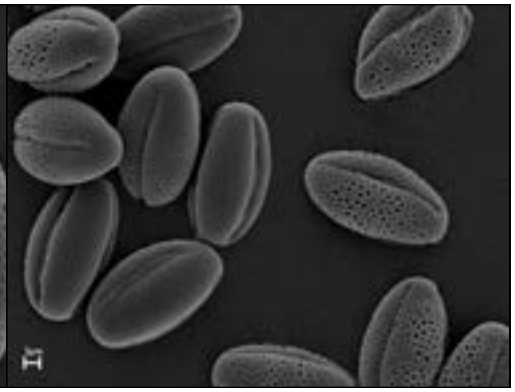
Family: *Brassicaceae*



Sisymbrium officinale **Hedge Mustard**

Collection date: 17/5/07 **SEM date:** 25/5/07 **Location:** Stamnar Woods, West Sussex

Sisymbrium officinale pollen grains are elliptic in equatorial polar view, trizonocolpate, reticulate with the colpus almost running the full length of the grain and terminating at the poles. The colpi are consistently narrow in width and are coarsely reticulate to the colpi margins. The lumina are very large and show little decrease in size towards the colpus and the poles. The muri are simplicolumellate and are narrower than the lumina. These characteristics are common to many genus and species in the *Brassicaceae* family (see family summary for further details).

A common plant to hedges, waste places and roadsides in England. Annual or biennial to 1m in height.

Brassicaceae family summary.

Many pollen grains of members of the *Brassicaceae* family have very similar characteristics and are very difficult to distinguish to the genus levels according to research by Erdtman *et al. (1963)* and Moore *et al* (1991, pg. 125) even with type collections for reference. Moore *et al* (1991) lists the following genera which are involved in this identity crisis: *Sinapsis, Matthiola, Bunias, Cakile, Teesdalia, Isatis, Crambe, Armoracia, Brassica, Arabis alpinea, Cardamine bulbifera, C. pratensis, C. flexuosa, Alliaria, Braya linearis, Diplotaxis, Draba, Erophilia, Erucastrum, Lepidium latifolium, L. ruderale, Lunaria, Raphanus, Rorippa, Sisymbrium, barbarea, Cochlearia, Erysimum, Subularia, Cardaminopsis arenosa, Camelina microcarpa* and possibly more.

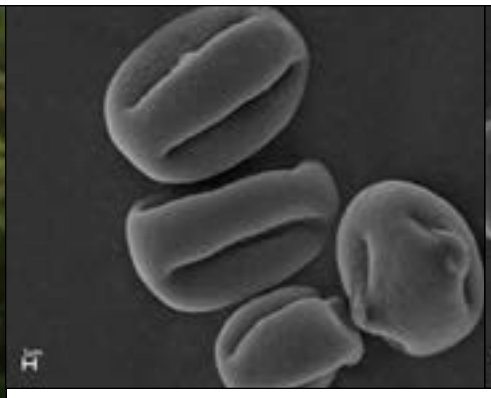
The above listed pollen grains are elliptic in equatorial polar view, trizonocolpate, reticulate with the colpus almost running the full length of the grain and terminating at the poles. The colpi are consistently narrow in width are coarsely reticulate to the colpi margins. The lumina are very large and show little decrease in size towards the colpus and the poles. The muri are simplicolumellate and are narrower than the lumina.

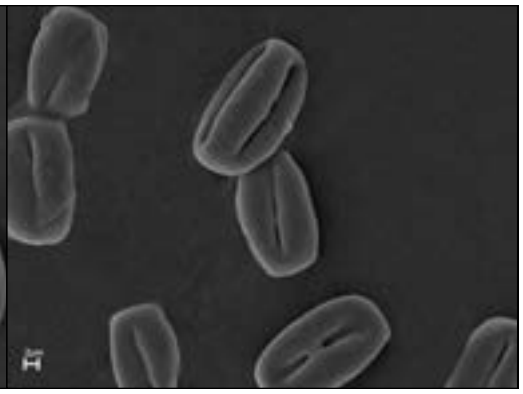
Brassicaceae family summary continued.

According to Stace (1997, pp. 249-280) the following *Brassicaceae* family members are common in Britain and might warrant inclusion in SEM analysis in the future even though the results may be morphologically indistinct: *S. loselii, S. altissimum, S. orientale, S. erysimoides, E. chaerianthoides, M. sinuate, M. longipetala, C. bulbifera, C. hetaphylla, C. trifolia, C. amara, C. raphanifolia, C. impatiens, C. flexuosa, C. hrsuta, L. sativum, L. heterophyllum, L. ruderale, L. latifolium, L. graminifolium, L. draba, B. tournefortii, B. nigra, S. alba, C. cordifolia, R. macrophylla, R. paulustris* and *R. sylvestris.* This list is quite extensive and does not include other genera not analyzed during the period of this research hence the list could most likely double.

As *Erdtman et al. (1963)* and Moore *et al* (1991, pg. 125) stated this family's pollen grains are difficult to classify to the species and even genus level for some, so even though an extensive list is included of other candidates for SEM analysis this might prove to be a fruitless exercise with no determinable or distinguishing differences found to assist in classification; then again many of the plants listed have not yet been analyzed by SEM or LM so there is the possibility that some morphological character reference points may be discovered that would allow refined classification.

Family: *Buddlejaceae*





Buddleja davidii **Butterfly-bush**

Collection date: 6/6/07 **SEM date:** 8/6/07 **Location:** Adur Valley, West Sussex

Buddleja davidii pollen grains overall are elliptic to rhombic-obtuse in equatorial view but appear circular in polar view. *B. davidii* pollen grains are tetrazonocolporate with long colpi terminating at or close to the poles. The pori are not large and thus not easily seen in the magnifications above. Each colpus has a constriction rupture or equatorial bridge and is obtuse ended. The apocolpia appears flat to concave while the sculpture is psillate-scabrate.

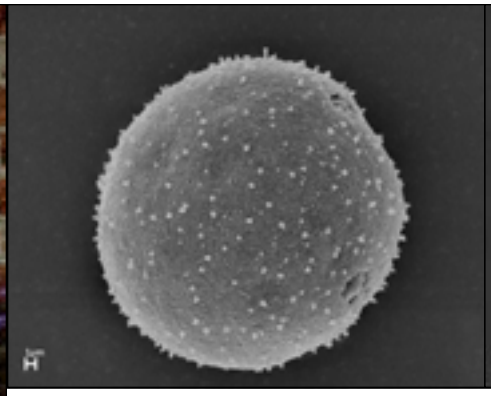
An introduced plant that has readily naturalized and is found growing in dry , gravel-like soils on walls, road allowances, waste ground, banks and railway lines. A robust shrub to over 3m in height.

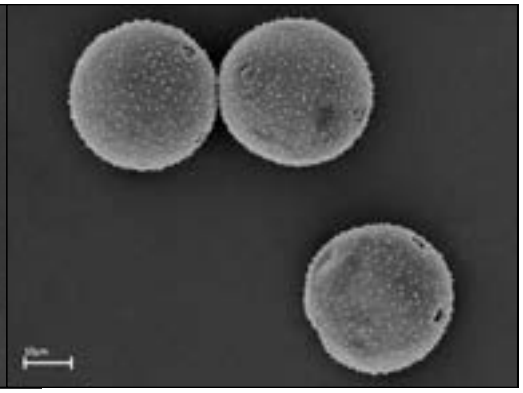
***Buddlejaceae* family summary.**

Stace (1997, pp. 585) lists two other *Buddleja* species and one hybrid that commonly occur in England: *B. alternifolia, B. globosa* and *B. x weyeriana.* All three individuals should be included in further examinations as this is a very small family and there is no comparative data available.

The pollen grains of *Buddleja davidii* are not distinct and could resemble many other genera presented here, that is with one exception; the distinct equatorial bridge In combination with the other more common traits such as shape, surface sculpture and colpus arrangement. Hence the importance in examining the other *Buddleja* species to see if this characteristic is evident in them.

Family: *Campanulaceae*





Campanula rapunculoides Creeping Bellflower

Collection date: 14/6/07 **SEM date:** 21/6/07 **Location:** Hollingburry Park Avenue, Brighton West Sussex

Campanula rapunculoides is a trizonoporate echinate grain with a diameter of > 30 µm and is orbicular in both polar and equatorial views. The echinae are narrow and disticnt with the underlying tectum being micro-scabrate. The circular sunken pori appear large in relation to grain size.

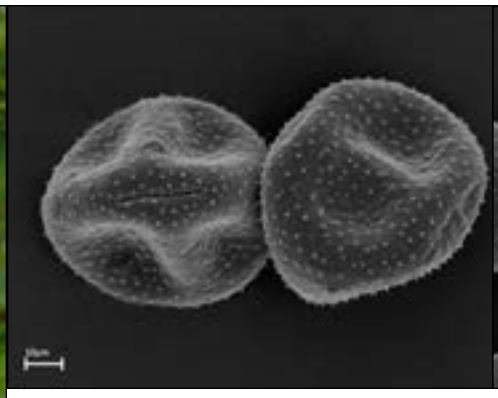
An introduced plant that if often found growing on walls and in pavment cracks where it has escaped from the garden. To about 10cm in height.

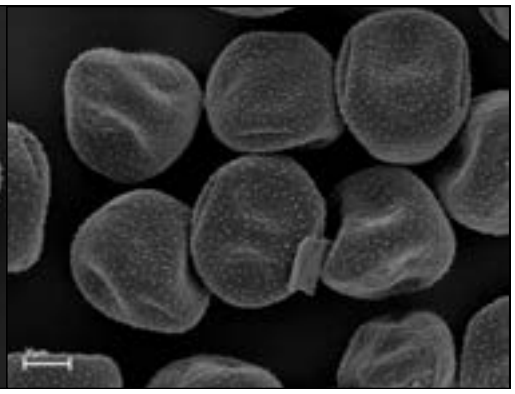
Campanulaceae family summary.

A pollen rain similar to *Lonicera* and *Arum* species. According to Moore *et al* (1991, pg. 102) some confusion may occur when keying *Campanula* grains as the pori are wide spaced and the grain may be perceived as trizonocolpate to trizonolcolporate unless the grain is turned to reveal all colpi.

A diverse group of plants that are common to the British landscape both as natives and introduced plants and although Moore *et al* (1991, pp. 103) identifies them only to the genus level in his pollen key with no explanation why further classification could not occur to the species level it warrants investigation.

Family: *Caprifoliaceae*



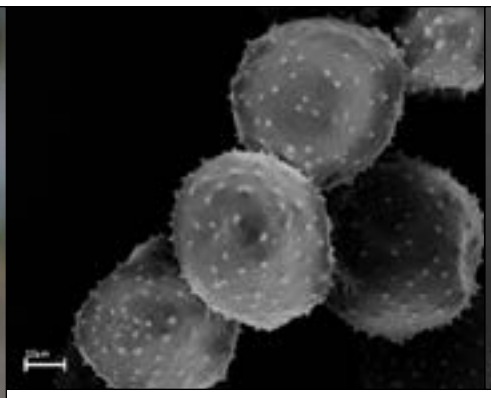


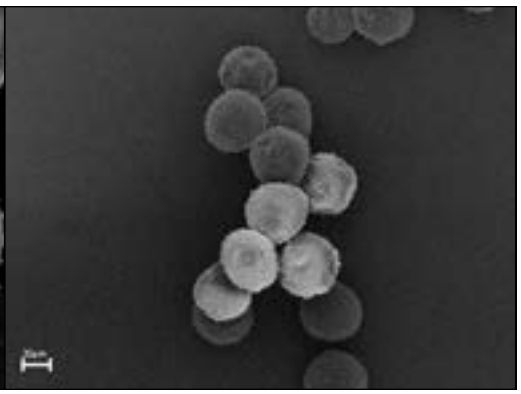
Lonicera periclymenum **Honeysuckle**

Collection date: 17/5/07 **SEM date:** 25/5/07 **Location:** Ardingly Reservoir, West Sussex

Lonicera periclymenum is a trizonolcolporate pollen grain that is commonly orbicular to triangular convex in equatorial and polar views. Echinae of varying size are densely packed on the exine. Each porous is represented by a large, wide transverse endocolpus that is indicated by its margins. The colpi are short and narrow often at an angle with the apocolpia very large.

A deciduous climbing vine that is found along shrubby meadow edges and woods, growing up to 10m in length. The blooms are quite attractive, bi-coloured and fragrant.





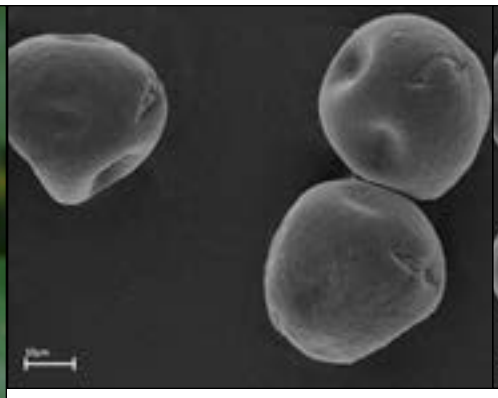
Lonicera 'Winter Beauty' **Winter Beauty Honeysuckle**

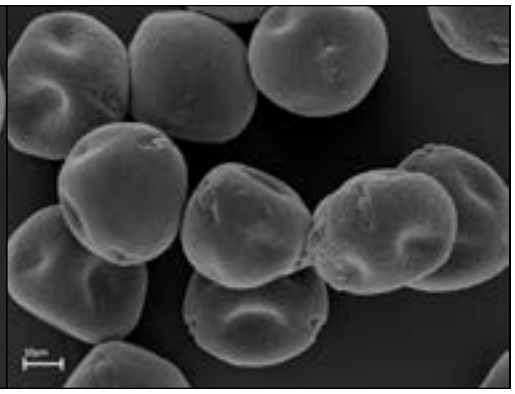
Collection date: 19/2/07 **SEM date:** 19/2/07 **Location:** University of Sussex, West Sussex

Lonicera 'Winter Beauty' is a trizonolcolporate pollen grain that is commonly orbicular in equatorial and polar views. Echinae of varying size are sparsely distributed across the exine. Each porous is represented by a large, wide transverse endocolpus that is indicated by its margins. The colpi are purported to be short and narrow but are only faintly visible as in the top right image.

A common landscape shrub flowering it very early spring, *Lonicera 'Winter Beauty'* can reach a height of 3m.

Family: *Caprifoliaceae*





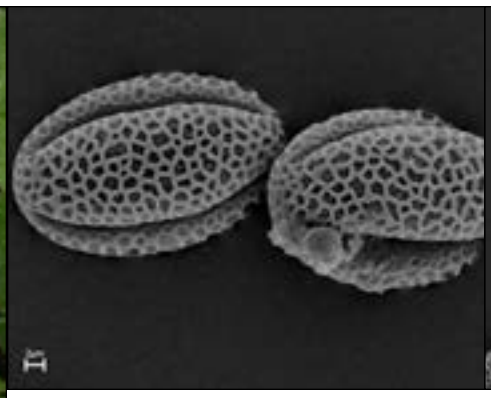
Symphoricarpos albus — Snowberry

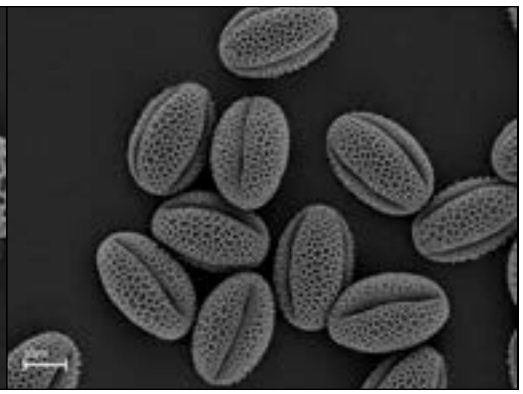
(synonymous *with S. rivularis*)

Collection date: 7/6/07 **SEM date:** 15/6/07 **Location:** Brighton, West Sussex

Symphoricarpos rivularis is a psilate grain, < 45 µm long but with some variation in size, orbicular-triangular-obtuse or orbicular -triangular convex in equatorial view. The colpi are short and very narrow and appear to be split and gaping resulting in some grain distortion. The colpus membranes are granulate.

An introduced shrub that has occasionally naturalized in woods, waste ground and remnant hedgerows. Reaching a height of about 2m and known for its white berries; hence the common name Snowberry.





Viburnum opulus — Guelder-rose

Collection date: 17/5/07 **SEM date:** 25/5/07 **Location:** Stamnar Woods, West Sussex

Viburnum opulus pollen grains are < 36µm in size, elliptic to rhombic-obtuse in equatorial view and broadly elliptical in polar view, trizonocolpate, eureticulate with the colpi almost running the full length of the grain and terminating before the poles. The colpi is consistent in width and depth. Exine is lacunae-rugulate with the lumina sizing decreasing towards the colpi. There appears to be a slight constriction of the colpus at the equator but it does not result in a equatorial girdle or bridge.

A shrub to about 4m in height and almost as broad, often found growing in groups in woods and waste land where the soil is not particularly impoverished.

Caprifoliaceae family summary.

According to Moore *et al* (1991, pg. 102) some confusion may occur when keying *Lonicera* and *Symphoricarpos* grains as the pori are wide spaced and the grain may be perceived as trizonocolpate to trizonolcolporate unless the grain is turned to reveal all colpi.

The pollen grains of the four species represented in the *Caprifoliaceae* family presented here are quite distinct from each other, although in the genera *Lonicera* the differences are minor and warrant further investigation and comparison to a type collection, but promise, in this analysis, enough distinguishing characteristics to classify the grains separately.

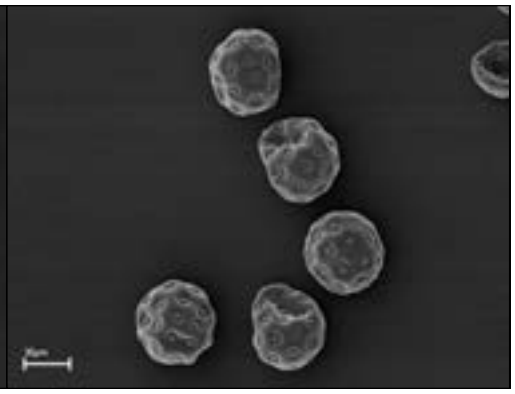
The distinguishing features between the two species of *Lonicera* appear to revolve around the echinae and the colpi. On *L. periclymenum* the echinae are various sizes and are densely packed on the exine, while the echinae on *L. 'Winter Beauty'* pollen grains are sparsely distributed but are much larger in size. The colpi of L. *periclymenum* are short but gaping, being very prominent while on *L. 'Winter Beauty'* they are hardly in evidence.

Symphoricarpos rivularis is a psilate grain, orbicular in shape and similar to the *Lonicera* species but without the echinae characteristic of that particular species.

Viburnum opulus would appear the most uncharacteristic member of this group with pollen grains eureticulate which closely resemble members of the Oleaceae family. Perhaps this one species taxonomic classification should be investigated if no other family members listed below have a similar pollen grain sculpture.

According to Stace (1997, pp. 650-656) the following plants in the *Caprifoliaceae* family are considered common in England and warrant inclusion in future SEM analysis: *S. x chenaultii, S. orbiculatus, L. pileata, l. nitida, L. xylosteum. L. tatarica, L. japonica, L. caprifolium*, *L. x italica, V. lantana* and *V. tinus.* Several genera are not included here, they are not excluded but also warrant investigation although the discussion relates to only those species analyzed.

Family: *Caryophyllaceae*

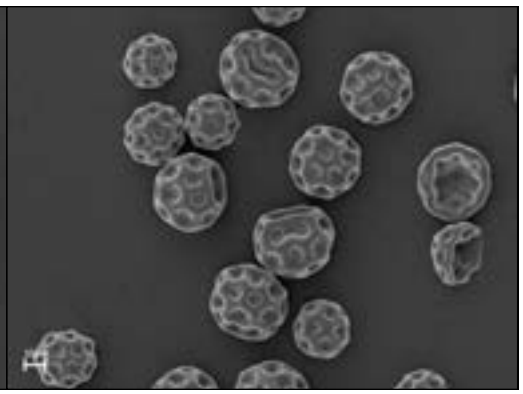


Agrostemma githago — Corncockle

Collection date: 6/6/07 **SEM date:** 8/6/07 **Location:** Brighton, West Sussex

Agrostemma githago is an orbicular polypantoporate grain, >45 µm in size, tectate-perforate with numerous (approximately =>15) protruding pori, circular in shape but clearly defined by their domed presence above the exine. The pori are equally spaced. The columellae are irregularly arranged but not in a reticulate pattern and are found in a similar ratio to the perforations. Some pollen grain collapse can be seen in this sample.

A plant that was once common on agricultural land but it is now rare. Height: 75cm.



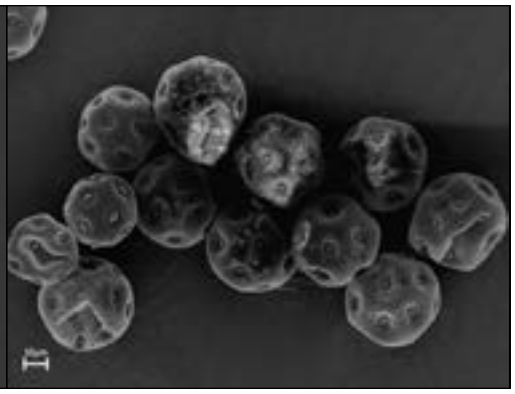
Cerastium arvense — Field Mouse-ear

Collection date: 28/4/07 **SEM date:** 2/5/07 **Location:** Preston Park, Brighton, West Sussex

Cerastium arvense is an orbicular polypantoporate grain, >45 µm in size, tectate-perforate with numerous (approximately15) protruding pori, circular in shape but clearly defined by their domed presence above the exine. The pori are equally spaced across the exine. The columellae are irregularly disbursed with coarse ones in the centre of the mesoporium and being sparsely arranged. More densely arranged ones in the region of the nearest pori appearing aggregated. Some pollen grain collapse can be seen in this sample.

A native plant common to dry grassland, height 25cm.

Family: *Caryophyllaceae*

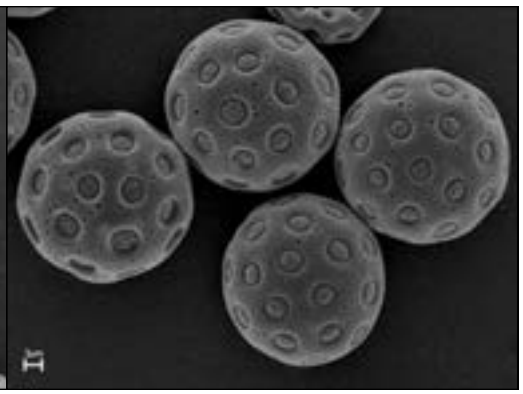


Dianthus gratianopolitus — Cheddar Pink

Collection date: 10/5/07 **SEM date:** 16/5/07 **Location:** Wakehurst Place, West Sussex

Dianthus gratianopolitus is an orbicular polypantoporate grain, > 48 µm in size, tectate-perforate (large, distinct perforations) with numerous (approximately 16 pori or less) protruding pori, circular in shape but clearly defined by their domed presence above the exine. The pori are sparsely scattered across the surface. The columellae are rather irregularly arranged and not in a reticulate pattern and are found in a similar ratio to the perforations. Evidence of pollen grain collapse is depicted in the top right image.

A rare plant found only on the cliffs of the Cheddar George, forming small mounds to about 20cm in height.



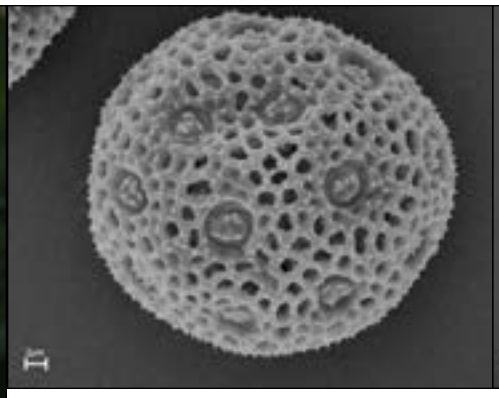
Lychnis flos-cuculi — Ragged Robin

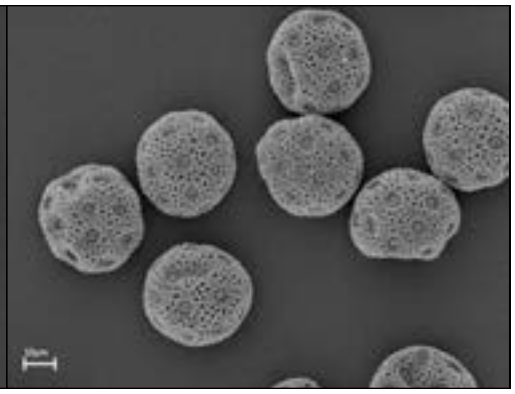
Collection date: 10/5/07 **SEM date:** 16/5/07 **Location:** Wakehurst Place, West Sussex

Lychnis flos-cuculi is an orbicular polypantoporate grain, <45 µm in size, tectate-perforate with numerous (approximately 15) protruding pori, circular in shape but clearly defined by their domed presence above the exine. The pori are sparsely scattered across the surface. The columellae are rather irregularly arranged and not in a reticulate pattern and are found in a similar ratio to the perforations.

Often found growing in damp, marshy locations or low lying areas amongst grass, usually small colonies, to 70cm.

Family: *Caryophyllaceae*



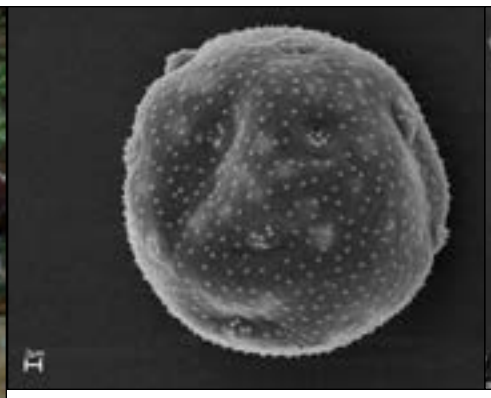


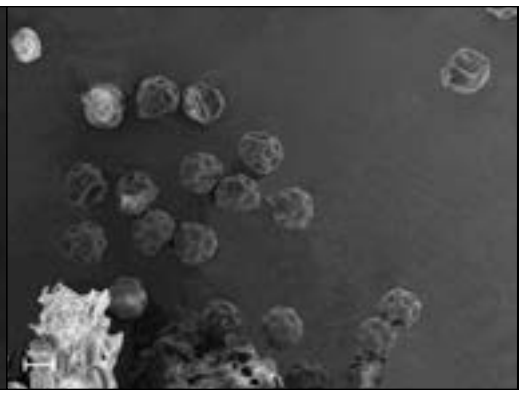
Silene alba **White Campion**

Collection date: 30/4/07 **SEM date:** 2/5/07 **Location:** Castle Hill, West Sussex

Silene alba is an orbicular polypantoporate grain, <45 µm in size, tectate-perforate with numerous (approximately 15) recessed pori, circular in shape but clearly defined by their presence below the exine. The lumina are perforate, with muri thickness approximately half the width of the lumina.

A plant common to grassy areas, roadsides and wood edges often growing in partial shade, to 1m in height.





Silene maritima **Sea Campion**

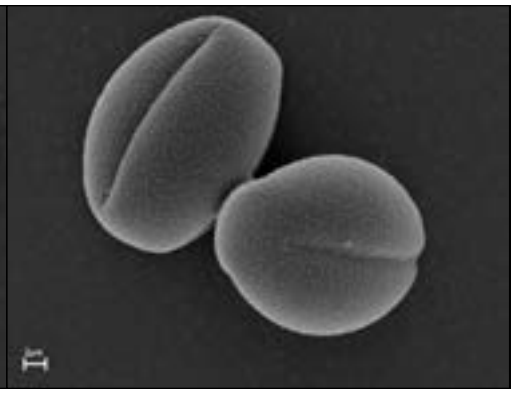
(synonymous with S. uniflora and S. vulgaris ssp. Maritima)

Collection date: 10/5/07 **SEM date:** 16/5/07 **Location:** Wakehurst Place, West Sussex

Silene maritima is an orbicular polypantoporate grain, <45 µm in size, tectate-perforate with numerous (approximately 15) protruding pori, circular in shape but clearly defined by their domed presence above the exine. The pori are sparsely scattered across the surface but surrounded by a halo making them quite distinct.. The columellae are rather irregularly arranged and not in a reticulate pattern and are found in a similar ratio to the perforations. Extensive pollen grain collapse can be seen in this sample.

A low growing plant to 50cm, with small blooms in relation to the large bladders, common to the seashore.

Family: *Caryophyllaceae*



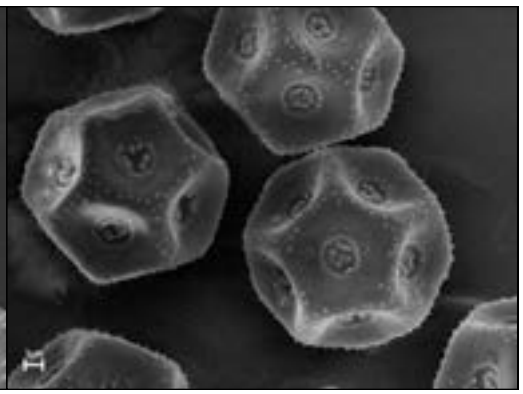
Spergularia marina

Lesser Sea-spurrey

Collection date: 6/6/07 **SEM date:** 8/6/07 **Location:** Adur Valley, West Sussex

Spregularia marina is a trizonocolpate, psilate grain , <45 µm in length. The pollen grain shape is lobed to circular in polar view and elliptic-obtuse with flattened poles in equatorial view. The tectum is microechinate, with copli meeting the poles and wide to gaping and ending obtusely and with finely granulate membranes. For further clarification on identification refer to family summary.

