



Pollen- and Dispersal Units

monad – 132

dyad – 134

pseudomonad – 135

tetrad – 137

tetrad tetrahedral – 138

tetrad decussate – 142

tetrad planar – 143

polyad – 145

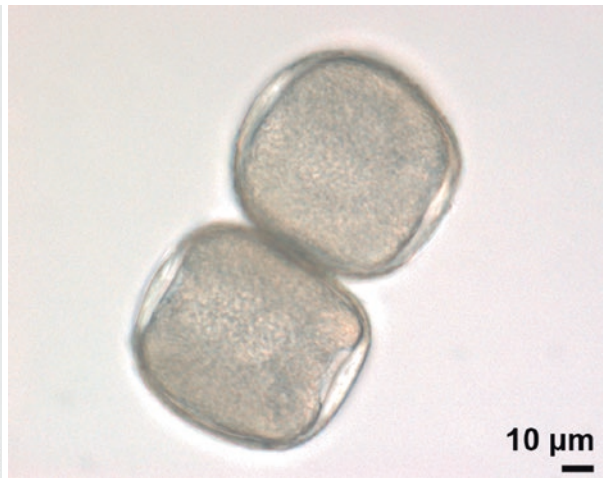
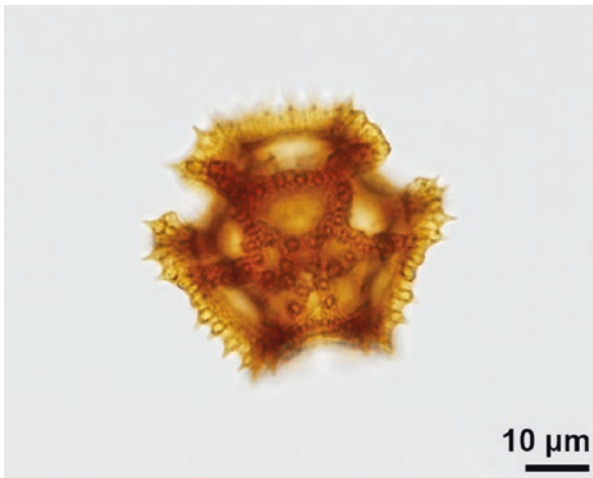
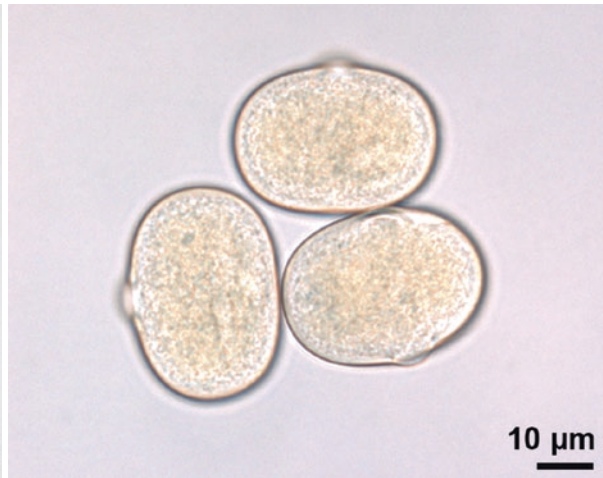
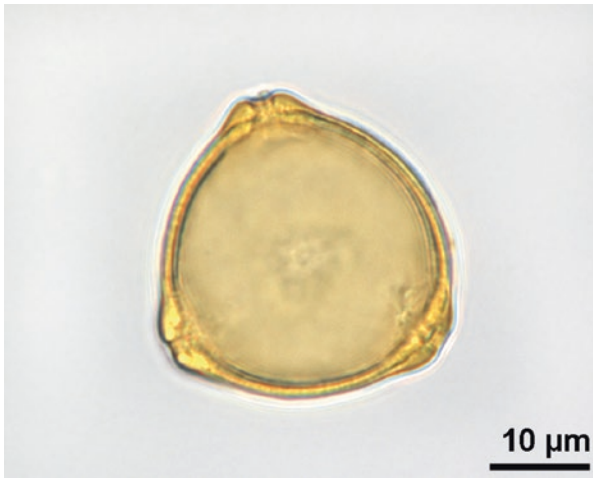
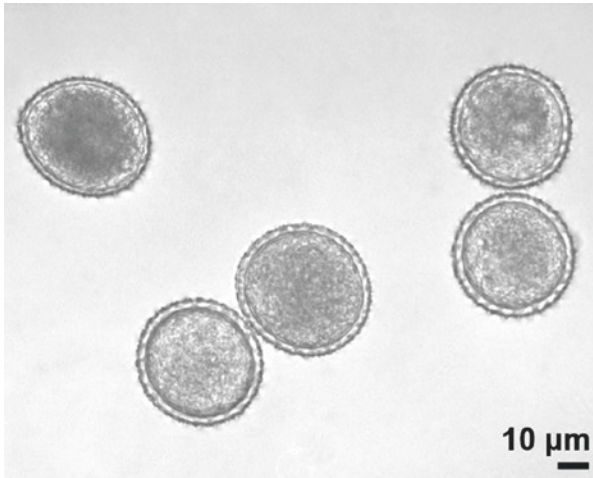
massula – 147

pollinium – 148

pollinarium – 150

monad

unit consisting of a single pollen grain



■ *Alocasia odora*, Araceae
■ inaperturate pollen, hydrated

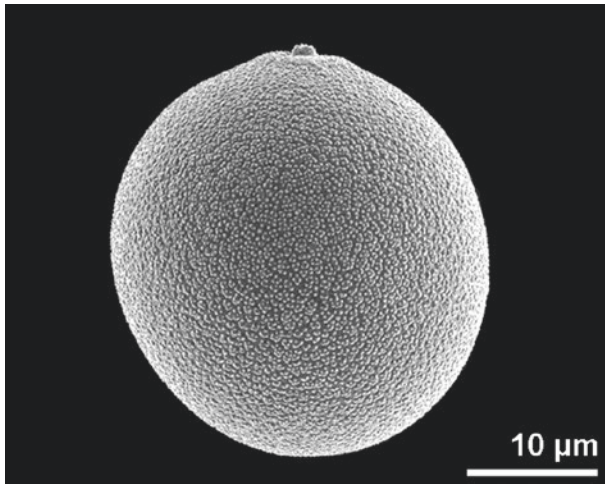
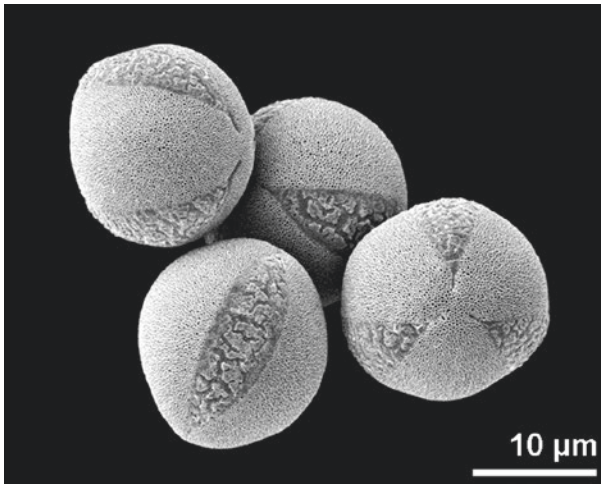
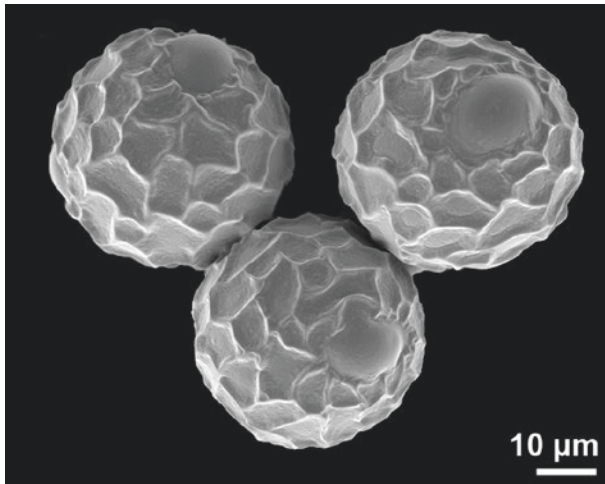
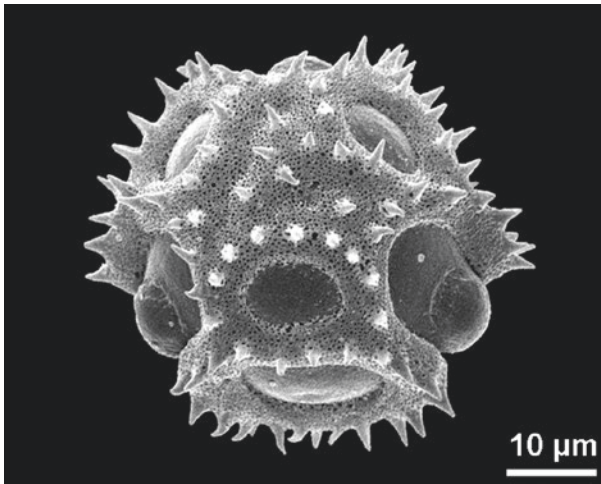
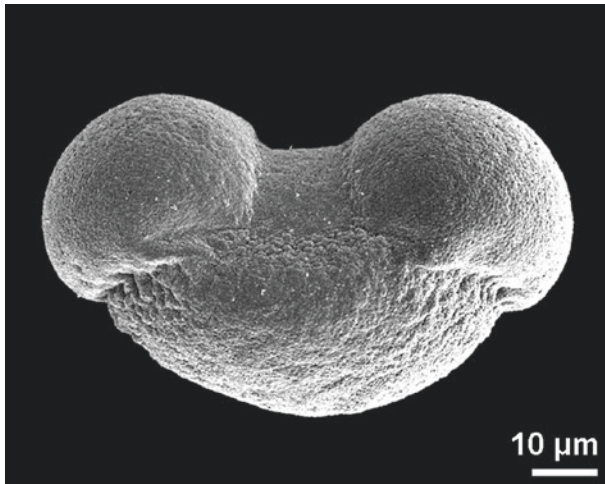
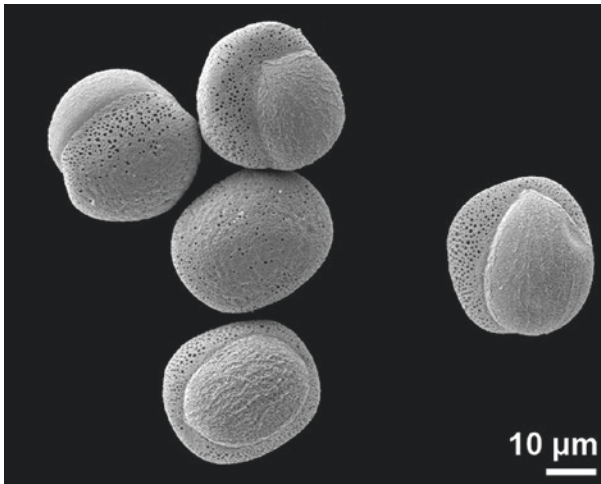
■ *Betula humilis*, Betulaceae
■ triporate, polar view

■ *Tragopogon orientalis*, Asteraceae
■ tricolporate, oblique polar view

■ *Tilia tomentosa*, Malvaceae
■ tricolporate, polar view

■ *Lathyrus pratensis*, Fabaceae
■ tricolporate, equatorial view, hydrated

■ *Gonatopus bovinii*, Araceae
■ ring-like aperture, equatorial view, hydrated



■ ■ *Haworthia herbacea*, Xanthorrhoeaceae
■ ■ sulcate

■ ■ *Tragopogon orientalis*, Asteraceae
■ ■ tricolporate, oblique polar view

■ ■ *Lamium galeobdolon*, Lamiaceae
■ ■ tricolpate

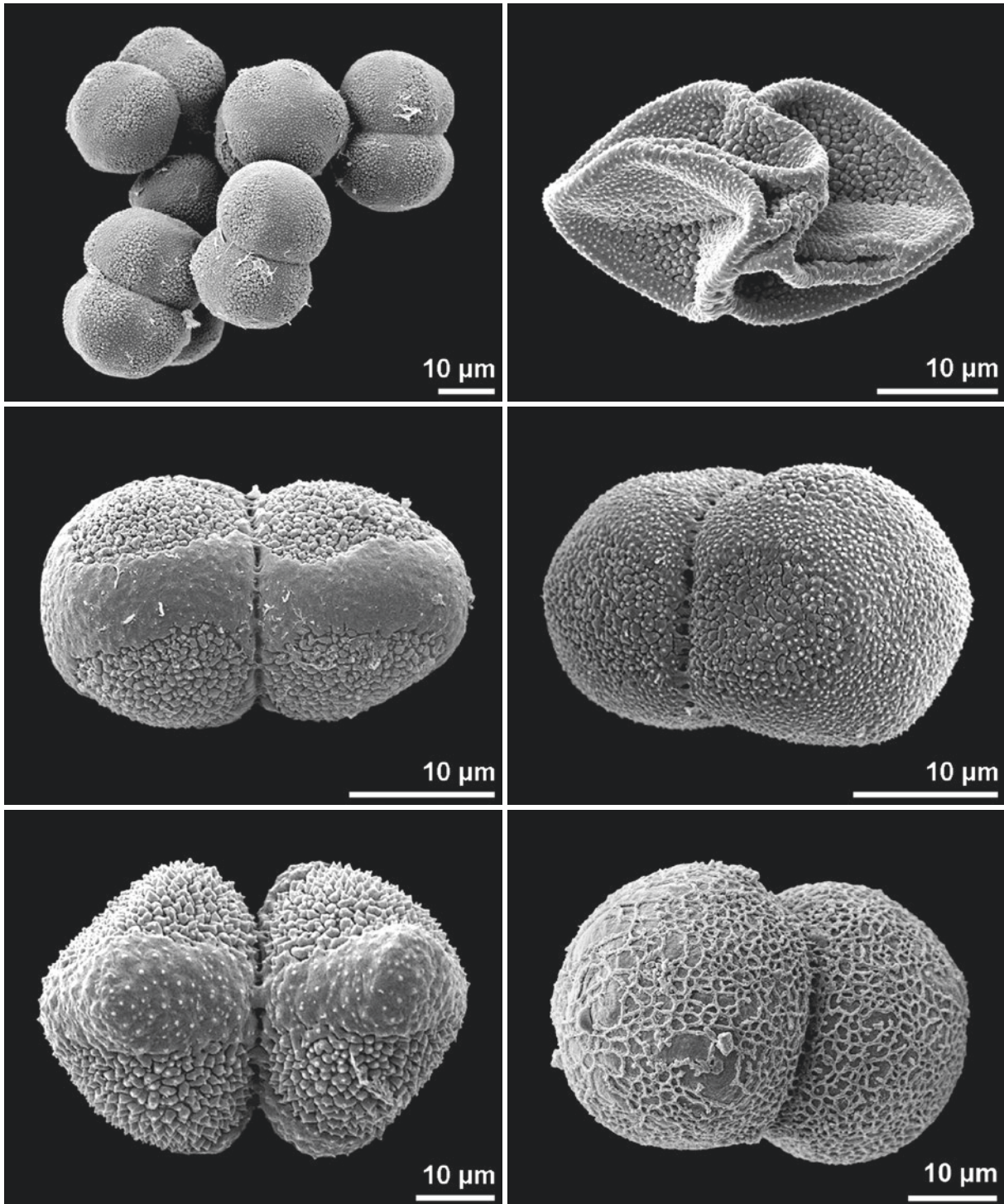
■ ■ *Pinus strobus*, Pinaceae
■ ■ bisaccate, equatorial view

