RPS DEGREE COLLEGE

BALANA (MAHENDERGARH)-123029

Lab Manual

Botany (B.Sc. 5th & 6th Semester)

Department of Botany

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A. PLANT PHYSIOLOGY

Experiment-1

Aim - To demonstrate the phenomenon of imbibation pressure by plaster of paris method

Material Required

Dry seeds, water, filter paper, funnel, flask, plaster of paris, petri dish, etc.

Imbibition

It is the process of absorption of solvent (i.e. liquid) by the solute particles of a substance without forming any solution

Procedure

1. In a conical flask, adjust a wide mouthed glass funnel.
2. Now fold a filter paper and fit it into the glass funnel.
3. Take 100 gm of plaster of paris and mix it in 36-40 mil of water and prepare a paste.
4. Now pour this paste into the funnel.
5. Add some amount of dry seeds into this funnel containing plaster of paris paste
6. Cover all the seeds with remaining paste and keep it aside for few minutes
7. When all the extra water is drained out, take one petriplate filled with water and take out the cone of Plaster of Paris from funnel and put into this petriplate.
8. Now slowly remove the filter paper from the cone.
9. Keep it aside for some time and observe it.

Result

Due to imbibation pressure of dry seeds the cone will break out.

Conclusion

Imbibation pressure is developed towards outside ie. on plaster of paris due to water by the solute particles i.e. dry seeds due to which cone is broken down.

Precautions

1. Make fresh paste of plaster Paris when required.
2. Take completely dry seeds for this experiment

Experiment-2

Aim- To demonstrate the process of osmosis by means of potato osmoscope

Material Required

Large size potato, knife, scalpel, pins, sugar, water, beaker.

Procedure

1. Take a large size potato. Then remove its skin with the help of knife and base is cut to make it flat.
2. A hollow cavity is made in the centre with the help of scalpel in such a way as to leave a thin wall at the base.
3. The cavity of potato is filled with the strong concentrated sugar solution.
4. The starting level of the solution is marked with the help of pin inserted in the wall of the tuber.
5. The tuber is then left within a beaker filled with water.
6. After a few hours, the solution within the cavity is found to be at a higher level.

Conclusion

The raise in the level of the inner solution is due to inward diffusion of water in the tuber wall acting as a vegetable semi-permeable membrane.

Experiment-3

Aim- To study the phenomenon of plasmolysis

Material Required

Rhoeo discolox leaf, covex slip, slides, safety blades, sugar solutions of different concentrations, water and microscope.

Procedure

1. Peel off a small lower leaf segment surface by tearing the leaf obliquely with a jeck.
2. Then mount the peeled segment in a drop of water on a clean slide and then cover it with cover slip.
3. Observe the segment under microscope.
4. Draw the protoplasm and let the preparation as 1^{st}.
5. Similarly, peel off some more segments and mount them in sugar solution of different concentrations.
6. Observe every preparation under the microscope and draw boundaries of protoplasm and let preparations as 2^{nd} 3^{rd} 4^{th} and 5^{th} respectively in increasing order of concentration.

Result

1. In 1^{st} condition the cell structure is very clear. The cells are turgid and protoplasm is closely pressed against the cell wall.
2. In 2^{nd} condition where we use 0.25 M sugar solution for mounting, the cell contents were withdrawal a little from the cell wall.
3. In 3^{rd} condition where little more concentrated solution is used, the cell conent move appreciably away from the cell wall and more colourless space is distinct between cell wall and cell sap.
4. In 4^{th} condition where we use 0.75 M sugar solution the cell contents withdraw from the wall and shrink into a small ball like structure.

Conclusion

1. In preparation 1^{st} normal condition is present where cell sap prasses the protoplasm against the cell wall and this condition of cell is known as turgid cell condition.
2. In condition 2^{nd} the space between the cell content and cell sap is due to loss of water from the cell.
3. In stage 3^{rd} 4^{th} 5^{th} the process of exosmosis continuous due to increase in concentration of sugar in solution. Finally, due to continued exosmosis the cell content shrinks and collected at one of the corner and this condition of cell is known as plasmolysed cell.

