**Basics of Biology**
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**Lecture No. 02**
**Classification of the Living Organisms (Part – IV)**

Hello everyone, this is Doctor Vishal Trivedi from Department of Biosciences and Bioengineering, IIT Guwahati and what we were discussing, we were discussing about the living organisms in this course, and so far what we have discussed, we have discussed about the evolutions and we have discussed about the classification of the animals and so, far what we have discussed, we have discussed about on what basis the animals are or the organisms are being classified and then we have also discussed about the different types of the criterias through which the scientists have actually classified the animals.

So, they have, they have in our previous lecture, we discuss about that how the animals are being classified into the starting from the Porifera, Coelenterata and then we have also discussed about the Platyhelminthes, Aschelminthes, Mollusca and then ultimately, we also discuss about the Phylum Chordata and within the Phylum Chordata also based on the different types of properties and different types of similarity and the dissimilarities, the Chordates are also further divided into the many sub classes or subdivisions.

So, the idea of that discussion was that we would like to say that how the similarity and the dissimilarity between the different organisms could be a basis for the classifications. To understand that same process, we are actually now going to discuss about the classifications of the plants.

This is not an extensive or exhaustive discussion about plant classification, the purpose of this discussion is that we would like to emphasise how the classification actually works and that is how we have taken an example of the two different division, we have taken a kingdom Animalia (03:05). Kingdom Animalia is being divided and now, we are going to take up the kingdom Plantae.

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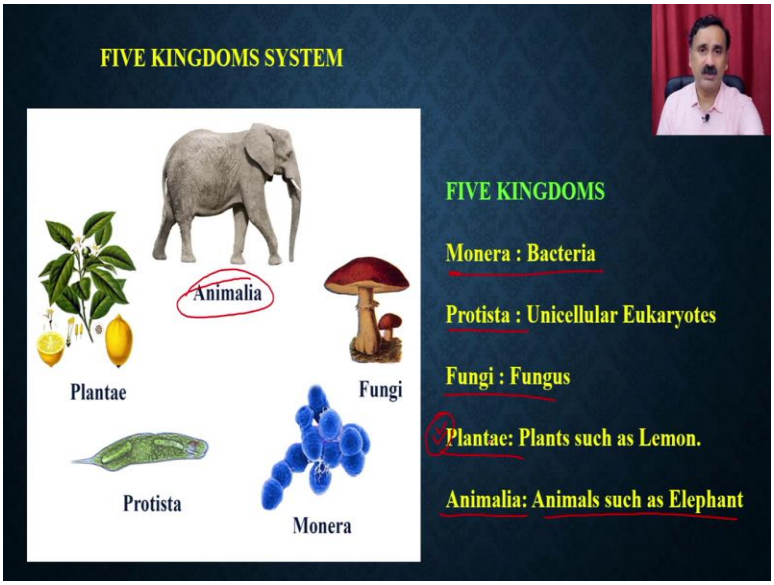


So, initially if you recall we have discussed that the organisms are being divided into the 5 kingdoms we have said about the Monera. So, we have discussed about the Monera, Protista, Fungi, Plantae and the animals and in the previous lectures. We have also discussed about the Animalia like the animals such as the elephants what you see here.

And now, in today's lecture we are going to discuss about how the people have used the different criteria to classify the plants. But before we get into the details of the plants, let us discuss about the different parts of the plant and how they are actually been formed.

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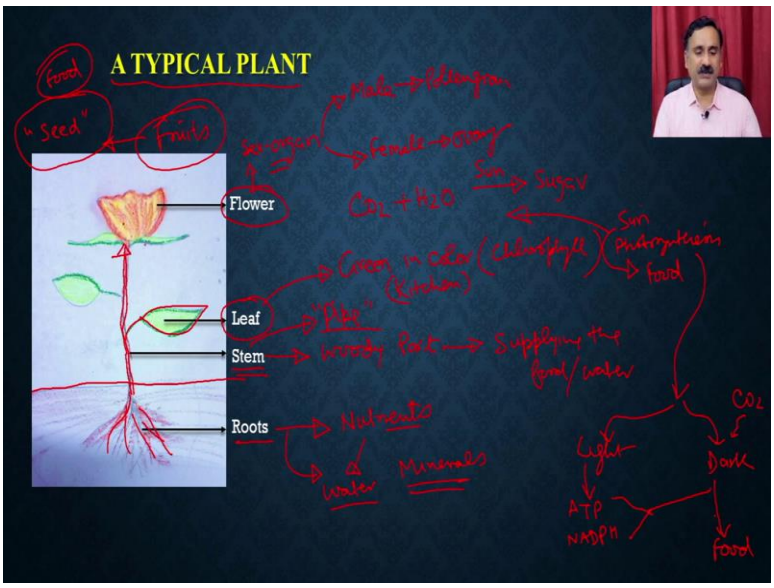