■ ■ *Bituminaria bituminosa*, Fabaceae
■ ■ tricolporate, dry pollen

■ ■ *Dactylis glomerata*, Poaceae
■ ■ ulcerate, equatorial view

dyad

unit of two pollen grains



■ ■ *Polypleurum stylosum*, Podostemaceae

■ ■ *Zeylanidium olivaceum*, Podostemaceae
equatorial view

■ ■ *Thelethylax minutiflora*, Podostemaceae
equatorial view

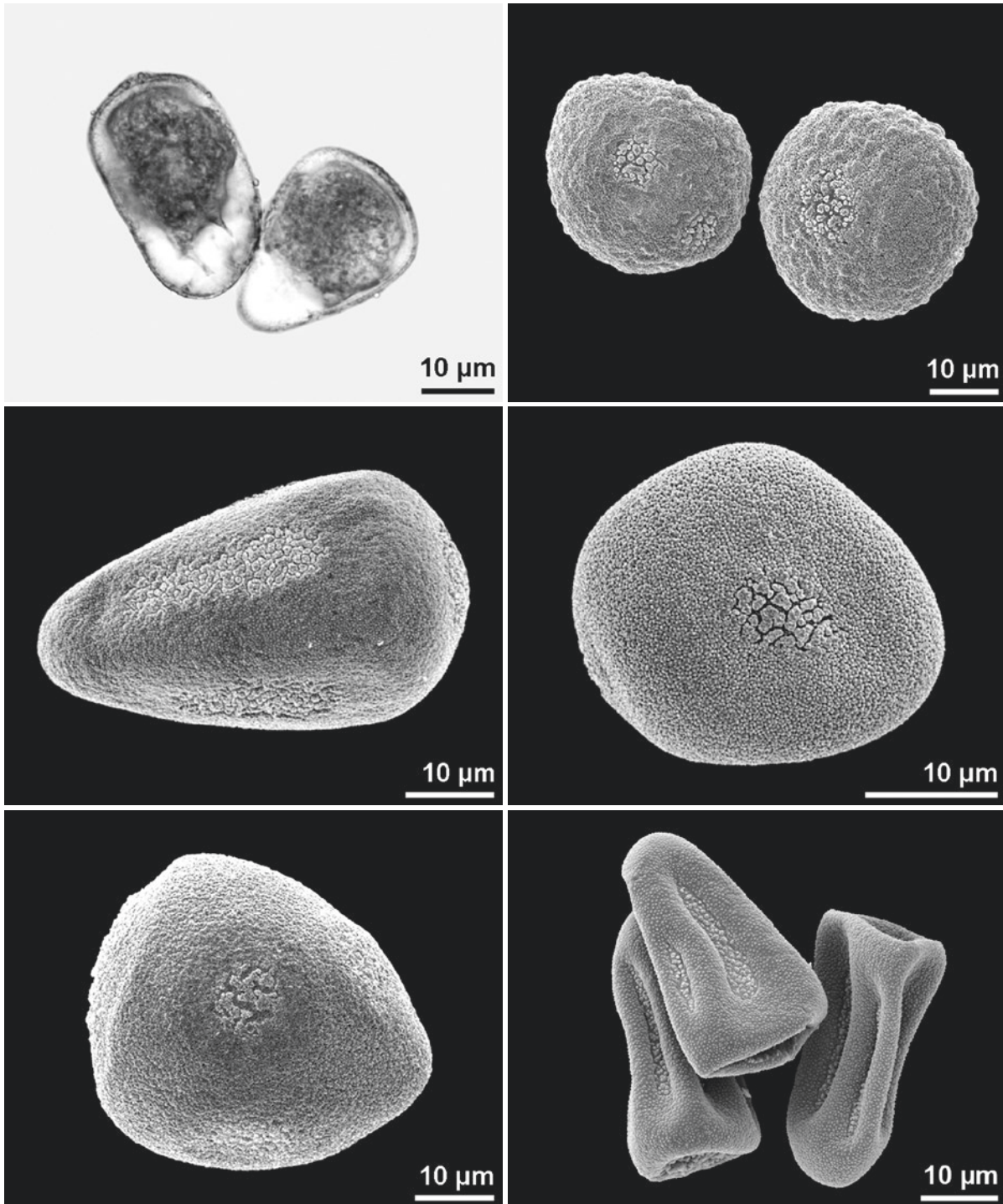
■ ■ *Polypleurum stylosum*, Podostemaceae
pollen collapsed

■ ■ *Zeylanidium subulatum*, Podostemaceae

■ ■ *Scheuchzeria palustris*, Scheuchzeriaceae

pseudomonad

unit of a permanent tetrad with three rudimentary pollen grains



■ *Carex* sp., Cyperaceae
hydrated pseudomonads, note remnants of aborted pollen at proximal pole (white zone)

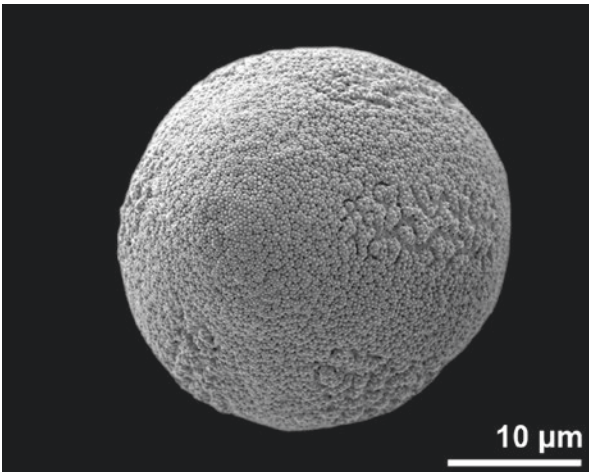
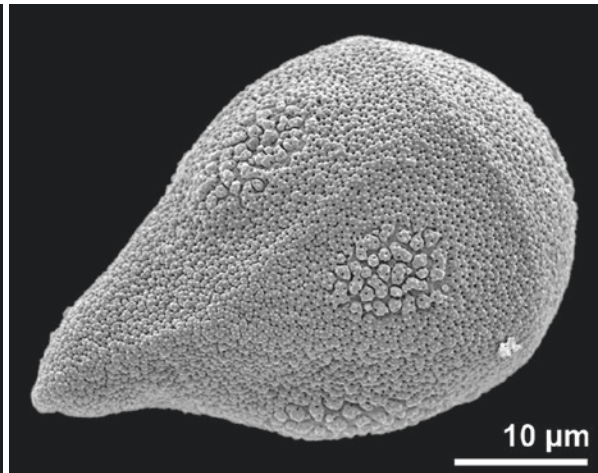
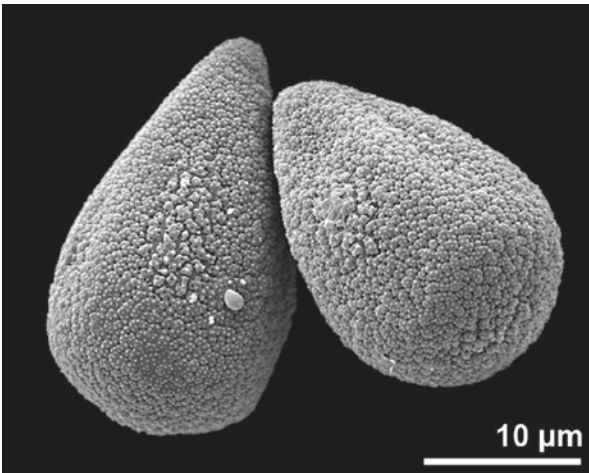
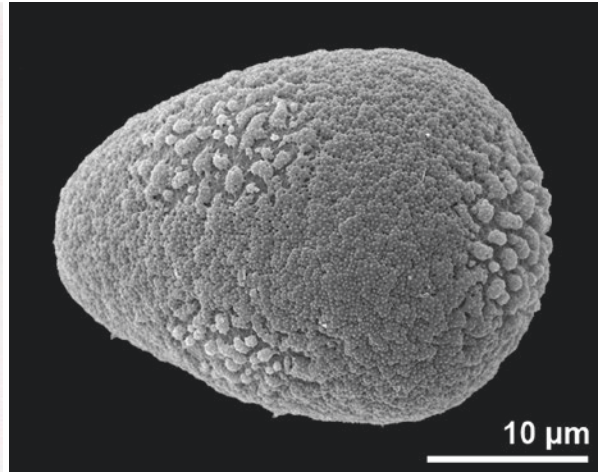
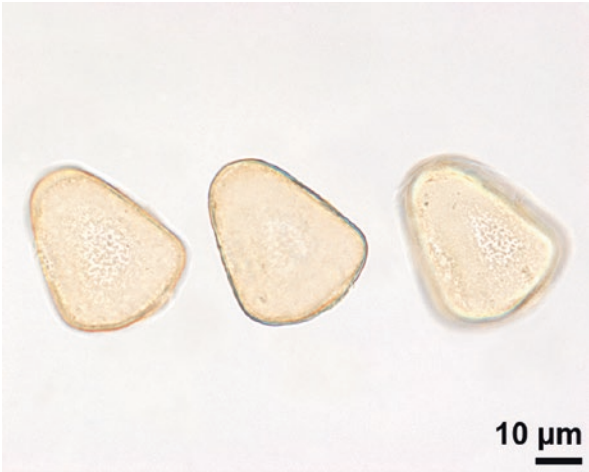
■ *Schoenoplectus lacustris*, Cyperaceae
equatorial view

■ *Carex distans*, Cyperaceae
equatorial view

■ *Carex atrata*, Cyperaceae

■ *Scirpus sylvaticus*, Cyperaceae
equatorial view

■ *Cyperus conglomeratus*, Cyperaceae
dry pollen



■ ■ *Carex digitata*, Cyperaceae
pollen at different focal depths

■ ■ *Cyperus diffusus*, Cyperaceae
equatorial view

■ ■ *Eleocharis palustris*, Cyperaceae
proximal polar view

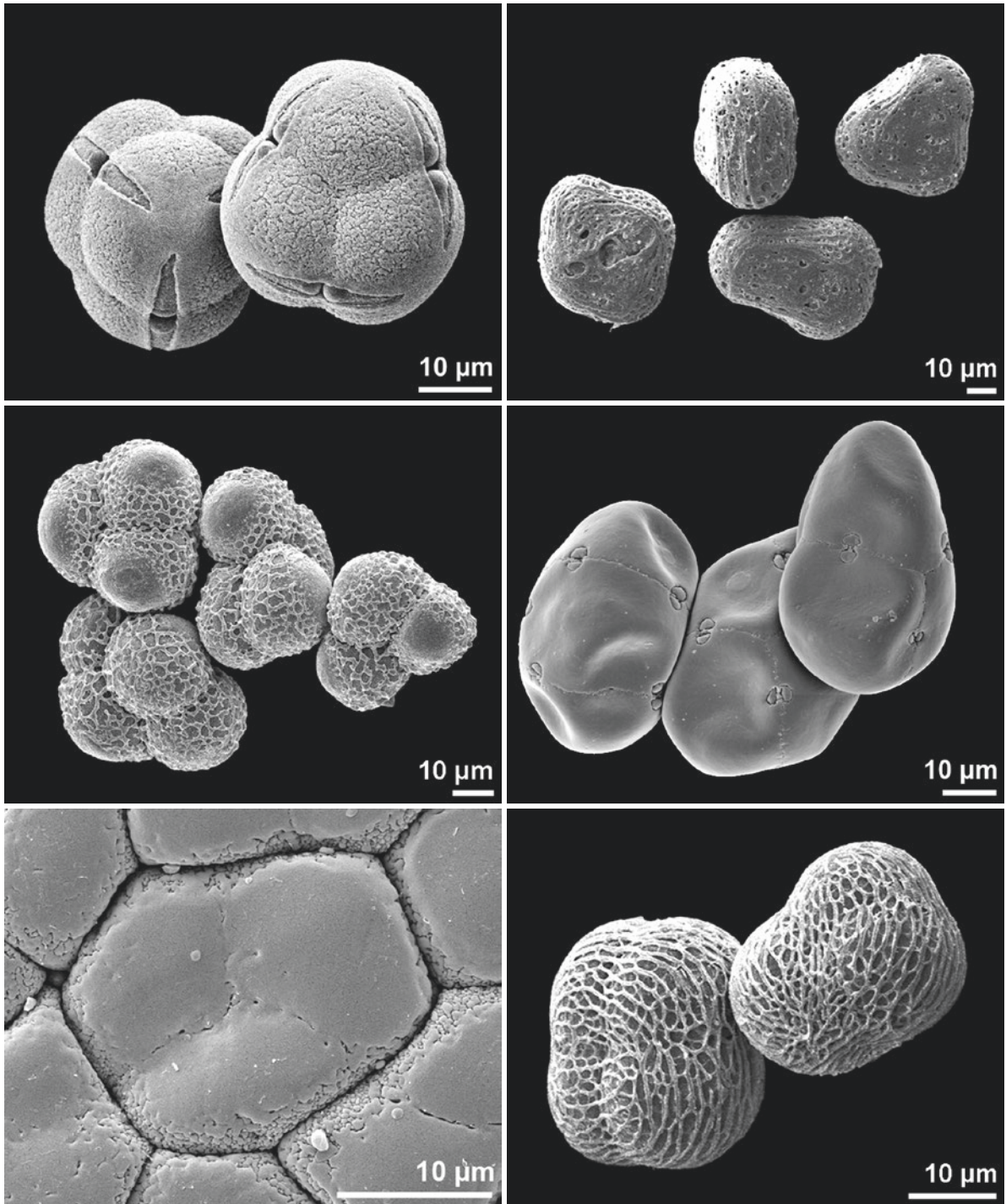
■ ■ *Trichophorum cespitosum*, Cyperaceae
equatorial view

