same specimen showing typical
characters of *Bryum alpinum*.

