Practical 10 - T(a)(d) The structure of wind pollinated flowers and fruit.

This practical focuses on recording accurately – Biological drawings. You will be developing other assessed skills throughout the practical.

Intended learning outcomes

By the end of this practical and its write-up you should be able to:

- Identify the main features of a wind pollinated flower
- Explain the significance of the adaptations shows by flowers that are wind pollinated
- Identify pollen of a wind pollinated flower
- Observe and measure the rate of germination of pollen grains
- Identify the main features of a maize fruit
- Draw accurately the main structures and organisation of a wind pollinated flower
- Draw accurately the internal structure of a maize fruit
- Experience relevant methods and conclusions.

Safety Precautions/Risks.

No specific hazards identified.

A risk assessment should be carried out as a matter of course.

Background information

- All flowers are formed from modified leaves and arranged on a specialised stem called the receptacle
- There are four flower components; sepals, petals, stamens and ovules
- The flower components are arranged in rings called whorls, one inside the other on the receptacle. These whorls have collective names: calyx, corolla, androecium, and gynoecium.
- Starting from the outer side the order is: calyx (sepals), corolla (petals), androecium (stamens) and gynoecium (carpels).
- The androecium is the male reproductive component and the gynoecium is the female reproductive component
- Wind pollinated plants generally show only the reproductive component. Sepals and petals are replaced in modified leaves, called bracts, which vary greatly in appearance and are used in taxonomic grouping.
- Wind pollinated flowers are adapted in a variety of ways to increase the chance of pollination. Overall the adaptations result in maximum exposure to the air of the pollen producing anthers and the pollen collecting stigmas.
- Some plants are monoecius – their flowers have either an androecium or a gynoecium. Some plants are dioecius – their flowers have either an androecium or a gynoecium, both types of flower occur on the same plant. Some plants are hermaphrodite – their flowers have both an androecium and a gynoecium.
- Monoecius plants cannot be self pollinated. Dioecius plants and hermaphrodite plants can be self pollinated.
- Outbreeders are plants that do not normally self pollinate. If they are dioecius or hermaphrodite there are structural and physiological methods of preventing self pollination.
- Inbreeders are plants that normally self pollinate. If they are dioecius or hermaphrodite there are structural and physiological methods of encouraging self pollination.

You will investigate the structural organisation of a number of wind pollinated plants. You will also investigate the structure of a maize fruit.

- Read the information above
- Produce a table that you can complete with the number of each flower structure present in the flowers you study.

Method

Identification of floral structures

1 Observe the appearance of the inflorescence of each of the flowering plants.

2 Carefully detach a single flower from each inflorescence and identify the different whorls present.

3 Draw a diagram and label the structure of each of the individual flowers.

4 Carefully remove each separate structure from the flower and count the number of each structure present.

5 Make accurate drawings of a single stamen and ovule. Annotate each diagram with the functions of each of the parts of the stamen and anther, noting those features that adapt the structures to their function.

Pollen study

1 Gently shake each inflorescence onto a sheet of plain paper.

2 Place a drop of 0.5% sucrose on a slide. Use a paint brush to transfer some pollen from one of the flowers onto a slide and cover with a cover slip.

3 Using x400 magnification count the number of pollen grain visible in the field of view.

4 Leave the slide for a minimum of twenty minutes while continuing with 7 and 8.

5 Note the time the slide was left and then count the number of pollen grain that have germinated.

6 Measure the length of the pollen tubes.

7 Using a different slide, transfer some of each type of pollen onto the slide. The pollen may stick better if the slide is slightly damp.

8 Observe, measure and draw each type of pollen at x400 magnification. Take care in measuring that you measure the pollen grain only and not any air bladders that may be present.

Maize grain study

1 Observe the outside appearance of a single fresh or soaked maize fruit.

2 Draw and label the main features – fruit wall, scars of attachment.

3 Cut a vertical section along the widest part of the seed.

4 Identify the endosperm and embryo.

5 Use a hand lens to identify the main regions of the embryo – radicle, plumule and cotyledon. You may also find the coleoptile and coleorhiza.

6 Draw a diagram of a section through the fruit and annotate with the functions of the different structures.

Calculations

1 Calibrate your microscope and calculate the actual size of the pollen grains and pollen tubes.

2 Calculate the percentage germination for the pollen grains.

3 Calculate the mean size of the pollen grains

4 Calculate the growth rate of the pollen tubes.

5 Record the percentage germination, mean size of pollen grain and growth rate for each of the germinated pollen grains on a class results table.