■ ■ *Scirpoides holoschoenus*, Cyperaceae
equatorial view

■ ■ *Cyperus papyrus*, Cyperaceae
equatorial view

tetrad

unit of four pollen grains



■ *Erica herbacea*, Ericaceae
tetrahedral tetrads

■ *Epipactis helleborine*, Orchidaceae
decussate tetrads

■ *Epidendrum centropetalum*, Orchidaceae
tetrad, part of pollinium

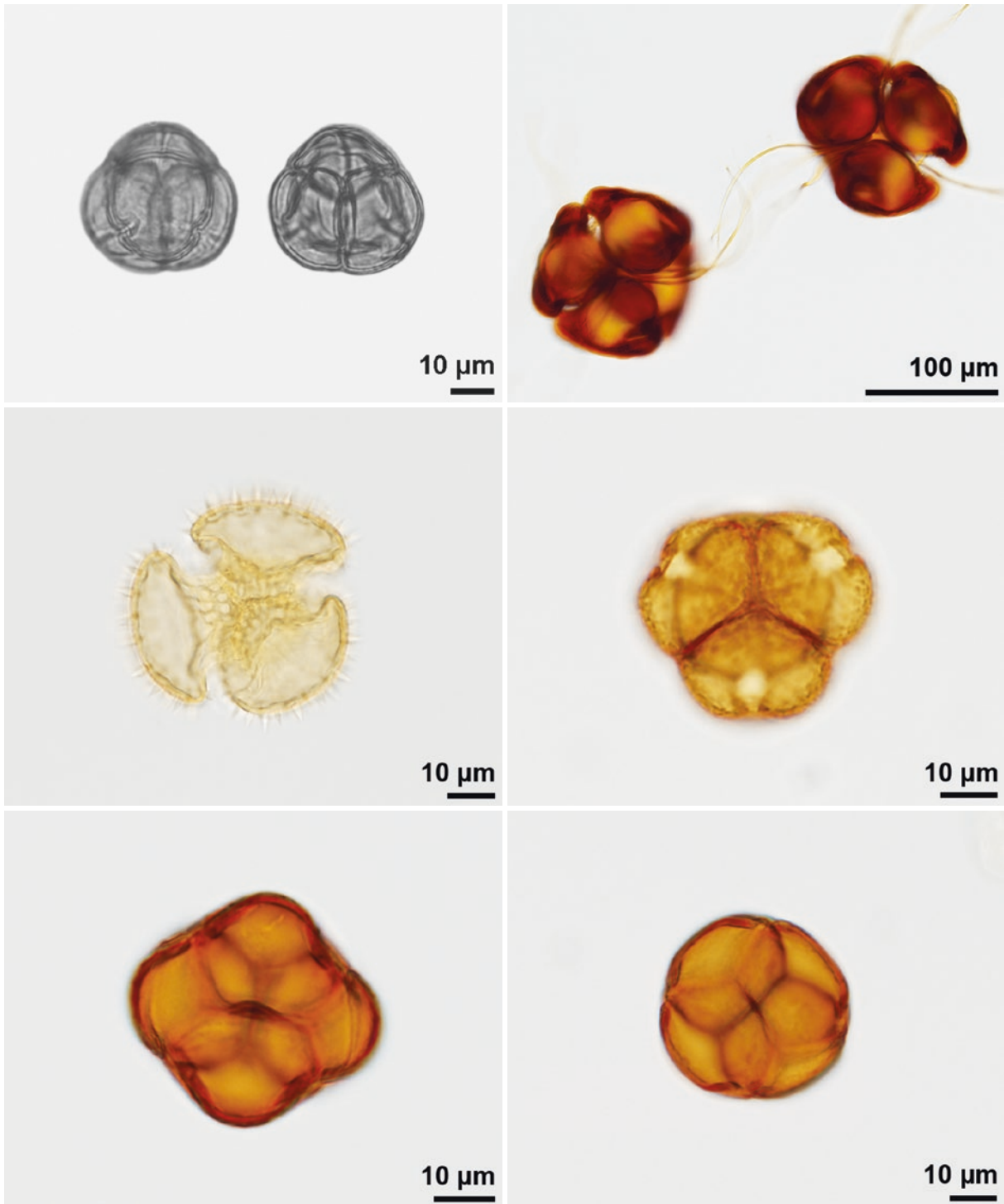
■ *Chlorospatha kolbii*, Araceae
different planar tetrads

■ *Cyprinia gracilis*, Apocynaceae
planar tetrads, dry pollen

■ *Xanthosoma ceronii*, Araceae
tetrad planar (left) and decussate (right)

tetrad tetrahedral

unit of four pollen grains in which the centers of the grains define a tetrahedron



■ Ericaceae
fossil, Miocene, China

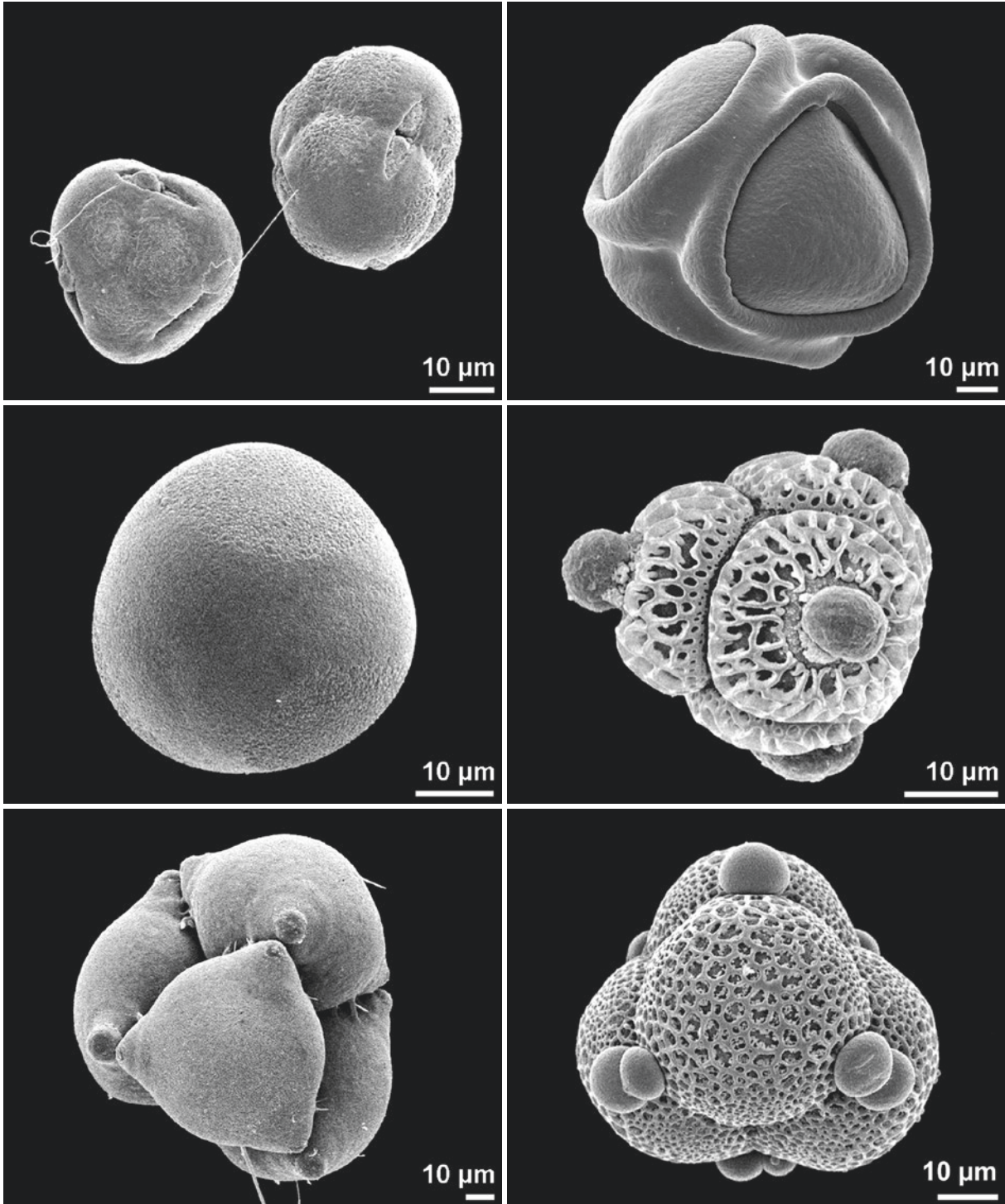
■ *Drosera scorpioides*, Droseraceae

■ *Vaccinium myrtillus*, Ericaceae
lateral view

■ *Epilobium hirsutum*, Onagraceae
tetrads with viscin threads

■ *Erica tetralix*, Ericaceae

■ *Andromeda polifolia*, Ericaceae
lateral view



■ ■ *Rhododendron hirsutum*, Ericaceae
tetrads with viscin threads

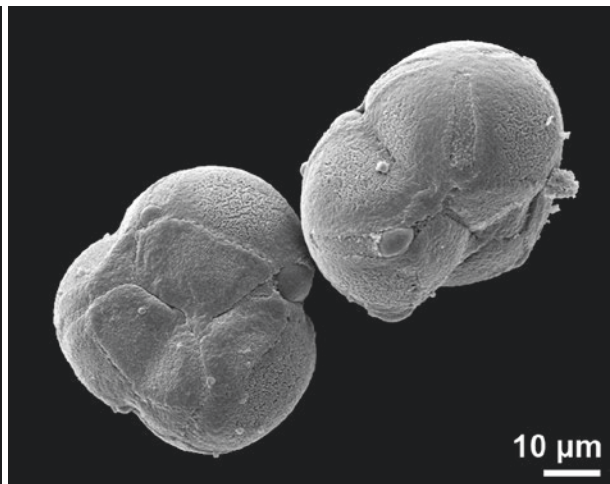
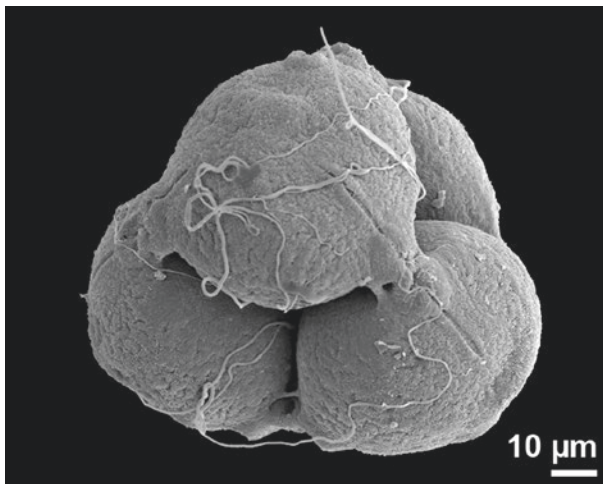
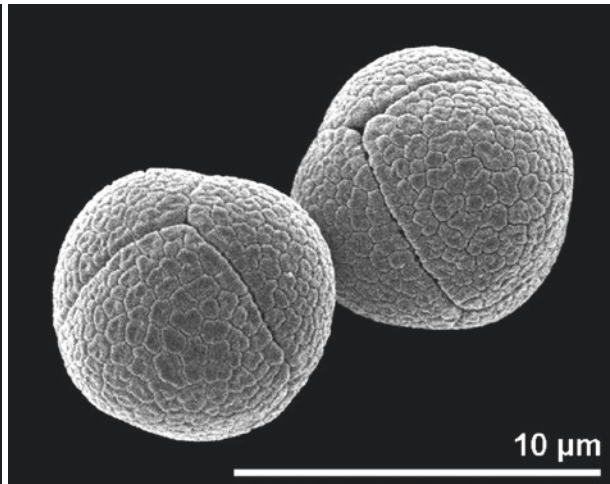
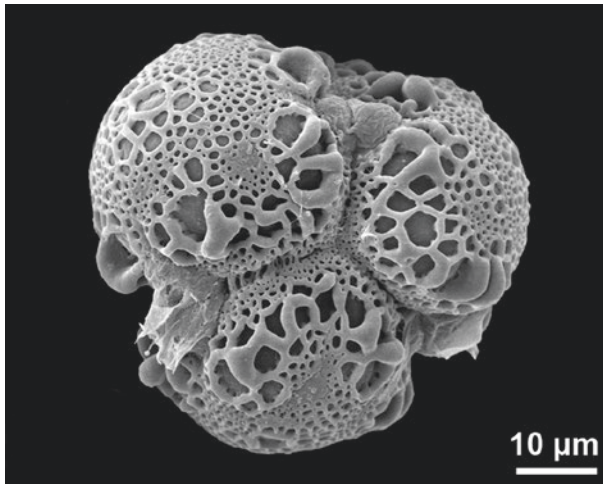
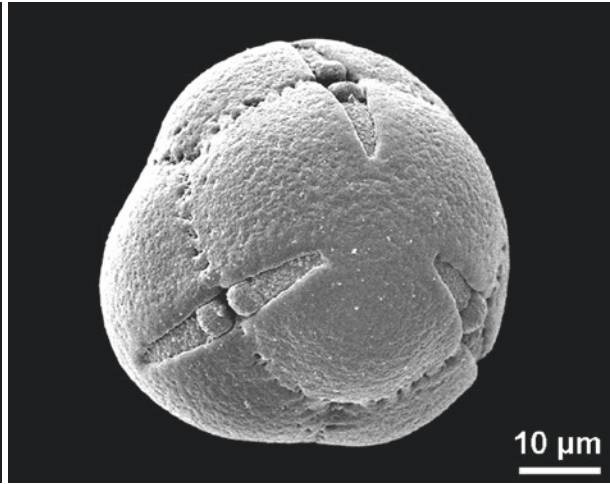
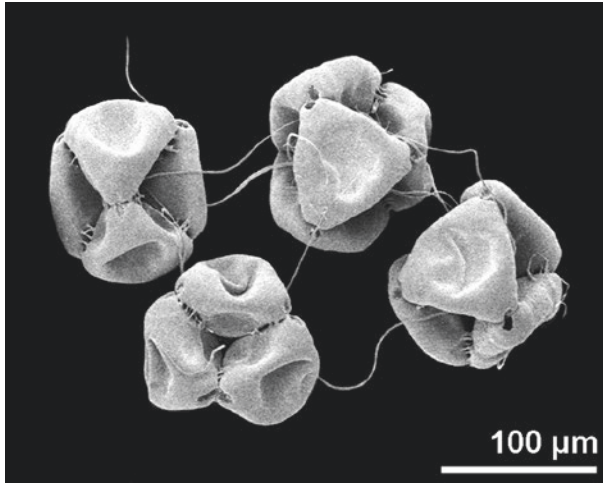
■ ■ *Luzula campestris*, Juncaceae
ulcerate pollen

