Microscope power

A compound microscope of 100 times overall magnification is needed to see pollen grains. With a x100 microscope you will just be able to see the grains of pollen. Using x400 you will be able to see some identifying features. You will need x1000 to see the level of detail shown here.

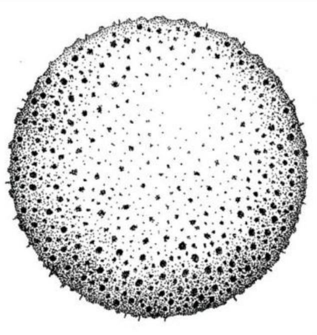
Scarlet Pimpernel (Anagallis arvensis)

Pollen study

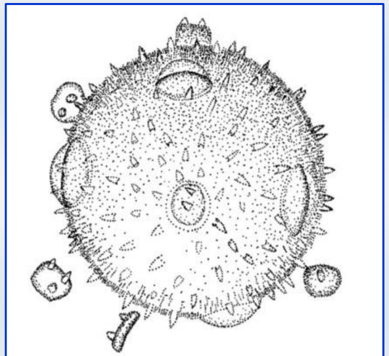
You should be able to find plants in flower, with pollen available, at most times of the year.

For example (with the approximate week of flowering):

- Winter Aconite (Week 1)
- Blackthorn (Week 11)
- Bramble spp. (Week 25)
- Hollyhock (Week 33)



Spring Crocus pollen, 115 microns dia.



One of the largest pollen grains. Marrow (Curcubita Pepo ovifera), 168 microns dia.

Other pollens easy to collect are:

- Yew (Week 9)
- Catkin-bearing (Week 9 onward):
    - Hazel, Willow, Alder
    - Birch, Oak, Walnut
- Late flowering Ivy (Week 39)

Some common pollens with interesting sculptured forms include:

- Dandelion
- Borage
- Heather
- Rosemary
- Umbellifers e.g. Cow Parsely

Drawings in this leaflet are mostly examples of the larger, more interesting pollen grains, all of which you should be able to find and study yourselves.

To learn more about microscopes, find links to useful websites and see great images, visit www.quekett.org

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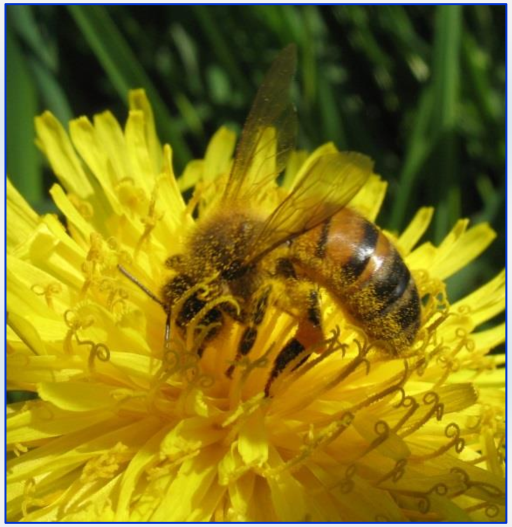
Things to look at with microscopes: Pollen

All flowering plants produce pollen (Latin for Powder) grains, an essential function for plant species survival. Pollen contributes half the genetic material required to produce a viable seed. Two main methods have evolved to carry pollen grains from one plant to another.

WIND POLLINATION is the means used by all grasses and many large plants, e.g. catkin bearing trees such as Hazel, Yew, Walnut and Oak. The quantity of pollen required is far greater for this method than other, more direct, means. Pollen grains carried by the wind eventually settle and as they do so can be drawn toward receptive flowers (by electrostatic attraction) should they be in the vicinity. The size of pollen grains is largely within the range 20 to 40 microns (a micron is one thousandth of a millimetre), a diameter that ensures a reasonable rate of descent in still air.

A huge quantity of these grains fall everywhere in this very "hit and miss" solution. Because of their hard outer protective coat the grains can remain in the environment for generations and are a useful dating tool in archaeology.

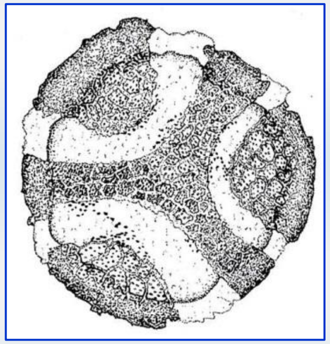
INSECT POLLINATION is far more efficient, requiring far smaller quantities of pollen. These pollen grains can be much more varied in size than those relying on wind distribution. Many insects act as pollinators. Of these the bees are the most familiar to most people. Plants and bees, in particular, have co-evolved over millions of years for mutual benefit.