A low growing plant , to 25cm in height, found along the edges of estuaries , muddy flats and moist dunes along the seashore.



Stellaria holostea

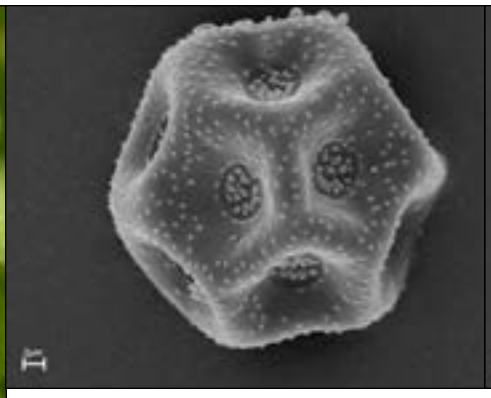
Greater Stitchwort

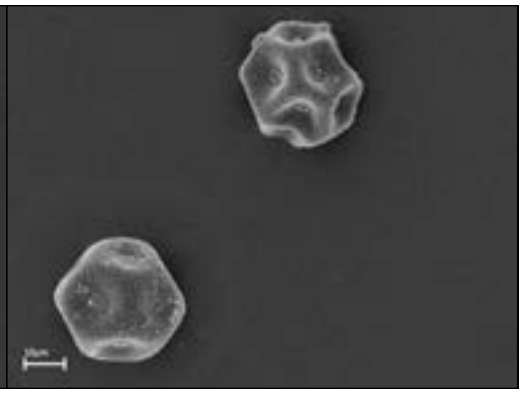
Collection date: 17/4/07 **SEM date:** 18/4/07 **Location:** Wakehurst Place, West Sussex

Stellaria holostea is an obtusely angular, 5-6 sided polypantoporate grain, >45 µm in size, tectate-perforate with numerous (<15 pori) recessed pori, circular in shape but clearly defined by their concave presence and granular mesocolpium membrane. The pori are equally spaced across the exine centered in the depressions surrounded by prominent ridges. Very prominent microechinae are found along the ridges randomly arranged.

Often seen in low grass areas through native woods, to about 20cm in height.

Family: *Caryophyllaceae*





Stellaria media **Common Chickweed**

Collection date: 5/5/07 **SEM date:** 16/5/07 **Location:** Castle Hill, West Sussex

Stellaria media is an obtusely angular, 12-14 sided polypantoporate grain, >45 µm in size, tectate-perforate with numerous (<12-14 pori) recessed pori. The pori are circular in shape but clearly defined by their concave presence and granular mesocolpium membrane. The pori are equally spaced across the exine centered in the depressions surrounded by prominent ridges that are doubly echinate.

A common plant of open grounds, generally in moist soils and partially shaded areas but not always. Height: 10cm.

Caryophyllaceae family summary.

Caryophyllaceae is a large family with over 130 members listed by Stace (1997, pp. 158-178) as growing in Britain, hence much work could be done on this family attempting to distinguish distinct pollen morphological characteristics. According to Moore *et al* (1991 pp. 119) *Spergula, Spergularia* and *Polycarpon* require type slide comparison for confirmed identification at the genus level and they expresses resignation at identification beyond this level. Moore *et al* (1991, pp. 112.) also states that confusion and variability occurs with *Silene* and *Lychnis*.

Spregularia marina is a trizonocolpate, pollen grain, shape is lobed to circular in polar view and elliptic-obtuse with flattened poles in equatorial view with a psilate-microechinate tectum. This is the most unusual pollen grain in this family that was analyzed since it has morphological characteristics distinct from all other grains least of which is its shape. All other grains examined in this family were orbicular.

Caryophyllaceae family summary.

Lychnis flos-cuculi, Silene alba and *Silene maritima* are orbicular polypantoporate grains of similar size and overall similar structure to each other and closely resemble *Stellaria* species with a few exceptional differences.

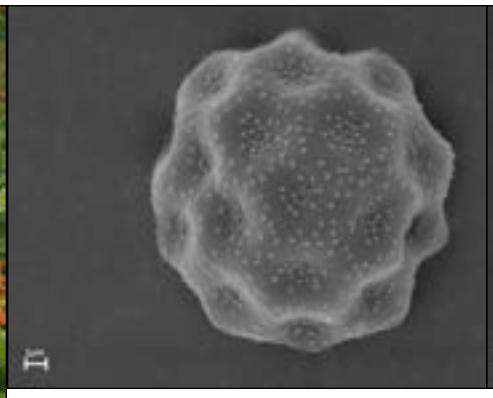
Agrostemma githago and *Cerastium arvense* are identical morphologically and it would be hard to distinguish them apart using SEM alone.

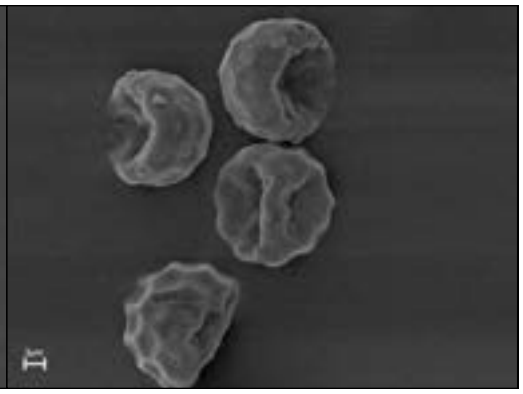
Stellaria holostea and *Stellaria media* are similar with the following noted exception *S. media* is 12-14 sided compared to the 5-6 sided form of S. *holostea* . This may not hold true across a greater sampling range but warrants further investigation.

Silene alba with a reticulate exine is unique, however again comparison to a type collection would warrant exploration since no reference can be found to this unique identifying character, it is the only reticulate pollen grain examined in this family.

Perforations of the tectum are common in several species, and are quite pronounced, several texts make reference to this character as well as some of the other species being micro-reticulate, current SEM analysis did not show this characteristic.

Family: *Chenopodiaceae*





Atriplex laciniata **Frosted Orache**

Collection date: 1/6/07 **SEM date:** 8/6/07 **Location:** Shoreham Beach, West Sussex

Atriplex laciniata is an obtusely angular, 5-6 sided polypantoporate grain, with numerous (>15) recessed pori, circular in shape but clearly defined by their concave presence and granular mesocolpium membrane. The pori are equally spaced across the exine centered in the depressions surrounded by shallow, rounded, ridges. Very prominent microechinae are found along the ridges randomly arranged. Substantial grain collapse is evident.

Found along the upper tide marks of beaches and along cliff tops, to 50cm in height and rather coarse looking.

Chenopodiaceae family summary.

Since only one member of this family was examined no comparative analysis can be performed within the family. However *A. laciniata* has many character points that are identical to members of the *Caryophyllaceae* family. *A. laciniata* has a similar overall structure to both *Stellaria* species represented in the *Caryophyllaceae* family with the main distinguishing feature between the two species being the number of pori. *A. laciniata* has >15 pori while both both *Stellaria* species have <15 pori.

Other species of *Atriplex* that are common and warrant comparative anlaysis are *A. prostrata, A. longipes, A. praecox, A. littoralis, A. patula, A. halimius* as well as representatives from the following genera within the *Chenopodiaceae* family: *Salicornia, Sarcocornia, Salsola, Suaeda, Spinacia, Corispremum, Bassia, Beta* and *Chenopodium* (Stace, 1997, pp. 134-150).

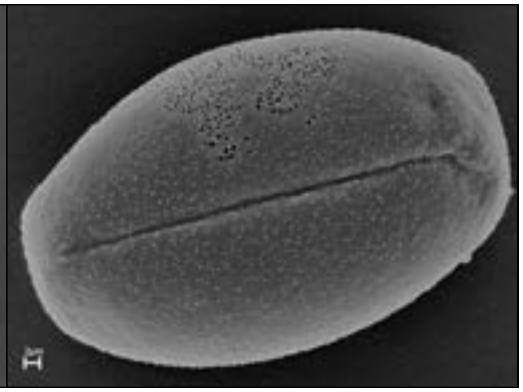
Family: *Convolvulaceae*

Calystegia silvatica — Large Bindweed

Collection date: 28/4/07 **SEM date:** 1/5/07 **Location:** Adur Valley, West Sussex

Calystegia sylvatica is a orbicular, polypantoporate grain, that is tectate-perforate, large, > 70 µm in size with detectable minute perforations across the tectum. The pori, lnumber ess than 40, are circular and sunken and`are clearly defined from the exine by their depressed appearance. Microechinae are present and are randomly scattered across the tectum, appearing less in frequency than the perforations.

A vigoorous climbing perennial weed, with large, not unattrative trumpet shaped blooms. As with *Convolvulus arvensis* it is found in similar locations although seldom growing along the ground. It is problematic in cultivated grounds.



Convolvulus arvensis — Field Bindweed

Collection date: 19/2/07 **SEM date:** 19/2/07 **Location:**

Convolvulus arvensis is a trizonocolpate perforate grain, > 45 µm long, elliptic to rhombic obtuse in shape with blunt poles in equatorial view. There are very closely spaced perforations in distinctly defined areas but with no clearly defined pattern or arrangement. The colpi are medium in width and terminate at the poles.

A very common,climbing or trailing plant, with distinct multi-coloured blooms, found in grassy areas, verges, roadsides and waste ground, rhizomatous it can become quite prolific and problematic in cultivated grounds.

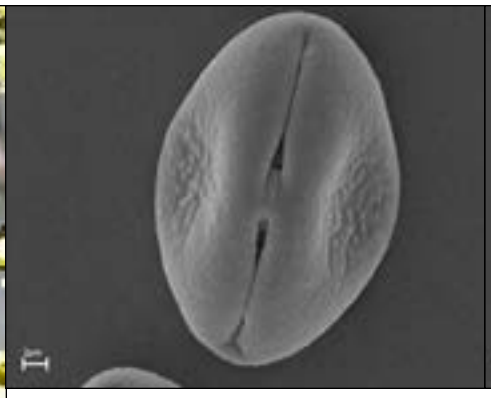
Convolvulaceae family summary.

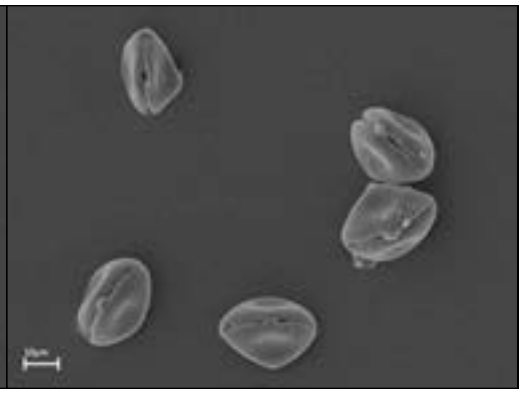
Two representatives of the *Convolvulaceae* family are presented here, of note is that in the past both fell under the genus *Convolvulus*. Floristically that would have seemed a correct assumption, however when examining the pollen grains of the two species we can see a distinct evolutionary difference and thus begin to understand their recent separation and reclassification.

Calystegia sylvatica is a polypantoporate perforate, orbicular grain while *Convolvulus arvensis* is a trizonocolpate, elliptic, perforate pollen grain. Differences are quite pronounced.

Stace (1997, pp. 534-535) lists only one other species of *Convolvulus* as a possible escapee in Britain, *C. tricolor,* but eleven other *Calystegia* species or hybrid crosses. This closey allied group of plants needs further comparssion to determine if the distinct morphologiucal characteristcs observed here hold true across each of the genera.

Family: *Cornaceae*



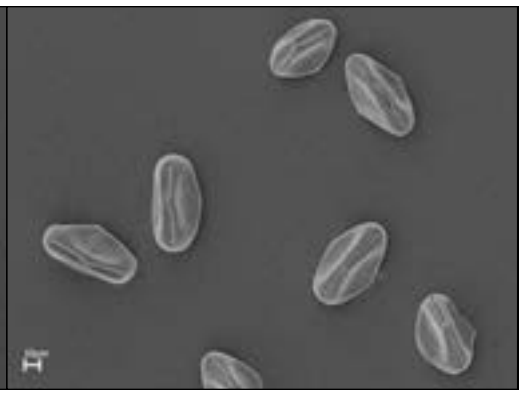


Cornus mas — Cornelian-cherry

Collection date: 28/4/07 **SEM date:** 1/5/07 **Location:** Wakehurst Place, West Sussex

Cornus mas has an obovate to obtuse shape with a pronounced equatorial bridge, the pollen grain is widest at its center. The grain is trizonocolpate, with the exine psilate -verrucate, less so at the equator and bordering the mesocolpia. The colpi run the length of the grain but terminate obtusely in the poles with a widening occurring on each side of the equatorial bridge and the terminus of the copli in the poles.

A plant mainly of the cultured landscape with the occasionally escapee, to about 3m in height and width.



Cornus sanguinea — Dogwood

Collection date: 29/4/07 **SEM date:** 2/5/07 **Location:** Preston Park, Brighton, West Sussex

A obtuse to slightly elliptic shape with a pronounced equatorial bridge, the grain is widest at its center. The grain is trizonocolpate, with the exine psilate-verrucate but more so at the equator and bordering the mesocolpia but fading at the poles . The colpi run the length of the grain but terminate obtusely in the poles with a widening occurring on each side of the equatorial bridge.

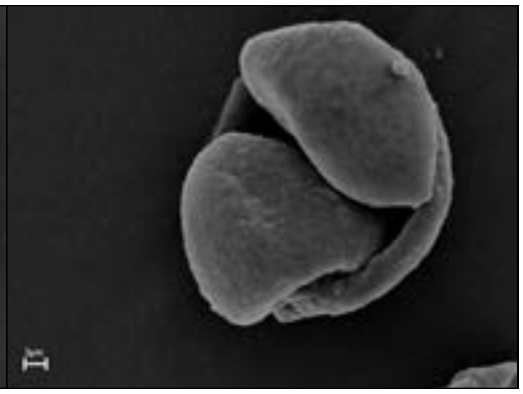
A common shrub of low lying hedgerows, moist areas and wasteland with a preference for calcareous or basic soils, to about 3m in height and width.

Cornaceae family summary.

Two species of *Cornus* are represented here. *C. mas* and *C. sanguinea,* both are common species found throughout England with *C. mas* found in the cultured landscape as opposed to the natural environment. Their pollen grains appear to differ slightly, but not enough to warrant accurate identification between the two species. *C. mas* pollen grain shape differs slightly from that of *C. sanguinea*; the grains are broadly obovate to obtuse and quite broad at the equator. *C. sanguinea* grains are obtuse-elliptic and are narrower at the equator with sharper poles than *C. mas.* The exine also appears to differ slightly between the two species. *C. mas* exine is psillate -verrucate but less so at the equator while *C. sanguinea* is again psillate - verrucate but more so at the equator. Differences in colpi also exist, *C. sanguinea* experiences a widening of the colpi on each side of the equatorial bridge while *C. mas* has a widening of the colpus occurring on each side of the equatorial bridge and at the terminus of the copli in the poles. Reference to type collections is recommended to determine if these slight differences in pollen morphology remain true for that specific genus.

Stace (1997, pp. 453-454) lists *C. sericea, C. alba* and *C. suecia* as common in Britain, these three additional species may warrant comparative analysis in the future.

Family: *Crassulaceae*



Rhodiola rosea — Roseroot

Collection date: 10/5/07 **SEM date:** 16/5/07 **Location:** Wakehurst Place Kew West Sussex

Rhodiola rosea is a saccate pollen grain with the dorsal exine scabrate and the saccus psilate-scabrate. The colpus is wide, most likely due to pollen grain collapse. Pollen was very hard to extract from this plant and only one grain was found under SEM.

A rare native plant found on mountains and rocky areas, reaching a height of 25cm.

Sedum acre — Biting Stonecrop

Collection date: 16/6/07 **SEM date:** 29/6/07 **Location:** Pevensey, East Sussex

Sedum acre is a trizonolcolporate pollen grain with the colpi widening appreciably towards the equator. The porous is represented by an equatorial bridge. Sculpture is striate to rugulate with the striae short and straight traveling meridionally, transversely and randomly over the exine.

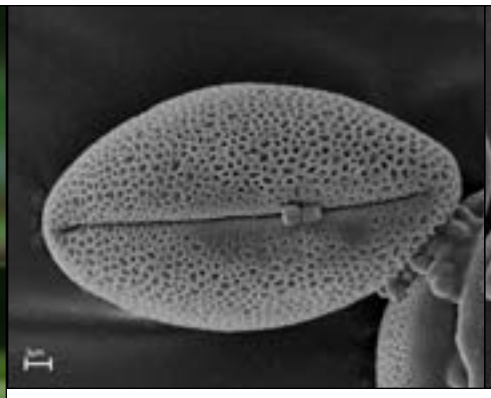
A native often found on walls and hedges, open grassland and maritime shore, often forming a low, thick mat, to 10cm in height.

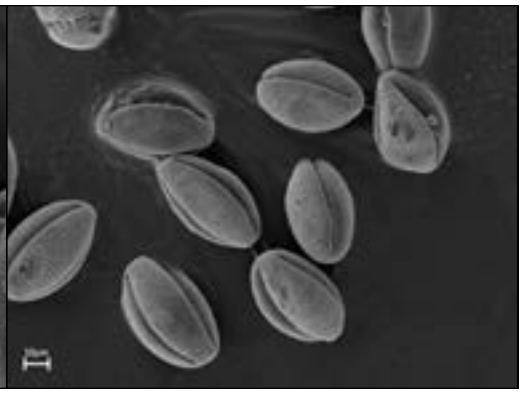
Crassulaceae family summary.

Some members of *Crassulaceae* family have undergone reclassification in recent years with a few individuals of the *Sedum* genus being moved to *Telephium,* thus it is of little surprise that the two *Crassulaceae* examples analyzed under SEM are morphologically distinct as this complex genus would appear to be in a state of flux.

Sedum acre is a trizonolcolporate pollen grain while *Rhodiola rosea* is a saccate grain similar to *Pinus* species. Moore *et al* (1991, pp. 153-154) suggests that identification of this complex genus is confusing and difficult with pollen grain classification resulting in large unrestricted groups such as *Crassula, Sedum (*Now including *Telephium), Sempervivum* or in many cases only to the *Crassulaceae* family. Stace (1997, pp. 307-313) lists ten different genera of the *Crassulaceae* family found in Britain, comparative analysis should be explored to determine if other profound differences exist in this diverse family. The *Crassulaceae* family is a very dynamic but confusing group of plants both floristically and morphologically.

Family: *Cucurbitaceae*





Bryonia dioica **White Bryony**

Collection date: 28/607 **SEM date:** 29/6/07 Location: Clayton, West Sussex

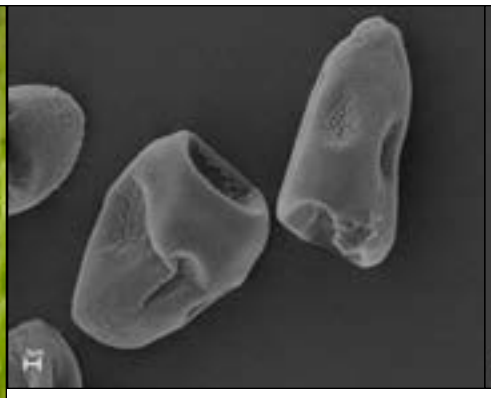
Bryonia dioica is a trizonocolpate perforate, reticulate grain, > 45 µm long, elliptic in equatorial and polar views. There are very closely spaced perforations in distinct areas with a clearly defined pattern or arrangement. These perforate lumina decrese in size towards both the pole and the lumina. The colpi are medium in width and terminate before the poles, the colpi margins are in rollled.

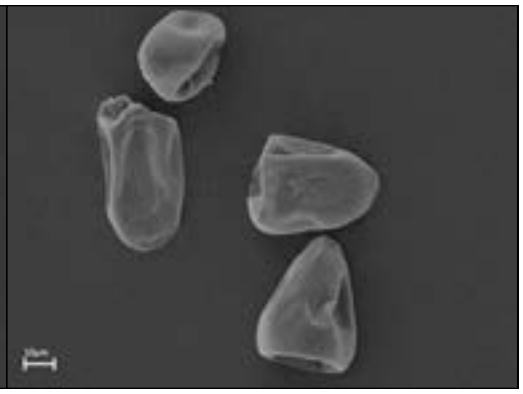
A single native species that is often found on rich soils on the edges of fields and in hedgrows. A trailing or climbing vine.

Cucurbitaceae family summary.

Bryonia dioica is a trizonocolpate perforate, reticulate grain, with almost all lumina being perforate, this is a unique identification characteristic found in all samples analyzed so far. Stace (1997, pp. 223) list only this one species as common in Britain although five other genera of the *Cucurbitaceae* family are mentioned.

Family: *Cyperaceae*



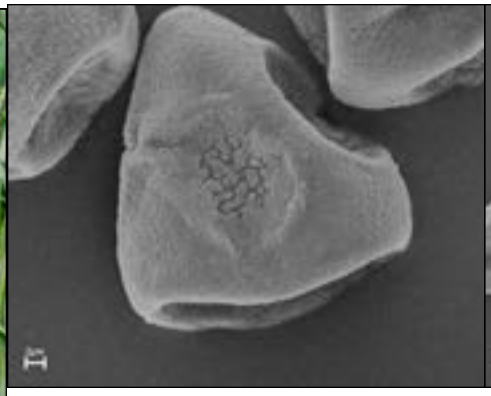


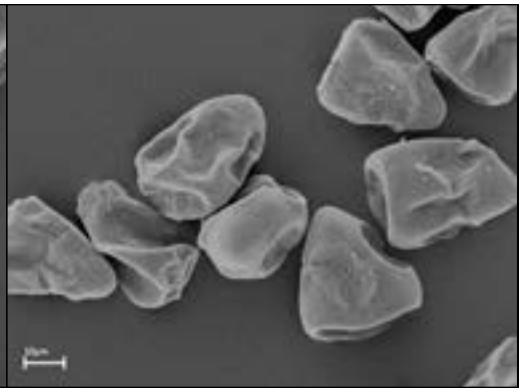
Carex montana Soft-leaved Sedge

Collection date: 6/6/07 **SEM date:** 8/6/07 **Location:** Adur Valley, West Sussex

Carex montana pollen grain is psillate to slightly granulate. The porous may not be so well defined and is without a thickened margin (absence of costa). The porous edge is often ragged but is difficult to locate. Pollen grains as members of the *Cyperaceae* family are tectate-perforate with visible columellae and evenly distributed . The lacunae is semi-tectate verrucate. The grain is pear-shaped and is typically collapsed or crumpled.

A native plant common to wet or boggy places, usually forming large patches or groups. To about 75cm in height.





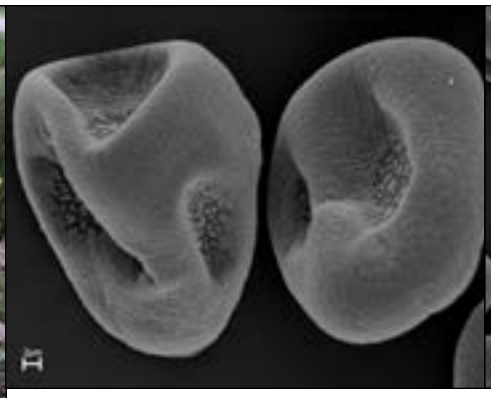
Carex pendula Pendulous Sedge

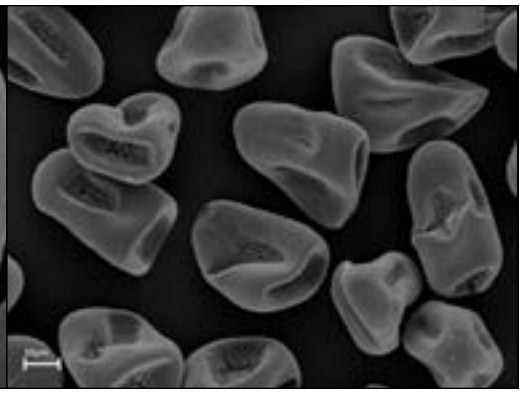
Collection date: 29/4/07 **SEM date:** 2/5/07 **Location:** Preston Park, Brighton, West Sussex

The grain surface of *Carex pendula* is psillate to slightly granulate. The porous may not be so well defined and is without a thickened margin (absence of costa). The porous edge is often ragged but is difficult to locate. Pollen grains as members of the *Cyperaceae* family are tectate-perforate with visible columellae and evenly distributed . The lacunae is semi-tectate verrucate. The grain is pear-shaped, broadly so and is typically collapsed or crumpled.

Often seen on the edges or along the paths of moist woods, *Carex pendula* is a large and as the name implies a weeping plant, to about 1m+.

Family: *Cyperaceae*





Carex strigosa **Thin-spiked Wood Sedge**

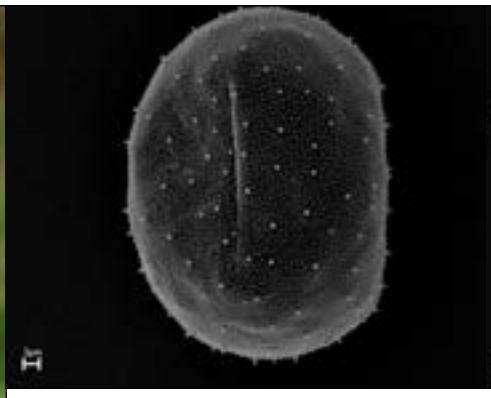
Collection date: 9/5/07 **SEM date:** 25/5/07 **Location:** Bedgeburry Pinetum, West Sussex

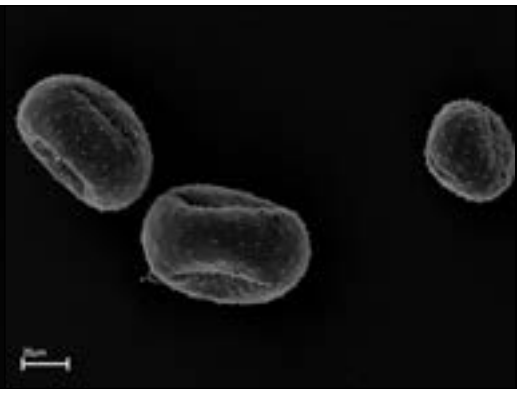
Carex strigosa pollen grain is psillate to slightly granulate. The porous may not be so well defined and is without a thickened margin (absence of costa). The porous edge is often ragged but is difficult to locate. Pollen grains as members of the *Cyperaceae* family are tectate-perforate with visible columellae and evenly distributed . The lacunae is semi-tectate verrucate. The grain is pear-shaped and is typically collapsed or crumpled, more so than the other two species represented here. Found in damp moist clearings in woods, it is a local to rare plant obtaining heights of 75cm.

Cyperaceae family summary.

Stace (1997, pp. 803-823) lists 75 species of *Carex* in three subgenus thus indicating the complexity of this genus, it is interesting to note that he (Stace) has devoted several pages to images of seed, indicating that this characteristic leads to confirmed identification in many members of the genus. If this is so could the same not be said for pollen morphology, SEM analysis I believe is not a sufficient indicator of accurate identification beyond the genus level. The three *Carex* species examined here demonstrate no discernable in morphology that would warrant confirmed identification beyond the genus level however with the addition of LM images greater clarity may be evident. Moore *et al* in his book *Pollen analysis* does not even address the *Carex* species in the pollen key. *C. pendula* appears to have a wider grain than the other two species shown however this is difficult to confirm since pollen grain collapse is evident in all three species indicating a characteristic of *Carex* to be anticipated in future collections.

Family: *Dipsacaceae*





Scabiosa columbaria **Small Scabious**

Collection date: 27/6/07 **SEM date:** 29/6/07 **Location:** Stamnar Woods, West Sussex

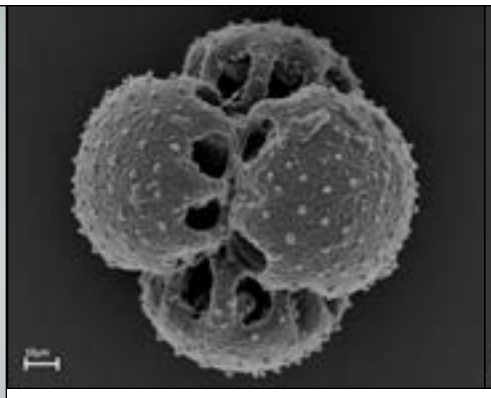
Scabiosa columbaria is a trizonocolpate grain, >50 µm in size with an echinate-micro-echinate exine. The colpi are short and narrow, almost faintly so and terminating well before the poles. The colpus is slightly sunken. The micro-echinae are thin and are densely packed all over the exine. The micro-echinae appear as distinct as the echinae. Overall grain shape is broadly elliptic to rhombic-obtuse.