■ ■ *Epilobium montanum*, Onagraceae
viscin threads

■ ■ *Victoria regia*, Nymphaeaceae
dry pollen

■ ■ *Drimys granatensis*, Winteraceae
ulcerate pollen

■ ■ *Oxyanthus subpunctatus*, Rubiaceae
apical view



■ ■ *Epilobium parviflorum*, Onagraceae
 ■ ■ tetrads with viscin threads, dry pollen

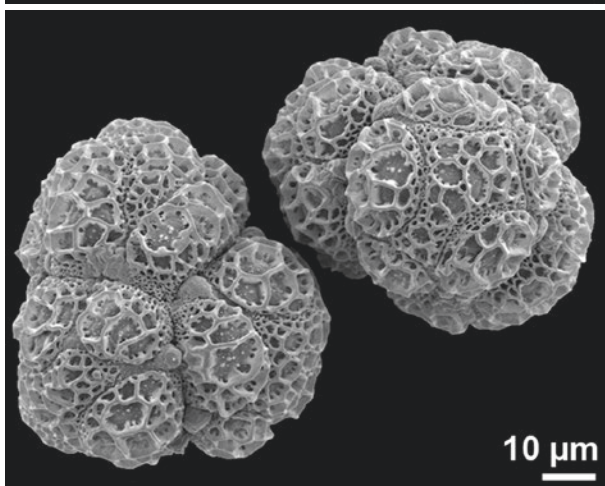
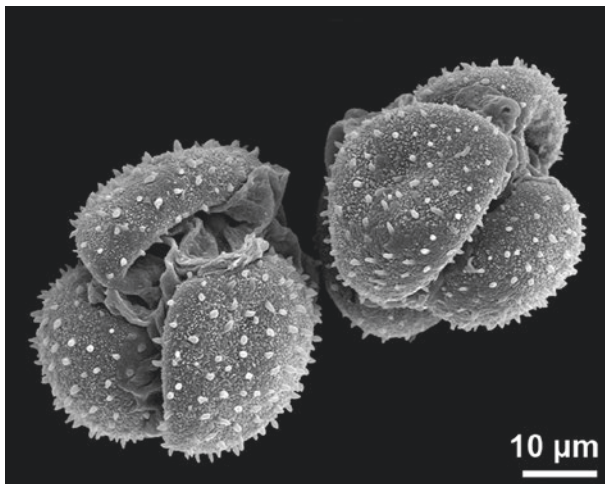
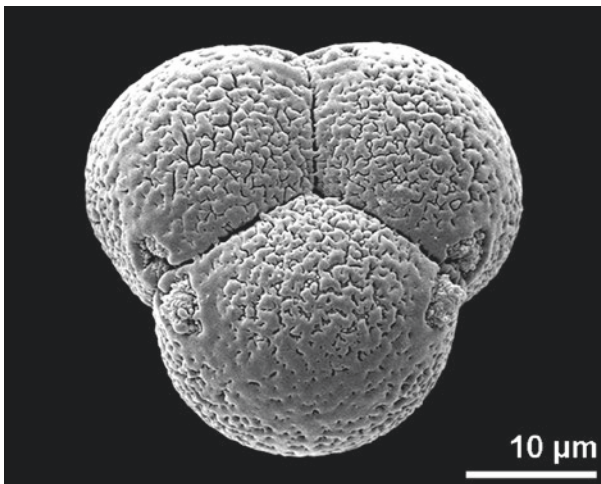
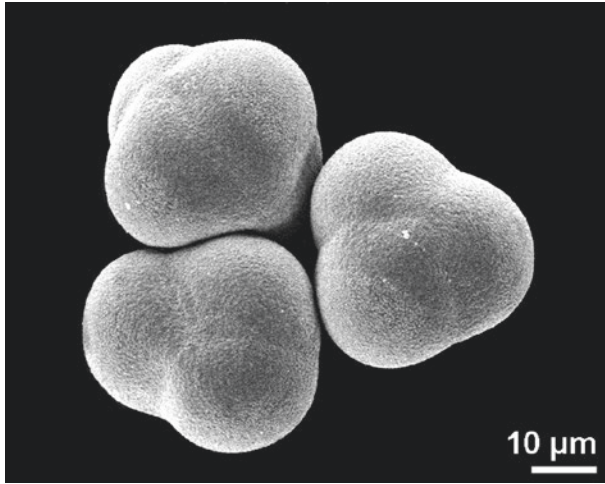
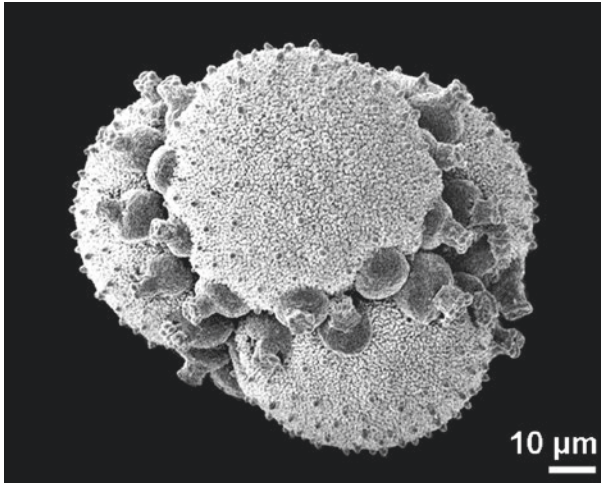
■ ■ *Chelonanthus alatus*, Gentianaceae
 ■ ■ basal view

■ ■ *Ludwigia octovalvis*, Onagraceae
 ■ ■ pollen with viscin threads

■ ■ *Arbutus unedo*, Ericaceae

■ ■ *Mimosa pudica*, Mimosaceae

■ ■ *Agapetes macrantha*, Ericaceae
 ■ ■ tetrads with aborted monad ("pseudotriads")



■ ■ *Dionaea muscipula*, Droseraceae

■ ■ *Juncus effusus*, Juncaceae
ulcerate pollen

■ ■ *Moneses uniflora*, Ericaceae
basal view

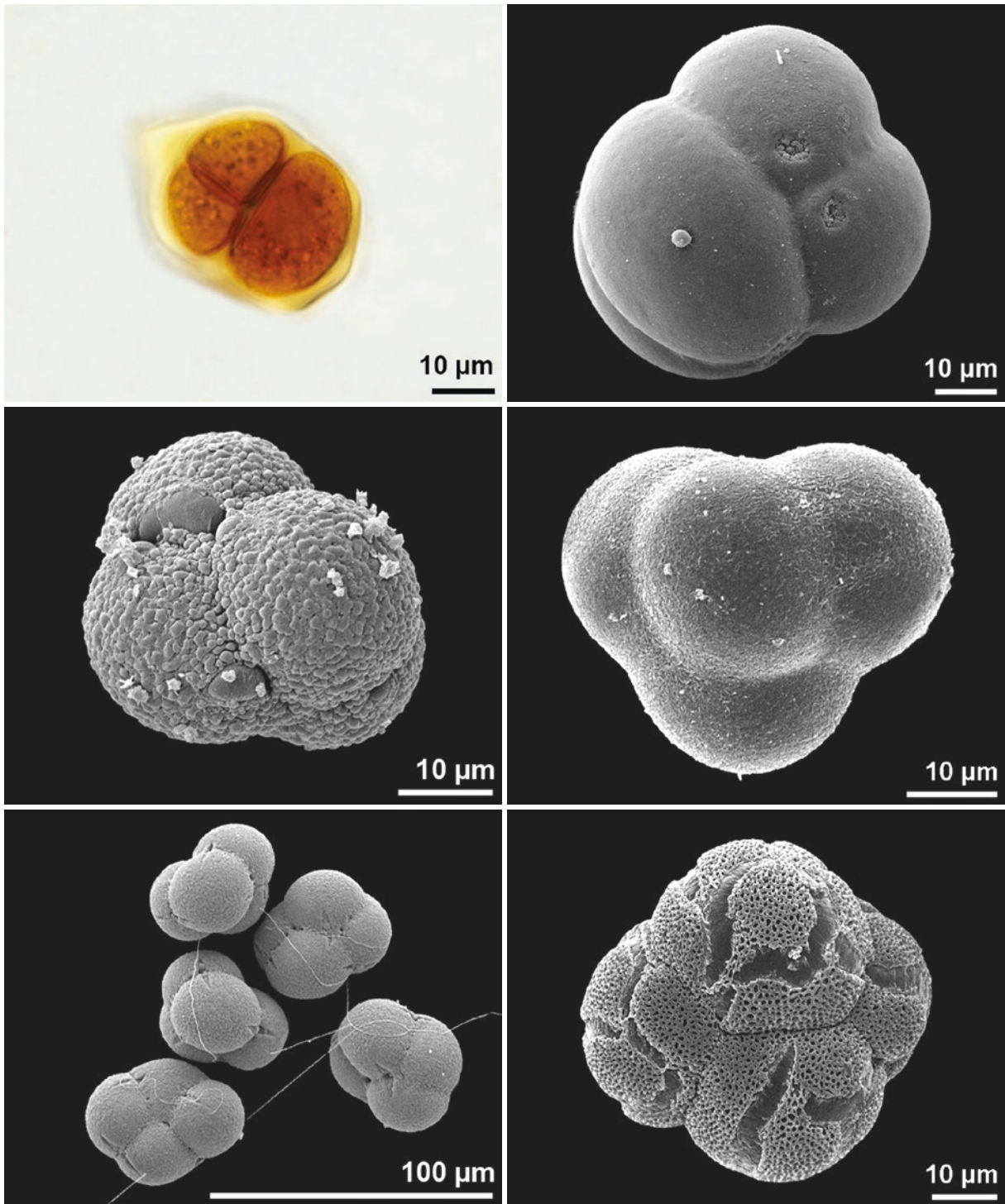
■ ■ *Drosera binata*, Droseraceae
dry pollen

■ ■ *Vaccinium vitis-idaea*, Ericaceae

■ ■ *Calolisianthus pendulus*, Gentianaceae

tetrad decussate

unit of four pollen grains arranged in two pairs in two different plains



■ ■ *Calla palustris*, Araceae
 ■ ■ early tetrad stage enclosed in callose

■ ■ *Calluna vulgaris*, Ericaceae

■ ■ *Rhodothamnus chamaecistus*, Ericaceae
 ■ ■ viscin threads

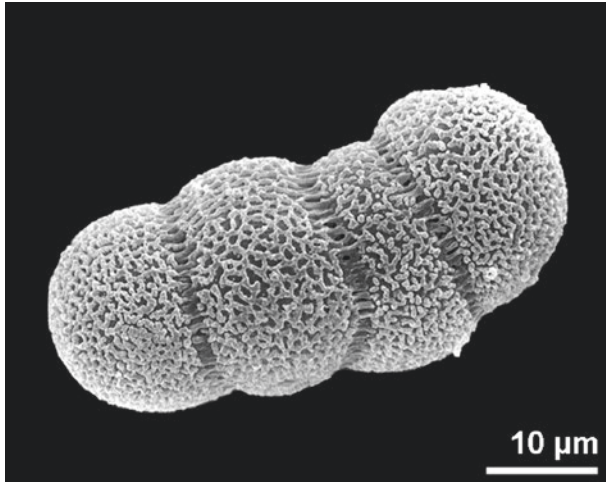
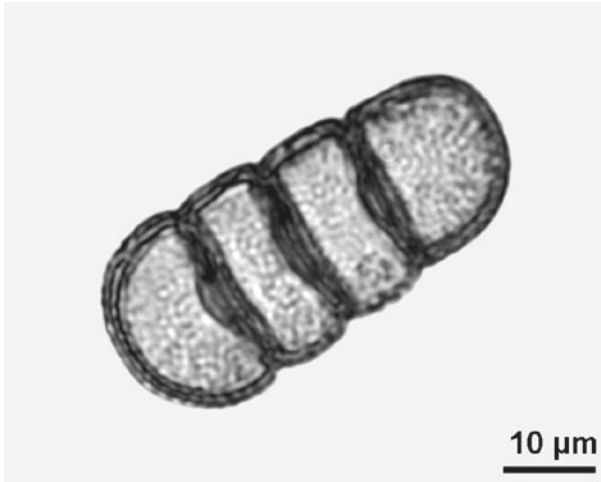
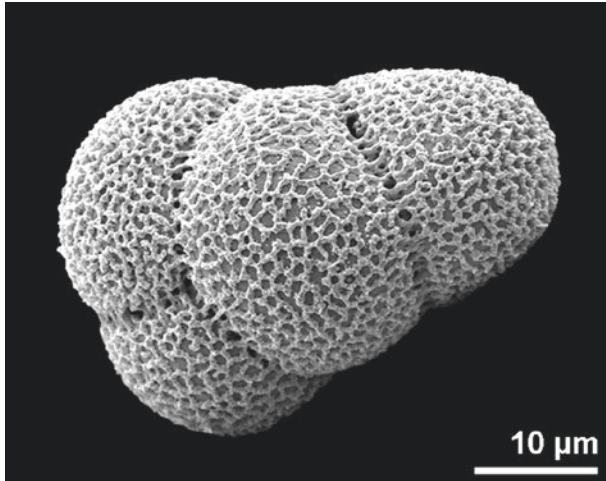
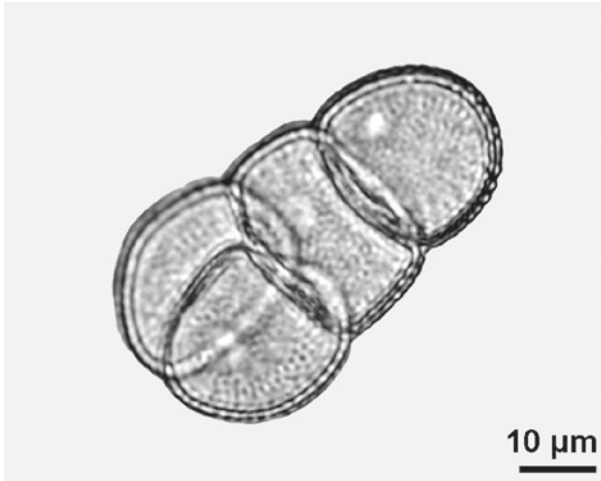
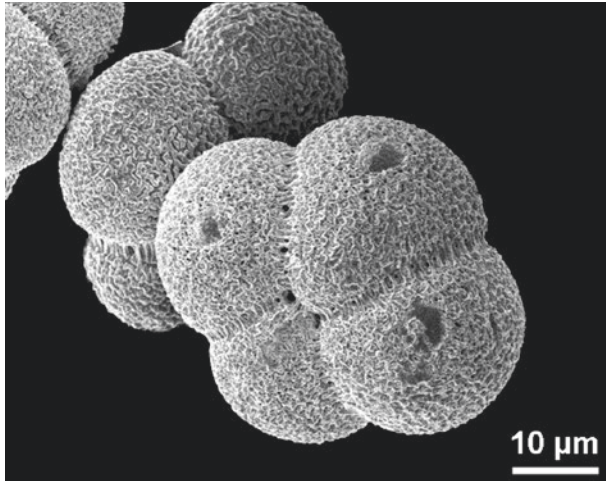
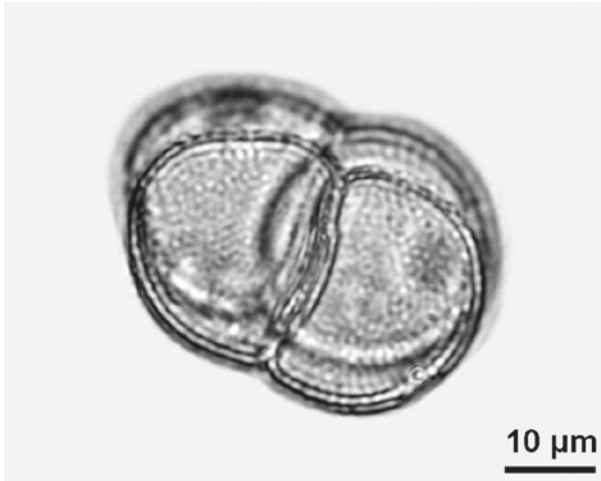
■ ■ *Androlepis skinneri*, Bromeliaceae