Experiment-4

Aim- To study the phenomenon of deplasmolysis.

Material Required

Rhoeo discolox leaf, covex slip, slides, safety blades, sugar solutions of different concentrations, water and microscope.

Procedure

1. Peel off a small lower leaf segment surface by tearing the leaf obliquely with a jeck.
2. Then mount the peeled segment in a drop of sugar solution of different concentrated on a clean slide and then cover it with cover slip.
3. Then take out the leaf segment from hypertonic sugar solution and put them in plain water or in hypotonic solution and observe one leaf segment after 30 seconds under microscope and another after 1 min under microscope.

Results

1. In condition A1where we use 0.75 M sugar solution we observe a plasmolysed cell having a small ball like structure due to shrinkage of cell content.
2. In A2 condition the shrinkage is in more amount and all the content observed as a small dot.
3. In B condition the plasmolyesd cell again start retaining its shape.

Conclusion

In a Plasmolysed cell the space present between the cell wall and the cell contents is filled with the hypertonic solution placed outside the cell. The plasmolysis can be stopped if such plasmolysed cells were placed in plain pure water or in hypotonic solution.

Experiment-5

Aim - To compare stomatal and cuticular transpiration by four leaf method

Material Required

Four fresh dorsiventral leaves, stands, grease/Vaseline, thread etc

Procedure

1. Take four leaves of a plant and tide them with the help of thread on stand.
2. Apply Vaseline on both the surfaces of one of the leaf and mark it as A.
3. Apply Vaseline on lower surface of one of the leaf and mark it as B.
4. Apply Vaseline on upper surface of one of the leaf and mark it as C.
5. And leave leaf D without applying grease on it.
6. Note the changes in all the leaves after some time.

Results

Sr. No.	Leaves	Surface with Vaseline	Result observed
1	A	Both sides	Very little or no change
2	B	Lower surface	Leaf wilting at 3rd number
3	C	Upper surface	Leaf wilting at 2nd number
4	D	Without Vaseline	Leaf completely wilted

Conclusion

The leaf possesses stomata on both the surfaces. On lower surface more amounts of stomata is present then on upper surface. Hence, above conclusions were observed.

Experiment-6

Aim - To demonstrate ascent of sap

Material Required

Beaker, water, razor, plant twig and wax.

Procedure

1. Take a plant twig and with the help of razor remove a ring of bark without injuring cambium. Mark it as 1.
2. Take one more twig and remove xylem elements from it but without injuring cortex and phloem. Mark it as 2.
3. The removal of tissue s should be done only when twigs are kept under water. Immerse the plant twigs into the beaker filled with water in it and leave for few hours.

Results

In condition 1, no change was observed and leaves remain turgid.

In condition 2, leaves of twig wilted and loose their normal condition.

Conclusion

The leaves remains turgid in condition 1 because in this condition xylem was not disturbed by removal of bark, only cortex and phloem was removed which do not play role on transportation of water.

Leaves wilted in condition 2 when water does not reach the leaves as xylem is blocked by removal. It shows that phloem and cortex does not participate in ascent of sap.

Experiment-7

Aim – To demonstrate hydrotropism

Material Required

Germinating seedlings, wire gauge, moist saw dust, water etc.

Procedure

1. Take some germinating of germinating seedlings and allow to grow them on an inclined wire-gauge which is covered with moist saw dust.
2. Then leave for some time and observe them.

Results

The radicals at first grow in downward manner due to positive geotropism but after some time roots bend towards moist saw dust to show positive hydrotropism due to closeness of geminating roots to water.

Experiment-8

Aim – To demonstrate phototropism

Material Required

A potted plant, a chamber with a hole inside on one side and it is painted black from inside and saw dust.

Procedure

1. Take a potted plant and keep it in dark chamber and allow it keep there for 2-3 days.
2. Direct the hole of chamber towards the light.

Result

The stem grows and bends towards the source of light.