So, if you see the plant what you see here is they have a very well defined structures or the anatomy. So, starting from the bottom, so you know that the plants are present into the soil they could be present in the aquatic plants, they could be terrestrial plants and this they are present in the soil and within the soil, they have a well defined vascular system, so that vascular system is made up of the roots.

The purpose of the root is that they are actually going to suck the nutrients from the soil. So, they are going to suck the nutrients from the soil and they are also going to suck the water. So, they are going to suck the water, nutrients, they are also going to suck the minerals and all other enough things.

So, that material will actually going to travel all the way up to the top and the portion what is going to help in terms of the supplying the food material to the different parts of the body is actually being the part of the stem. So, stem is actually the woody part, which is being present into the plants and their job is that they will be helped in supplying the food or supplying the water to the different parts of the body.

So, stem is nothing but a pipe like structure so that is actually going to supply the food or to the water to the different parts. And then we have the leaves which are attached to the plants and the leaves are actually green in colour, you know that, the leaf is green in colour and it is green because it has pigment which is called as the chlorophyll and the plant leaves are also called as the kitchen of the plant.

So, here the food is going to be prepared and how the food is going to be prepared remember that food is going to be prepared by a process where it is going to utilise the light or the energy from the sun and it is actually going to prepare the food by the process which is called as photosynthesis.

Photosynthesis is a very complex process, where you have the two phases, you have a light phase and you have a dark phase and light phase is actually going to be utilised for capturing the sunlight from the sun so that it actually be able to capture the energy and that is how it is actually going to produce the NAD and the NADPH, ATP and NADPH.

Whereas the ATP and NADPH are going to be used in the dark reactions and in the dark reaction, it is actually going to take up the carbon dioxide from the environment and that is how

it is actually going to produce the food. So, if you seek the typical reactions, what is going to happen when you are going to have photosynthesis is that it is going to take up the carbon dioxide it is going to take the water from the roots and then it is actually going to generate the sugar in the presence of the sunlight.

Now, once the leaf is going to produce the food that food is going to be distributed to the roots, to the stem and to the flower also. So, on top of this, you are going to have the flowers. So, flowers are actually the sex-organs of the plant, not that all the plants are going to have the flowers, but these are the few typical parts which are present in a typical plant.

So, flowers are actually the sex-organs and plant could we have the either the separate male and female plant or it could be bisexual plants. So, it can be a male flower, or it could be a female flower, and they will be together. So, male is actually going to produce the pollen grain and the female is actually going to have the gynoecium or the ovary and that is how they are actually going to participate into the fertilizations and that is how the flower is going to give rise to the offspring.

So, it is going to form the seeds, then apart from that, it also could have the fruits. I think if you remember fruits are actually being material where you are actually going to have the seed and the seed is actually going to be covered by the food material. So, that is actually been a way to protect the seats. So, that the seats are actually going to be dispersed for a very long period. And in by taking the nutrition, because the food is there outside the seed, the seed is also going to be dispersed beyond the original location of this particular plant.

So, now let us talk about, so based on this kind of anatomical features or external features the seed the flower the plants are being divided based on the two factors one the plants which do not have the fruits or the plants which the plants which do not have the flowers or the plant which do have the flowers. Because this is the one which makes a very clear distinction between the two groups.