■ ■ *Chlorospatha dodsonii*, Araceae

■ ■ *Catalpa bungei*, Bignoniaceae

tetrad planar

unit of four pollen grains arranged in one plane: tetragonal, T-shaped, linear



■ ■ *Typha latifolia*, Typhaceae
tetrad tetragonal

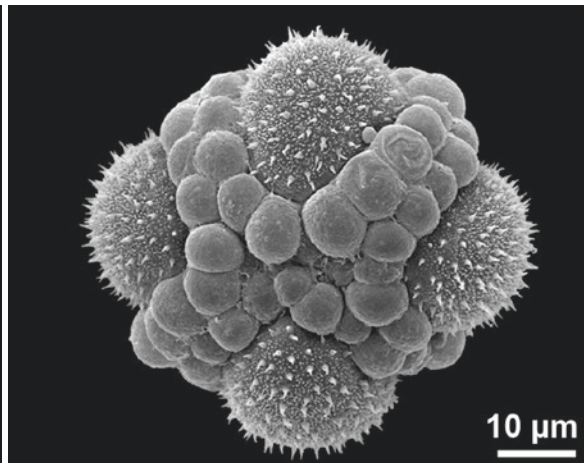
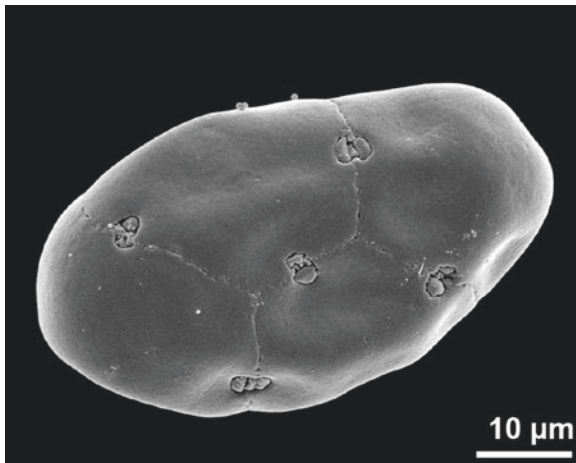
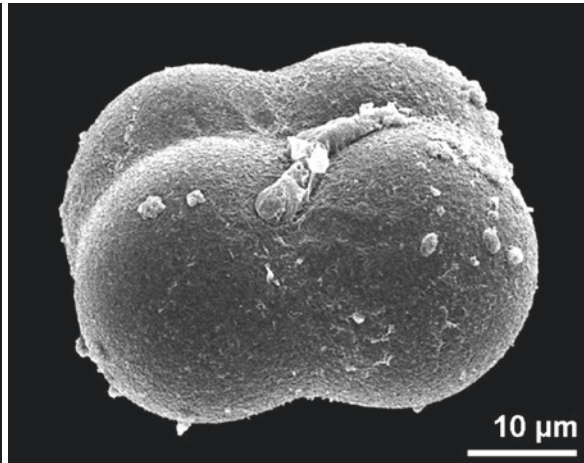
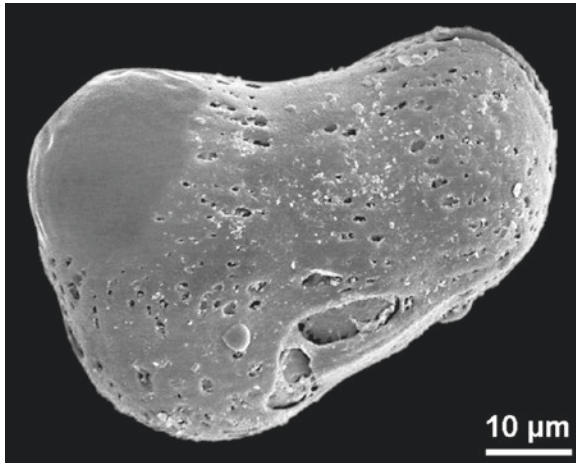
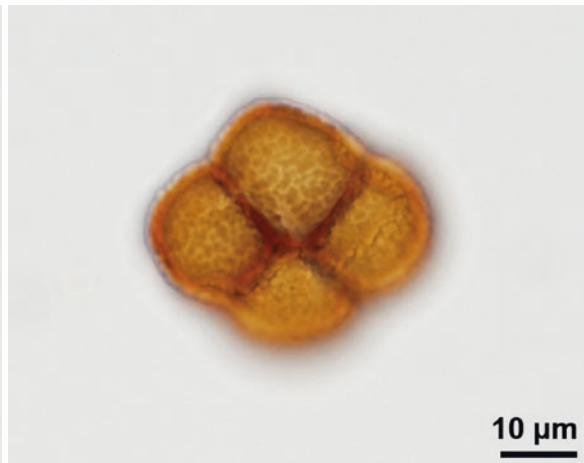
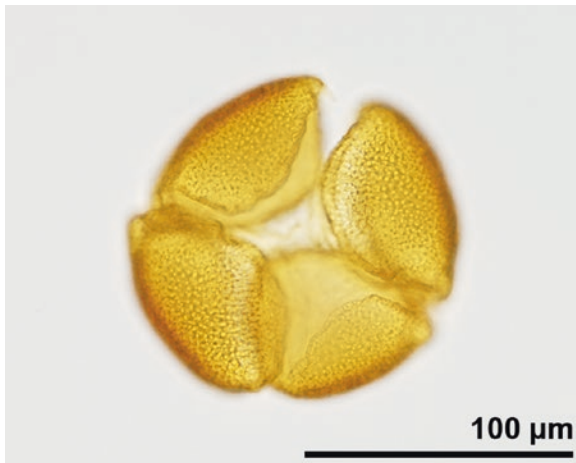
■ ■ *Typha latifolia*, Typhaceae
tetrad tetragonal

■ ■ *Typha latifolia*, Typhaceae
tetrad T-shaped

■ ■ *Typha latifolia*, Typhaceae
tetrad T-shaped

■ ■ *Typha latifolia*, Typhaceae
tetrad linear

■ ■ *Typha latifolia*, Typhaceae
tetrad linear



■ *Asimina triloba*, Annonaceae
tetrad tetragonal

■ *Chlorospatha kolbii*, Araceae
tetrad T-shaped

■ *Cyprinia gracilis*, Apocynaceae
tetrad planar, dry pollen

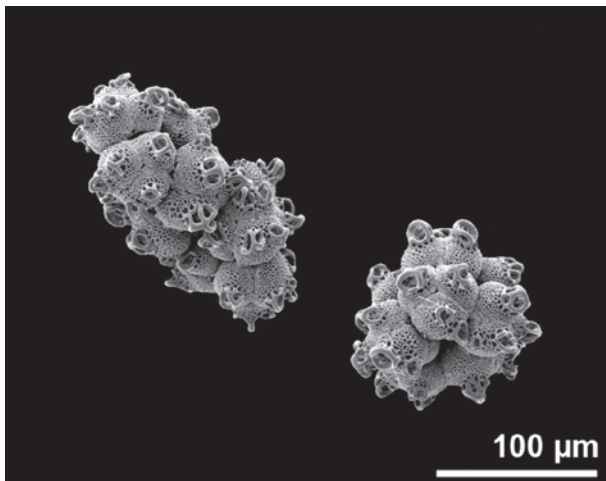
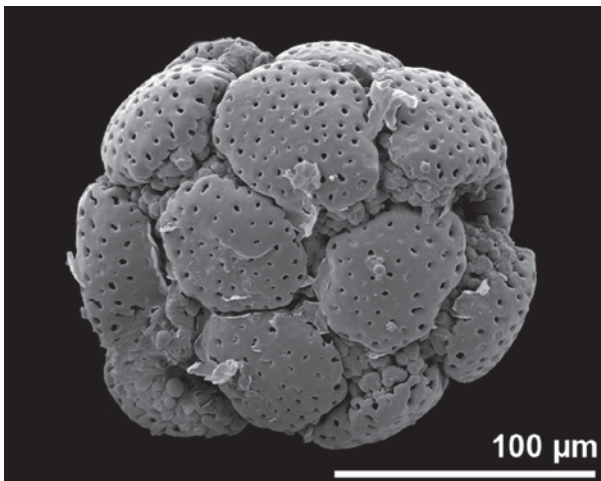
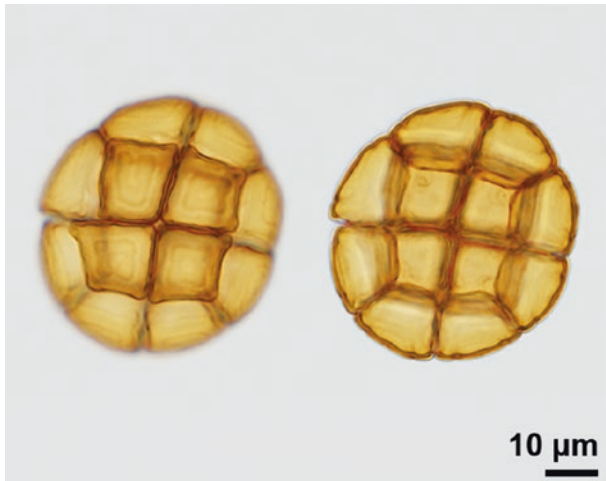
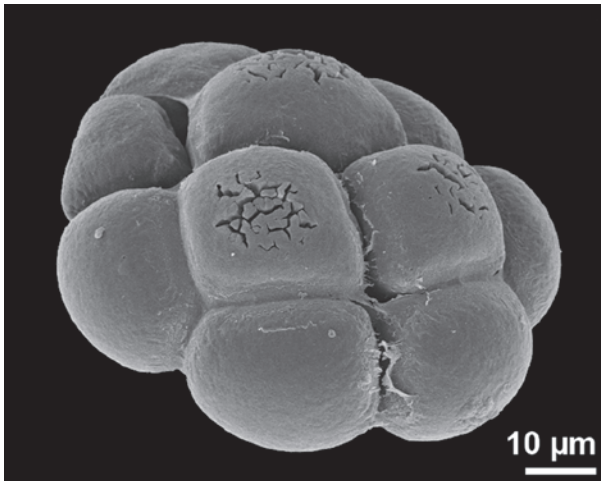
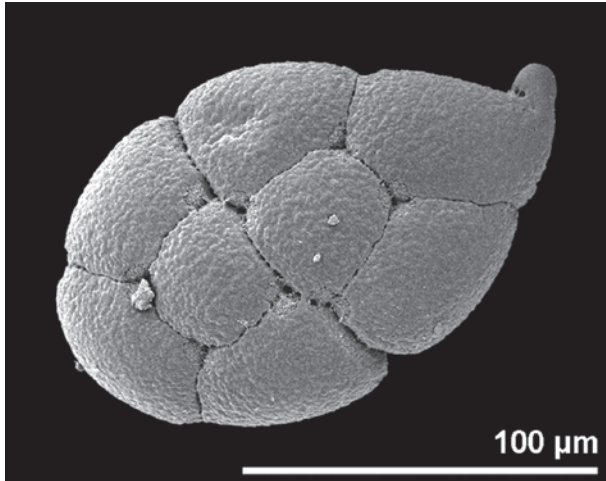
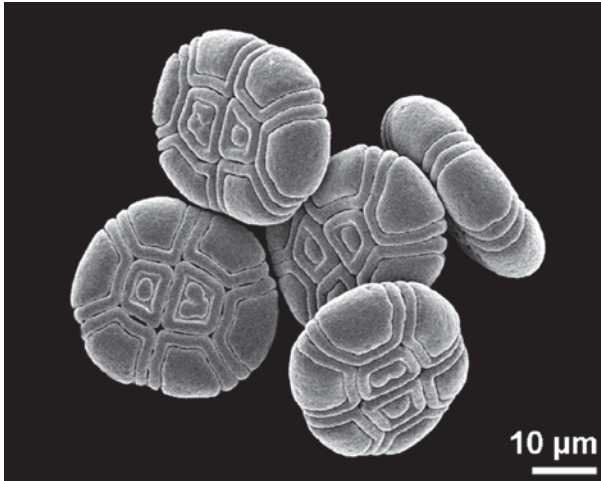
■ *Calluna vulgaris*, Ericaceae
tetrad tetragonal