6 When all the results have been recorded in the class results table, calculate the mean percentage germination and mean growth rate for each type of pollen.

7 Optional – use the student T-test to find there is a significant difference in the growth rate of the different types of pollen.

8 Work out the magnification of your drawing of a maize fruit.

Write-up

- Construct a table of the similarities and differences between each of the flowers studied.
- List the features that the pollen grains have in common.
- Explain why the organisation of maize inflorescence favours cross pollination.

Lesson Plan

The structure of wind pollinated flowers and fruit

This practical focuses on recording accurately – Biological drawings and measuring using a microscope.

Context

A practical investigation set in the context of 9700 Syllabus – the structure of wind pollinated flowers and the structure of maize fruits.

It is anticipated that students will have completed an AS practical course so that they will have good basic practical skills. It is also anticipated that they will have been given learning opportunities before this so that they know how to identify the components of flowers. These are often easier to recognise initially in an insect pollinated flower.

Key aims of lesson

This practical is designed to develop the skill of accurate drawing and measuring Students will be developing other assessed skills throughout the practical.

Intended learning outcomes

By the end of this practical and its write-up the student should be able to

- Identify the structural features of a wind pollinated flower and explain their role
- Identify the structural features of a maize fruit and explain their role
- Measure and calculate size using a microscope graticule
- Experience relevant methods and analysis.
- Calculate the rate of germination of pollen tubes.

Resources required

White board or flipchart and suitable pens or blackboard and chalks

Practical materials specified on the Technical Information sheet

Some spare copies of the student worksheet

Planned activities (timings can be altered to suit shorter or longer lessons)

Timings/ minutes	**Teacher / Student Activities**
0-4	**Introduction** to the aims, intended outcomes and shape of the lesson - teacher led oral presentation. |Give out student work sheets and inflorescences to be used.
4-8	**Context** – review of flower structure. Teacher-led questioning, student responses / discussion, students building a multicoloured learning outline on the board.

8-20	**Introduction to method** – teacher demonstration of the removal and dissection of a single flower. Each student should have an inflorescence and follow each step along with the teacher. Teacher demonstration of the correct direction for cutting a maize fruit. Optional statistical test – direct students to germinate a particular type of pollen. Depending on the class size two or three types of pollen may be compared.
20-45	**Carrying out the practical** - students carry out the practical work, entering their results into a table on the board and tidying away apparatus as soon as they have finished.
50-60	**Drawing together the threads** - teacher-led class discussion on the skills that have been developed, as well as the results and their meaning - teacher led introduction to write-up, which should include class-work, finished off if necessary, (production of comparison tables and calculations) Optional t-test – teacher produced guide sheet or access to a computer programme.

Useful Information

- Most commercially grown wind pollinated flowers are grasses and show a 3 multiple of floral structures. However breeding programmes have caused changes in morphology that obscure these.
- Ripe stamens have anthers are visible outside the protective structures. Most inflorescences will have some ripe anthers.
- Ripe carpels have stigmas outside the protective structures.
- Maize plants have a modified floral structure as all the individual flowers are enclosed by large, protective, modified leaves
- Dry maize fruits need to be soaked at least 24 hours before use. Fruits need to be undamaged
- To gain sufficient data for at T-test at least 20 sets of data are needed. The class size will determine how many students need to be directed to grow a particular type of pollen

Technical Information - The structure of wind pollinated flowers and fruit

The **apparatus and materials** required for this are listed below.

The amount of apparatus listed is for **one student or one group of students** if they are to work in groups.

1 1 example of each of at least three different wind pollinated flowers. For the purposes of the practical the species is immaterial, but it would support the 9700 syllabus to have rice, sorghum and maize.

2 2 slides

3 5 cm^3 0.5% sucrose solution

4 1 scalpel or sharp knife

5 fine forceps

6 white paper

7 microscope with an eye piece graticule.

8 Access to a slide graticule if microscopes have not been previously calibrated

9 1 soft bristle paint brush. If these are not available the pollen can be shaken directly onto the slides

10 1 hand lens

11 Guide sheet to carrying out a student t-test.

Safety Precautions/Risks.

No specific hazards identified

A risk assessment should be carried out as a matter of course.