Honeybee dusted with pollen

Extensive devices can be found in the plants to encourage insects and thus ensure pollination. For instance, flowers can provide nectar as a reward, as well as pollen, both being essential foods for many insect species.

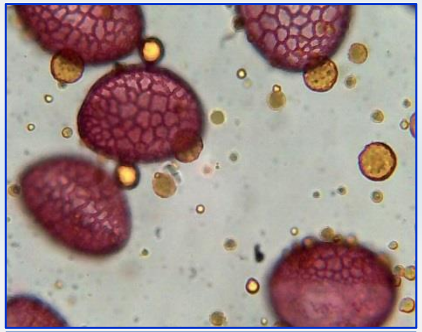
Form



Passion Flower pollen
80 microns dia

Pollen grains commonly enclose male genetic contents within two "skins", the 'intine' (inner), a relatively thin, flexible film, and the 'exine', a far less flexible outer cover. The exine is sculpted with furrows and pores. Furrows may expand in the presence of moisture. The pollen tube, carrying the genetic material to the female ovary will eventually emerge from one of the pores.
A significant proportion of known pollen grains, particularly the smaller, relying on insect pollination, have three furrow and pore structure sets. Minor differences in these help with identification. Many other arrangements are seen through the microscope, particularly among the larger pollen grains.

Surface structure is more easily discerned if grains are stained before mounting or by stains taken up from the mounting medium. Of the popular mountant Glycerine Jelly is recommended for a five to eight year project. Canada Balsam provides much longer stability but requires more pre-processing of the pollen. More information on stains and mountants is given in microscopy texts and is also readily available via the Internet.



Iris sp. pollen

Cornflower pollen.
36 microns dia.
Showing one of three furrows, each with a single pore.

Allergy

Some pollens, always the large quantities of some wind borne grains e.g. grasses, can cause allergic reactions known as Hay Fever.

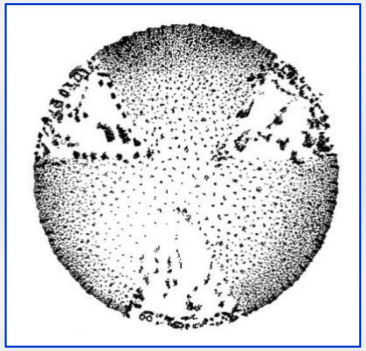
Honey bees

Bees are adapted in form and habit for the reciprocal service of inadvertent carrying of pollen between plants. The service to the plant by honey bees is particularly useful as bees have the habit of constancy i.e. visiting the same flower species sequentially, thus giving the maximum effectiveness in cross-pollination.

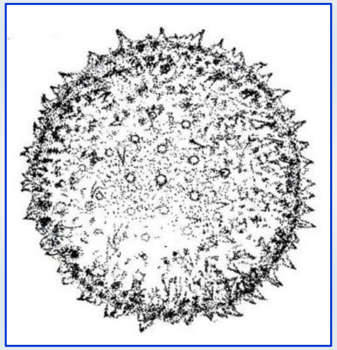
It has been estimated that an average hive of honey bees will collect 44 kilograms of pollen in a season, dusting recipient flowers and cross-pollinating in the process.

Pollen Morphology

Pollen grains vary considerably in colour, size and form (more so in pollen from insect pollinated plants).



Helleborus sp. pollen
25 microns dia.



Mallow pollen
191 microns dia.

Size

Individual grains of pollen are generally too small to be seen unaided, other than as a fine dusting. Most are near the average of 30 microns dia. and spherical. The thickness of newspaper is about 50 microns, a human hair 50 to 80 microns. Measurement of typical pollen grains gave the following results, though precise size may vary:

- Forget-me-not – 7 microns
- Green Alkanet – 12 microns
- Mock Orange – 14 microns
- Great Evening Primrose – 167 microns
- Marrow – 168 microns

Pollen studies

The exine can survive for many years long after the remainder of the pollen grain has been lost. Pollen identification can provide information on the plant origin, climate, geography and season of production. These characteristics are particularly useful in forensics and archaeology.

Because honey bee individuals forage on one species at a time, studying the pollen they collect provides important information on where and when they visited the pollen source. Beekeepers can derive lots of information on the day-to-day foraging of their bees by studying the colour of the pollen pellets collected in a pollen trap in the hive. Pollen analysis can also be used to identify the source of honey and wax.