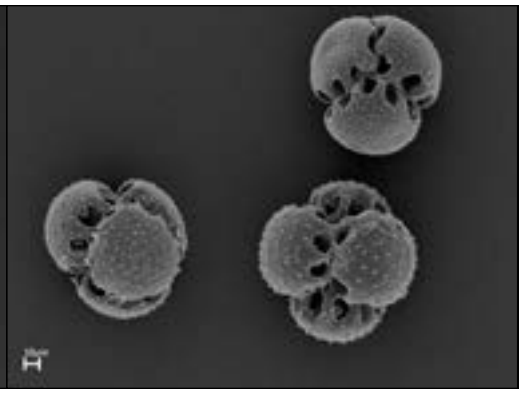
Found on dry calcareous soils usually along cliffs at the seashore, a small plant to about 20cm in height.

Dipscaceae family summary.

A very large pollen grain from a very small plant. A distinct grain in that the colpi finish well before the poles, the surface sculpture is micro-echinate to echinate with sparsely but evenly scattered echinae between the micro-echinae. It is according to Stace (1997, pp. 138) one of only two species naturally occurring in Britain, the other being *S. atropurpurea* however Stace does list 9 other plants in the same family as naturalized or indigenous.

Family: *Droseraceae*





Drosera capensis **Sundew**

Collection date: 24/5/07 **SEM date:** 31/5/07 **Location:** University of Sussex, West Sussex

Drosera capensis is a tetrad-quadrate pollen grain with densely packed rounded echinae, < 5µm long. The exine where the grains touch is often thrown into folds which converge towards the innner most point of the tetrad. The exine in addition to the echinae appears scabrate. Processes are all of similar length.

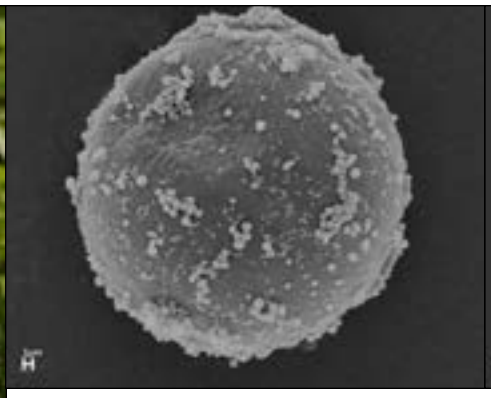
A introduced plant found in wet, acid, peaty environments (see below for details) and to about 25cm in height.

Droseraceae family summary.

A distinct pollen grain with only a distant resemblance to that of *Rhodiola rosea* in overall shape. The tetrad to quadrate shape is very distinct as are the pori, which are very large and circular in shape. The surface sculpture, a combination of blunt echinae and micro-echinae is also unique. Stace (1997, pp. 217) lists two other species and two hybrid crosses occurring in England but also mentions the above listed *D. capensis* a South African plant and *D. binata* from Australia being planted on bogs in Surrey in the 1970's and 1980's but still surviving today.

All other *Drosera* species including the introduced aliens might warrant SEM analysis, since this is a little known species with regard to pollen morphology.

Family: *Equisetaceae*



Equisetum arvense

Field Horsetail

Collection date: 7/6/07 **SEM date:** 15/6/07 **Location:** Adur Valley, West Sussex

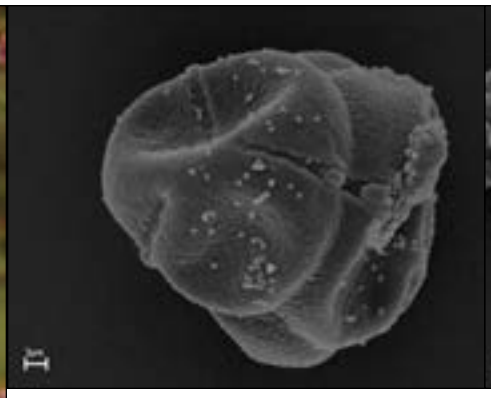
Equisetum arvense pollen grains are psillate, or possessing two coats more or less separate and in some cases cracked and fractured exposing the inner grain. The grain is approximately circular, including the inner grain. *Equisetum* has an outer coat that is often loose and maybe wrinkled and folded and often with granulate debris adhering to it. Often in association with the pollen grains are the long. Curling, spatulate terminated elaters.

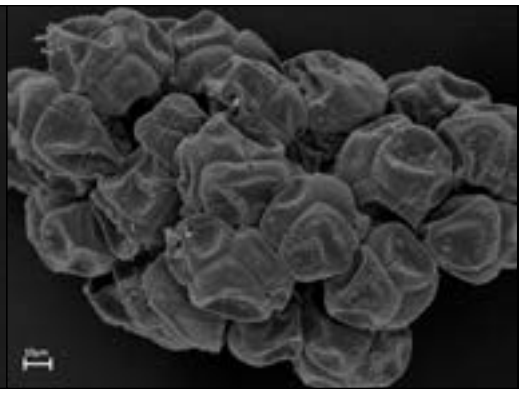
Often considered a garden pest where soil is moist this common species is found throughout England in moist grassland and waste ground, growing to a height of 75cm.

Equisetaceae family summary.

Stace (1997, pp. 9-11) lists 10 other species or hybrids of *Equisetum* common to England. Moore *et al* (1991, pp. 95) indicates that all *Equisetum* have an outer coat as depicted above revealing little of the exine sculpturing below. This species might warrant further SEM and LM analysis but should include a wash with either acetone or ethyl acetate as recommended by Parnell (2007) to reveal the underlying sculptural details..

Family: *Ericaceae*



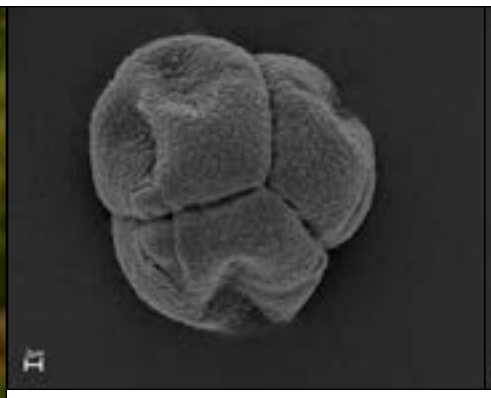


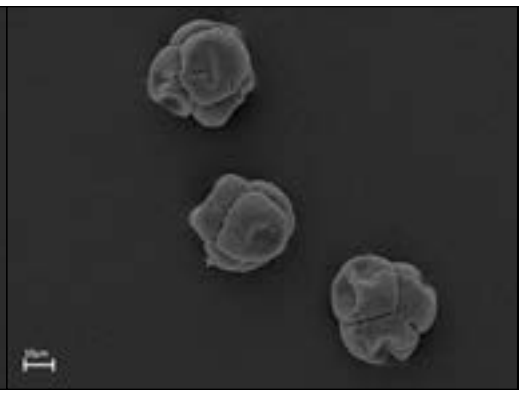
Erica cinerea **Bell Heather**

Collection date: 10/6/07 **SEM date:** 15/6/07 **Location:** Ashdown Forest, West Sussex

Erica cinerea pollen is tetrad, distinctley lobed and tetrahederally arranged with the grain size >45µm. In polar view each individual grain of the tetrad appears more or less circular, never triangular. The tetrads are lobed, globular or triangular-obtuse and are globular in shape with the apocolpia flat. The copli often widens towards the equator but is infrequently narrow. The costae are quite obvious and endocracks are prominent. Porous are represented as a narrow elliptic-acute endoporus or transverse endocolpus.

Often found growing in association with *E. tetralix* in moist acid bogs, heath land and moors. To 70 cm in height.





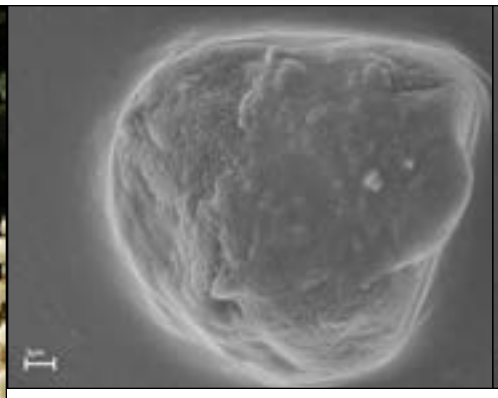
Erica tetralix **Cross-leaved Heath**

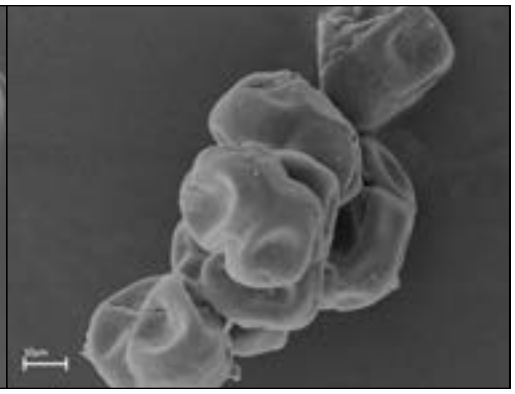
Collection date: 10/6/07 **SEM date:** 15/6/07 **Location:** Ashdown Forest, East Sussex

Erica teralix pollen is a tetrad that is distinctley lobed and tetrahederally arranged with flatened apoclpi and grain size of >45µm. In polar view each individual grain of the tetrad appears more or less circular, never triangular. The tetrads are lobed, globular or triangular-obtuse and are globular in shape with the apocolpia flat. The colpi commonly widens towards the equator where a clear porous is seen. Costae to the colpi apparent in surface view and usually tapers towards the polar end of each colpus. The sculpture is generally coarsely scabrate-verrucate.

Often found growing in association with *E. cinerea* in moist acid bogs, heath land and moors. To 70 cm in height.

Family: *Ericaceae*



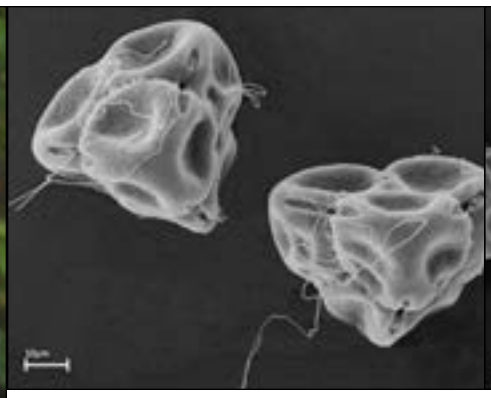


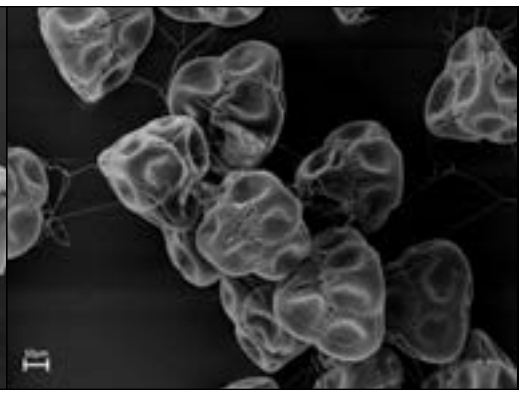
Pieris floribunda **Large Flowered Pieris**

Collection date: 13/3/07 **SEM date:** 21/3/07 **Location:** Wakehurst Place, West Sussex.

Pieris floribunda tetrads are often very large, commonly >50µm in size. The tetrad is distinctley lobed, and occasionally tetrahederally arranged, with the grains held loosley together, so much so that a gap is ofen visible between them or they are relased completely from the arrangment. The sculpture is psilate to scabrate and uniform over the entire pollen grain. The colpi are prominent and apaer to be circular. Some grains have a heavy coating or tectum.

An introduced but popular landscape plant, with larger blooms than the rare garden escapee *P. japonica.* To about 5m in height and often as much in spread.





Rhododendron ponticum **Rhododendron**

Collection date: 6/6/07 **SEM date:** 8/6/07 **Location:** Wakehurst Place, West Sussex

In *Rhododendron ponticum* the tetrads are often very large (commonly >50µm). The tetrad is distinctley lobed, tetrahederally arranged, with the grains held loosley together, so much so that a gap is ofen visible between them. Each colpi is commonly crossed by a long, narrow traverse endocolpus. According to light microscope evidence the grain walls are often quite thick when compared to other pollen grains (Moore *et al,* 1991, pp. 121). The grains are lobed or globular in shape with the colpi always widening towards the equator. The sculpture is psilate to scabrate and uniform over the entire pollen grain. The colpi are not granulate, have a clear outline and a have prominent costae outlined by a series of endocracks.

An escapee from gardens well over a hundred years ago this introuduced Asain plant has now become problematic in native woods. Height and spread can be 5m or more.

Ericaceae family summary.

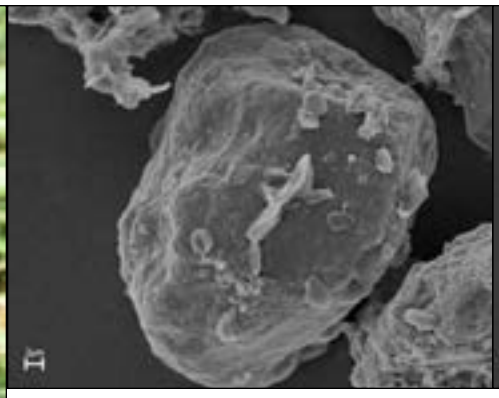
Pollen grains represented in the *Ericaceae* family are large, from 45- 50µm or greater, the *Erica* being the smallest, *Pieris* mid-sized and the *Rhododendron* the largest. All four species are tetrad in shape although the *Pieris* occasionally loosely so, most pollen grains are distinctly lobed and tetrahederally arranged but again the *Pieris* may occasionally be excepted.

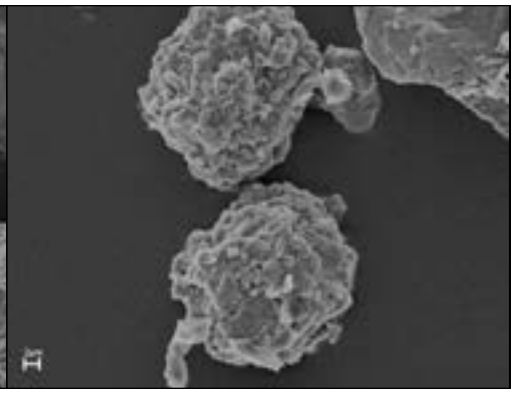
The visin strands are typical with *Rhododendron* pollen samples although this should not be relied upon for absolute confirmation of species as some previous SEM samples showed little or no visin strands present, yet visin threads are also common to the *Onagraceae* family.

The *Erica* species can be distinguished from each other by a widening of the colpi toward the equator for *E.. tetralix* but which does not occur with *E. cinerea* (Moore *et al* , 1997, pp. 88). Also *E. tetralix* appears to be heavily scabrate while *E. cinerea* is not so. The four species represented here show slight but significant differences in pollen morphology promising further identification to the species level with other family members.

Stace (1997, pp. 285-292) lists the following plants that warrant SEM comparison and analysis: *R. luteum, Loiseleuria procumbens, Kalmia polifolia, K. angustifolia, K. latifolia, Phyllodoce caerulea, Daboeca cantabrica, Andromeda polifolia, Gaultheria shallon, G. procumbens, G. mucronata, Arbutus unedo, Arctostaphyllos uva-ursi, A. alpinus, Calluna vulgaris*, 8 other species of *Erica* including hybrid crosses, *Vaccinum oxycoccos, V. microcarpum, V. macrocarpon, V. vitis-idea, V. uliginosum, V. myrtillus,* and *V. corymbosum*.

Family: *Euphorbiaceae*



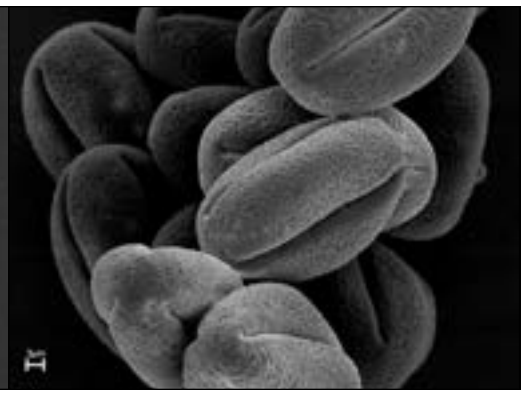


Euphorbia amygdaloides Wood Spurge

Collection date: 2/4/07 **SEM date:** 4/4/07 **Location:** Stamnar Woods, West Sussex

Since *Euphorbia amygdaloides* has a granulate tectum covering the exine very little sculptural detail is revealed. It could be assumed that the grain is trizonolcolporate based on the analysis of *E.. cyparissus* below however at this point it can only be an assumption. The image top right demonstrates some possibility of sculpturing however unless an acetone wash is used in future SEM preparation it appears little will be revealed with fresh, untreated, pollen.

This 75cm tall plant can be found along wood edges and hedgerows usually in partial shade.



Euphorbia cyparissus Cypress Spurge

Collection date: 19/5/07 **SEM date:** 25/5/07 **Location:** Wakehurst Place, West Sussex

Euphorbia cyparissus is a trizonolcolporate pollen grain, that is commonly elliptical-obtuse in equatorial views. The colpi are broad with the margins appearing to be in rolled terminating at the poles producing a somewhat lobed polar view.. Sculpture is consistently rugulate and possibly slightly perforate across the exine. But becoming psilate towards the colp margins and at points close to the equator.

A rampant short plant (30cm) found on rough grassland and native chalk areas.

Family: *Euphorbiaceae*

Mercurialis perennis **Dog's Mercury**

Collection date: 2/4/07 **SEM date:** 4/4/07 **Location:** Stamnar Woods, West Sussex

Mercurialis perennis pollen grains are trizonocolporate, baculate or pilate, perforate and are typically elliptic to rhombic in equatorial view with a transverse endocolpus crossing each colpus at the equator. The reticulum is composed of exine and pila with heads joined laterally. Sculpture is verrucate-rugulate and sporadically porous.

A perennial plant common to woods and shaded areas where it may form large patches to the exclusion of almost all other plants. To 50cm in height.

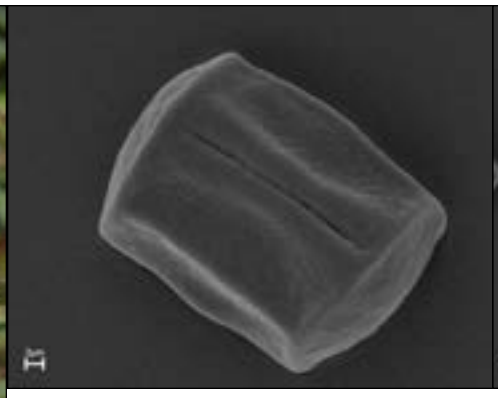
Euphorbiaceae family summary.

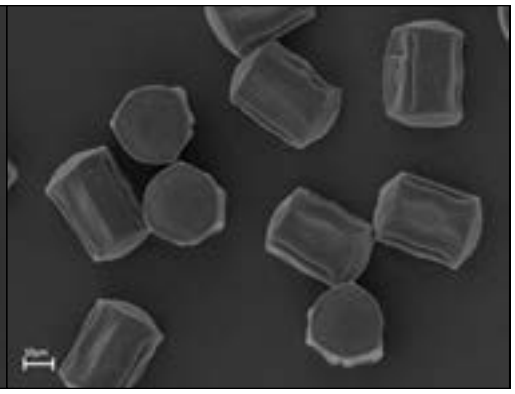
A variable species of plant with regard to both to flower and plant morphology as well as pollen characteristics.

M. perennis and *E.. cyparissus* pollen grains are trizonocolporate, baculate or pilate, perforate and are typically elliptic to rhombic in equatorial view however since *E.. amygdaloides* has a granulate tectum its underlying pollen grain shape is hard to define but it is suspected that it is orbicular to rhombic obtuse in shape. Both *M. perennis* and *E.. cyparissus* are perforate although *E.. cyparissus* appears less so than with *M. perennis* whose perforations being localized about the equator.

E.. amygdaloides might warrant further SEM and LM analysis but include a wash with either acetone or ethyl acetate to remove the tectum and reveal the underlying sculptural details (Parnell, 2007).

Family: *Fabaceae*



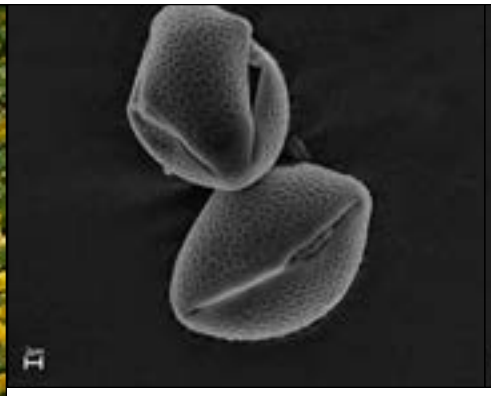


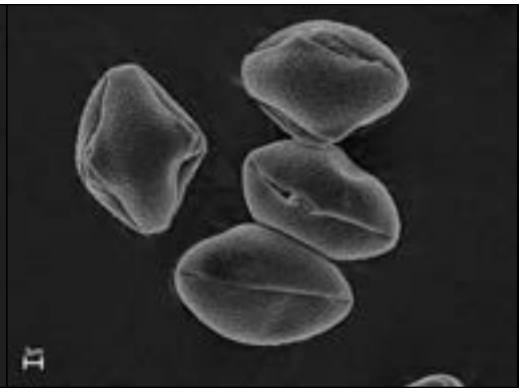
Anthyllis vulneraria — Kidney Vetch

Collection date: 1/6/07 **SEM date:** 8/6/07 **Location:** Shoreham Beach, West Sussex

Anthyllis vulneraria pollen grains are heterocolpate with 3 meridial porate colpi. The pollen grain in a polar view has a triangular or prism shape. Sculpture is rugulate-verrucate in the apocolpia but with much finer sculpturing in the mesocolpia, here, being psillate-scabrate. The mesocolpia is flattened while the apocolpia is flat or concave producing a somewhat angular, drum like appearance to the grain. The apocolpia is flat or concaved.

Found along coastal areas often on dunes or amongst beach rubble well back fro the shore line, to about 50cm in height and spreading about the same.





Cytisus scoparius — Broom

Collection date: 10/5/07 **SEM date:** 25/5/07 **Location:** Wakehurst Place Kew West Sussex

Cytisus scoparius is trizonolcolporate pollen grain, >< 30 µm in size that is commonly broadly elliptical in equatorial view. The colpi are narrow and parallel sided with the margins appearing to be in rolled terminating at the poles. The mesocolpia extends through the colpi at the equator producing and equatorial bridge. Sculpture is consistently rugulate across the exine.

A native shrub to 2m in height found on dry banks and well drained lean soils.

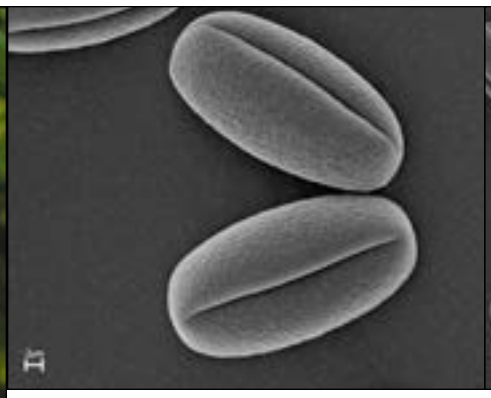
Family: *Fabaceae*

Genista tinctoria — Dyer's Greenweed

Collection date: 27/6/07 **SEM date:** 29/6/07 **Location:** Stamnar Woods, West Sussex

Genista tinctoria is a trizonolcolporate pollen grain, >< 30 µm in size that is commonly broadly elliptical in equatorial view. The colpi are narrow and parallel sided with the margins appearing not to be in rolled but terminating at the poles. Sculpture is consistently rugulate across the exine and appears occasionally perforate.

A native plant found on rough banks, and waste places usually associated with well drained and lean soils. To about 50cm in height.



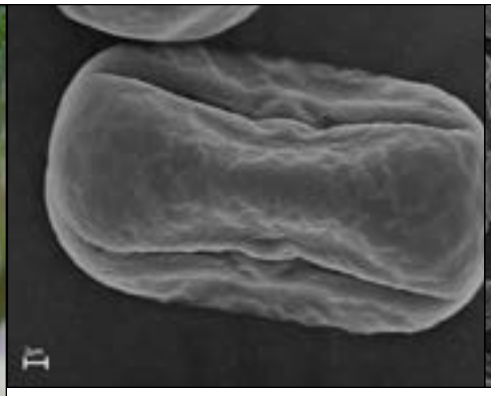
Laburnum anagyroides — Golden Chain Tree

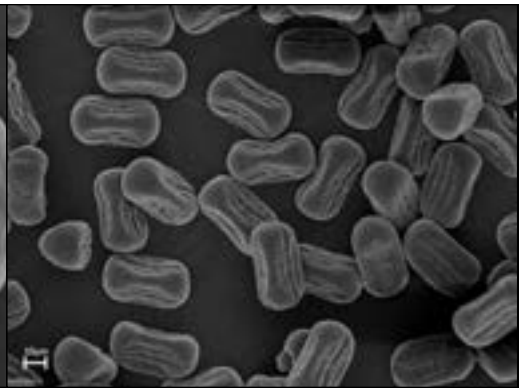
Collection date: 5/5/07 **SEM date:** 19/5/07 **Location:** Hollingburry Park Avenue, Brighton, West Sussex

Laburnum anagyroides is a trizonolcolporate pollen grain, >< 30 µm in size that is commonly rhombic obtuse in equatorial view. The colpi are narrow and parallel sided with the margins appearing to be in rolled terminating at the poles. Sculpture is consistently finely rugulate across the exine.

An introduced tree, very common in the cultured landscape and a not uncommon escapee, to about 5m in height.

Family: *Fabaceae*





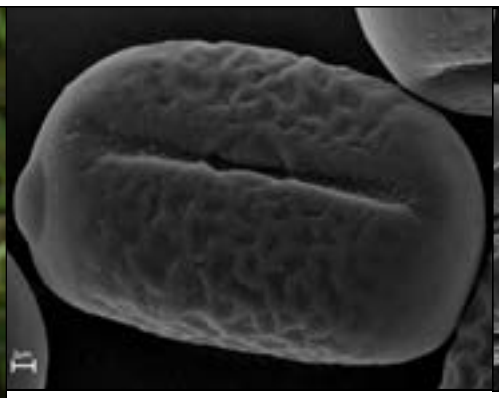
Lathyrus japonicus — Sea Pea

(synonymous with *L. maritimus*)

Collection date: 10/5/07 **SEM date:** 16/5/07 **Location:** Wakehurst Place Kew West Sussex

Lathyrus japonicus is a trizonolcolporate pollen grain, that is commonly rectangular-obtuse in equatorial view with pori in the equatorial region and faintly elliptic in shape. A distinct restriction at the pori result in a constricted grain at the equator. The colpi are narrow with the margins terminating a slight distance from the poles. Sculpture is consistently shallow-rugulate to verucate with very wide muri and very wide lumina across the exine and especially so at the equator. The reticulum is faint at the poles or may be restricted to a few very widely spaced lumina.

Found on maritime shingle and rough banks close the sea shore, to about 75cm in height.



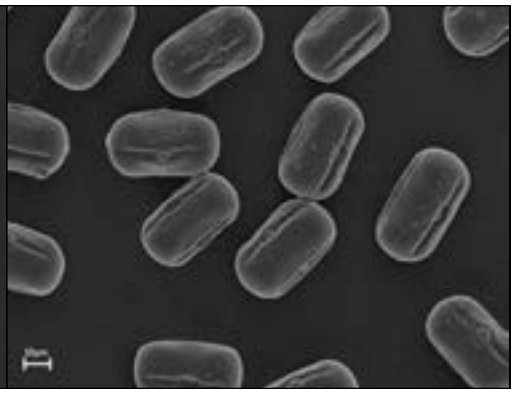
Lathyrus latifolius — Broad-leaved Everlasting-pea

Collection date: 27/6/07 **SEM date:** 29/6/07 **Location:** Stamnar Woods, West Sussex

Lathyrus latifolius is a trizonolcolporate pollen grain, that is commonly rectangular-obtuse in equatorial view with pori in the equatorial region and faintly elliptic in shape. The colpi are narrow with the margins appearing to be in rolled terminating at a slight distance from the poles. Sculpture is consistently rugulate with very wide muri and very wide lumina across the exine and especially so at the equator. The reticulum may disappear at the poles or may be restricted to a few very widely spaced lumina.

An introduced, naturalized plant found on banks, roadsides and waste places, climbing and sprawling. Very showy when in bloom in July and August.

Family: *Fabaceae*

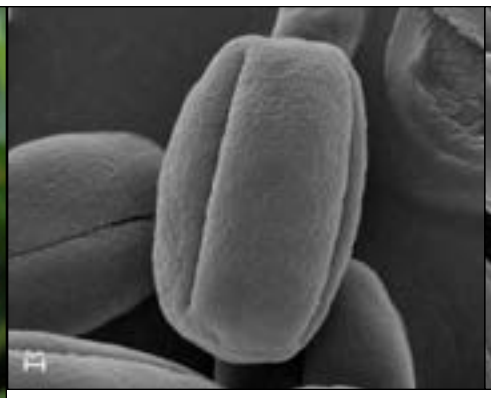


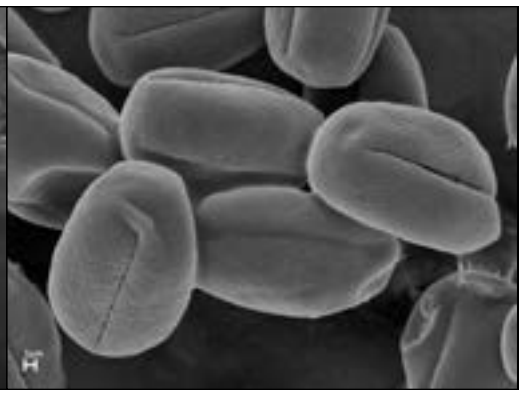
Lathyrus pratensis — Meadow Vetchling

Collection date: 9/6/07 **SEM date:** 15/6/07 **Location:** Adur Valley, West Sussex

Lathyrus pratensis is a trizonolcolporate pollen grain, that is commonly rectangular-obtuse in equatorial view with pori in the equatorial region. The pori are distinctly elliptical , in pairs forming a circle and produce a slight restriction at the equator. The colpi are narrow with the margins appearing to be in rolled terminating at a slight distance from the poles. Sculpture is consistently rugulate with wide muri and narrow lumina across the exine and especially so at the equator. The reticulum disappears at the poles or may be restricted to a few very widely spaced lumina.