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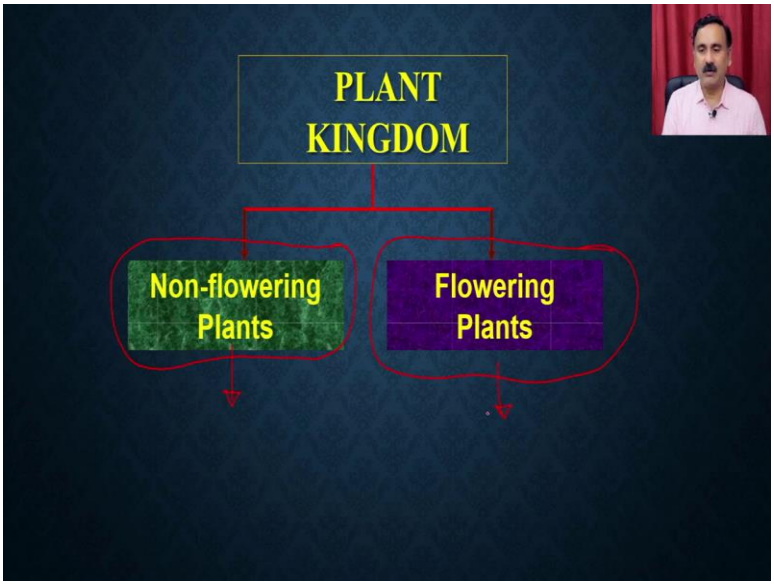


So, what you have done is the people have divided the plant kingdom into the two groups, one the plants which do not have the flower or the non flowering plant and the other group is called as the flowering plants, within the non-flowering plant we have the many classes and non flowering class also we have the few classes.

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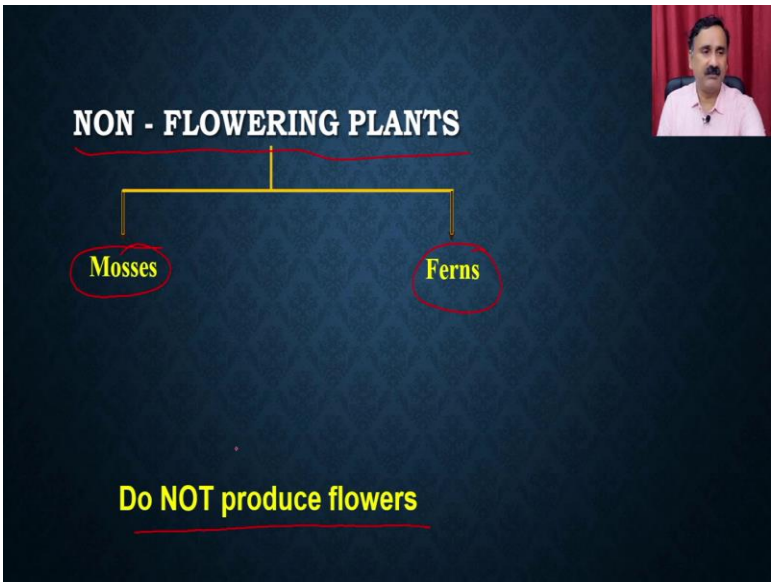


So, within the non-flowering plants we have the two classes one is called as the Mosses the other one is called as the Ferns, they do not produce the flowers which means they are actually going to have the reproduction by the other means.

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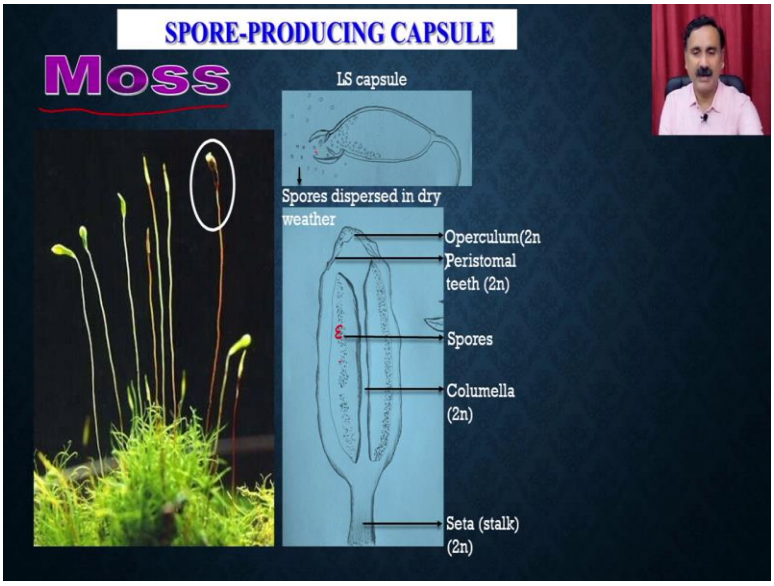


Now, this is the spore forming capsules. So, what you see here is a typical moss and what you see here is actually a spore forming capsule. So, in this capsule you have the spores which are stored and the spores are getting when the spores are being stored in this particular organ as and once, they will be suitable weather the spores are actually going to be dispersed and that is how they are these spores will fall onto the distant locations and that is how they are going to give rise to the new plants.