Conclusion

The curvature induced by unilateral source of light is called phototropism. This response is shown due to the unequal growth rate present on two sides of stem. The illuminated side show less growth then the opposite side which is away from source of light.

Experiment-9

Aim – To demonstrate geotropism with clinostat.

Material Required

A potted plant and clinostat etc.

Procedure

1. Clinostat is a type of instrument or apparatus having a disc which rotates in clock-wise manner. A pot is attached with this drum ant it also rotates with the drum. Both pot and drum are attached on the opposite ends of the rod.
2. Fit a potted plant clinostat on the clinostat and then rotate it with the help of hand due to which an equal stimulation of gravity is present all over the plant.
3. At regular intervals the plant is allowed to stop at a particular position.

Result

1. No curvature was observed in roots as well in shoot.
2. Root grows towards gravity and shoot bend away from the force of gravity.

Conclusion

The movement of shoot and root depends upon the concentration of auxin, towards the stimulus concentration of auxin is more.

Experiment-10

Aim - To demonstrate the rate of transpiration by using 'Farmer's potometer /Ganog's photometer

Material Required

Any potometer, stop watch, water, plants beaker, grease etc.

Procedure

Since two types of potometer are used so, construction of both of them are described separately

1. **Farmer's potometer**: This potometer consists of a large wide mouthed bottle closed with the help of a rubber cork having three holes. Now insert thistle funnel (with a stop-cock acting as a reservoir through one of the hole, a twig through another hole and a bent tube of narrow diameter through the third hole. This third tube is fixed or attached with a scale. The bottle, reservoir and the bent tube are filled with water and a air bubble is introduced into the bent tube. The rate of transpiration is determined by the movement of bubble from one place to another over a definite distance and time was noted with the help stop-watch.

2.**Ganog's photometer:** This apparatus consist of a capillary tube having a wide vertical end on one side, and a bent end on opposite side end filled with water in it.

The rate of transpiration with different of bubble conditions can be noted

(A) Plants kept in darkness i.e. without sunlight.
(B)Plants in atmosphere with higher relative humidity.
(C) Under high temperature.
(D) Under fan and
(E) Under decreased amount of soil water.

Result

(A) In darkness there is no movement of air bubble.
(B) The bubble moves slowly under higher relative humidity.
(C) Under high temperature the bubble moves very fast.
(D) Under fan, the air bubble moves faster.
(E) Under decreased amount of soil water i.e. when less amount of water is provided to the plant bubble moves slowly.

Conclusion

(A) Under darkness: There is no movement of air bubble due to lack of transpiration as the stomata remain closed under such condition

(B) Under high humidity the rate of transpiration is slow as the stomata remain closed under such condition the less humid atmosphere is present externally. Hence, a vapour pressure gradient exists between internal and external atmosphere and the vapour diffuses out from the leaf to the external atmosphere rapid diffusion of vapours occurs when less humid condition present outside the leaf but under present condition high humidity occurs outside the leaf so, less transpiration rate occur.

(C) Under high temperature air bubbles moves faster due to high transpiration.

(D) When the plant kept under fan (air movement) the transpiration rate increases.

(E) Under decreased amount of soil water, transpiration rate decreases due to stomatal movement i.e. gradual increase in stomatal opening.

B. BIOCHEMISTRY

Experiment-11

Aim - To demonstrate aerobic respiration

Material Required

Bottle, cork, water reservoir, stop cock, beaker, stand, water and germinating seeds etc.

Procedure

1. Take a glass bottle and put some germinating seeds into this.
2. Close the bottle with the help of cork and make two holes into the cork surface from one of the cork hole put a bent tube inside the bottle and allow the free lower end to dip in water
3. Through another hole insert a tube attached with water reservoir with stop cock.
4. The stop cock and water seal are closed and allow seeds to respire.
5. Then water seal is replaced by lime water container and open the stop cock of reservoir.

Result

From bent tube air bubbles come out into the beaker containing lime water as a result it turns milky.