A common plant to grassy places and rough pasture, to about 25cm in height.





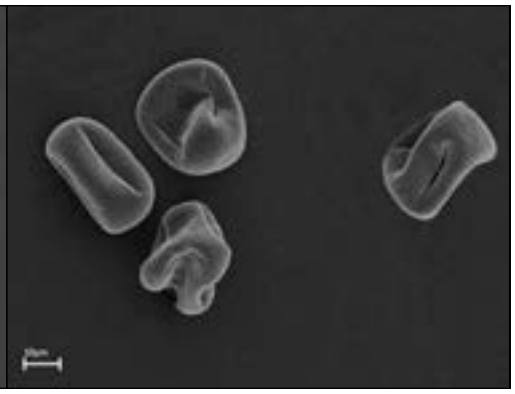
Lotus corniculatus — Common Bird's-foot-trefoil

Collection date: 28/4/07 **SEM date:** 21/5/07 **Location:** Castle Hill, West Sussex

Lotus corniculatus is a trizonolcolporate pollen grain, that is commonly rectangular-obtuse in equatorial view. The colpi are narrow with the margins appearing to be in rolled terminating a slight distance from the poles. Sculpture is consistently psilate-rugulate.

A native plant found along sparsely grassed areas, path and roadsides and waste ground. To about 30cm in height.

Family: *Fabaceae*

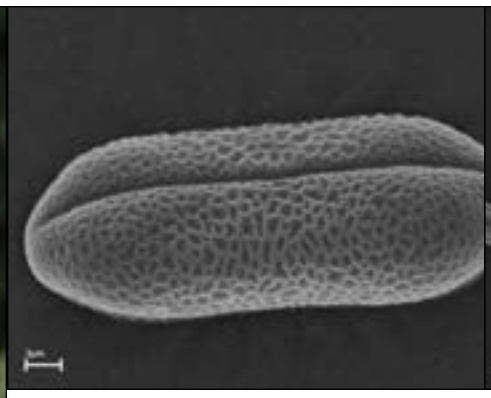


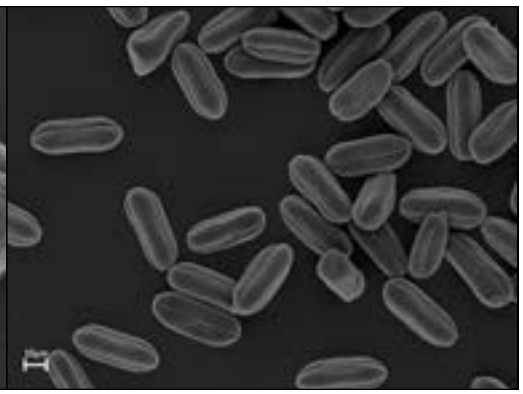
Medicago lupulina — Black Medick

Collection date: 19/5/07 **SEM date:** 25/5/07 **Location:** Wakehurst Place, West Sussex

Medicago lupulina is a trizonolcolporate pollen grain, that is commonly rectangular-obtuse in equatorial view. The colpi are narrow with the margins appearing to be in rolled terminating at a slight distance from the poles. Sculpture is consistently psilate-rugulate, less rugulate towards the poles.

A native plant found along sparsely grassed areas, lawns, meadows, path and roadsides and waste ground. To about 25cm in height.





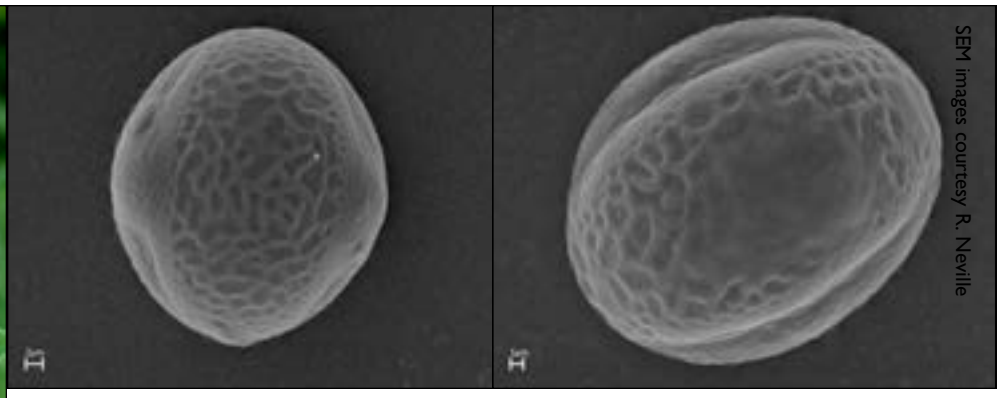
Onobrychis vicifolia — Sainfoin

Collection date: 5/5/07 **SEM date:** 16/5/07 **Location:** Castle Hill, West Sussex

Onobrychis vicifolia is a trizonocolpate suprareticulate grain, rectangular obtuse in equatorial view with rounded poles but elliptic in polar view. The mesocolpium is flattened or slightly concave in the equatorial region only. The copli are narrow slits (with very straight edges) terminating in the poles. The lumina size decreases sharply towards the edges of the colpus but are otherwise consistent across the grain. Muri are as wide, as thick as the width of the lumina.

Native to grassland, roadsides on calcareous soils, to about 75cm in height, quite floriferous and not unattractive when in bloom.

Family: *Fabaceae*

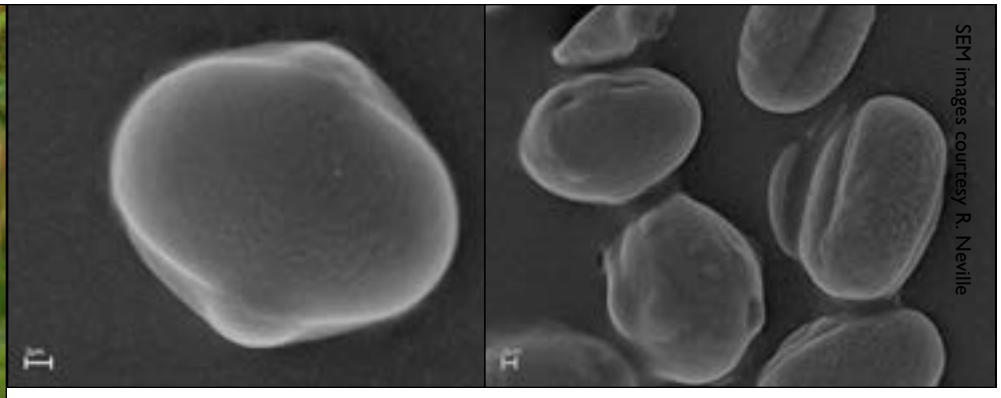


Trifolium pratense — Red Clover

Collection date: **SEM date:** 16/11/06 **Location:**

Trifolium pratense is a trizonolcolporate pollen grain, that is commonly rhombic-obtuse in equatorial view with pori in the equatorial region. The colpi are narrow with the margins appearing to be in rolled terminating a slight distance from the poles. Sculpture is consistently rugulate with wide muri and lumina across the exine. The reticulum may disappear at the poles or may be restricted to a few very widely spaced lumina.

A common plant to grassland where it can be seen as a cultivated or naturalized species, to about 50cm in height, flowering throughout most of the active growing season.



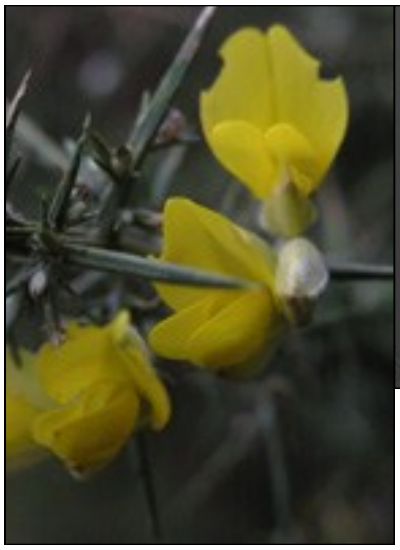
Trifolium repens — White Clover

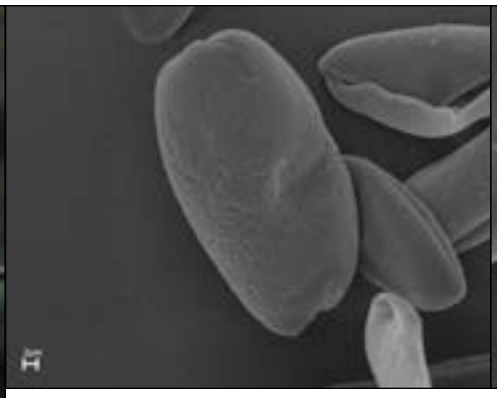
Collection date: **SEM date:** 16/11/06 **Location:**

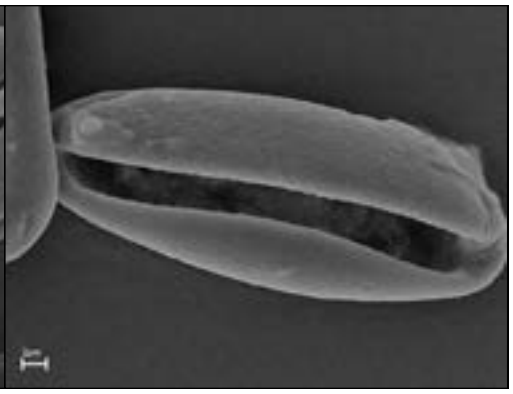
Trifolium repens is a trizonolcolporate pollen grain, that is commonly rhombic-obtuse in equatorial view with pori in the equatorial region. The colpi are narrow with the margins appearing to be in rolled terminating at a slight distance from the poles. Sculpture is consistently rugulate with wide muri and lumina across the exine. The reticulum may disappear at the poles or may be restricted to a few very widely spaced lumina.

Common to fields, meadows and grassy areas where it produces a low, lush mat, to about 25cm.

Family: *Fabaceae*





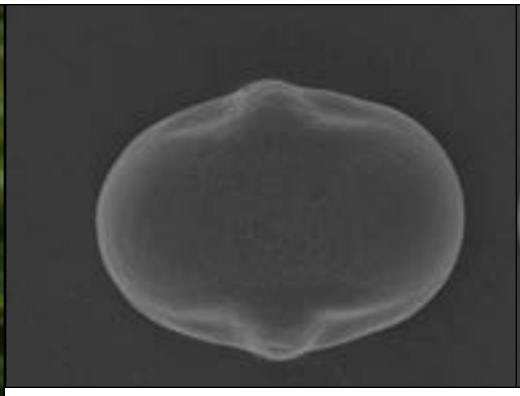


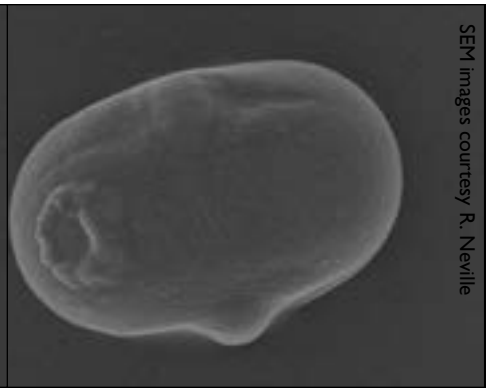
Ulex europeaus — Gorse

Collection date: 18/2/07 **SEM date:** 19/2/07 **Location:** Friston Forest, East Sussex

Ulex europeaus is a trizonolcolporate pollen grain, >< 30 µm in size that is sharply elliptical in equatorial view The Sculpture is rugulate to verrucate across the exine. These images show possible grain collapse which could be attributable to the pollen collection time. The gaping colpus maybe a distinguishing characteristic if it does not relate to pollen grain collapse.

A common shrub to open heath land and moors, often preferring acid or peaty soils. To about 2m in height and often as broad.





SEM images courtesy R. Neville

Vicia cracca — Tufted Vetch

Collection date: **SEM date:** 19/2/07 **Location:**

Vicia cracca is a trizonolcolporate pollen grain, that is commonly rhombic-obtuse in equatorial view with pori in the equatorial region. Sculpture is consistently rugulate across the exine.

A plant of rough ground and banks, where it climbs above other plants using them for support. It can and has been used on steep highways banks as a means of erosion control.

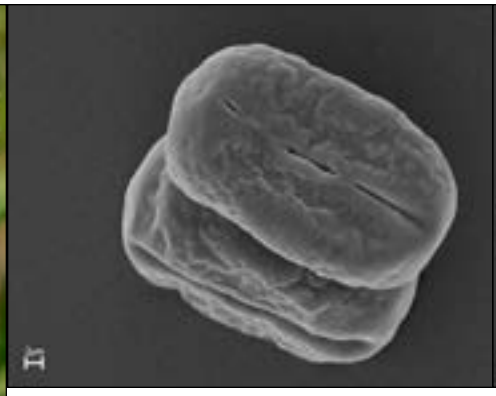
Family: *Fabaceae*

Vicia sativa — Common Vetch

Collection date: 9/6/07 **SEM date:** 15/6/07 **Location:** Adur Valley, West Sussex

Vicia sativa is a trizonolcolporate pollen grain that is commonly rectangular-obtuse in equatorial view with pori in the equatorial region. The colpi are narrow with the margins appearing to be in rolled terminating a slight distance from the poles. Sculpture is consistently coarsely rugulate with wide muri and very wide lumina across the exine and especially so at the equator. The reticulum may disappear at the poles or may be restricted to a few very widely spaced lumina.

Native to rough grassy places.



Vicia sepium — Bush Vetch

Collection date: 28/4/07 **SEM date:** 1/5/07 **Location:** Ditchling Beacon, West Sussex

Vicia sepium is a trizonolcolporate pollen grain, that is commonly rectangular-obtuse in equatorial view with pori in the equatorial region. The colpi are narrow but periodically open at the equator and poles with the margins appearing to be in rolled terminating a slight distance from the poles and periodically bridge the exine. Sculpture is consistently coarsely rugulate with wide muri and lumina across the exine and especially so at the equator. The reticulum may disappear at the poles or may be restricted to a few very widely spaced lumina.

Native to rough grassy places, scrub and wasteland, to about 1m.

Fabaceae family summary.

Anthyllis vulneraria pollen grains are heterocolpate with 3 meridial porate colpi and in polar view has a triangular or prism shape. The mesocolpia is flattened while the apocolpia is flat or concave producing a somewhat angular, drum like appearance to the grain. It is the only pollen grain analyzed from this large family that has this very distinctive shape and colpi arrangement.

Cytisus scoparius is trizonolcolporate pollen grain that is broadly elliptical in equatorial view and is one of the shortest grains represented in this family. Its reticulate surface is also somewhat distinct although it is similar to *Onobrychis vicifolia.*

Genista tinctoria is a trizonolcolporate pollen grain, >< 30 µm that is commonly broadly elliptical in equatorial view however it closely resembles *Laburnum anagyroides* except that the surface is slightly more rugulate and the grain shape is sharply elliptic while *L. anagyroide*s is bluntly elliptic.

Lathyrus latifolius, Lathyrus japonicus and *Lathyrus pratensis* are trizonolcolporate pollen grains that are commonly rectangular-obtuse in equatorial view with pori in the equatorial region and faintly elliptic in shape. The colpi are narrow with the margins appearing to be in rolled terminating at a slight distance from the poles. Sculpture is consistently shallowly rugulate with very wide muri and very wide lumina across the exine and especially so at the equator. *Lathyrus pratensis* pori are distinctly elliptical and produce a slight restriction at the equator, floristically they are very similar.

Lathyrus japonicus is a plant that is in a state of flux regarding its taxonomic classification. (Streeter, 1988) lists it as *L. maritimus* while Stace (1997) lists it as *L. japonicus*. According to Heywood *et al* (2007) the *Fabaceae* family, one of the most wide-spread geographically is confusing and varied and requires further work in understanding and directing subfamily relationships. *Lotus corniculatus* and *Medicago lupulina are* trizonolcolporate pollen grains that are commonly rectangular-obtuse (more so for *M. lupulina)* in equatorial view. The colpi are narrow with the margins appearing to be in rolled terminating at a slight distance from the poles. Sculpture is consistently psilate-rugulate but becoming more psilate towards the poles although *M. lupulina* appears to be more scabrate than *L. corniculatus.*

Fabaceae family summary continued.

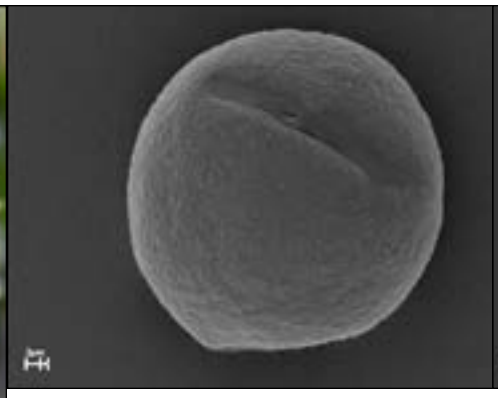
Onobrychis vicifolia is a trizonocolpate suprareticulate grain, rectangular obtuse in equatorial view with rounded poles but elliptic in polar view. Both the shape and the consistency of the lumina are unusual in this family and distinguish this grain readily from all others presented.

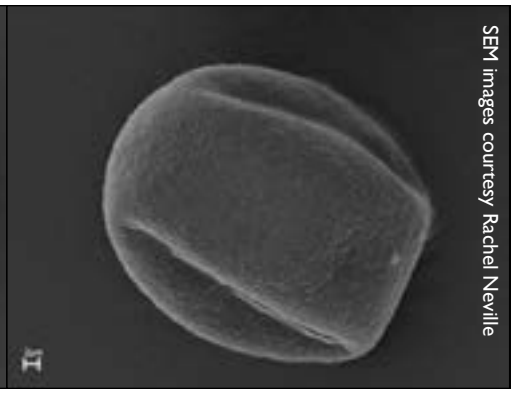
Both *Trifolium pratense* and *Trifolium repens* according to Moore *et al* (1991, pg 151) may be difficult to identify as to individual species (including many other *Trifolium* species) as the grains are quite variable and should be compared to a type collection for further definition. *Vicia cracca* is a trizonolcolporate pollen grain, similar to *Trifolium* however it is according to Moore *et al* (1991, pp. 151) the smallest grain of the group.

Ulex europeaus is a trizonolcolporate pollen grain, >< 30 µm that is commonly sharply elliptical in equatorial view The sculpture is rugulate to verrucate across the exine. These images show possible grain collapse which could be attributable to the pollen collection time. The gaping colpus maybe a distinguishing characteristic if it does not relate to pollen grain collapse. Grain shape, sharply elliptical is again a dominant distinguishing characteristic of this genus.

Vicia sativa and *Vicia sepium* are trizonolcolporate pollen grains that are commonly rectangular-obtuse in equatorial view with pori in the equatorial region, *V. sepium* being more obtuse than *V. sativa*. The colpi are narrow with the margins appearing to be in rolled terminating at a slight distance from the poles. Sculpture is consistently coarsely rugulate with wide muri and very wide lumina across the exine and especially so at the equator, however on *V. sepium* the muri appear much more flattened than those of *V. sativa*. The reticulum in both pollen grain species disappears at the poles or may be restricted to a few very widely spaced lumina. *Vicia* species as well as some *Lathyrus* can be identified to a reliable degree of accuracy by comparing the size of the reticulum meshes however to be absolutely sure a type collection needs to be used for further comparison Moore *et al* (1991, pg 151).

Family: *Fagaceae*





SEM images courtesy Rachel Neville

Fagus sylvatica — Beech

Collection date: 28/4/07 **SEM date:** 1/5/07 **Location:**

Fagus sylvatica is a trizonocolporate finely rugulate pollen grain, while the grain is circular in equatorial view and is as long as is broad. The endopori are large and circular to elliptic. The colpi are short, terminating well before the poles but are broad and shallow. The mesocolpia is convex and in polar view maybe somewhat lobed to triangular.

A large native tree (45m) found on well drained soils, often in pure stands on calcareous and acid sandstone.

Quercus robur — Pendunculate Oak

Collection date: 19/2/07 **SEM date:** 19/2/07 **Location:**

Quercus robur is a trizonocolporate saccate, scabrate verrucate pollen grain, while the grain is circular in equatorial and polar views and is as long as is broad. The tectum sculpturing is more or less irregular, scabrate to shallow verrucate. The endopori are large and circular to elliptic. The colpi are short, terminating well before the poles but are broad and shallow. The mesocolpia is convex and in polar view maybe somewhat lobes to triangular.

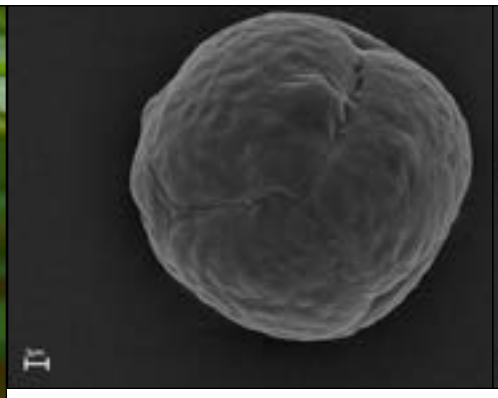
A large native tree to 40m in height, forming dense woods on a variety of soils throughout the country.

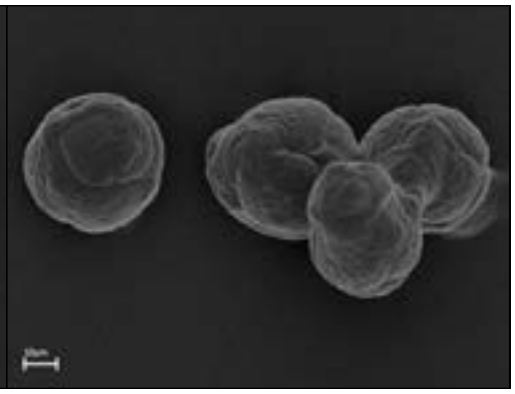
Fagaceae family summary.

The primary and most obvious difference between the two pollen grains analyzed in the *Fagaceae* family is that *Quercus robur* is a trizonocolporate saccate, scabrate verrucate pollen grain while *Fagus sylvatica* is a trizonocolporate finely rugulate pollen grain. According to Moore *et al* (19991, pp. 126). it is sometimes difficult to distinguish between microechinae and scabrate and hence some confusion may occur with the sculpturing details of *F. sylvatica.*

Both grains are distinct within their family (based on this limited analysis) but also within the context of this research although *Q. robur* pollen is very similar to *Rhodiola rosea* pollen grain morphology, this coincidence warrants further investigation since in both cases only one grain was found in each analysis and since *R. rosea* is autogamous, thereby producing very limited amounts of pollen that pollen grain is suspect. This confusion is further reinforced by plant location, *R. rosea* was located under a large grouping of trees, thus I suspect that the pollen could be an imposter such as a *Quercus* species that landed on the flowers of *R. rosea* and that the pollen presented as *R. rosea* is in fact *Quercus.*

Family: Fumariaceae



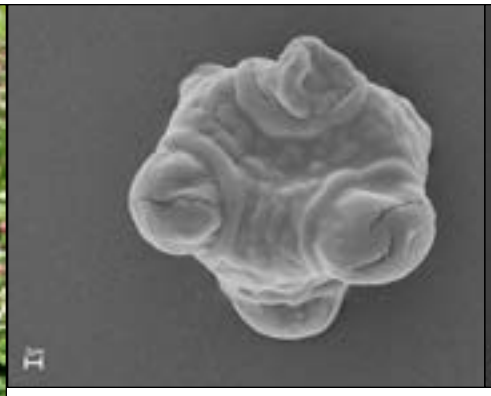


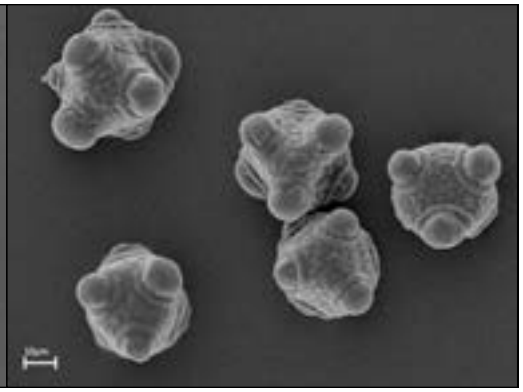
Corydalis lutea — Yellow Corydalis

Collection date: 14/6/07 **SEM date:** 15/6/07 **Location:** Hollingburry Park Avenue, Brighton West Sussex

Corydalis lutea is an orbicular shaped 6-12 pantocolpate pollen grain, orbicular in polar views but appearing somewhat elliptic in equatorial views. The tectum is slightly verrucate with no distinct or clear endocracks although endosculptures are present. The colpi run straight over the surface but divide it into somewhat rounded plates. No sculpturing detail is seen because of the all encompassing tectum. Individual pollen grains are > 22 in length.

An introduced plant to about 40cm in height and found on walls and other dry stoney places throughout the country.





Fumaria officinalis — Common Fumitory

Collection date: 28/4/07 **SEM date:** 1/5/07 **Location:** Ditchling Road, Brighton, West Sussex

Fumaria officinalis is polypantoporate, verrucate pollen grain with 6 pori. It has very large pori surrounded by a very thick, distinct annuli composing the exine. Each porus is covered by a thin psilate membrane which appears ruptured or cracked. Microechinae are scattered over the entire exine.

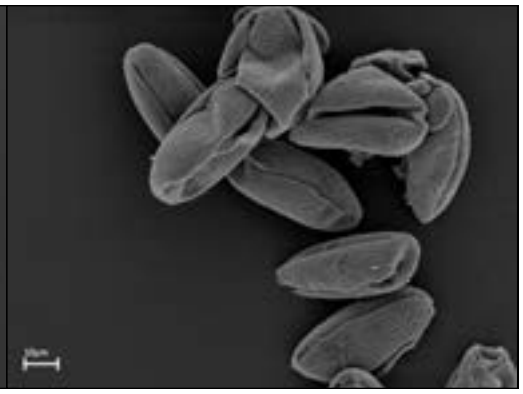
A native plant found sporadically both on cultivated and waste ground. A sprawling plant about 30cm in height and approximately twice as broad.

Fumariacea family summary.

Corydalis lutea is an orbicular shaped 6-12 pantocolpate pollen grain that could initially be confused with *Mahonia* sp. as at a glance the morphological characteristics appear identical. However the primary distinction between the two pollen types is that in *C. lutea* the colpi run straight over the surface and divide it into somewhat rounded plates while with *Mahonia* the colpus divisions are much more irregular.

Fumaria officinalis is polypantoporate, verrucate pollen grain with 6 very large pori surrounded by a very thick, distinct annuli composing the exine. Each porus is covered by a thin psilate membrane which appears ruptured or cracked and microechinae are scattered over the entire exine. These characterisitcs make this pollen grain one o f the easiest to distinguish amongst the 267 pollen types presnented in this research. According to Moore *et al* (1991, pp. 105) this characteristic is distinct to *Fumaria* however identification to the species level has not been proven.

Family: *Gentianaceae*



Meyanthes trifoliata **Bogbean**

Collection date: 14/6/07 **SEM date:** 21/6/07 **Location:** Wakehurst Place Kew West Sussex

Meyanthes trifoliata is a trizonolcolporate, elliptic pollen grain with no visible opercula present. Meridionally elongate endopori represented as ruptures or constrictions to the colpi. Surface is striate with numerous short muri running meridionally and transversely across the mesocolpia . The muri are interwoven, often complexly so especially at the poles. They run up to the end thirds of the colpi.

A native plant in shallow bogs and swamps throughout England, to about 1-1.5m.

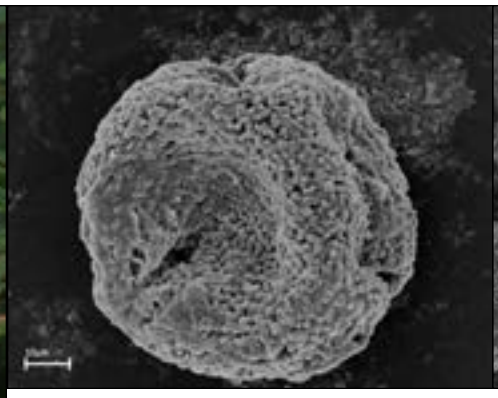
Gentianaceae family summary.

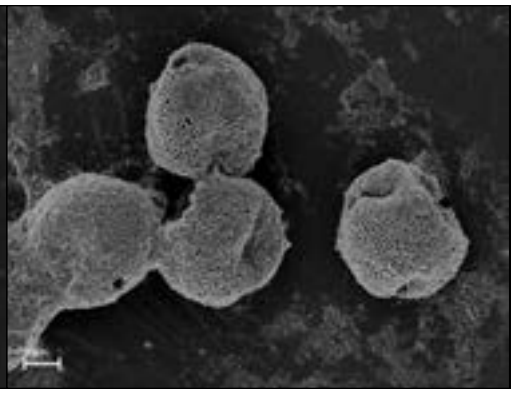
Stace (1991, pp. 538-539) lists only one species of *Meyanthes* found in England, that of *M. trifoliata* shown above, and lists *Nymphoides peltata* as the only other member of this family present in Britain.