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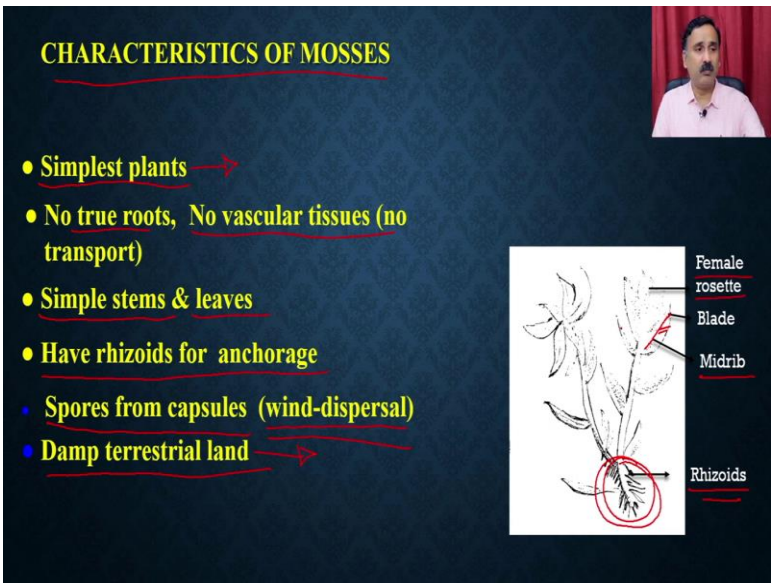

What are the characteristics of mosses? The characteristics of mosses is that they are actually the simplest plant they actually do not have the flowers they do not have the very well developed vascular tissues which means they do not have the roots and as well as they do not have the very well developed vascular tissues. They have a very simple stem and the leaves and they have the rhizoids for the anchorage which means they have the rhizoids likes route like structure, but it is not a well-developed or true roots actually. So, only for anchorage purposes.

Then it has it is forming the spores and the spores are then going to be dispersed by the wind, these are the damp terrestrial lands. So, they are being formed in the places where you have the large quantity of water but it is they are not the aquatic plants. So, what you see here is a rhizoid which actually helps to hold these and plants into the soil then it has a midrib so, within the leaves you would you see leaf has a blade and it also has the midrib, then it has a female rhizoid and these female rhizoids are actually going to produce the spores.

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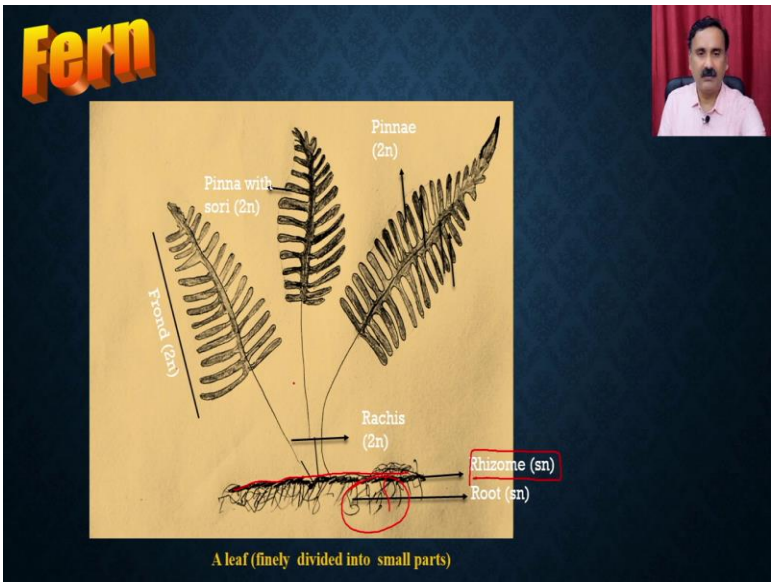


Now, let us talk about ferns. So, ferns are actually the, you might have seen the ferns in your home. So, ferns are actually having the rhizome which actually are going to be present into the soil and the rhizome has the roots. So, the clear-cut distinction between the mosses and the ferns is that the mosses does not contain the roots, the well-developed root whereas the ferns are actually containing the roots.