■ *Chlorospatha dodsonii*, Araceae
tetrad tetragonal

■ *Drosera peltata*, Droseraceae
tetrad tetragonal

polyad

unit of more than four pollen grains (multiple of 4)



■ ■ *Acacia myrtifolia*, Fabaceae
polyad with 8 monads, dry pollen

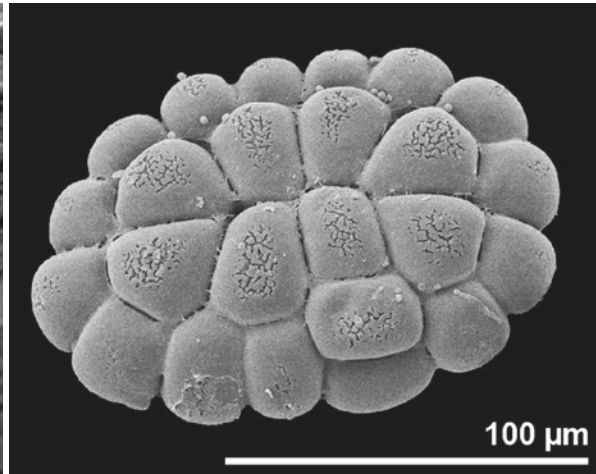
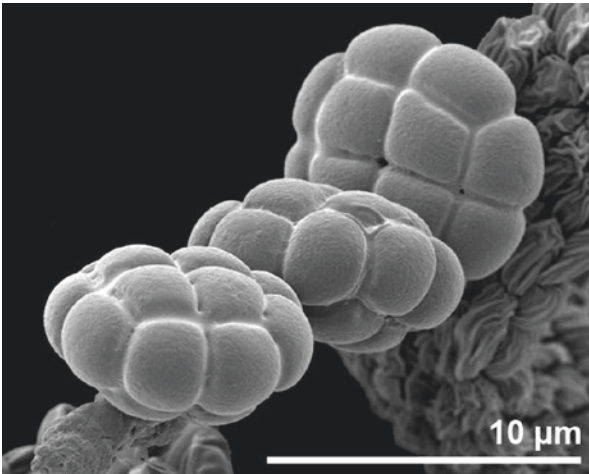
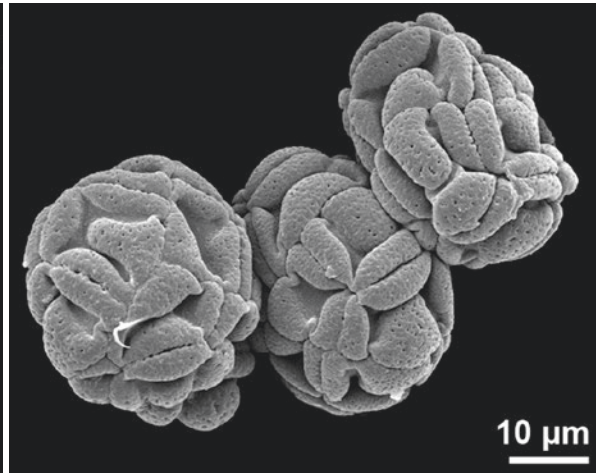
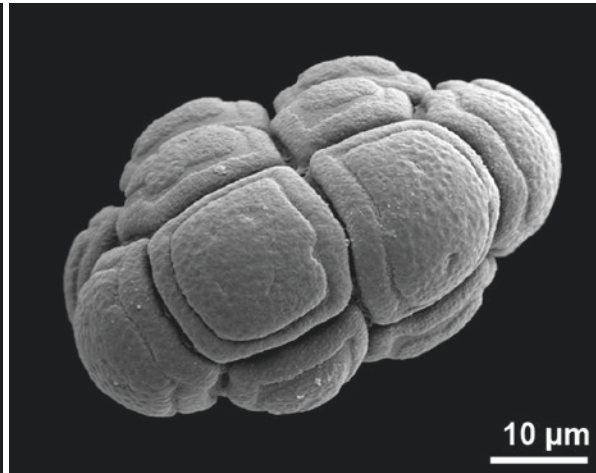
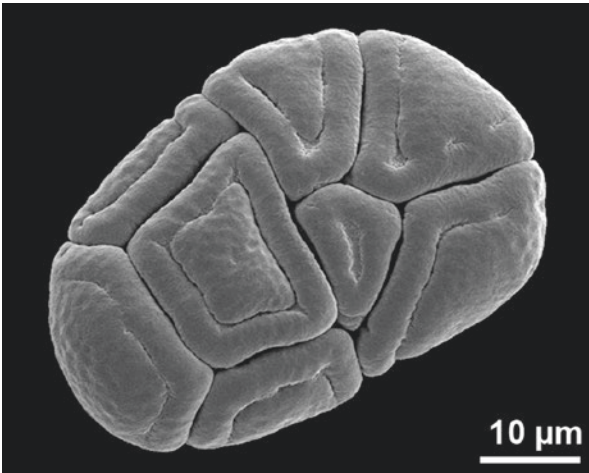
■ ■ *Calliandra tergemina*, Fabaceae
polyad with 8 monads

■ ■ *Pithecellobium dulce*, Fabaceae
polyad with 16 monads

■ ■ *Acacia* sp., Fabaceae
polyad with 16 monads

■ ■ *Cymbopetalum aequale*, Annonaceae
polyad with 16 monads

■ ■ *Chelonanthus purpurascens*, Gentianaceae
polyad with 32 monads (8 united tetrads)



■ ■ *Acacia* sp., Fabaceae
polyad of 8 monads, irregularly arranged, dry pollen

■ ■ *Acacia dealbata*, Fabaceae
polyad with 16 monads

■ ■ *Acacia karroo*, Fabaceae
polyad with 16 monads

■ ■ *Acacia karroo*, Fabaceae
polyad with 16 monads, dry pollen

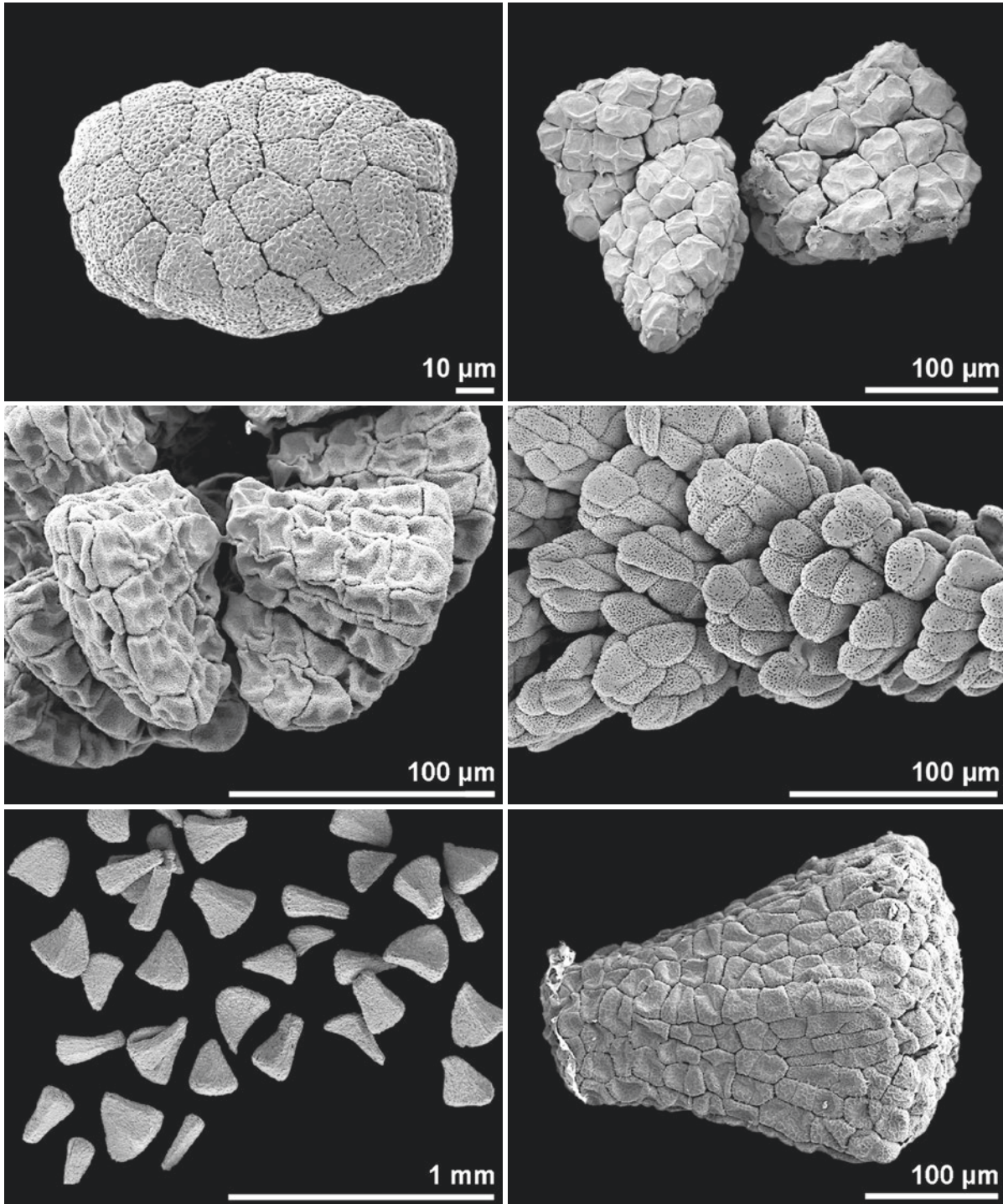
■ ■ *Albizia julibrissin*, Fabaceae
polyad with 16 monads

■ ■ *Albizia saman*, Fabaceae
polyad with 32 monads

massula

unit of more than four pollen grains but less than the locular content of a theca

Comment: In angiosperms only used for Orchidaceae with sectile pollinia



■ ■ ■ *Traunsteinera globosa*, Orchidaceae

■ ■ ■ *Epipogium aphyllum*, Orchidaceae

■ ■ ■ *Herminium monorchis*, Orchidaceae
massulae forming pollinium

■ ■ ■ *Gennaria diphylla*, Orchidaceae
massulae forming pollinium

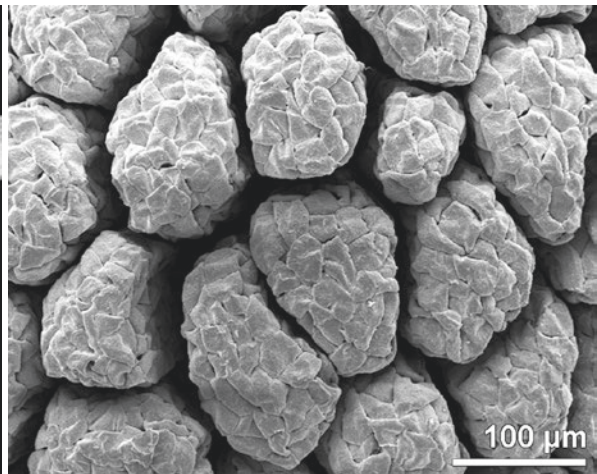
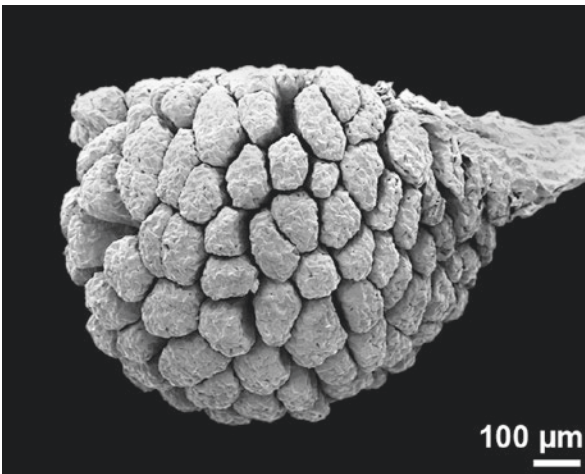
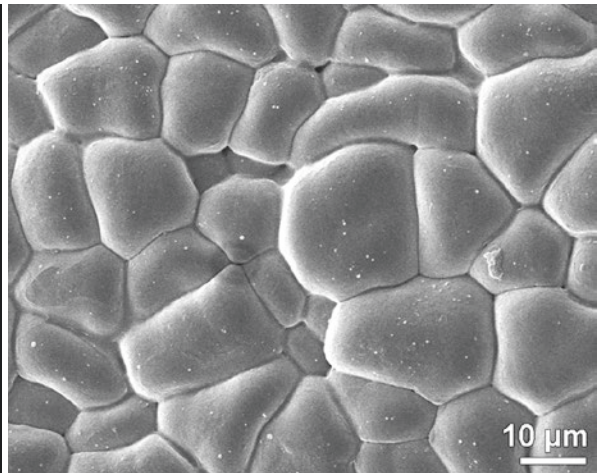
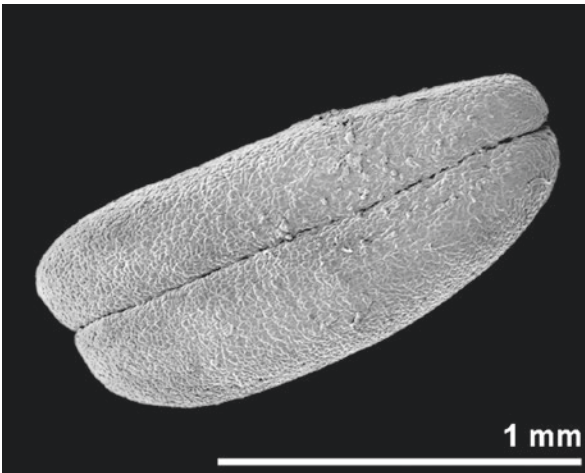
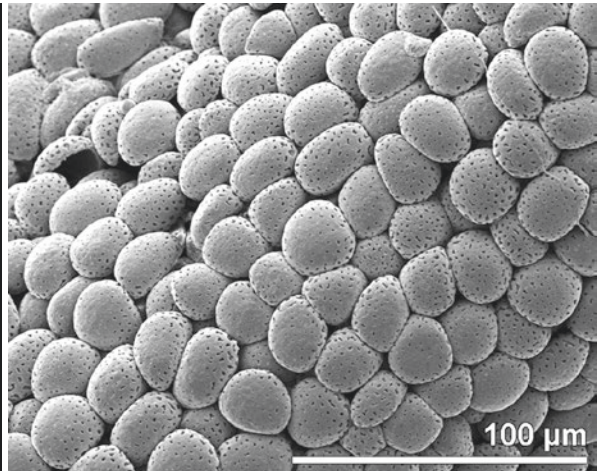
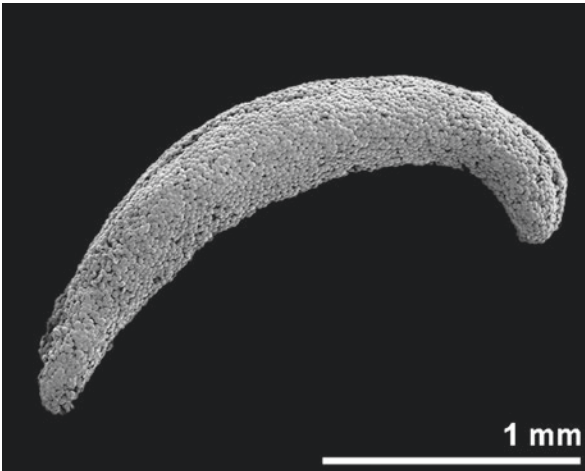
■ ■ ■ *Orchis italica*, Orchidaceae