Comparison is then limited, however further research should include *N. peltata* for comparative analysis.

M. trifoliata sculpturing is striate with numerous short muri running meridionally and transversely across the mesocolpia . The muri are interwoven, often complexly so especially at the poles and run up to the end thirds of the colpi. This characteristic is unique to this study again making identification of this pollen grain amongst the 267 analyzed simplistic.

Family: *Geraniaceae*



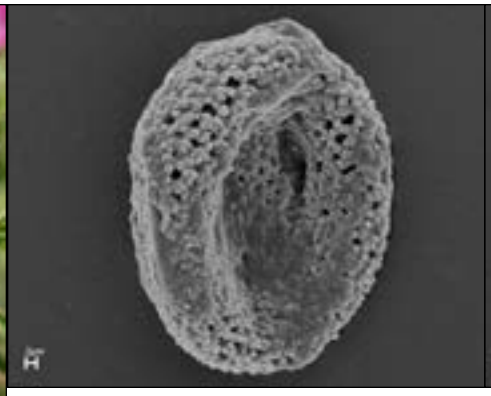


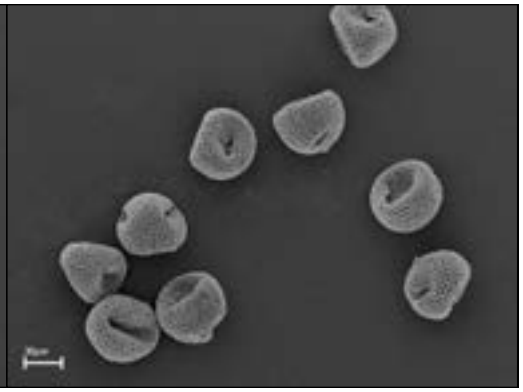
Geranium cinerea — Garden Geranium

Collection date: 14/6/07 **SEM date:** 29/6/07 **Location:** Wakehurst Place, West Sussex

Geranium cinerea is a trizonoporate grain, >55µm without vestibulate pori. Geranium pollen grains are typically semitectate, reticulate with each porous elongated into an ellipse . In this example however the grain appears to be tectate to semitectate. The exine structure is often complex, with clavate or baculate projections on top of the reticulum muri.

A garden plant that may form localized patches as a garden escapee, to about 75cm in height.





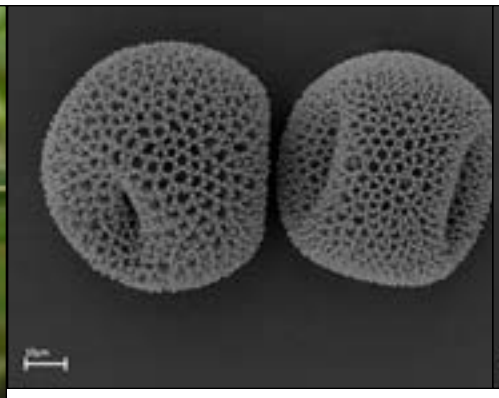
Geranium dissectum — Cut-leaved Crane's-bill

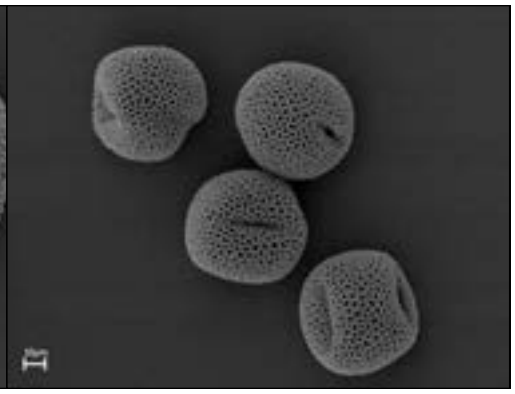
Collection date: 5/5/07 **SEM date:** 16/5/07 **Location:** Castle Hill, West Sussex

Geranium dissectum is a trizonoporate grains, >55µm without vestibulate pori. Geranium pollen grains are typically semitectate, reticulate with each porous elongated into an ellipse . In this example however the grain appears to be tectate to semitectate. The exine structure is often complex, with clavate or baculate projections on top of the reticulum muri. Pollen grain collapse is evident in this particular sample and species.

Native to grassy and rough ground, often growing in dry, lean conditions. Height: 30cm.

Family: *Geraniaceae*





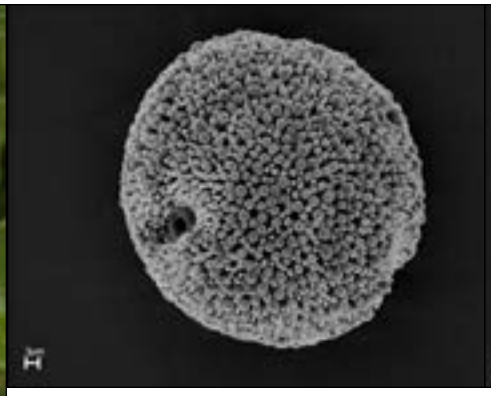
Geranium molle

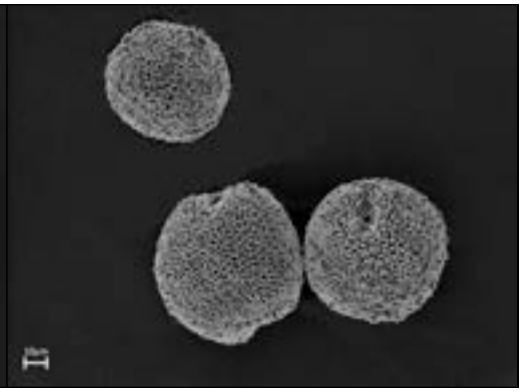
Dove's-foot Crane's-bill

Collection date: 1/6/07 **SEM date:** 8/6/07 **Location:** Shoreham Beach, West Sussex

Geranium molle is a trizonoporate grains, >55µm without vestibulate pori. Geranium pollen grains are semitectate, reticulate with each porous elongated into an ellipse . The exine structure is often complex, with clavate or baculate projections on top of the reticulum muri appearing even in height and consistent in size.

A native plant to rough ground, dry grass areas and waste land, to about 30cm in height.





Geranium pratense

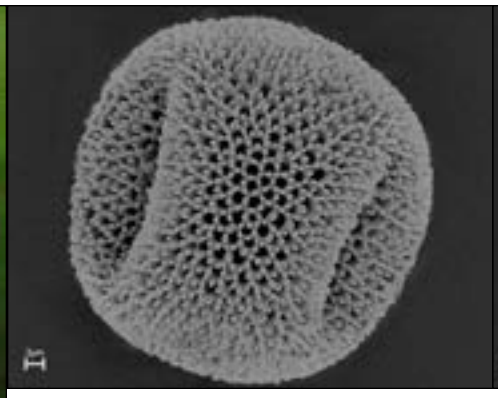
Meadow Crane's-bill

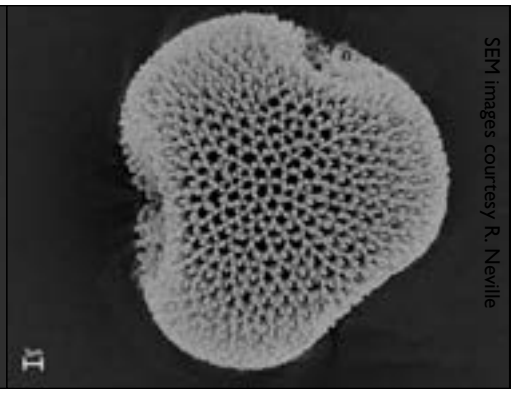
Collection date: 14/6/07 **SEM date:** 21/6/07 **Location:** Ditchling Road, West Sussex

Geranium pratense is a trizonoporate grains, >55µm without vestibulate pori. Geranium pollen grains are semitectate, reticulate with each porous elongated into an ellipse . The exine structure is often complex, with clavate or baculate projections on top of the reticulum muri but appearing uneven in height.

Native to meadows, damp places and road sides, to about 75cm in height and often sprawling.

Family: *Geraniaceae*





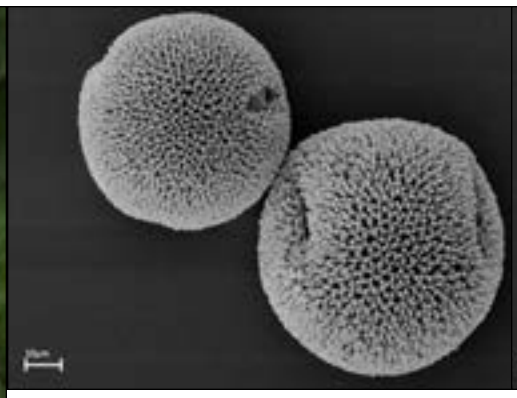
SEM images courtesy R. Neville

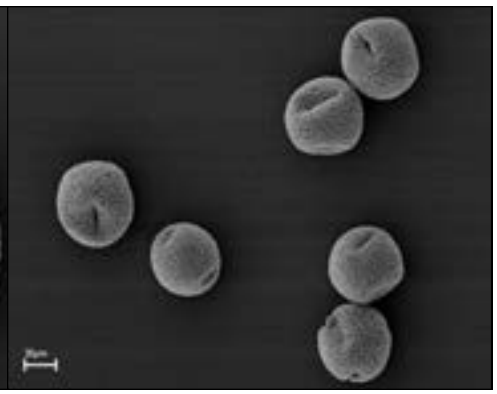
Geranium robertianum — Herb-Robert

Collection date: **SEM date:** 26/10/06 **Location:**

Geranium robertianum is a trizonoporate grains, >55µm in size without vestibulate pori. Geranium pollen grains are semitectate, reticulate with each porous elongated into an ellipse . The exine structure is often complex, with clavate or baculate projections on top of the reticulum muri appearing even in height and consistent in size.

A very common plant to moist, shaded areas often along the edges of woods, old gardens and maritime shingle and scree. To about 50cm in height and flowering sporadically throughout the growing season.





Geranium sylvaticum — Wood Crane's-bill

Collection date: 6/6/07 **SEM date:** 8/6/07 **Location:** Brighton, West Sussex

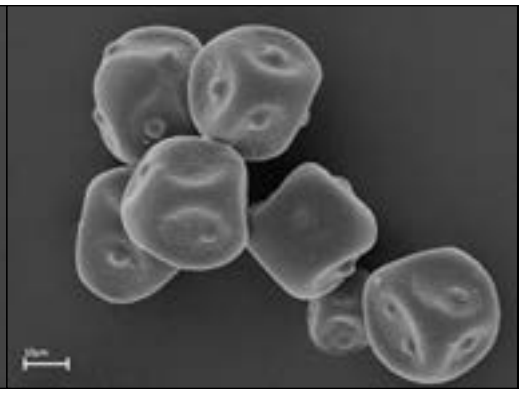
Geranium sylvaticum is a trizonoporate grains, >55µm in size without vestibulate pori. Geranium pollen grains are semitectate, reticulate with each porous elongated into an ellipse . The exine structure is often complex, with clavate or baculate projections on top of the reticulum muri appearing slightly uneven in height and size.

Native to woods, hedges, roadsides and commonly found in shade, to about 50cm in height and often sprawling.

Geraniaceae family summary.

The six *Geranium* species featured in this family are all trizonoporate grains, >55µm in size without vestibulate pori. *Geranium* pollen grains are semitectate, reticulate with each porous elongated into an ellipse . The exine structure is often complex, with clavate or baculate projections on top of the reticulum muri. The differences exist in the tectum and the bacula. *Geranium cinerea* and *Geranium dissectum* have a heavy tectum covering the underlying sculpture revealing little below. While *Geranium sylvaticum* projections on top of the reticulum muri appear slightly uneven in height and size. *Geranium molle, Geranium robertianum* and *G. sylvaticum* appear identical both is overall sculpturing detail, the consistency of that detail and the overall shape of the grain. Moore *et al* (1991, pp. 123) makes no distinction of individual pollen grains of the *Geranium* family below that of the genus level.

Family: *Grosulariaceae*



Ribes sanguineum **Flowering Currant**

Collection date: 17/4/07 **SEM date:** 18/4/07 **Location:** Wakehurst Place, West Sussex

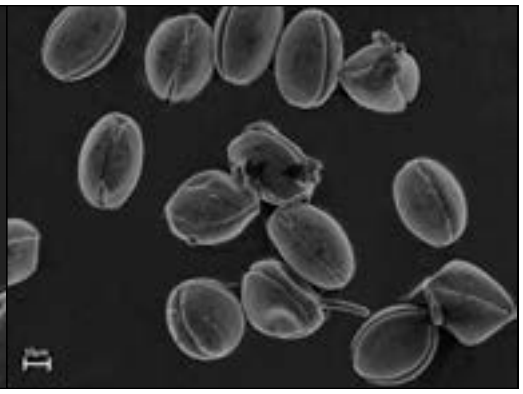
Ribes sanguineum is a hexopantoporate psilate grain, circular to obtusely angular appearing almost square and 'dice' like. The endopori (pori) occur on the flattened or concave areas of the exine. Each endopori is surrounded by a defined but irregular intectate-granulate zone. Occasionally these zones join so that two endopori share the same zone (see image, above right, grain in the lower right corner).

A common landscape shrub found in gardens that maybe found as a relic on abandoned land. A large shrub to about 3m in height.

Grosulariaceae family summary.

According to Moore *et al,* (1991, pg 107) *Ribes sanguineum* is not distinguishable from other *Ribes* species including he following, *R. rubrum, R. nigrum, R. petraeum, R. spicatum* and *R. aureum.* The grains of *R. sanguineum* however, are in the course of this research unique and easily distinguished from the 267 samples collected defined by their characteristic circular to obtusely angular shape with protruding, clearly defined endopori surrounded by a defined intectate-granulate zone.

Family: *Gunneraceae*



Gunera manicata **Prickly Rhubarb**

Collection date: 7/5/07 **SEM date:** 35/5/07 **Location:** Bedgeburry Pinetum, Kent

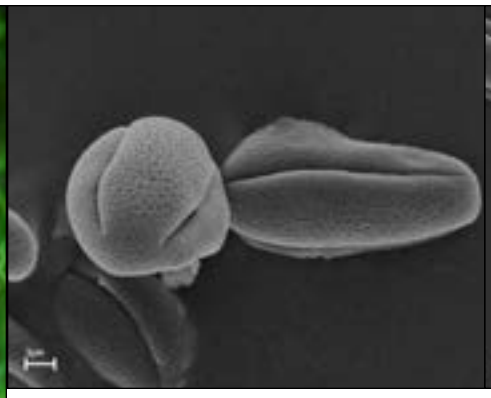
Gunera manicata is a trizonocolporate psilate pollen grain, the grain is circular-elliptic in equatorial view and it is longer than it is broad. The colpi terminate well before the poles but are broad and shallow. The grain lacks any sculpturing detail.

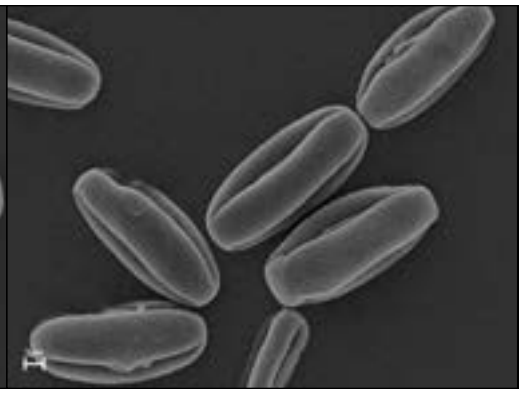
A plant from South America that has been in cultivation for over 100 years (Sanders) in English gardens, found as an escapee along streams, rivers, swamps and other damp places, it can reach a height of over 3m.

Gunneraceae family summary.

A pollen grain of little distinction except in its simplicity and rounded form. These two dull characteristics, or in the one case the lack of character, bestow a degree of distinction on this pollen grain within the context of the 267 grains analyzed. Coutts (1937) lists one other *Gunera* as popular at that time that G. manicata was introduced: *G. scabra.* Hence confusion may exist today about which species is currently in cultivation as their identities are very similar excepting that *G. scabra* has a slightly red tinge to its blooms. The plant pictured above located in the Bedgeburry Pinetum is labeled *G. manicata* but according to the description given by Coutts it more closely resembles *G. scabra.* If this confusion were resolved it would be interesting to compare the pollen gain morphology of each as this species of this plant which is quite common, especially in the southwest of England where the moist climate is conducive to rapid and full growth. It is a plant that produces copious amounts of pollen.

Family: *Hyperaceae*





Hypericum perforatum **Perforate St John's-wort**

Collection date: 9/6/07 **SEM date:** 15/6/07 **Location:** Adur Valley, West Sussex

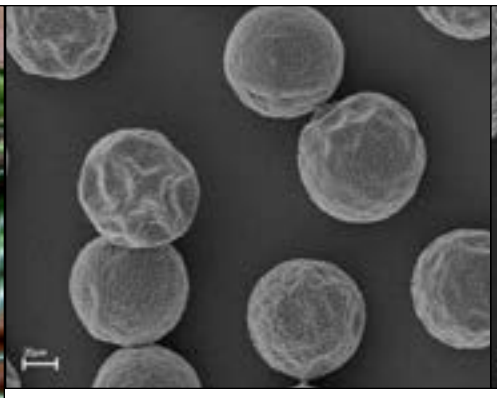
Hypericum perforatum is a trizonolcolporate pollen grain, >< 30 µm is size that is commonly elliptic to rhombic obtuse in equatorial view. The colpi are narrow with the sides slightly gaping and with the margins appearing to be in rolled except at the bridge portion, terminating at the poles. The psillate colpus membrane extends through the colpi at the equator producing an equatorial bridge. Sculpture is microreticulate to reticulate across the exine.

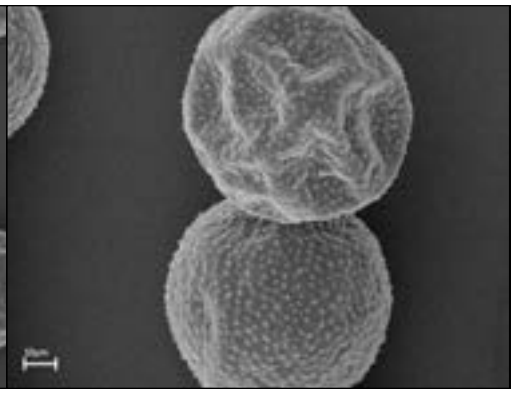
A native plant to dry grassland and waste places. Height: 75cm.

Hyperaceae family summary.

Hypericum perforatum is a trizonolcolporate pollen grain very similar in structure to such grains as *Lepidium campestre* however according to Moore *et al* (1991, 127) careful keying of this genus is important as its morphological characteristics closely resemble that of many other pollen grains. The following pollen grains, *H. perforatum, H. tetraterum, H. hirsutum, H. maculatum, H. pulchrum* are according to Clarke (1976) are difficult to discern to the species level without a type collection to compare them against.

Family: *Iridaceae*





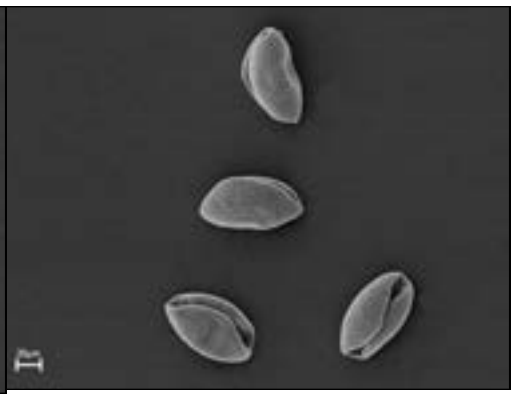
Crocus tommasinianus

Lavender Crocus

Collection date: 28/4/07 **SEM date:** 1/5/07 **Location:**

Crocus tommasinianus is a monoporate, echinate pollen grain, >40µm in size and orbicular in shape. The echinae are variable in size and are acutely pointed and evenly scattered across the exine.

A cultivated plant but often naturalizing in abandoned areas and waste ground near gardens. To about 15cm in height.



Iris foetidisima

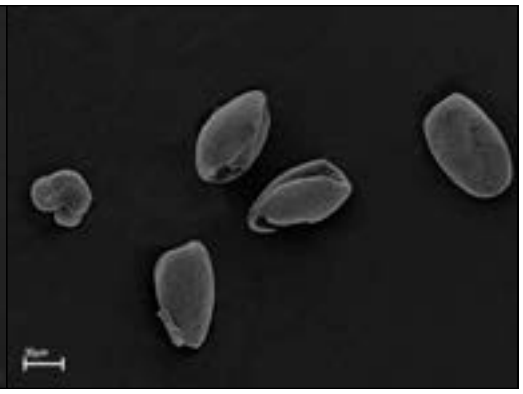
Stinking Iris

Collection date: 6/6/07 **SEM date:** 8/6/07 **Location:** Ditchling Road, Brighton, West Sussex

Iris foetidisima pollen grains are bean or D-shaped, monocolpate reticulate, quite large, > 50 µm in length. The lumina are consistent in size and are clearly defined but showing some decrease in size towards the colpus margins and poles. The lumina arrangement are angular irregular in form, with muri in some instances abrutly terminating. The colpus is large, and quite irregular in form, apparing as if torn or ruptured and folding over upon istself at the equator.

A native plant found in dry locations in woods, hedges, banks and cliffs, common on calcareous soils, to 75cm in height and recognizable after flower by the clustrer of orange-red berries that are produced.

Family: Iridaceae



Iris pseudocorus **Yellow Iris**

Collection date: 17/5/07 **SEM date:** 25/5/07 **Location:** Ardingly Reservoir, West Sussex

Iris pseudocorus pollen grains are bean or D-shaped, monocolpate reticulate, quite large, > 50 µm in length. The lumina are consistent in size but showing some decrease towards the colpus margins and poles. The colpus is large, and quite irregular in form, apparing as if torn or ruptured.

A native plant found along the edges of swamps, wet meados, slow moving rivers and streams and bogs. A tall plant to about 1-1.5m in height.

Iridaceae family summary.

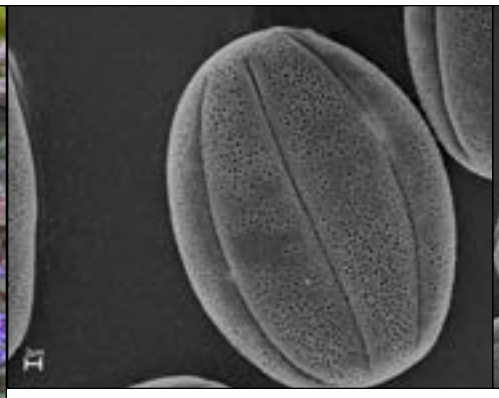
Crocus tommasinianus is a monoporate, echinate pollen grain, orbicular in shape while both *Iris* species pollen grains are bean or D-shaped, monocolpate reticulate, quite large, > 50 µm in length.

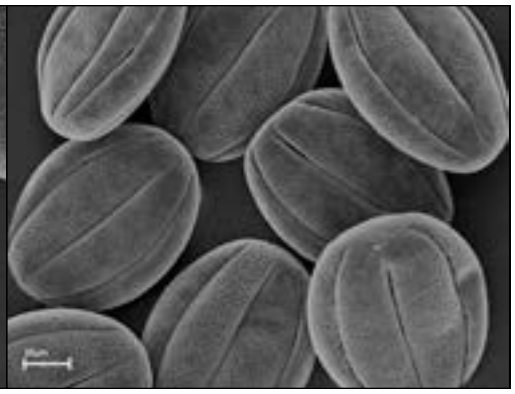
The *Iris* are indistingguishable from each other since both have identical surface scultupturing, however *C. tommasinianus* is distinct both in its shape and surface scultputre; being regulary echinate and orbicular.

Stace (1991, pp. 950-960) lists 12 other *Iris* species and hybids and 13 *Crocus* species and hybrids in addition to 11 other genera in the *Iridaceae* family, hence there is ample oppurtunity for further SEM analysis and comparrion.

The echinae of C. *tommasinianus* are variable in size and are acutely pointed and evenly scattered across the exine, these characteristics are very similar to those associated with the pollen of *Lonicera* and *Arum* species.

Family: *Lamiaceae*



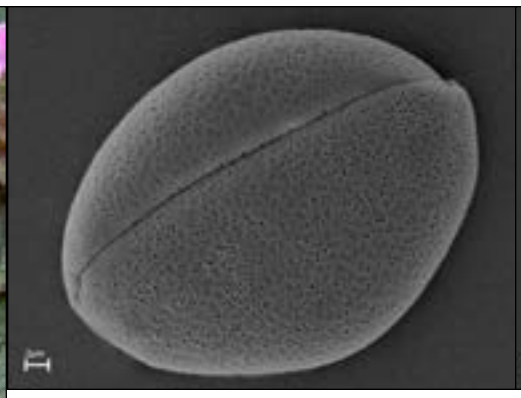


Glechoma hederaceae **Ground-ivy**

Collection date: 2/4/07 **SEM date:** 4/4/07 **Location:** Stamnar Woods, West Sussex

Glechoma hederaceae pollen grains are pentazonocolporate, psilate, suprareticulate, perforate, with not all lumina being perforated. Overall grain shape is orbicular obtuse in equatorial view but elliptical in polar views with grain size consistent. The mesocolpia is only slightly convex and the colpi appear not to be deeply sunken.

A native plant common to woods, hedgerows, gardens, lawns and moist grassy areas on heavy soils.



Lamium purpurem **Red Dead-nettle**

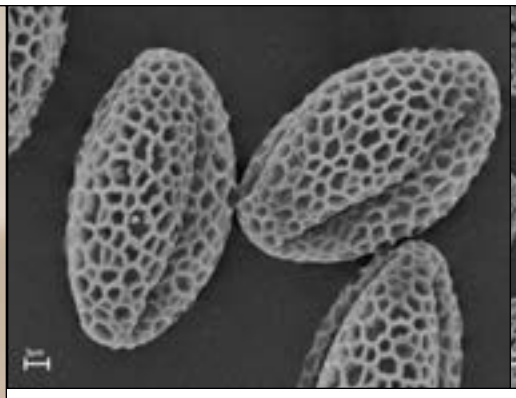
Collection date: 19/2/07 **SEM date:** 19/2/07 **Location:**

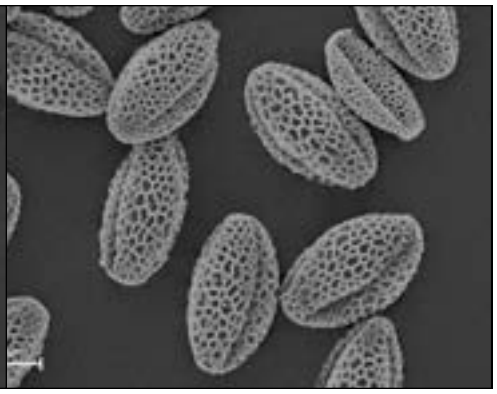
Lamium purpureum is a trizonocolpate suprareticulate grain, < 45 µm long, circular to lobed circular in equatorial view. The colpi is wide, longer than the grain in equatorial view and terminates acutely in the poles. The lumina appear similar in size to that of the muri under image magnification with a scattering of perforations throughout.

A common native plant frequently found on both waste and cultivated grounds, to about 25cm in height.

Flower mages courtesy : http://www.plant-identification.co.uk/images/labiatae/lamium-purpureum-4.jpg

Family: *Lamiaceae*



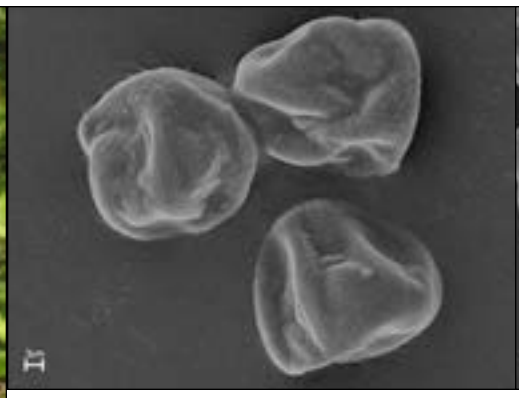


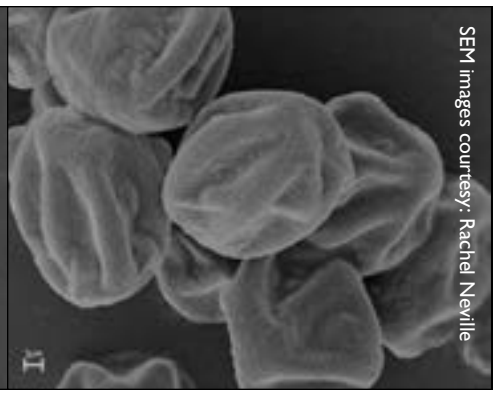
Mentha aquatica — Water Mint

Collection date: 28/4/07 **SEM date:** 1/5/07 **Location:**

Mentha aquatica pollen grains are elliptic in equatorial polar view, trizonocolpate, reticulate with the colpus almost running the full length of the grain and terminating at the poles. The colpi are consistently narrow in width are reticulate to the colpi margins. The lumina are large and show little decrease in size towards the colpus and the poles. The muri are simplicolumellate and are narrower than the lumina. These characteristics are common to many genus and species in the *Brassicaceae* family.