And then it has the leaves and all the pinnacles and the these are actually being utilised for the photosynthesis and within the ferns you have the spore forming units, (13:03) are present onto the backside of the leaf and that is how they are actually going to form this spores. These spore forming units are called as Polypodium.

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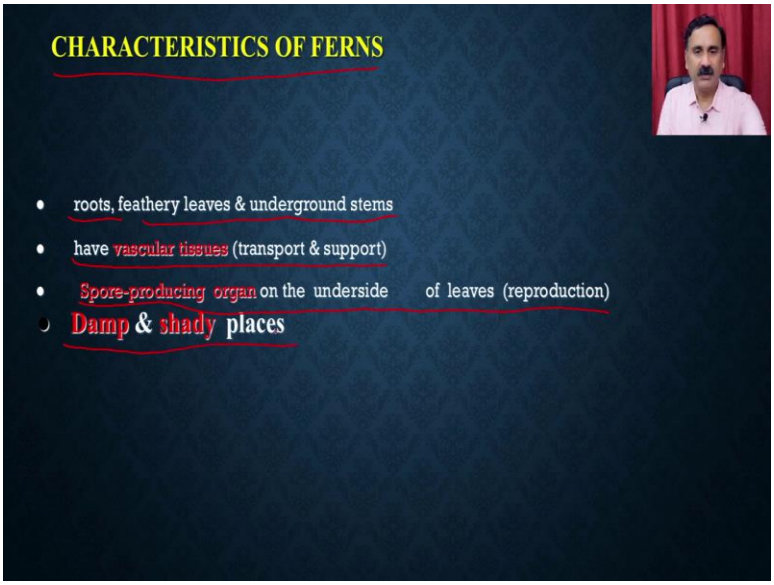


The what are the characteristics of the fern? They are having a well developed root and the feathery leaves and the underground stems, they have the vascular tissues for the transport and the support of the plants. They are spore producing organs on the underside of the leaf and they are actually going to be formed in the damp and the shady places. So, this is all about the classification and the discussion about the plants which are being non flower farming plants then we are going to discuss about the flowering plants.

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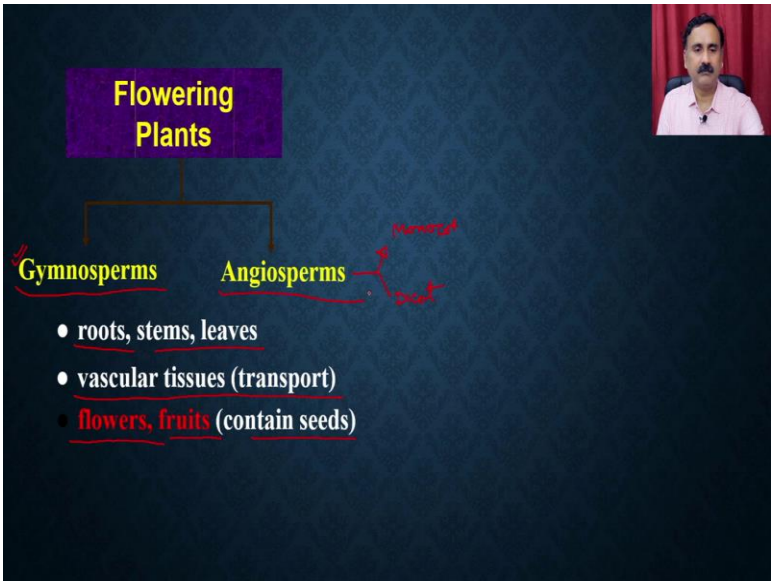

So, within the flowering plants you can have the two sub-classes; one is called as the gymnosperms and the other one is called as the angiosperms. So, gymnosperms are they are actually going to contain the roots, stems and leaves and they are going to have the vascular tissues and then they are going to have the flowers as well as the fruit, which actually will contain the seeds. So, in the (gym) angiosperm again can be classified into two classes one is called as the monocot and the other one is called as the dicot.