■ ■ ■ *Orchis purpurea*, Orchidaceae

pollinium

unit of a more or less interconnected loculiform pollen mass

Comment: loculi may be subdivided by septae, thus resulting in more than two pollinia



■ ■ *Cephalanthera longifolia*, Orchidaceae

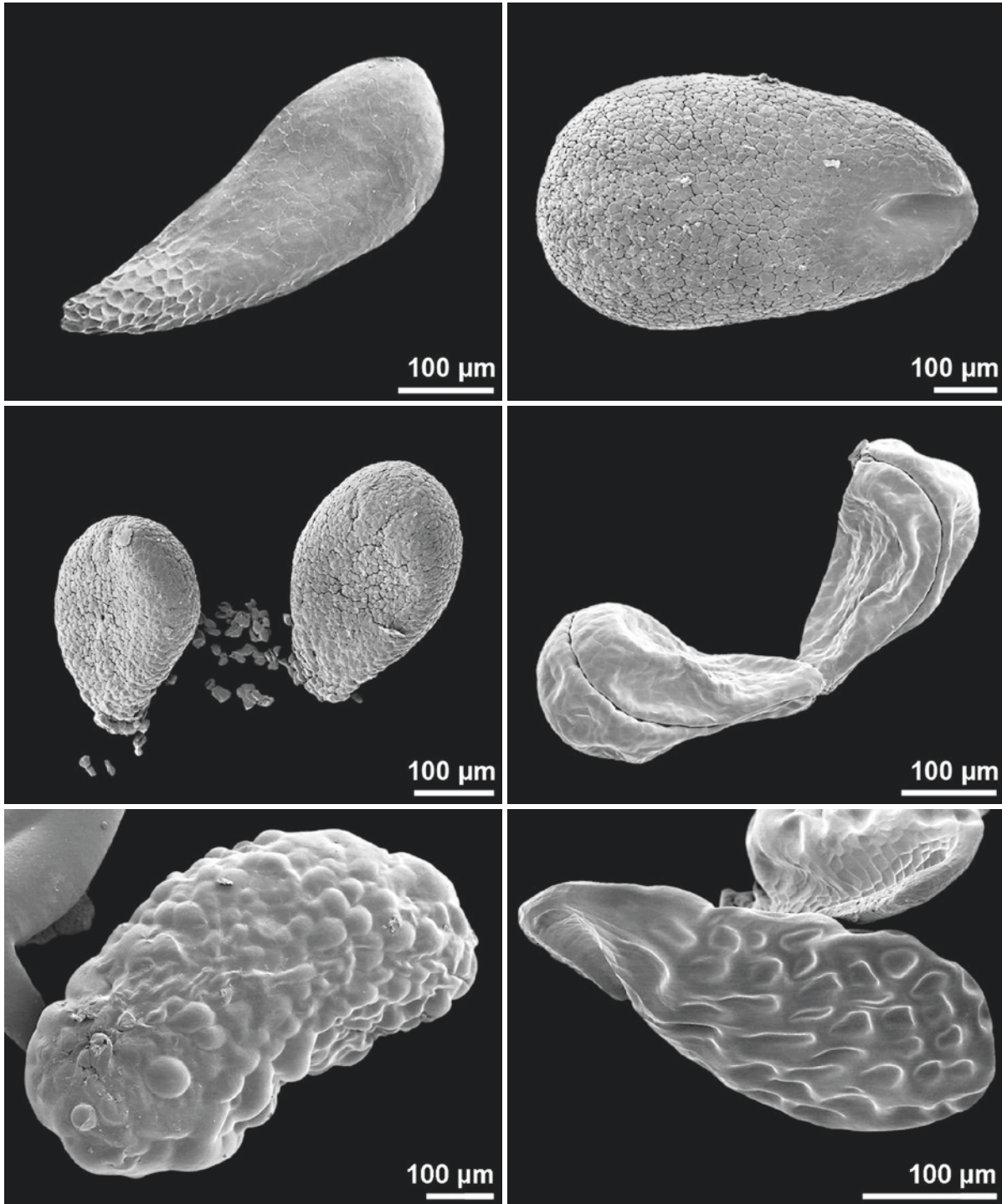
■ ■ *Cephalanthera longifolia*, Orchidaceae
detail (monads)

■ ■ *Dendrobium farmeri*, Orchidaceae

■ ■ *Dendrobium farmeri*, Orchidaceae
detail (tetrads)

■ ■ *Steveniella satyrioides*, Orchidaceae
sectile pollinium

■ ■ *Steveniella satyrioides*, Orchidaceae
sectile pollinium, detail (massulae)



■ ■ ■ *Hammarbya paludosa*, Orchidaceae

■ ■ ■ *Restrepia muscifera*, Orchidaceae
2 pollinia

■ ■ ■ *Stephanotis floribunda*, Asclepiadaceae

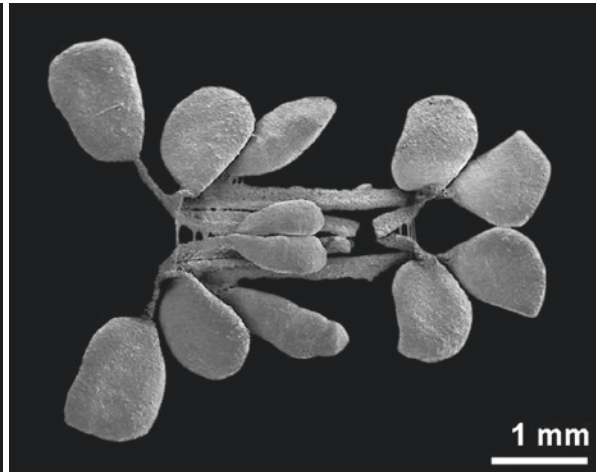
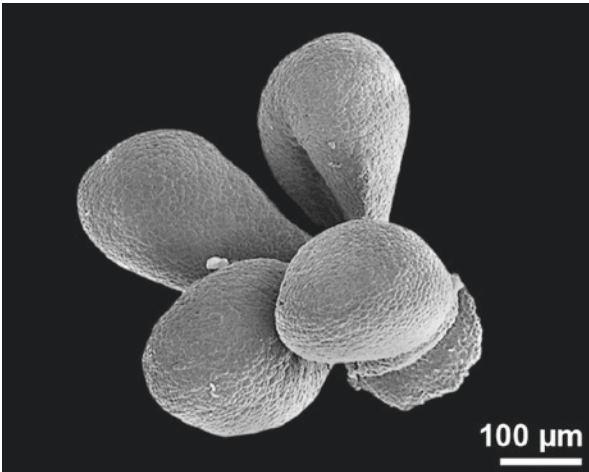
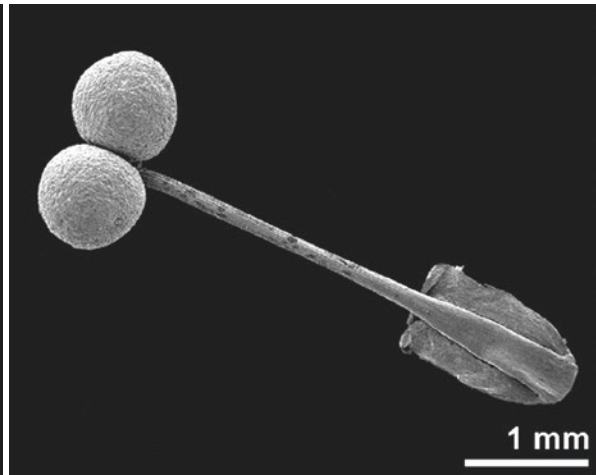
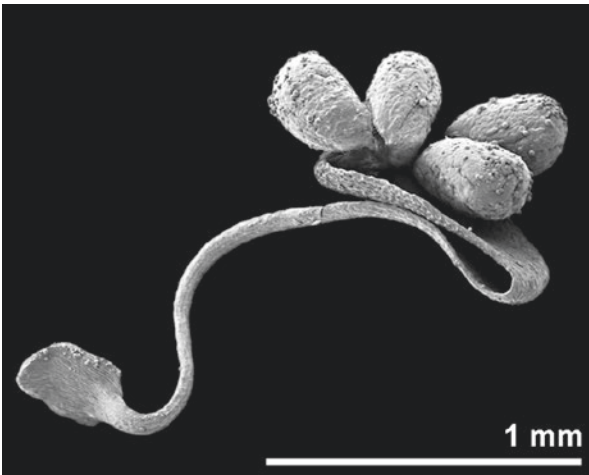
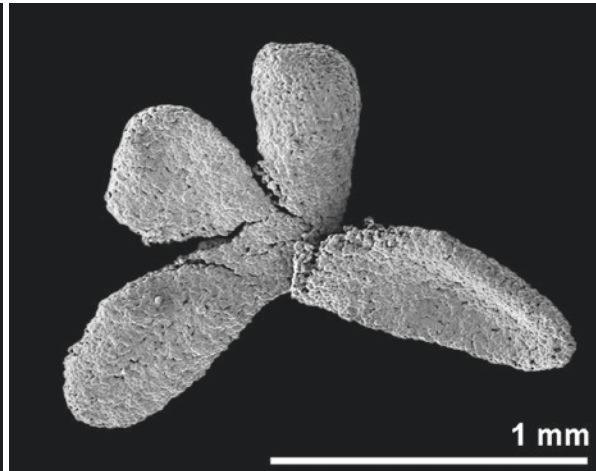
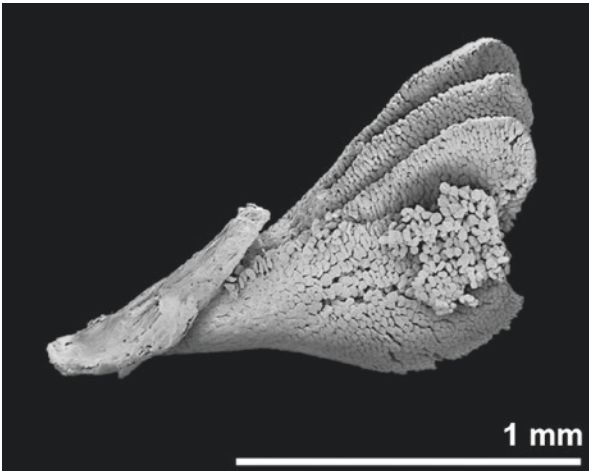
■ ■ ■ *Plectrophora cultrifolia*, Orchidaceae

■ ■ ■ *Malaxis monophyllos*, Orchidaceae
4 pollinia

■ ■ ■ *Hoodia flava*, Asclepiadaceae

pollinarium

dispersal unit of pollinium (or pollinia) plus secretions and/or tissues that aid in the removal of the structure from the flower