A native plant to marshes, wet ditches moist fields and pond margins, to about 75cm in height.





SEM images courtesy: Rachel Neville

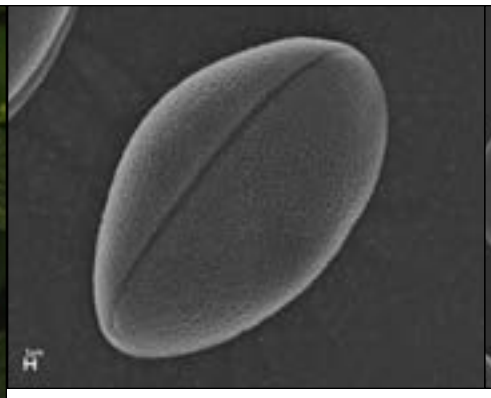
Prunella vulgaris — Self-heal

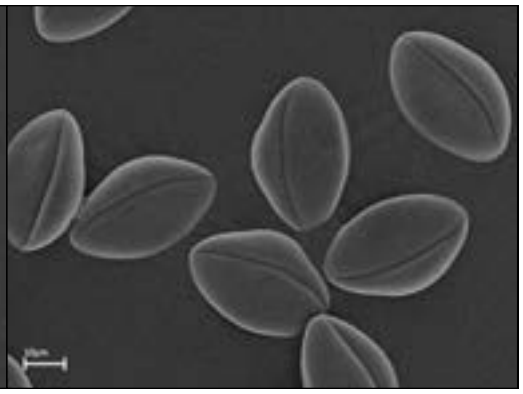
Collection date: 19/2/07 **SEM date:** 19/2/07 **Location:**

The pollen grains of *Prunella vulgaris* demonstrate consistent collapse, however in polar views the grains appear to be pentazonocolporate, psilate to scabrate and suprareticulate, this would appear consistent with Moore's interpretation of this genus (Moore, 1991, pp. 131).

A native plant common to most grassy areas in Britain. To about 40cm in height.

Family: *Lamiaceae*



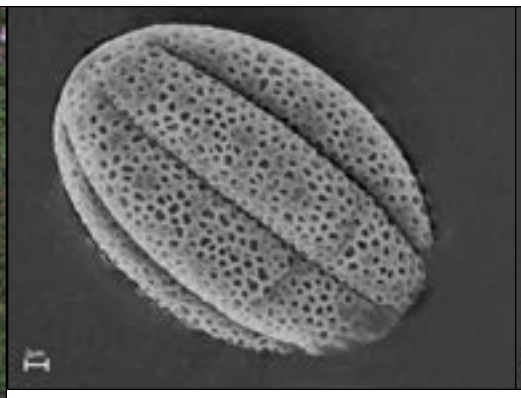


Stachys sylvatica — Hedge Woundwort

Collection date: 9/6/07 **SEM date:** 15/6/07 **Location:** Adur Valley, West Sussex

Stachys sylvatica is a trizonocolpate suprareticulate grain, < 45 µm long, elliptic to circular in equatorial view. The colpi is wide, longer than the grain in equatorial view and terminates acutely in the poles. The lumina appear similar in size to that of the muri under image magnification with a scattering of perforations throughout and are consistent across the surface appearing psilate at a glance.

A common, native plant found throughout Britain on rough ground, hedgerows and native wood margins. Height: 75cm. Identifiable by its strong, unpleasant bitter smell when the foliage is crushed.



Thymus serphyllum — Breckland Thyme

Collection date: 14/6/07 **SEM date:** 29/6/07 **Location:** Wakehurst Place, West Sussex

Thymus serphyllum pollen grains are polyzonocolpate which are eureticulate to suprareticulate and consistently scattered across the exine with small lumina with possible perforations in the floor of these. The mesocolpia is slightly convex with the colpi sunken and terminating before the poles. Pollen grain shape is obtuse-orbicular in equatorial view and elliptical in polar view with the grain size being consistent.

Native to sandy heaths and lean soils, to about 15cm in height.

Lamiaceae family summary.

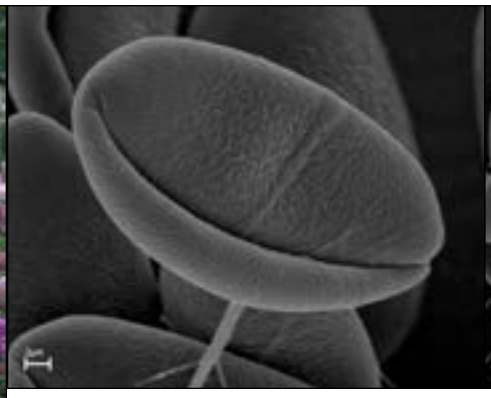
Mentha aquatica pollen grains are elliptic in equatorial polar view and trizonocolpate, reticulate with the colpus almost running the full length of the grain and terminating at the poles. The lumina are large and show little decrease in size towards the colpus and the poles. The muri are simplicolumellate and are narrower than the lumina. These characteristics are common to many genus and species in the Brassicaceae family. *M. aquatica* both floristically and morphologically resembles members of the *Brassicaceae* more so than members of the *Lamiaceae* family: this plant may warrant closer taxonomic scrutiny to determine if it is in fact in the correct family.

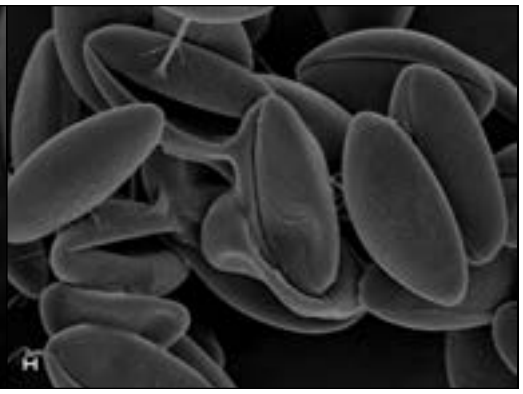
Thymus serphyllum pollen grains are polyzonocolpate while *Glechoma hederaceae* pollen grains are pentazonocolporate however their exine sculpture and grain shape is identical. Both pollen grains are eureticulate to suprareticulate with this characteristic consistently scattered across the exine. Small lumina are present with possible perforations in the floor of these. The mesocolpia is slightly convex with the colpi sunken and terminating before the poles. Pollen grain shape is obtuse-orbicular in equatorial view and elliptical in polar view with the grain size being consistent. The overall character of these two members of the *Lamiaceae* family bear a close resemblance to the pollen morphology of *Primula vulgaris* and *Primula veris.*

Lamium purpureum and *Stachys sylvatica* are trizonocolpate suprareticulate pollen grains, < 45 µm long, circular to lobed circular in equatorial view. The colpi is wide, longer than the grain in equatorial view and terminates acutely in the poles. The lumina appear similar in size to that of the muri under image magnification with a scattering of perforations throughout, this character is especially noticeable on *L.. purpureum. S. sylvatica* surface sculpture is much more pronounced, being almost rugulate when compared to the surface sculpture of *L. purpurem* which is psilate to possibly micro-scabrate.

The pollen grains of *Prunella vulgaris* demonstrate consistent collapse, however in polar views the grains appear to be pentazonocolporate, psilate to scabrate and suprareticulate, this would appear consistent with Moore's interpretation of this genus (Moore, 1991, pp. 131).

Family: *Liliaceae*



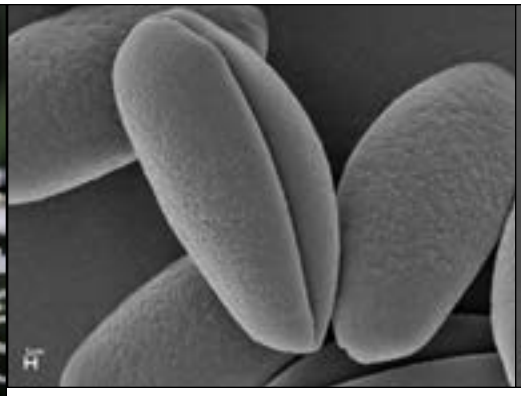


Allium schoenoprasum Chives

Collection date: 9/5/07 **SEM date:** 16/5/07 **Location:** Wakehurst Place, West Sussex

Allium schoenoprasum is a monocolpate, psilate-scabrate, non-perforate elliptical grain with the copli restricted to the distal side of the grain and terminating before the poles; grain size is > 35 µm . The mesocolpium is flat or slightly concave with the colpus margins appearing in rolled.

A plant common to rocky ground, usually limestone and hence found frequently along the Sussex cliffs. The plant is clump forming, to 50cm in height topped by purple blooms in May-June. The plant has tubular leaves and a distinct onion smell when the foliage is crushed. Very common and often grown as a cultivated vegetable.



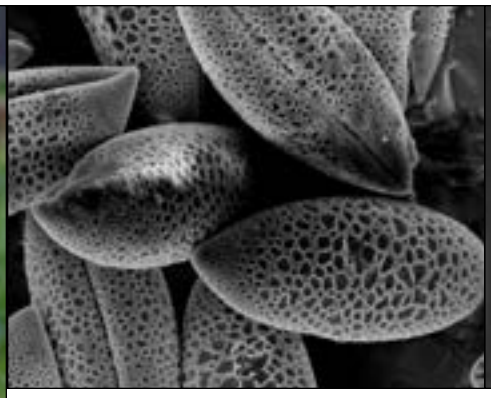
Allium ursinum Ramsons

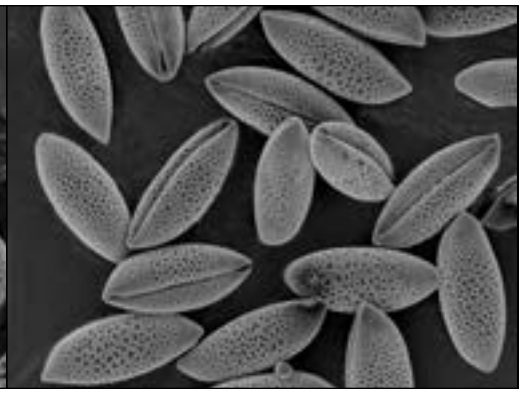
Collection date: 10/5/07 **SEM date:** 16/5/07 **Location:** Wakehurst Place Kew West Sussex

Allium ursinum is a monocolpate, psilate-scabrate, non-perforate bluntly elliptical grain in equatorial view with the copli restricted to the distal side of the grain and terminating before the poles; grain size is > 35 µm . The mesocolpium is flat or slightly convex with the colpus margins appearing in rolled and wider than *A. schoenoprasum.*

A very common plant to 45cm found in shade often growing in native woods and undisturbed soil that may be slightly damp. It can form a thick carpet of white blooms with the foliage basally arranged and not superseding he blooms.

Family: *Liliaceae*



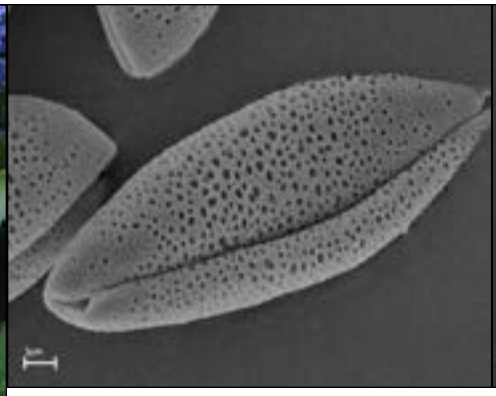


Fritilaria melagris **Fritillary**

Collection date: 10/4/07 **SEM date:** 11/4/07 **Location:** Wakehurst Place, West Sussex

Fritilaria melagris is a monoporate reticulate sharply elliptical grain with the copli restricted to the distal side and terminating before the poles. The size of the lumina in the center of the mesocolpium are quite large, although smaller lumina adjoin the larger ones. The lumina decrease in size towards the margins of the colpus, in some instances the exine in this area appears almost psilate.

A plant infrequent to damp meadows growing to a height of 50cm. Both purple and white flowered forms are found growing together: it is often cultivated in gardens



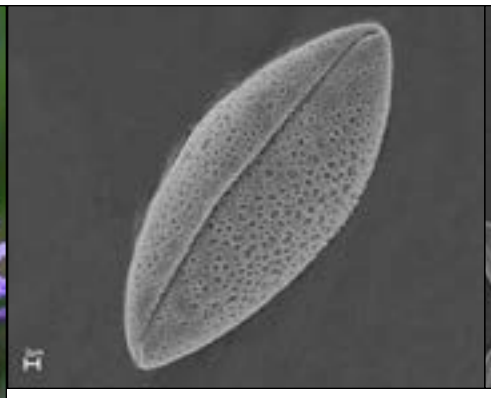
Hyacinthus orientalis **Hyacinth**

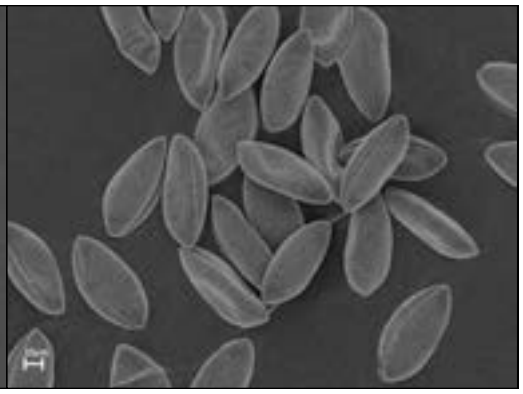
Collection date: 19/2/07 **SEM date:** 19/2/07 **Location:**

Hyacinthus oreintalis is a monoporate reticulate elliptical (some variance in shape) grain with the copli restricted to the distal side and terminating in the poles. The size of the lumina in the mesocolpium varies with a doubling in size in many instances but decreasing in size towards the margins of the colpus, in some instances the exine in this area appears almost psilate. The colpus appears in rolled and folded at the poles and widens at this point. There is an above average variance of grain size when compared to other members of the family.

Found as a garden escapee the plant is rare in the wild but common in the cultured landscape. Blooms can vary depending on the cultivar but may range from blue, white, pink, purple to red. Reaching a height of 40cm it has large fragrant, single stem blooms.

Family: *Liliaceae*



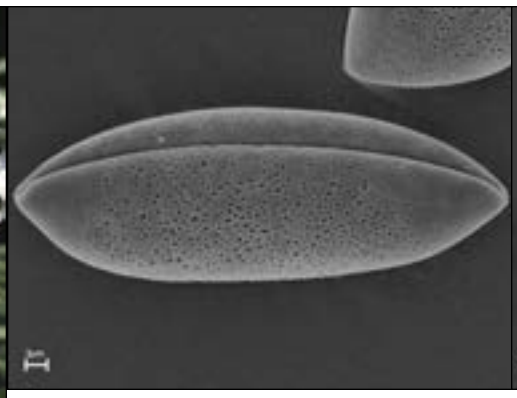


Hyacinthoides non-scripta **Bluebell**
(formerly *Endymion non-scriptus*)

Collection date: 10/4/07 **SEM date:** 18/4/07 **Location:** Wakehurst Place, West Sussex

Hyacinthoides no-scripta is a monoporate reticulate sharply elliptical grain with the copli restricted to the distal side of the grain and terminating at the poles. The size of the lumina in the mesocolpium varies with a doubling in size in many instances but decreasing in size towards the margins of the colpus, in some instances the exine in this area appears almost psilate.

A very common plant that symbolizes spring in Britain. Most commonly blue blooms but occasionally white and pink variations can be seen. Found in woods, hedges, banks and grassland where conditions may be moist, to about 40 cm in height.



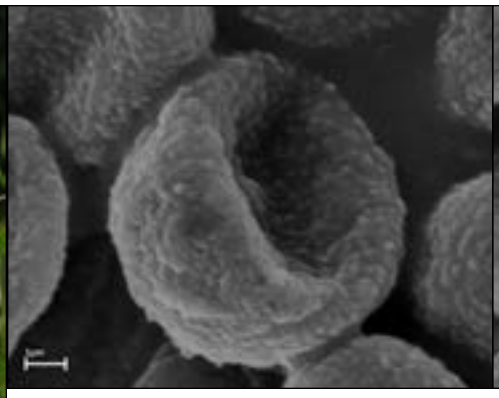
Hyacinthoides non-scripta **(white flowered form)** **Bluebell**
(formerly *Endymion non-scriptus*)

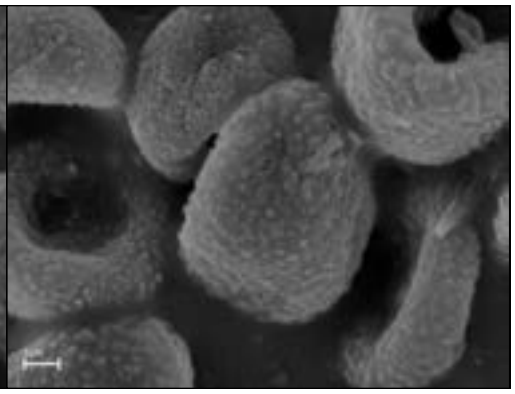
Collection date: 17/4/07 **SEM date:** 25/4/07 **Location:** Wakehurst Place, West Sussex

Hyacinthoides no-scripta is a monoporate reticulate sharply elliptical grain with the copli restricted to the distal side of the grain and terminating at the poles. The size of the lumina in the mesocolpium varies with a doubling in size in many instances but decreasing in size towards the margins of the colpus, in some instances the exine in this area appears almost psilate.

A very common plant that symbolizes spring in Britain. Most commonly blue blooms but occasionally whites and pink variations can be seen. Found in woods, hedges, banks and grassland where conditions may be moist, to about 40 cm in height.

Family: *Liliaceae*



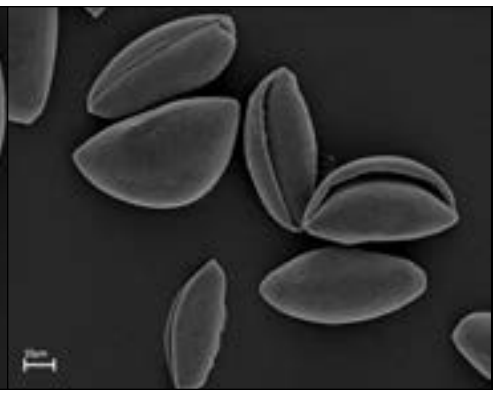


Muscari neglectum Grape-hyacinth

Collection date: 4/4/07 **SEM date:** 21/4/07 **Location:** Tongdean Road, Brighton, West Sussex

Muscari neglectum is a monoporate, orbicular shaped verrucate grain with the verrucae irregular in size and uniformity. The grain has little other distinguishing sculpturing details but does show signs of partial grain collapse.

Often confused with *M. aremeniacum,* a commonly naturalized plant in the south of England but rare in the north. *M. neglectum* has pale blue flowers with white borders while *M. armenicaum* has dark blue blooms. Found growing in dry pastures, fields and hedgerows it can reach a height 30cm. The flowers are sterile.



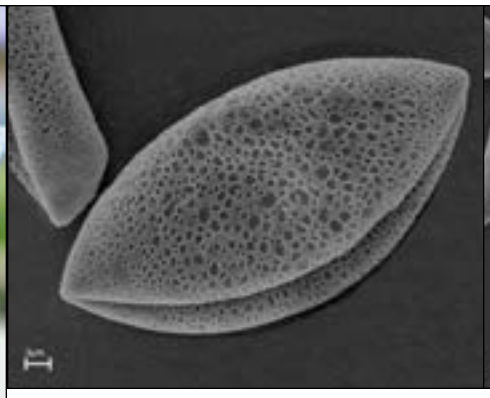
Polygonatum multiflorum Solomon's-seal

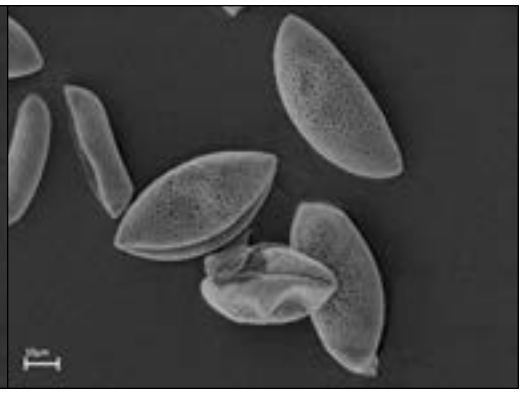
Collection date: 9/5/07 **SEM date:** 25/5/07 **Location:** Tongdean Road, West Sussex

Polygonatum multiflorum is a monocolpate, psilate-scabrate, non-perforate elliptical grain with the copli restricted to the distal side of the grain and terminating before the poles; grain size is > 35 µm . The colpi are broad spreading to open, rolling inwards to the meridian of the pollen grain.

A common plant of southern England, often found in moist, partially shaded wooded areas. A striking plant both in foliage characteristics and bloom it can reach height of 70cm and forms large clumps or groups.

Family: *Liliaceae*





Scilla siberica **Siberian Squill**

Collection date: 25/2/07 **SEM date:** 26/2/07 **Location:** Preston Manor, Brighton, West Sussex

Scilla siberica is a monoporate reticulate elliptical grain with the copli restricted to the distal side of the grain and terminating at the poles. The size of the lumina in the mesocolpium varies with a doubling in size in many instances but decreases in size towards the margins of the colpus, in some instances the exine in this area appears almost psilate.

A common spring geophyte often found growing and naturalized from gardens. The flower is typically blue although variations in colour intensity may be found. It will tolerate a wide variety of conditions but is typically found in partial, moist shade and reaches a height of 20cm.

Liliaceae family summary.

The *Liliaceae* family represented here contain three distinct pollen morphologies.

Monocolpate, psilate-scabrate, non-perforate elliptical grain representing A. *schoenoprasum A. ursinum* and *P. multiflorum.*

Monoporate reticulate elliptical grains are represented by *F. melagris, H. oreintalis, H. no-scripta* (both white and blue flower forms) and *S. siberica*. While one genera is represented in the monoporate, orbicular shaped verrucate pollen grain, that of *M. neglectum.*

The monocolpate group including the *Alliums*' and *Polygonatum* are very similar, both species of *Allium* according to Moore and Webb (1978, pp. 57), exhibit little distinction when compared to type slides collections for the genus and closely resemble that of *Polygonatum.* The two *Allium* species presented do exhibit distinct differences in grain morphology, the most obvious being the psilate-scabrate sculpting of A. *schoenoprasum* when compared to the psilate exine of *A. ursinum*. There are also

Liliaceae family summary continued.

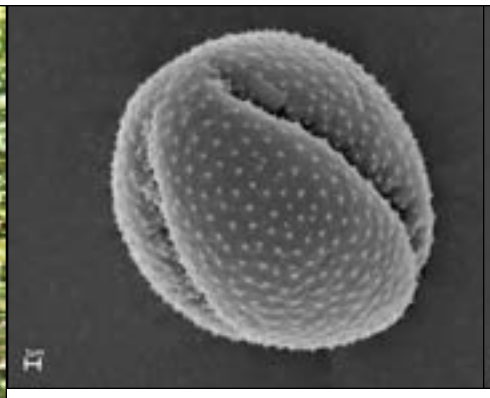
differences in the colpus width, *A. schoenoprasum* colpi width is much more pronounced than *A. ursinum* however it closely resembles that of *P. multiflorum,* rendering it as a distinct difference in these closely related group. It would be interesting to develop a type collection of related species to determine if in fact there were distinct, reliable differences between pollen grains of both the *Allium* and *Polygonatum* groups. What has been presented (pollen grain morphology) may be attributable variations in only one collection from one group of plants in one location. The variability in grains that does exist may not hold true through plants of the same species from other populations or variable environmental conditions. Common species of *Allium* that warrant further examination are *A. cepa, A. uniflorum, A. roseum, A. neapolitanum, A. moly, A. triquetrum, A. paradoxum, A. oleraceum, A. carinatum, A. satium, A. porrum, A. scorodoprassum , A. vineale* and the related species *Nectaroscordum siculum* (Stace, 1997, pp. 938-941). There are also two species of *Polygonatum* listed by Stace (1997, pp. 930) as common, *P. odoratum* and *P. verticillium* and one hybrid form *P. x hybridum* that should be collected and compared to *P. multiflorum* presented in this research.

The second group of pollen grains presented are monoporate reticulate elliptical grains represented by the genera *F. melagris, H. oreintalis, H. no-scripta* (both white and blue flower forms) and *S. siberica*. This group is also very close morphologically. No distinction under SEM exists between the blue and white flowered forms of *H. no-scripta,* typically what has been observed in variant flower forms of the same species is pollen grain collapse (see *Symphytum officinale* and *Verbascum thapsus*). *H. oreintalis,* and *H. no-scripta* are also identical in morphological characteristics although the lumina appear to be a little larger. This attribute needs to be further researched, measurements recorded again across a wider population before it can be listed as a firm identification characteristic, however they appear similar in character and size to *S. siberica. F. melagris* is undoubtedly one of the most distinct pollen grains in this monoporate grouping, with very large , coarse lumina, the largest of all the *Liliaceae* family members presented in this chapter. This grain characteristic should be compared to other members of the genus listed below for further confirmation. Stace (1997, pp. 928-934) lists the following common species of *Hyacinthoides* and *Scilla* that warrant collection and SEM analysis (note only one species of *Hyacinthus* and *Fritilaria* are listed as common in Stace, those are represented in this research): *Hyacinthoides italica, H. hispanica, H. non-scripta x H. hispanica, S. bifolia, S. verna, S. liliohyacinthus,* and *S. autumnalis.*

Liliaceae family summary continued.

The final pollen grain classification in the *Liliaceae* family presented is the monoporate, orbicular shaped verrucate grain of *M. neglectum.* This grain shows extensive collapse and although according to Moore *et al* (1991, pp. 115) the grain characteristics should closely resemble that of the *Allium* and *Scilla* genera the images presented here do not concur with that finding. Grain collapse could be I suspect a factor, since morphologic detail is difficult to read. This may be attributable to flower sterility (Stace, 1997, pp. 935) the handling and processing protocol and timing from pollen collection to analysis; 19days. Further analysis needs to be undertaken to determine reliable morphologic characteristics that are consistent with Moore *et al* and are representative of the genera. Stace (1997, pp. 935) lists four other species of *Muscari* common to Britain including the represented species, collections of *M. aremeniacum, M. botryoides* and *M. comosum* should be initiated for comparative analysis as well as a fresh collection of *M. neglectum.*

Family: *Lythraceae*



Lythrum salicaria **Purple-loosestrife**

Collection date: 14/6/07 **SEM date:** 29/6/07 **Location:** Wakehurst Place, West Sussex

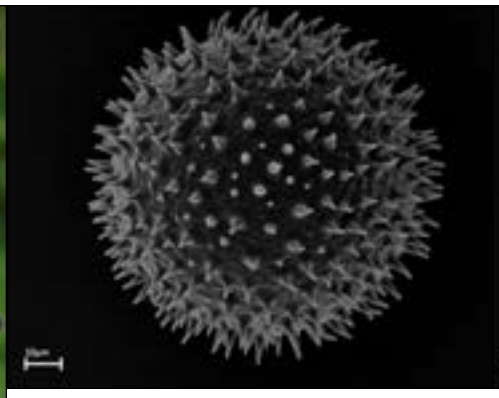
Lyhtrum salicaria is a heterocolpate pollen grain that is symmetrical in shape with apertures clearly zonally arranged. Pori are clearly defined, circular and not covered. Pollen grains are never equatorially constricted while the colpus membrane is clearly granulate with some areas of the exine striate. Non porate colpi are situated exactly between the porate colpi but not occupying wide areas.

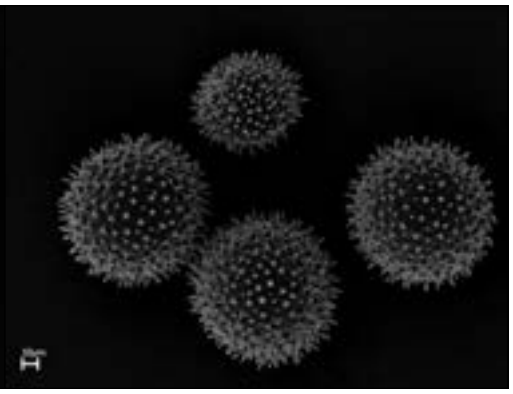
A common emergent aquatic species found along river edges, streams and swamps. Growing to 1.5m it is a striking, clump forming plant that may also be found cultivated in gardens.

Lythraceae family summary.

Lythrum salicaria is a heterocolpate pollen grain that is symmetrical in shape , the large echinae and wide colpus are unique characteristics that make this grain easily identifiable from the others collected and presented here. According to Moore *et al* (1997, pp. 154,-161) *L.. salicaria, L.. hyssopifolia* and *L.. portula* can be distinguished from each other and warrant collection and analysis. An introduced species, probably by birds, or from bird seed is *L.. junceum* and may warrant SEM analysis also (Stace, 1997, pp.440).