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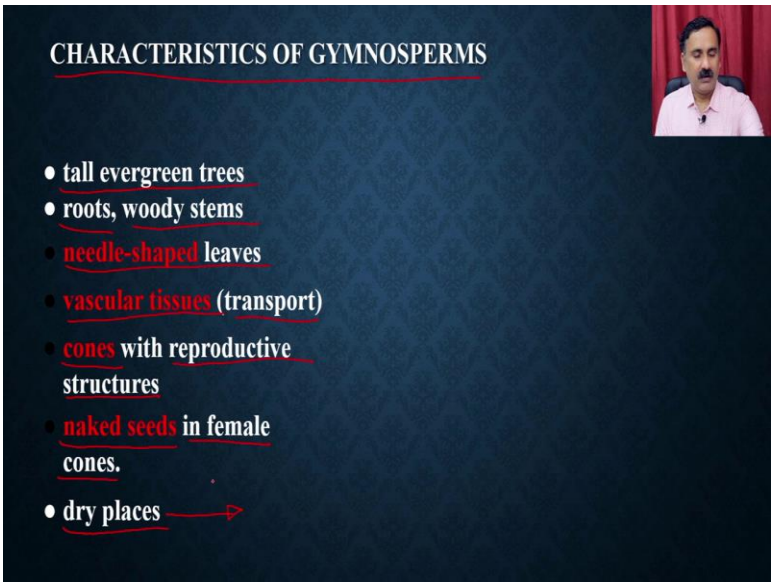


Now, let us see the characteristics of the gymnosperms. They are the tall evergreen trees. They have the well-developed root and the woody stems they have the needle shaped leaves, they have the vascular tissue which is you they use for the transportations, then they have the cones with the reproductive structures, and then they have the naked seeds in the female cones. So, they have the seeds but they do not have the fruits and then they are found into the dry places.

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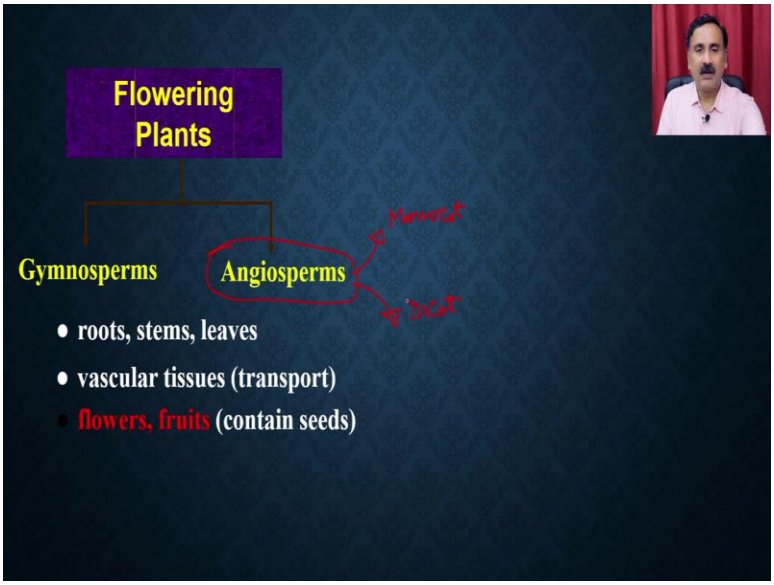


Now, let us talk about another class which is called as the angiosperm. So, angiosperm as I said, angiosperms can be further divided on to the based on the type of the seeds. So, it could be Monocot or the Monocotyledon plant or the Dicot or the Dicotyledon plants.

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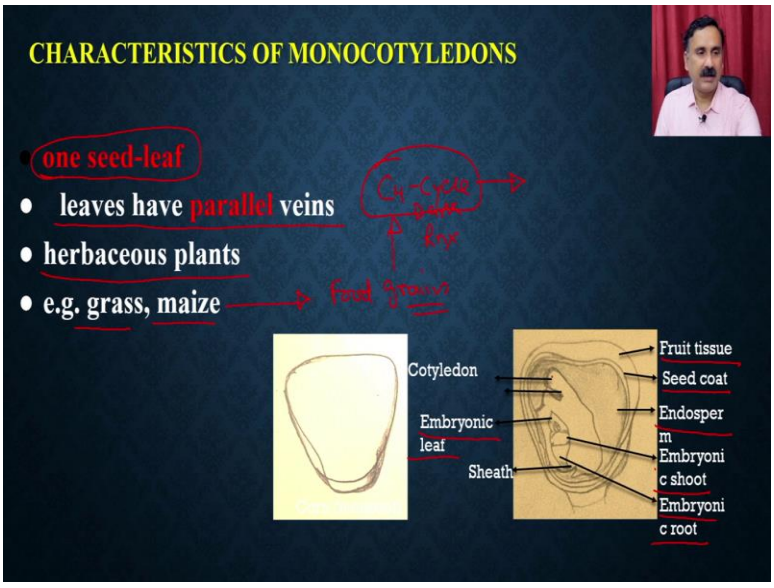