■ ■ *Spiranthes spiralis*, Orchidaceae

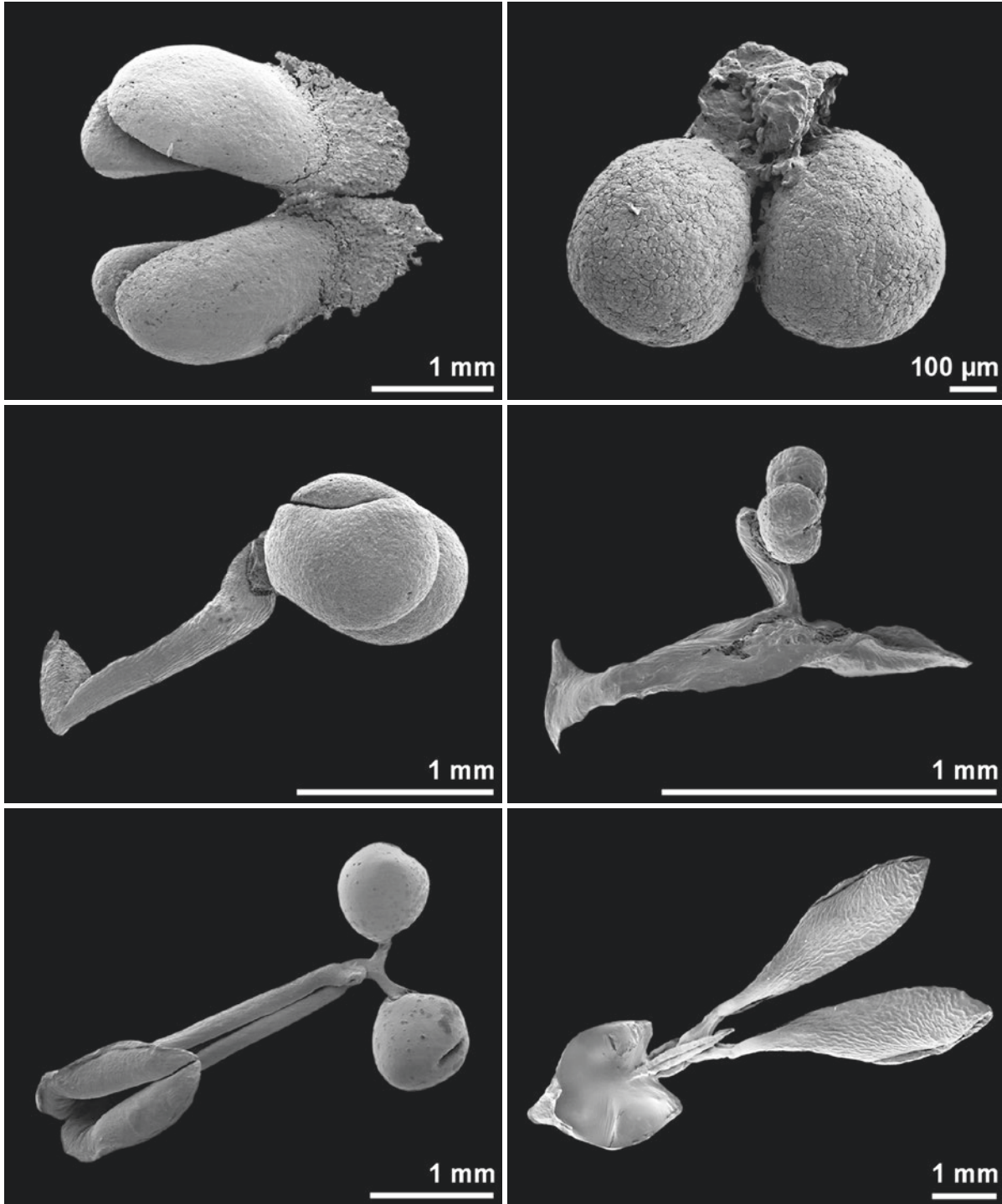
■ ■ *Caladenia latifolia*, Orchidaceae

■ ■ *Ornithocephalus myrtilcola*, Orchidaceae

■ ■ *Aerides multiflora*, Orchidaceae

■ ■ *Maxillaria densa*, Orchidaceae

■ ■ *Brassavola cucullata*, Orchidaceae
12 pollinia



■ ■ ■ *Coelogyne fimbriata*, Orchidaceae

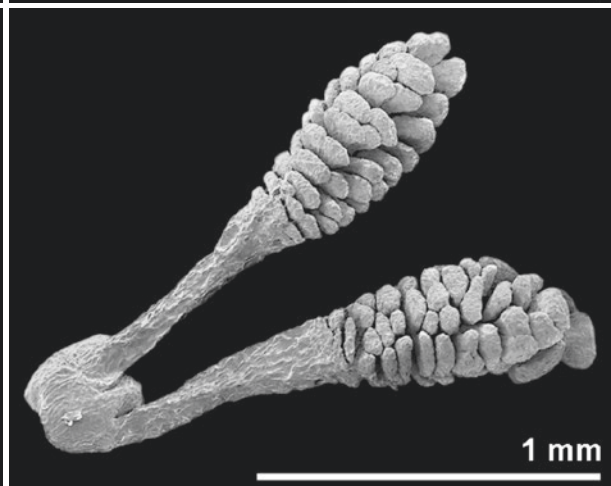
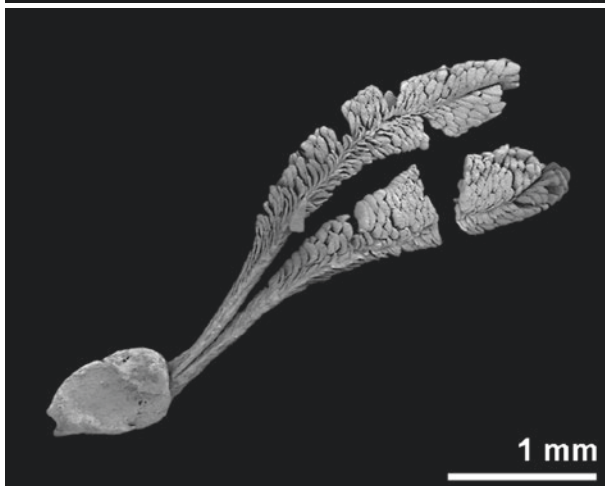
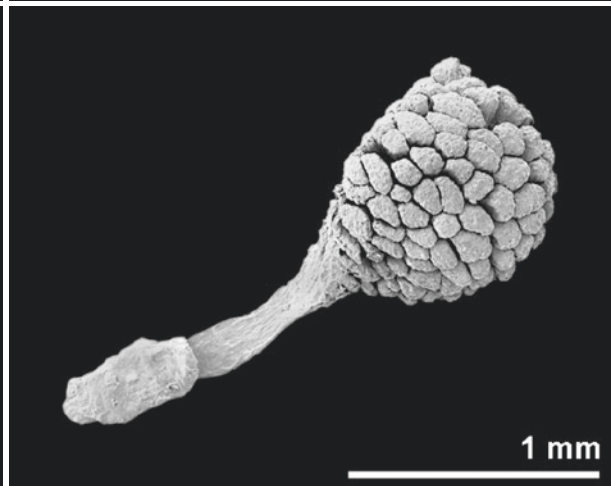
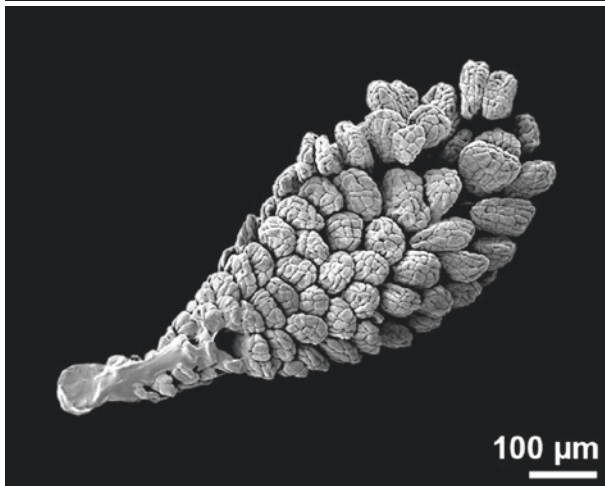
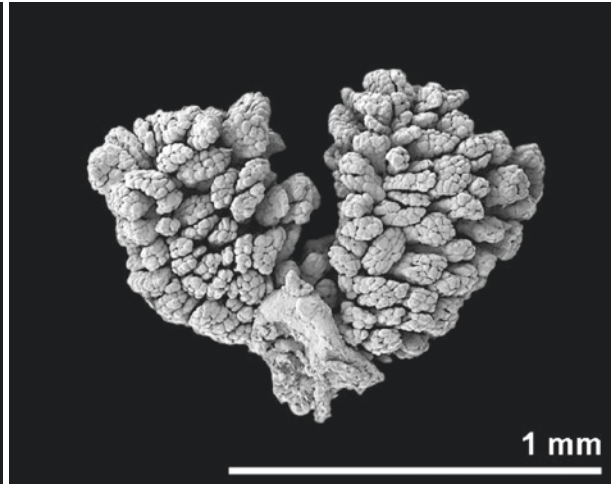
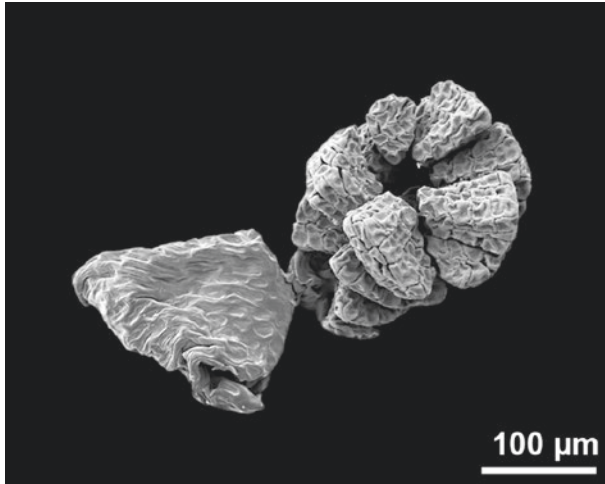
■ ■ ■ *Oncidium maizaefolium*, Orchidaceae

■ ■ ■ *Haraella odorata*, Orchidaceae

■ ■ ■ *Pleurothallis loranthophylla*, Orchidaceae

■ ■ ■ *Schoenorchis fragrans*, Orchidaceae

■ ■ ■ *Stanhopea oculata*, Orchidaceae



■ ■ ■ *Herminium monorchis*, Orchidaceae

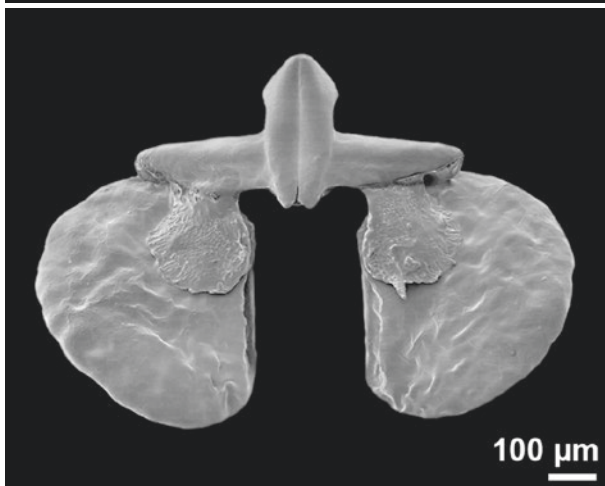
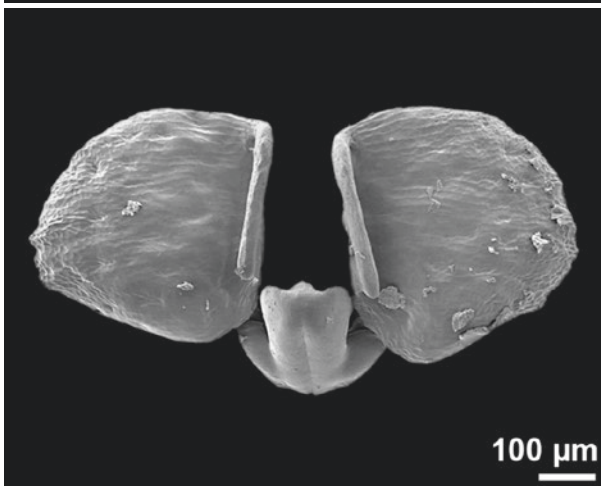
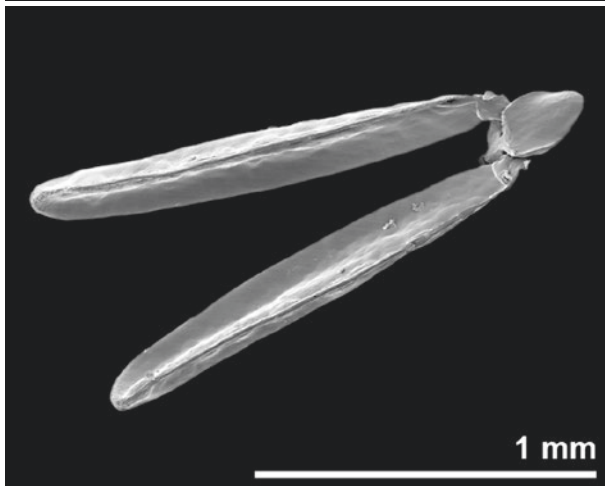
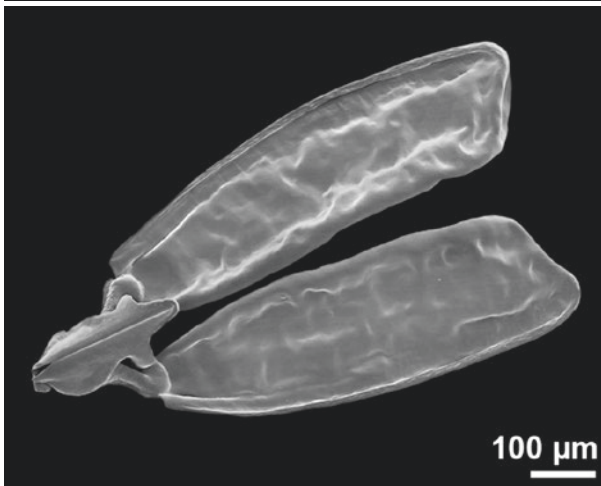
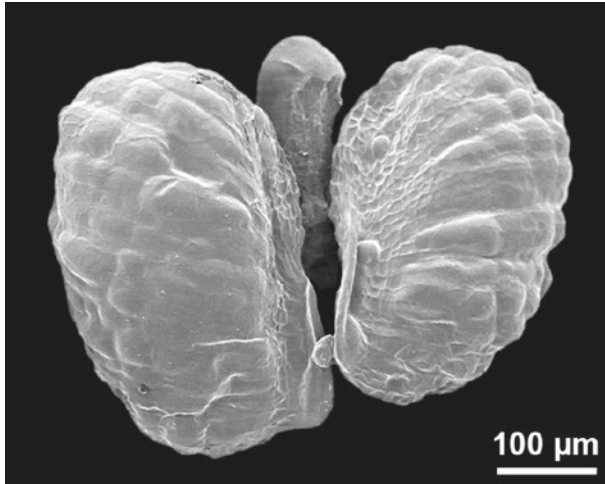
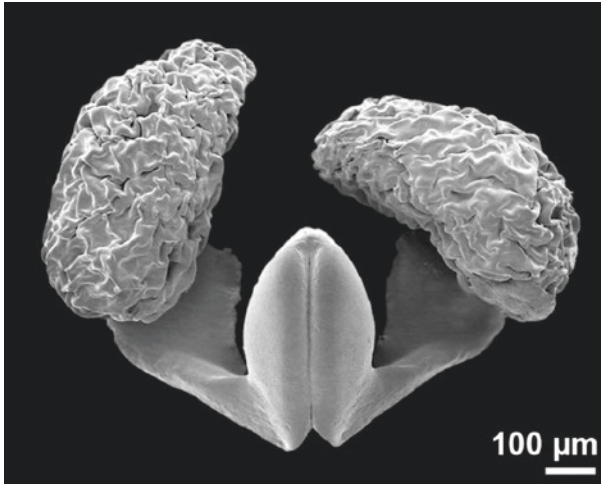
■ ■ ■ *Gennaria diphylla*, Orchidaceae

■ ■ ■ *Ludisia discolor*, Orchidaceae

■ ■ ■ *Goodyera repens*, Orchidaceae

■ ■ ■ *Steveniella satyrioides*, Orchidaceae

■ ■ ■ *Anacamptis pyramidalis*, Orchidaceae



■ ■ ■ *Stephanotis floribunda*, Asclepiadaceae

■ ■ ■ *Hoya carnosae*, Asclepiadaceae

■ ■ ■ *Frerea indica*, Asclepiadaceae

■ ■ ■ *Ceropogia sandersonii*, Asclepiadaceae

■ ■ ■ *Hoya multiflora*, Asclepiadaceae

■ ■ ■ *Orbeanthus hardyi*, Asclepiadaceae

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