Family: *Malvaceae*



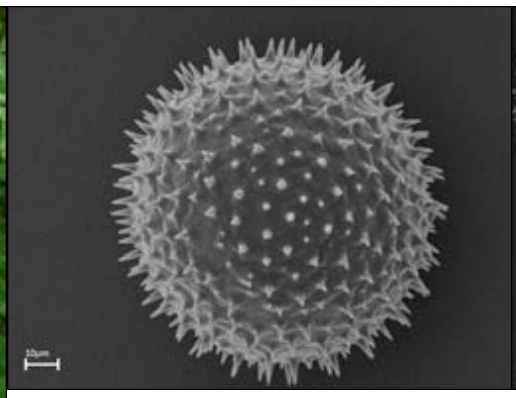


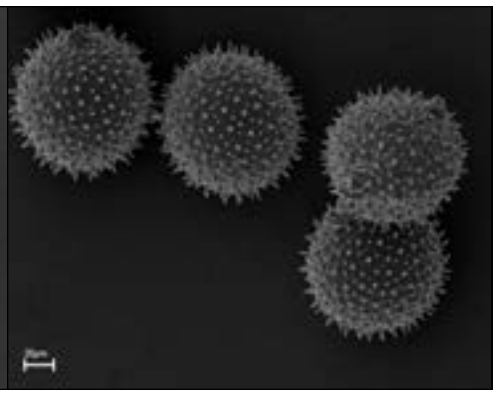
Malva moschata — Musk-mallow

Collection date: 27/6/07 **SEM date:** 29/6/07 **Location:** Stamnar Woods, West Sussex

Malva moschata is an orbicular polypantoporate, echinate, verrucate pollen grain. Grain size is quite large, > 60 µm with large, distinct, acultey pointed echinae evenly distributed across the exine. The verrucae are small and uneven is size and appear randomly scattered across the exine.

A native plant common to grassy banks, abandoned fileds and roadsides, especially prevelant on rich or recently abandoned but once cultivated areas. Quite showy in bloom the plant can reach a heigh of 1m.





Malva sylvestris — Common Mallow

Collection date: 6/6/07 **SEM date:** 8/6/07 **Location:** Ferring Rife, West Sussex

Malva sylvestris is an orbicular polypantoporate, echinate, verrucate pollen grain. Grain size is quite large, > 60 µm with large, distinct, acultey pointed echinae evenly distributed across the exine. The verrucae are small and uneven is size and appear randomly scattered across the exine.

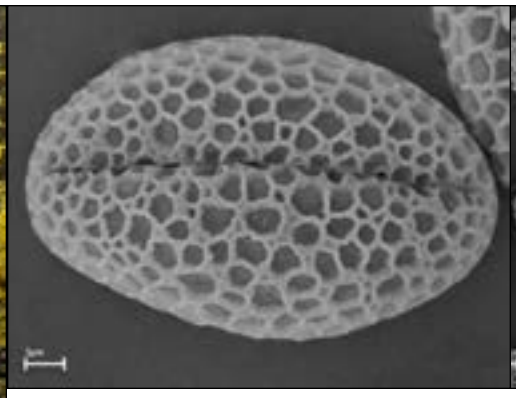
A native and often found on rough, abandoned ground or the gravel edges and shoulders of roads. *M. sylvestris* can reach a height of 1m and is easily distinguished from *M. moschata* by its prominent striping of the blooms.

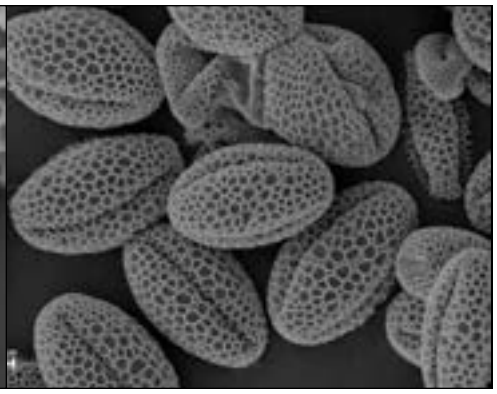
Malvaceae family summary.

Malva sylvestris and *Malva moschata* are similar both floristically and in pollen morphology. Pollen grain size and external morphologic characteristics such as echinae and verrucae are indistinguishable as per the examples. According to Moore *et al* (1991, pp. 109) there is little difference in pollen morphology between species of *Malva* and also the related genus of *Lavatera* and *Althaea.* However according to Culhane and Blackmore (1998), some distinction may be possible within this group of closely related species; *Althaea officinalis* may be distinguished from *Malva* and *Lavatera* because of the subglobose bases of the echinae which produce an undulating appearance in the pollen grain. One species of *Malva* however, according to Erdtman *et al* (1961) is distinct from other *Malva* species; *Malva pusilla* produces some grains with echinae while others may be baculate-clavate or verrucate. Further to Moore *et al* (1991) this may not be a reliable diagnostic tool since the variations occur too rarely for consistent and accurate identification.

Thus differentiation of *Malva* and other related species (*Lavatera and Althaea*) is still a point of confusion, no doubt personified by their similar floral evolution and floral morphology. Common species listed by Stace (1997, pp. 212—215) that might warrant comparative SEM analysis include *M. alcea, M. parviflora, M. neglecta,* and *M. verticllata,* but should also include the related genera of *Lavatera arborea, Althaea officinalis, A. hirsute* and *Alcea rosea.*

Family: *Oleaceae*



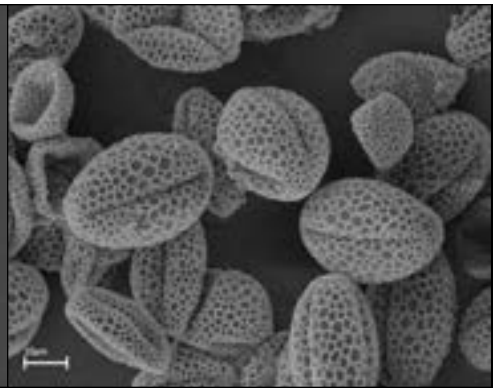


Forsythia x intermedia **Forsythia**

Collection date: 1/3/07 **SEM date:** 21/3/07 **Location:** Preston Park, Brighton, West Sussex

Forsythia x intermedia pollen grains are < 36µmin size, rhombic obtuse in equatorial view and orbicular in polar view. Grains are trizonocolpate, eureticulate with the colpi almost running the full length of the grain and terminating before the poles. The colpi is inconsistent in width and depth. The exine is lacunae-rugulate with the lumina size decreasing towards the colpi and the poles. The lumina floors are slightly granulate.

A plant of garden origin that has escaped or persisted in a few spots, to about 3m in height.



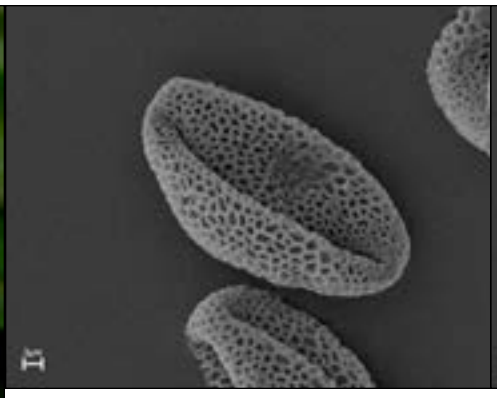
Forsythia x intermedia 'Lynwood' **Lynwood Forsythia**

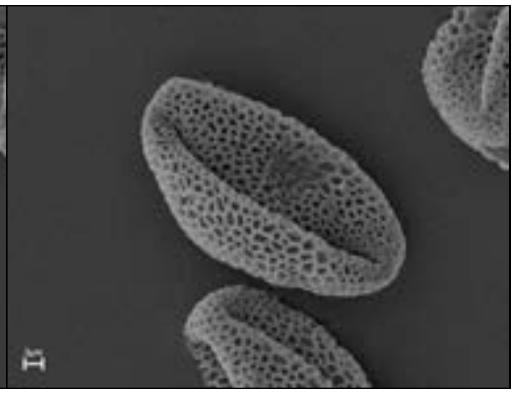
Collection date: 15/3/07 **SEM date:** 21/3/07 **Location:** Wakehurst Place, West Sussex

Forsythia x intermedia 'Lynwood' pollen grains are < 36µm in size, rhombic obtuse in equatorial view and orbicular in polar views. Pollen grains are trizonocolpate, eureticulate with the colpi almost running the full length of the grain and terminating before the poles. The colpi is inconsistent in width and depth. Exine is lacunae-rugulate with the lumina sizing decreasing towards the colpi and the poles. The lumina floors are slightly granulate.

A popular shrub of garden origin, many garden escapees may be this historic cultivar. Height: 3m.

Family: *Oleaceae*



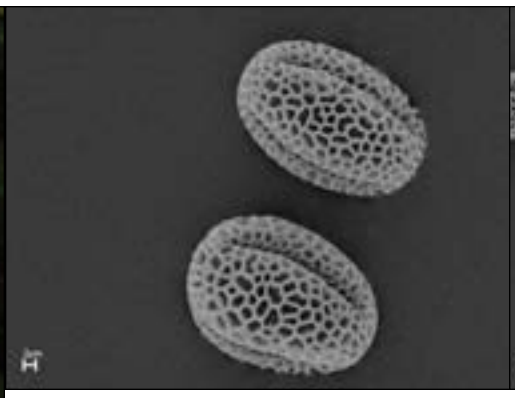


Jasminum nudiflorum — Winter Jasmine

Collection date: 25/2/07 **SEM date:** 26/2/07 **Location:** Preston Park, Brighton, West Sussex

Jasminum nudiflorum pollen grains are < 36µm in size, elliptic in equatorial view and elliptic-orbicular in polar view. Grains are trizonocolpate, reticulate with the colpi almost running the full length of the grain and terminating before the poles. The colpi is consistent in width and depth. Exine is lacunae-rugulate with the lumina sizing decreasing slightly towards the colpus margins and the poles and the muri approximately half the width of the lumina.

An introduced but often naturalized plant that is quite common. It is vine-like and flowers over the winter months.



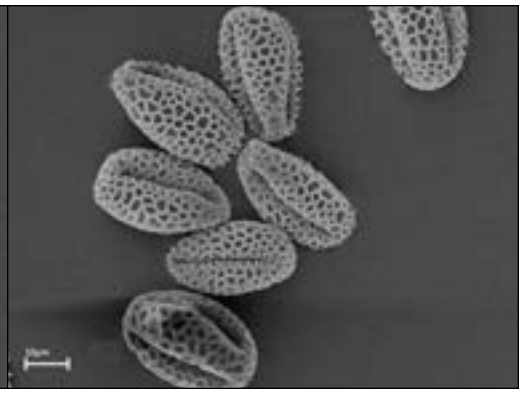
Ligustrum vulgare — Wild Privet

Collection date: 9/6/07 **SEM date:** 15/6/07 **Location:** Adur Valley, West Sussex

Ligustrum vulgare pollen grains are < 36µm in size, rhombic obtuse in equatorial view and orbicular in polar view. Grains are trizonocolpate, eureticulate with the colpi almost running the full length of the grain and terminating before the poles. The colpi is inconsistent in width and depth. The exine is lacunae-rugulate with the lumina sizing not decreasing towards the colpi.

A native plant common to hedgerows and also planted as a hedge. Fragrant white flowers that are very attractive to bees. To about 5m in height if not pruned.

Family: *Oleaceae*



Syringa vulgaris **Lilac**

Collection date: 29/4/07 **SEM date:** 2/5/07 **Location:** Preston Park, Brighton, West Sussex

Syringa vulgaris pollen grains are < 36µm in size, rhombic obtuse to elliptic in equatorial view and orbicular in polar view. Grains are trizonocolpate, eureticulate with the colpi almost running the full length of the grain and terminating before the poles. The colpi is consistent in width and depth. Exine is lacunae-rugulate with the lumina sizing decreasing slightly towards the colpus margins and the muri approximately half the width of the lumina.

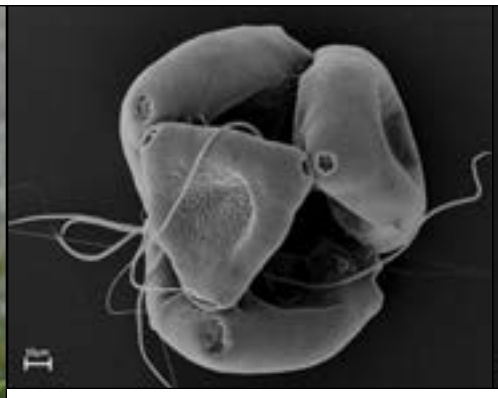
An introduced shrub that has naturalized and is now a frequent inhabitant of hedgerows and scrub. Height: 3m

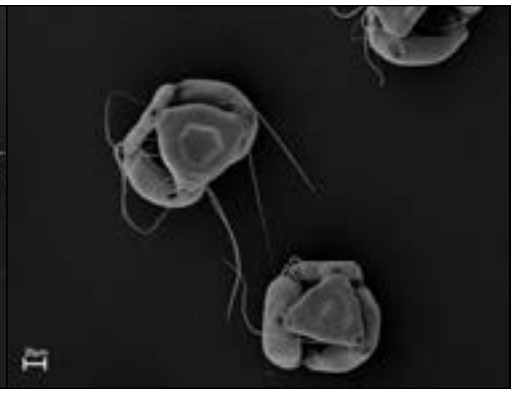
Oleaceae family summary.

All members of the *Oleaceae* family represented here have very similar shape and sculpturing of the pollen grains making determination of a specific genus challenging. Type slide collections might be a suitable tool for further reference as I suspect there will be slight incongruities within each pollen grain sculpturing. All grains are < 36µm in size, rhombic obtuse to elliptic in equatorial view and orbicular to elliptic in polar view. Grains are trizonocolpate, eureticulate with the colpi almost running the full length of the grain and terminating before the poles. The colpi is inconsistent in width and depth. The exine is lacunae -rugulate with the lumina sizing decreasing towards the colpi. Both *F. x intermedia and F. x intermedia 'Lynwood'* have lumina floors that are slightly granulate while the other species represented seem to lack this distinct identification characteristic.

Other common species (Stace, 1997, pp. 585-587) that warrant examination and comparison are F. *supensa, J. officinale, j. bessiana, Fraxinus excelsior* and *L. ovalifoium*.

Family: *Onagraceae*



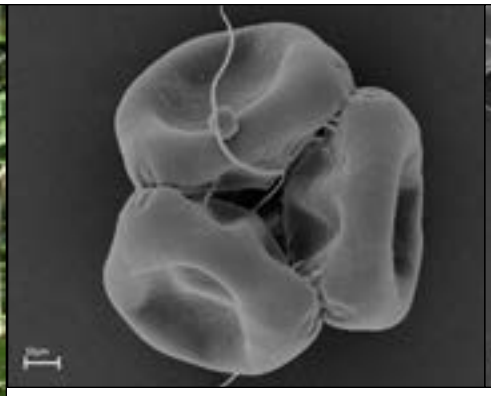


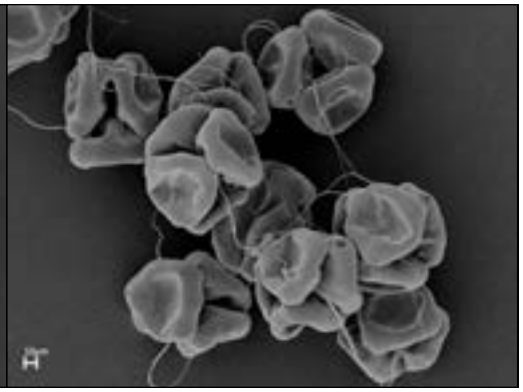
Epilobium hirsutum — Great Willowherb

Collection date: 28/607 **SEM date:** 29/6/07 Location: Clayton, West Sussex

Epilobium hirsutum is a loosely arranged tetrad with psillate-granulate surface. Each grain is trizonoporate, with large vestibule pori while the mesocolpium surface is scabrate. Individual grains are distinctly triangular in arrangement with the vestibule pori at each acute apex. Attached to the exine are viscin threads. A clear space exists between the grains.

A native plant found in a variety of wet or damp places. Height: 1.5m.





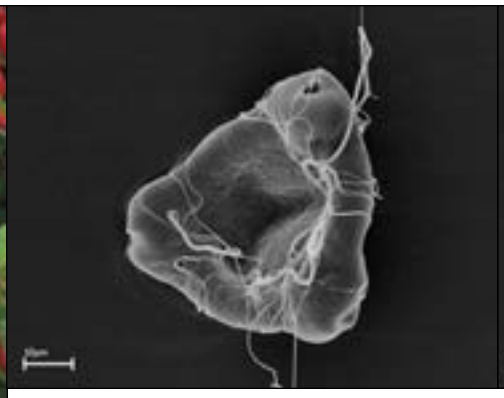
Epilobium tetragonum — Square-stalked Willowherb

Collection date: 28/607 **SEM date:** 29/6/07 Location: Clayton, West Sussex

Epilobium tetragonum is a loosely arranged tetrad with psillate-granulate surface. Each grain is trizonoporate, with large vestibule pori. Individual grains are distinctly orbicular in arrangement with vestibule pori along the edge. A clear space exists between the grains. Exine is psilate while the attached viscin threads are a characteristic of this genus.

A native plant common to hedgerows, waste ground and waysides. Height: 1m.

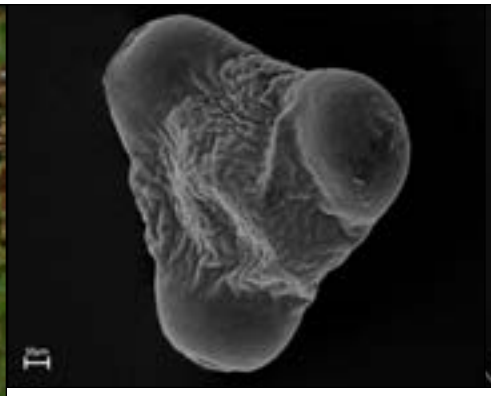
Family: *Onagraceae*

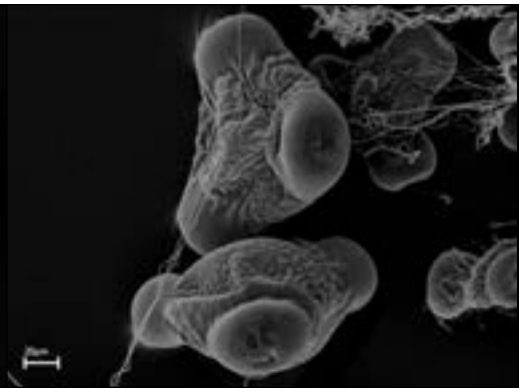


Fuchsia magellanica 'Thomsonii'

Collection date: 14/6/07 **SEM date:** 29/6/07 **Location:** Wakehurst Place, West Sussex

Fuchsia magellanica 'Thomsonii' is a trizonoporate pollen grain with vestibulate pori, with each of the pori being very large and conical to pyramidal in shape. The above pollen grains show evidence of collapse making accurate distinction between it and other species difficult. The pori lack any sculpture although the main exine is rugulate. Viscin threads are a common characteristic of this genus.
A garden cultivar of a common escapee *F. magellanica* that is often seen in hedgerows and has been and is still used as a hedge. Height: 1.5m.





Oenothera cambrica Small-flowered Evening-primrose

Collection date: 27/6/07 **SEM date:** 29/6/07 **Location:** Stamnar Woods, West Sussex

Oenothera cambrica is a trizonoporate pollen grain with vestibulate pori, with each of the pori being very large and conical to pyramidal in shape. The pori lack any sculpture although the main exine is rugulate. Viscin threads are a common characteristic of this genus.

An introduced plant that hybridizes freely, found mainly near the coast where it grows on dry banks. Height:1.5m.

Onagraceae family summary.

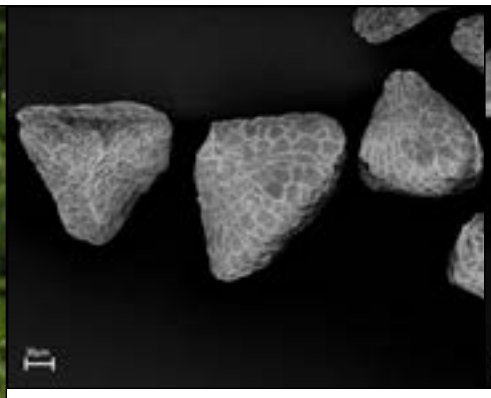
An unusual genus both floristically and morphologically. At a glance the flowers are quite different, however on closer inspection the extended pistil and anthers is common to all. Pollen morphology is similar in that all the plants represented here are trizonoporate pollen grains with vestibulate pori. Each of the pori being very large and conical to pyramidal in shape. Additionally viscin threads are characteristic to all and I expect are common to other family members also, similar to members of the *Ericaceae* family.

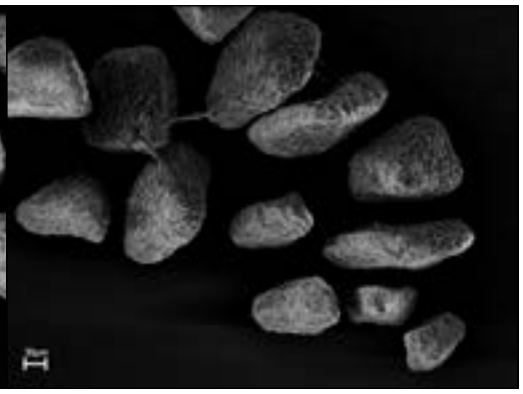
Epilobium hirsutum and *Epilobium tetragonum* as would be expected are similar in pollen morphological characteristics, however there is some variation between the two but it is slight and further comparison to a type collection is warranted. *E. tetragonum* although a tetrad in shape is in the sample presented slightly more orbicular in shape than *E. hirsutum.* Additionally *E.. tetragonum* has substantially less scabrae across the equator of the exine, with those existing being almost micro-scabrae.

Fuchsia magellanica 'Thomsonii' and *Oenothera cambrica* are trizonoporate pollen grains with vestibulate pori, with each of the pori being very large and conical to pyramidal in shape, identical to *E. hirsutum* and *E. tetragonum.* It is difficult to distinguish between the two since their morphology appears almost identical. This lack of differentiation is compounded by the collapsed *F. magellanica 'Thomsonii'* pollen grains; this pollen collapse could be a characteristic of the cultivar (sterile) or a characteristic of the genus: this point is worth investigating further.

Stace (1997, pp.446-452) notes that all three species represented here hybridize freely within their genus and that this has caused substantial confusion taxonomically.

Family: *Orchidaceae*



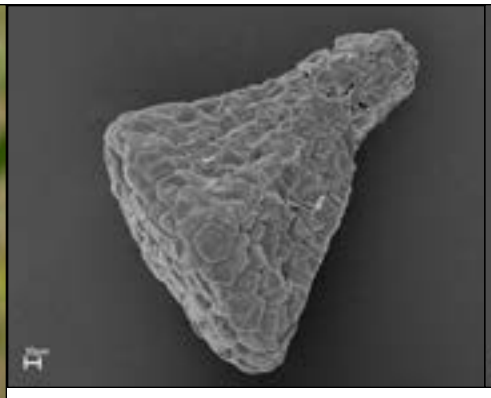


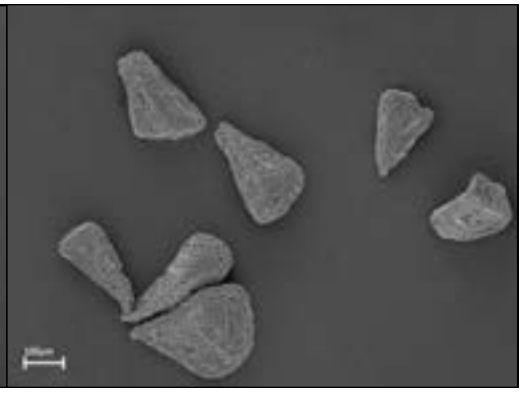
Anacamptis pyramidalis — Pyramidal Orchid

Collection date: 27/6/07 **SEM date:** 29/6/07 **Location:** Stamnar Woods, West Sussex

Anacamptis pyramidalis pollen grains are typically arranged as a group or large granule as are most members of the *Orchidaceae* family. Pollen grains are arranged as a polyad where individual grains are pressed together following no set pattern. The outside of the conglomerate is angular in shape resembling a piece of gravel.

A native, frequently found on dry calcareous grassland, the edges of woods and in meadows. Height to about 50cm.





Ophrys speghodes — Early Spider-orchid

Collection date: 30/4/07 **SEM date:** 2/5/07 **Location:** Castle Hill, West Sussex

Ophrys speghodes pollen grains are typically arranged as a group or large granule as are most members of the *Orchidaceae* family. Pollen grains are arranged as a polyad where individual grains are pressed together following no set pattern. The outside of the conglomerate is angular in shape resembling a piece of gravel.

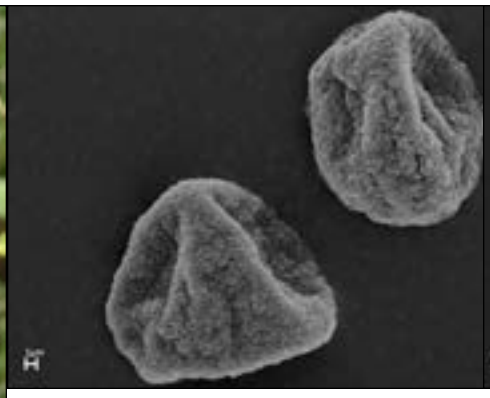
A native plant found on calcareous grassland. Height: 30cm.

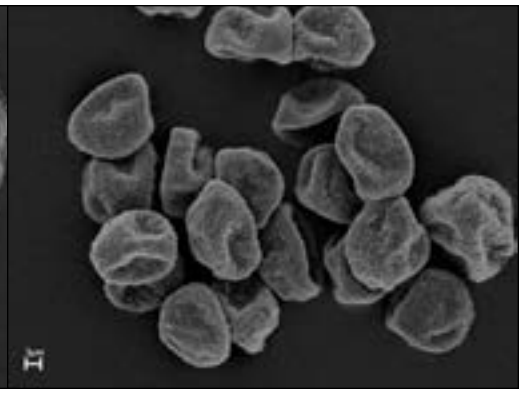
Orchidaceae family summary.

Both *Anacamptis pyramidalis* and *Ophrys speghodes* pollen grains are typically arranged as a group or large granule as are most members of the *Orchidaceae* family. Pollen grains are arranged as a polyad where individual grains are pressed together following no set pattern. The outside of the conglomerate is angular in shape resembling a piece of gravel. This characteristic is as Moore *et al* (1991, pp.90) states a characteristic of the entire family making individual species differentiation based on pollen morphology impractical.

A limited amount of pollen is produced by both species even though both are zoogamous. Lang (1980, pp. 135) states however, that both the minimal amount of pollen produced and its reliance in some cases (*Ophrys* sp.) on a specific insect pollinator does not seem to compromise seed set where 65-90% of the capsules in his field study of *A. pyramidalis* contained seed.

Family: *Orobanchaceae*





Orobanche minor **Common Broomrape**

Collection date: 18/5/07 **SEM date:** 25/5/07 **Location:** University of Sussex, West Sussex

Orobanche minor is a trizonocolpate, microreticulate pollen grain, size is > 25µm, possibly circular in polar and equatorial views (extensive collapse) with long, narrow colpi with ragged edges; colpi are slightly depressed.

A native plant found on lean sparse grasslands and meadow type areas, height to about 30cm.

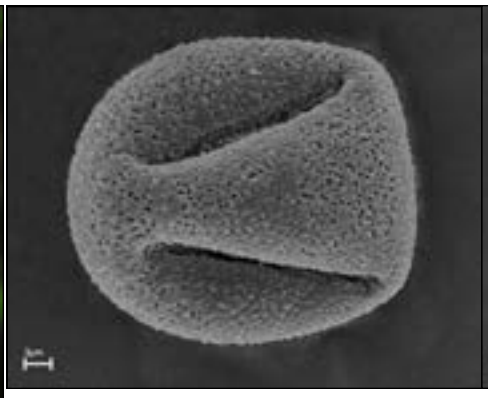
Orobanchaceae family summary.

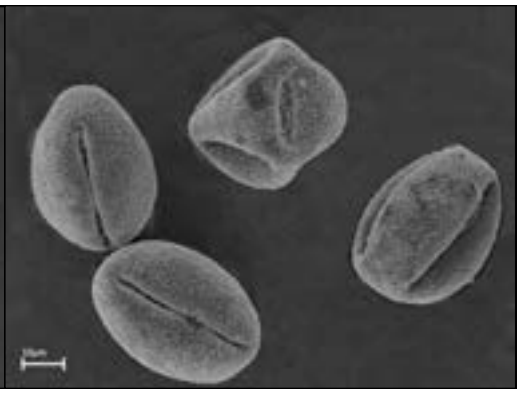
Orobanche minor is a trizonocolpate, microreticulate pollen grain, size is > 25µm, possibly circular in polar and equatorial views (extensive collapse) with long, narrow colpi with ragged edges; colpi are slightly depressed. These characteristics are common to many pollen grains such as *Rinanthus, Bartsia, Parentucellia, Euphraisa, Lathera, O. purpurea* and some *Pedicularis* species according to Moore *et al* (1991, pp 121).

Moore *et al* (1991,pp. 96) also states that *O. minor* may also conform to the characteristics of some *Taxus* and *Salix* species and that type collections should be consulted for accurate identification.

Extensive pollen grain collapse is evident, this could be attributable to pollen age, the plant pictured top left is past maturity and hence the pollen collected from this particular plant could have been exhausted at the time of collection: it was the last viable plant of a small population.