So, what is the characteristics of the monocotyledon plants for monocotyledon plants are actually going to contain the seeds which are actually going to have the one leaf and the leaves have parallel veins and it are herbaceous plants. For example, the grass and the maize. So, you can just remember by what is the monocot all the food grains in general are actually belonging to the

monocot because the food grains are and monocots are having a very unique and leaves autonomy and because of that they are actually running a C4 cycle of the dark reactions.

And because of that their food production is more because the C4 cycle is much more efficient compared to the C3 cycle. So, what you see here is a typical seed when you grow the seeds what you see here is the embryonic leaf, so it has only one leaf that is why this is called as monocot and it has one cotyledon and what you see here is this is the complete fruit so it has a fruit tissue seed coat and endosperm and the embryonic shoots and the embryonic root. So, when you grow them, it is actually going to give rise to the new plants.

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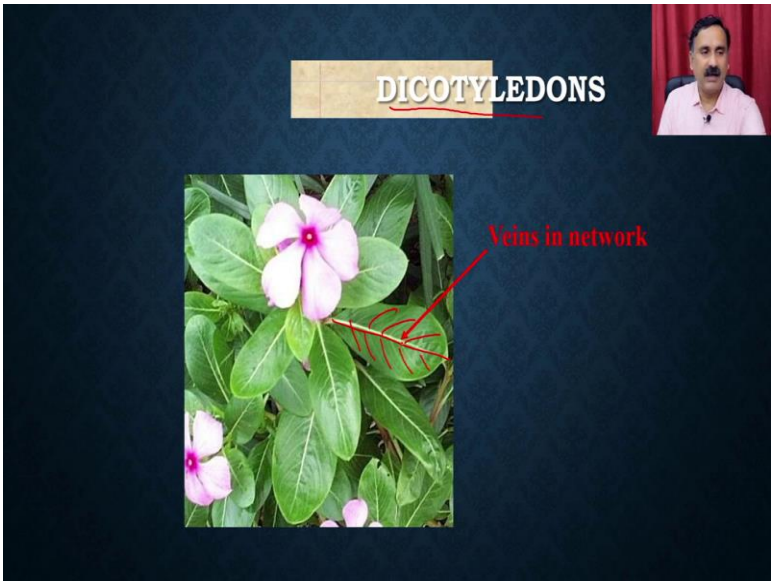


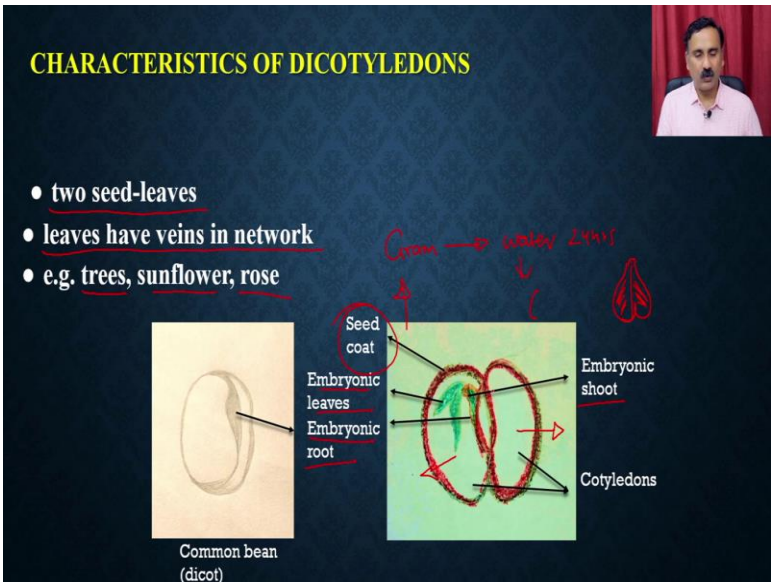

Then we are going to talk about the dicot. So, dicot is this is a you know evergreen plant what you have seen and this is the what you see here is the veins into the leaves so they are actually arrange in a typical pattern and the dicot are going to have the two leaves into the seed and the leaves have the veins in their network. These examples are trees and sunflowers and rows and what you see here is actually the two cotyledons.