Conclusion

The turning of lime water into milky indicates presence of CO, (carbon-dioxide) and it is released during seed germination in glass bottle. Release of CO, indicates aerobic respiration.

Experiment-12

Aim- To test the presence of sucrose in the given sample

Material required

Given sample, HCl, Benedict solution, sodium carbonate, test tube, test tube holder, spirit, lamp.

Procedure

1. In a clean dry test tube take little amount of sucrose and add equal amount of HCl in it.
2. Boil the mixture in a test tube for 4-5 min.
3. Neutrilise the solution in test tube with sodium carbonate.
4. Then add benedict solution in it.

Result

Due to Benedict solution, yellow red or green precipitate is formed.

Conclusion

The test tube indicates the presence of sucrose in given sample.

Experiment-13

Aim- Experiment to determine the peroxidase activity

Material required

Potato, knife, test tube, alcohol, benzidine, hydrogen peroxide, spirit lamp etc.

Procedure

1. With the help of knife, cut a section of potato.
2. Dip this potato in benzidine solution.
3. Wait for 15-20 min. then take out the potato slide from benzidine solution.
4. Keep it aside for another 15-20 min.
5. Then add hydrogen peroxide solution in a test tube containing potato slide.

Result

Due to oxidation of benzidine, blue color appears.

Conclusion

Peroxidase occur in plant tissue and oxidize various substrates in presence of water.

C. ECOLOGY

Experiment-14

Aim- To determine the pH of soil sample or water sample

Material required

pH paper, ph indicator, soil sample, water sample, distilled water etc.

Procedure

1. In a test tube, take 5 ml distilled water and add a pinch of soil in it for testing soil pH and for water take water sample.
2. Then with the help of pH paper indicator, try to find out pH of the soil by dipping the papers into the sample due to which color of paper changes./
3. Then match color of strip with color scale given on booklet, from which approximate pH of sample is determined.

Result

pH of sample is determined.

Experiment-15

Aim- To study morphological characters shown by xerophytes

Observations

Xerophytes are the plants growing in habitats where less water is available following morphological characters were observed in some common xerophytes.

1. **Roots-** Long tap root system that groe deeply into the soil to reach water table. In some desert plants, roots are present near the soil surface to trap the available water present on surface.

2. **Shoot-** Hard and woody stem covered with hairs, wax and silica etc. In few xerophytes, fleshy stem is present and the cells contain large quantity of mucilage ducts to store water. In extreme xerophytes, stem gets modified into leaf like structure to reduce transpiration. In some xerophytes, shoots become cushion like or stunted in growth.

3. **Leaves**- In many xerophytes, leaves fall down as soon as they are formed and these leaves are known as caduceus leaves. Many species of xerophytes show complete absence of leaves. Leaves are arranged in rosette fashion which cuts down light and reduces transpiration. In most of the cacti leaves get reduced into spines.

4. **Reproduction**- 3 cycle of reproduction present in xerophytes.
    a. **Drought resistant**- these xerophytes plants are strictly adapted to resist extreme drought conditions. They flower only in moist season.
    b. **Drought escaping**- these xerophytes plants complete their life cycle during moist season and before onset of dry season.
    c. **Drought enduring plants**- these plants continue their life cycle during dry weather but their activity rate is very slow. All succulent plant shows these conditions.

Experiment-16

Aim- To study morphological features of common hydrophytes

Observations

Hydrophytes are the plants growing in water or in water rich habitat. Following are the common morphological features of hydrophytes.

1. **Roots-** poor development of roots. In some cases they be absent. In some cases roots are well developed and work for attachment. For buoyancy of plant, adventitious roots are developed in free floating plants. Instead of root cap, root pocket are developed which help in floating.

2. **Shoot**- flexible, delicate and spongy stems are present in hydrophytes.

3. **Petiole**- it is stalk by which a leaf is attached to a stem. It is very long and delicate in these plants which help leaves to float.

4. **Leaves**- waxy coating of leaf hairs is present on the surface of floating leaves.