Family: *Oxalidaceae*



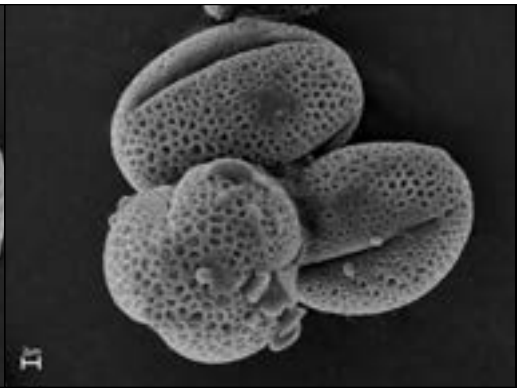


Oxalis acetosella — Wood-sorrel

Collection date: 10/4/07 **SEM date:** 18/4/07 **Location:** Wakehurst Place, West Sussex

Oxalis acetosella pollen grains are trizonocolpate and scabrate to micro-echinate across the exine. Overall grain shape is orbicular to rhombic in polar views and elliptic-obtuse in equatorial views. The tectum process is more or less irregular, perforate with regularly spaced, fine columellae. Colpi widen obtusely towards the poles but terminate before, while in polar view the colpi dissect the grain at approximately a 45° angle.

A native *Oxalis* common to grassy forest floors, hedges, banks and other shady places. Height: 20cm.



Oxalis incarnata — Pale Pink-sorrel

Collection date: 27/6/07 **SEM date:** 29/6/07 **Location:** Ditchling, Brighton, West Sussex

Oxalis incarnata pollen grains are trizonocolpate and are granulate reticulate across the exine. The lumina show a slight decrease in size towards the colpi but not towards the poles. The muri are as wide as the lumina, if not greater. Colpi are deep, wide and terminate at the poles, colpi edges appear granulate.

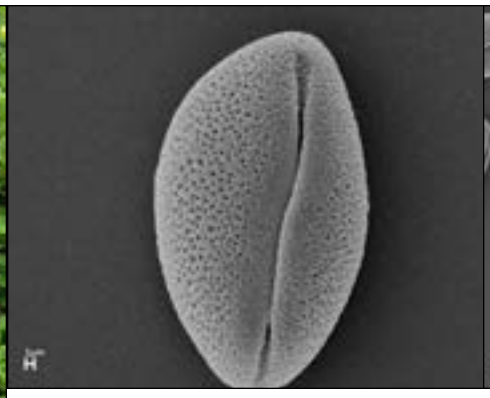
An introduced African species that is commonly found scattered in gardens and as an escapee, to about 35cm in height and normally forming large patches.

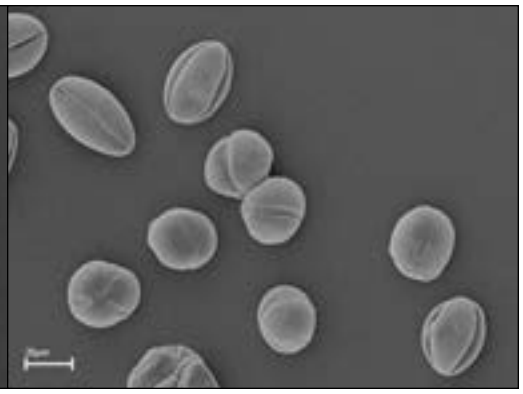
Oxalidaceae family summary.

Taxonomically *Oxalis* are closely related to *Geranium* species, both flower and pollen characteristics would seem to support this relationship. *Oxalis acetosella* pollen grains are trizonocolpate and scabrate to micro-echinate across the exine which closely resemble many of the characteristics of some members of the *Geraniaceae* family. *Oxalis incarnata* pollen grains are a little more distinct, the reticulum with a 1/1 muri/lumina ratio is unique in the pollen samples examined and make identification of this particular species in the context of this research quite simple.

Stace (1997, pp. 473-487) lists 18 additional species of *Oxalis* and 25 species of *Geranium,* in both cases all are species with no hybrid crosses (no apparent hybridization occurs). Thus there is ample room for further study of and comparison of both of these families in addition to the related *Geranium* species, *Erodiodea, Monsonia* and *Erodium* to determine if pollen morphological characteristics are common to both major families. As a caution in analyzing pollen morphology of this group though, some pollen grains that are usually trizonocolporate such as *Oxalis* may appear and key out as either tetrazonocolporate or pentazonocolporate further confusing the classification (Moore *et al,* 1991, pp, 130).

Family: *Paeonaceae*





Paeonia lutea **Yellow Tree Peony**

Collection date: 29/4/07 **SEM date:** 2/5/07 **Location:** Preston Park, Brighton, West Sussex

Paeonia lutea pollen grains are < 40µm in size, elliptic in equatorial view and orbicular in polar view. Grains are trizonocolpate, eureticulate, perforate with the colpi almost running the full length of the grain and terminating before the poles. The colpi is inconsistent in width and depth, widening at the poles and terminating obtusely. However at the equator it closes to form an equatorial bridge. The exine is lacunae-rugulate with lumina size decreasing towards the colpi and the poles. The tectum is psilate at the poles and colpus margins with the lumina possibly perforate.

An introduced large shrub common to parks and large landscapes, reaching a height and spread in excess of 4m.

Paeonaceae family summary.

The pollen grains of *Paeonia lutea which are* trizonocolpate, eureticulate and perforate are not uncommon in the context of this research and could be confused with many other species including some members of the *Oleaceae* family. The combination of the exine which is lacunae-rugulate, the lumina sizing decreasing towards the colpi, the tectum which is psilate at the poles, lumina possibly perforate with the colpus widening at each of the poles but closes to form an equatorial bridge may distinguish it with other conflicting grains on close examination.

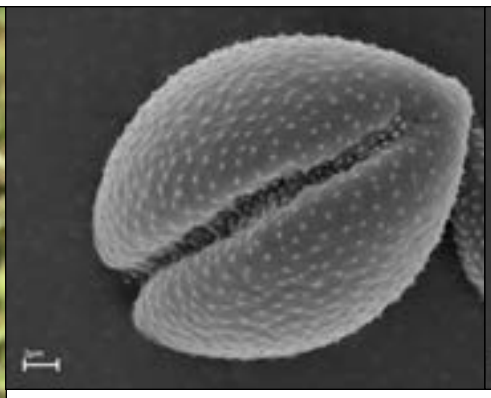
Family: *Papaveraceae*

Glaucium flavum — Yellow Horned-poppy

Collection date: 1/6/07 **SEM date:** 8/6/07 **Location:** Shoreham Beach, West Sussex

Glaucium flavum is a trizonocolpate grain, reticulate, perforate, elliptic to rhombic-obtuse in equatorial view and elliptic in polar view. The coarse columellae is irregularly arranged and porate except in the mesocolpium where they are in a rough reticulate pattern. Microechinae appear to be visible on the muri under image enlargement. The colpi widen at the equator and appear to be obtuse ended with a granulate membrane.

A coastal native plant found frequently growing on maritime shingle. Height: 75cm.



Papaver rhoeas — Common Poppy

Collection date: 5/5/07 **SEM date:** 16/5/07 **Location:** Castle Hill, West Sussex

Papaver rhoeas is a trizonocolpate grain with the exine traversed by regularly spaced microechinae on top of the tectum. Overall grain shape is elliptic in equatorial view. The colpi are consistently obtuse ended, touching the poles and contain a distinct granulate membrane. Overall grain shape is elliptic-obtuse in equatorial view and elliptic in polar views.

A plant common on arable land, roadsides, and waste land. Height: 75cm.

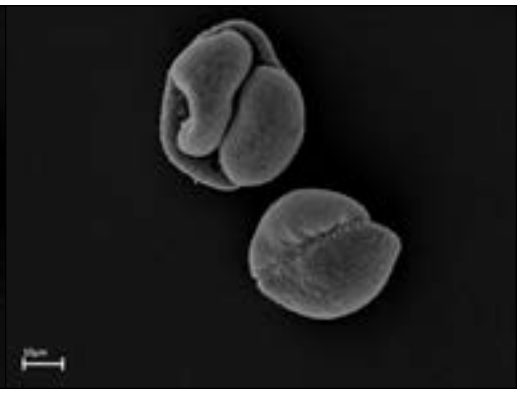
Papaveraceae family summary.

Both *Glaucium flavum* and *Papaver rhoeas* are trizonocolpate pollen grains. They exhibit some similarities yet some notable differences as well. Both species have a similar overall grain shape, elliptic to rhombic obtuse, although the shapes seem variable within each of the species. Secondly, both grains have a very wide colpus with a very distinct, granulate membrane that has rarely been seen in this research.

The noticeable differences are that *P. rhoeas* exine is traversed by regularly spaced microechinae on top of the tectum, this character is completely absent in *G. flavum*. *G. flavum* however, has a reticulate tectum that appears to be perforate, similar at a casual glance to some members of the *Geraniaceae* family.

Stace (1991, pp. 102-106) lists 7 species of *Papaver* including subspecies and hybrids but only one species of *Glaucium* as being common to Britain, there are however 5 other Genera in the family hence it warrants further investigation to determine if such distinct characteristics remain so across the entire family and within each genus. Moore *et al* (1991, pp. 126) states that *P. agremone, P. dubium, P. hybridum, P. nudicaule, P. orientale, P. rhoeas, P. somniferum* and *P. strigosum* can be keyed to the species level with a degree of accuracy.

Family: *Pinaceae*



Pinus sylvestris — Scots Pine

Collection date: 18/6/07 **SEM date:** 29/6/07 **Location:** Bergen, Norway

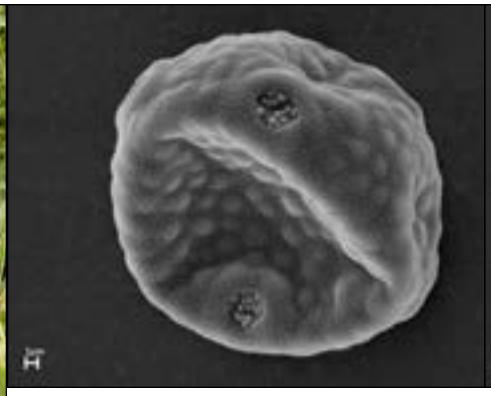
Pinus sylvestris have two separate sacci which are approximately equal in size. The sacci are constricted at their point of attachment to the body of the grain so that they are larger (balloon like) above this point of attachment. The size of the pollen grain may range from 40-60µm. An undulating frill-like marginal crest may sometimes exist under the sacci. The verrucae on the inner side of the distal body wall is either psillate or faintly granulate. The image top right shows some grain collapse, these were harvested from spent flowers late in the season.

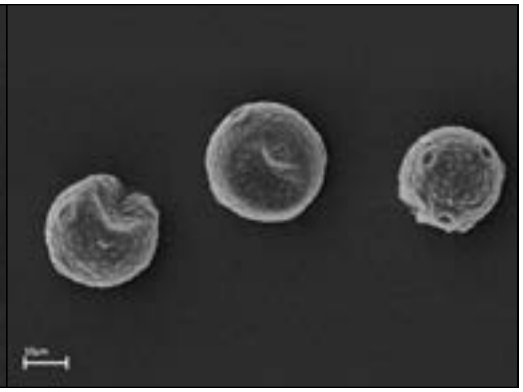
A native plant common to light and often lean soils. Height: 35m.

Pinaceae family summary.

Pinus sylvestris have two separate sacci which is a characteristic that is found in all *Pinus, Cedrus, Picea* and *Abies* species however some success can de made in distinguishing both individual genera and genus groupings, refinement beyond a genus grouping level though is not possible. Moore *et al* (1991, 91) states that *Pinus peuce, P. aristata, P. Cembra* and *P. strobus* can be distinguished from other *Pinus* species by their verrucae which are found on the inner side of the distal body wall, verrucae are lacking on *P. sylvestris, P. rigida, P. nigra, P. pinaster, P. ponderosa, P, mugo, P. resinosa* and others.

Family: *Plantaginaceae*



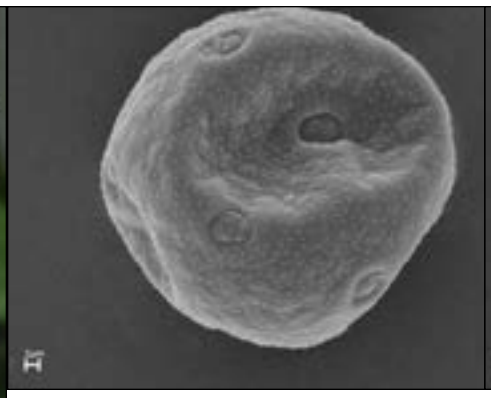


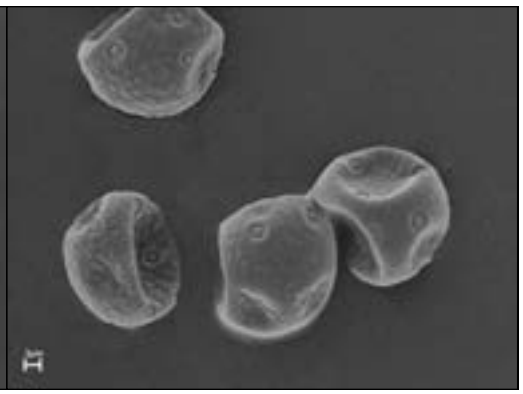
Plantago coronopus **Buck's-horn Plantain**

Collection date: 1/6/07 **SEM date:** 8/6/07 **Location:** Shoreham Beach, West Sussex

Plantago coronopus is an orbicular polypantoporate, verrucate pollen grain. With 8 or less pori, distinctly verrucate and having a granulate membrane with the margins of the pori poorly defined. The microechinae are indistinct. The verrucae are medium-large and coarse compared to the grain size but quite regular in arrangement with half the width of an individual verrucae between each verrucae. Grain size is < 30 µm with distint microechinae scattered over the entire exine.

P. coronopus may be found on bare ground, often near the sea with a prefrence for lean, gravelly or sandy soils. Height: 25cm.





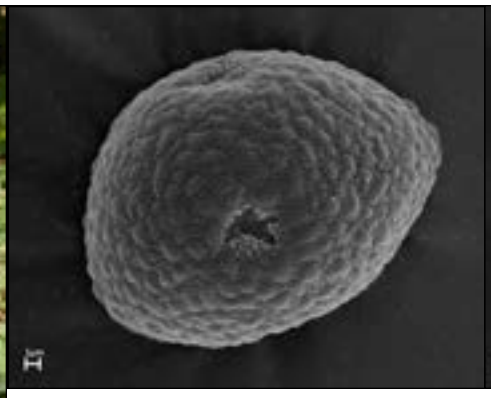
Plantago lanceolata **Ribwort Plantain**

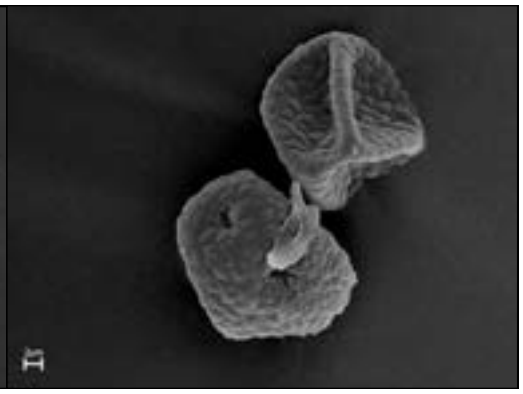
Collection date: 28/4/07 **SEM date:** 1/5/07 **Location:** Ditchling Road, Brighton, West Sussex

Plantago lanceolata is an orbicular polypantoporate, verrucate pollen grain. With 8 or less pori and having a granulate membrane with the margins of the pori poorly defined. The verrucae are small and indistinct when compared to the grain size but quite regular in arrangement. The microechinae are detectable and appear evenly distributed over the exine. Grain size is < 30 µm.

A common native plant to most grassy areas, tolerant of mowing so height can be varibale but unmown to 50cm.

Family: *Plantaginaceae*



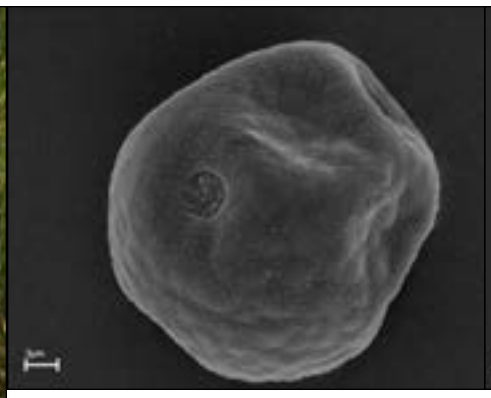


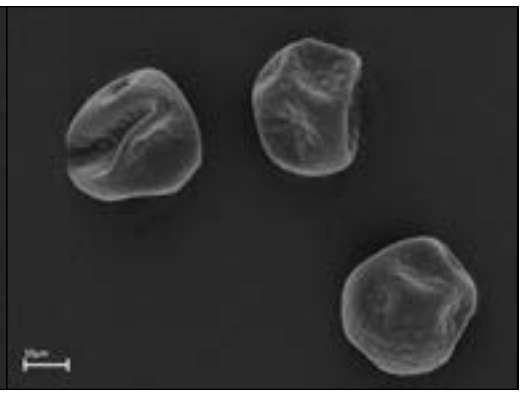
Plantago major — Greater Plantain

Collection date: 14/6/07 **SEM date:** 21/6/07 **Location:** Wakehurst Place Kew, West Sussex

Plantago major is an orbicular polypantoporate, verrucate pollen grain. With <8 or less pori and having a granulate membrane with the margins of the pori poorly defined. The verrucae are small compared to the grain size but quite regular and orbicular in arrangement. Grain size is < 30 µm with indistinct microechinae.

Native, common to grassy areas and waste land, heigjht 35cm.





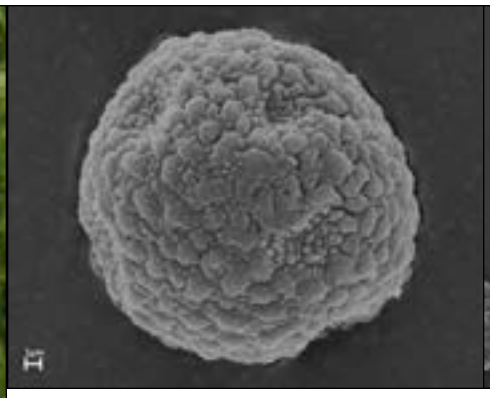
Plantago maritima — Sea Plantain

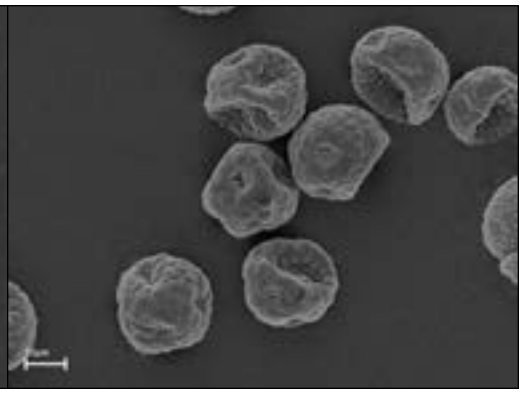
Collection date: 9/6/07 **SEM date:** 15/6/07 **Location:** Adur Valley, West Sussex

Plantago maritima is an orbicular polypantoporate, verrucate pollen grain. With <8 or less pori, distinctly verrucate and having a granulate membrane with the margins of the pori clearly delimited. Grain size is < 30 µm with quite distinct microechinae scattered over the entire exine.

Often found where brackwish water may exist such as salt marshes, estuarys and similar maritme situations. Height: 25cm.

Family: *Plantaginaceae*





Plantago media

Hoary Plantain

Collection date: 9/6/07 **SEM date:** 15/6/07 **Location:** Adur Valley, West Sussex

Plantago media is an orbicular polypantoporate, verrucate pollen grain. With <8 or less pori, distinctly verrucate and having a granulate membrane with the margins of the pori poorly defined. The verrucae are large and coarse compared to the grain size and quite irregular in arrangement. Grain size is < 30 µm and with distinct microechinae scattered over the entire exine. Extensive pollen grain collapse is evident in this sample.

A native to to grasslands although not as common as the other species is listed. Height: 40cm.

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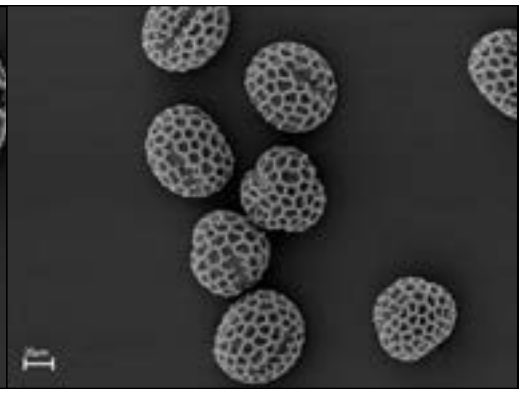
Plantaginaceae family summary.

Plantago coronopus, Plantago lanceolata and *Plantago maritima* are orbicular polypantoporate, verrucate pollen grains. With <8 or less pori, distinctly verrucate and having a granulate membrane with the margins of the pori poorly defined. The Microechinae are indistinct. The verrucae are medium-large and coarse compared to the grain size but quite regular in arrangement with half the width of an individual verrucae between each verrucae. Grain size is < 30 µm with distint microechinae scattered over the entire exine. Each of the 3 species has slight variations in surface sculpturing, these may be distinct differeces however with partial pollen grain collapse some of these characters may not be true to form.

In *Plantago major* and *Plantago media* the verrucae are large and coarse compared to the grain size and quite irregular in arrangement and although the above species also demonstrate, or partially so, this characteristic in these two species it is a dominant feature of the grain character. Moore *et al* (1991, pp. 109) states that these sculpturing elements do warrant classification of most *Plantago* to the species level but with no direct mention of *P. media* although the remaining four species are identified.

Family: *Plumbaginaceae*



Armeria maritima **Thrift**

Collection date: 1/6/07 **SEM date:** 8/6/07 **Location:** Shoreham Beach, West Sussex

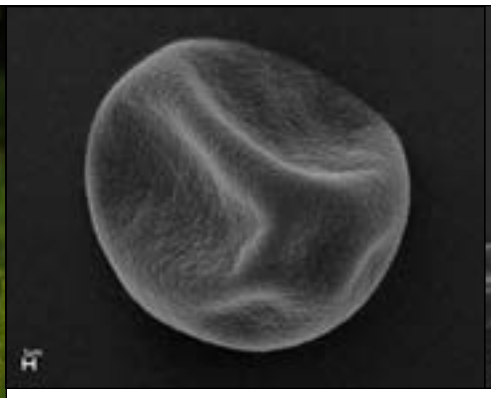
Armeria maritima pollen grains are trizonocolpate, eureticulate (the muri of the reticulum are the walls which join the heads of the columellae). Distribution of the columellae is commonly dependent of the pattern of the reticulum. The reticulum is large as is the lumina, often >1µm. The colpi is long, while the muri is supported by one row of echinae on top.

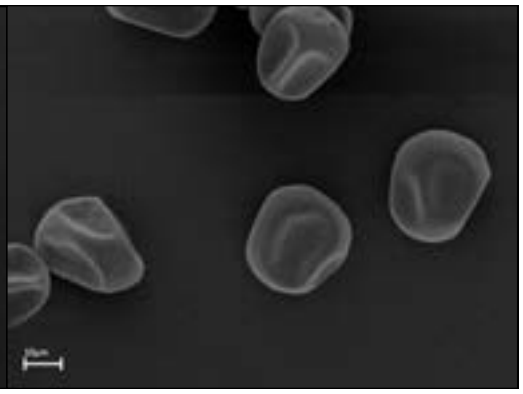
A native plant common to cliff tops and other low grassy areas near the ocean. Height: 25cm.

P*lumbaginaceae* family summary.

A very distinct pollen grain with the muri supported by one row of echinae on top and large and what would appear to be deep lumina. In the context of this research there has been no pollen grain of the 267 examined that has this unique combination of characteristic. However this sculptural detail is not unique to this particular species alone. Moore *et al* (1991, pp. 197) identifies the pollen of *Limonium hyblaeum* as having identical characteristics, there are 16 other species of *Limonium* and 2 of *Armeria* which I would suspect have similar morphological characterizes to that depicted above.

Family: *Poaceae*



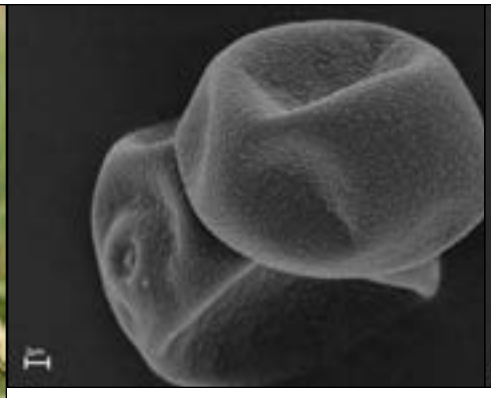


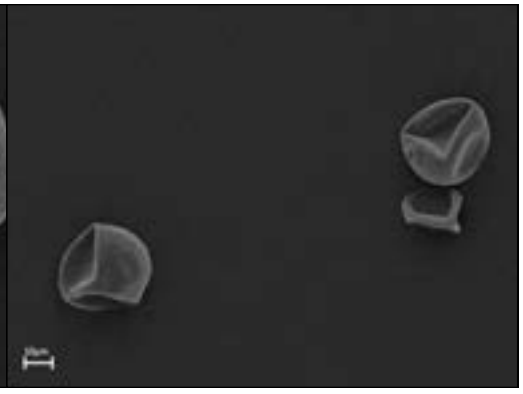
Cynosurus cristatus Crested Dog's-tail

Collection date: 9/6/07 **SEM date:** 15/6/07 **Location:** Adur Valley, West Sussex

Cynosurus cristatus is a monoporate grain with the verrucate exine. Porus is circular, well defined and prominent . The nexine is thickened around the porus to form the costa.

Found across Britain on a range on soils and locations, to about 75cm in height.





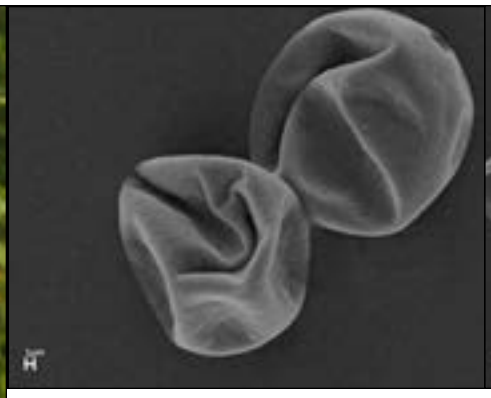
Dactylis glomerata Cock's-foot

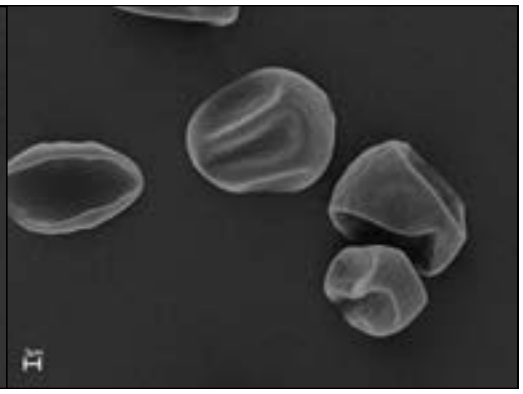
Collection date: 7/6/07 **SEM date:** 15/6/07 **Location:** Ferring Rife, West Sussex

Dactylis glomerata is a monoporate grain with a verrucate to rugulate exine. Porus is circular, well defined and prominent . The nexine is thickened around the porus to form the costa.

Often grown has a hay crop this native plant is found across Britain in a wide variety of situations. Height: 1.5m.

Family: *Poaceae*



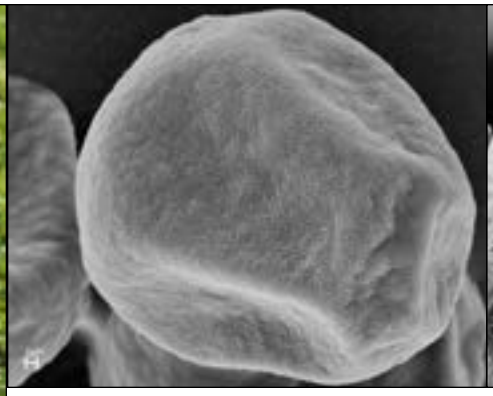


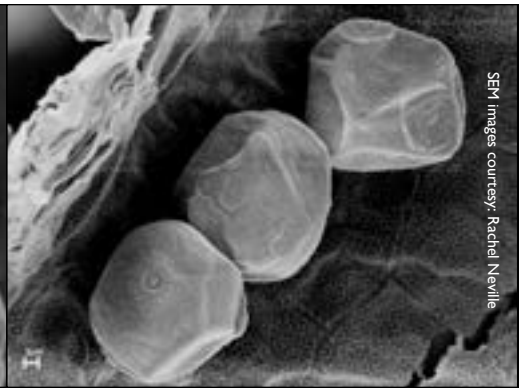
Holcus lanatus Yorkshire Fog

Collection date: 9/6/07 **SEM date:** 15/6/07 **Location:** Adur Valley, West Sussex

Holcus lanatus is a monoporate grain with the exine verrucate to micro-verrucate . Porus is circular, well defined and prominent . The nexine is thickened around the porus to form the costa.

A native plant found on rough grassland, meadows and wasteland. Height: 1m.





Lolium perenne Perennial Rye-grass

Collection date: **SEM date:** 14/12/06 **Location:**

Lolium perenne is a monoporate grain with the exine verrucate to micro-verrucate . Porus is circular, well defined and prominent . The nexine is thickened around the porus to form the costa.

A very common native plant found throughout the countryside in fields, lawns, rough ground and waste places, vigorous and forming large patches, height to 75cm.

Click for Part 3