So, what you see here is this is a seed coat and it has the two cotyledons. So, If you want to see very carefully about the dicot plants and understand what is the dicot and what is the two monocot and what is the cotyledons what you can do is just take the gram seed and soak it into the water, for maybe like 24 hours in warm weather, what you will see is that the have you seen the gram like it is like this.

So, if you grow them, it is actually going to show you the two cotyledons. So, this is actually going to those flashy things, what you see and that is what actually called is as cotyledons and then it is actually going to have the embryonic stem or the embryonic shoots and then it also has the embryonic root and embryonic leaves and it also has a seed coat, which actually be get dissolved when you put them into the water.

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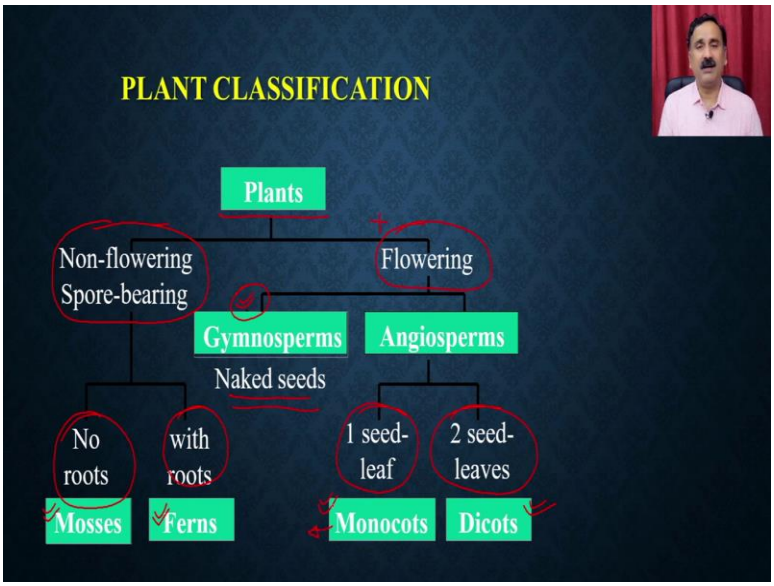


So, let us take a look at the plant classifications for plants are actually been classified based on whether the flower is absent or whether the flower is present. So, initially, you have the non flower spore bearing plants or the flowering plants. Non-flowering spore bearing plants can be

further classified based on whether they have the root or they do not have the roots. So, if they do not have the root, then you have an example of mosses. If they have the root, then they are being classified as the ferns.

Similarly, in the case of flowering plants, they can be further divided whether it contains the fruits or not. So, because if they do not have the fruits, then it is actually going to have the naked seed which is actually present in the gymnosperm but they have the fruits which means they are going to have this fruit so that it can cover the seeds then it is going to be called as the angiosperms and then angiosperms can be 1 leaf plant or the 2 leaf plants.

So, if it is 1 leaf plant then it is going to be called as monocot, if it is the 2-leaf plant then it is going to be called as dicot. So, based on this classification very carefully, you can see that the monocots are actually the most advanced and most developed plants which are present. So, with this, we have completed our discussion about the animal organisms as well as we have talked about the classifications.

And I hope you have could have understood the many aspects related to the classifications you might have understood the basis how which on which you can be able to do the classification of the different organisms, although we have just discussed about the animal classification and the plant classification to give you an idea, how the classification could have been working and how the people are actually classifying the different types of animals.

But, you can actually be able to utilise the similar kind of criteria's and similar kinds of properties even to classify the bacterial species, you can actually use that to classify the fungi's and you can also classify the same way to the other organism which are present in the other kingdoms as well. So, with this I would like to conclude my lecture here in our subsequent lecture, we are going to discuss some more properties related to the living organism in this course.

Thank you.