PHARMACOGNOSY AND PHYTOCHEMISTRY

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Week 12

Lecture56

Week 12: Lecture 56: Application of Databases for Plant Search

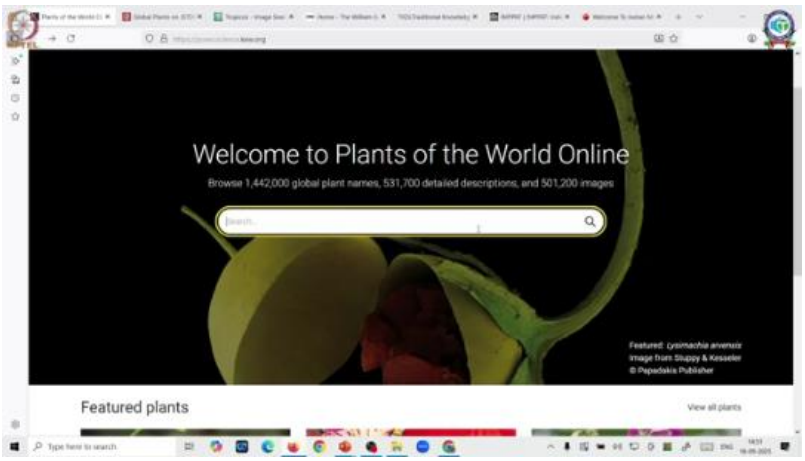
Thank you. Hello everyone, and welcome to week 12 of our course in Pharmacognosy and Phytochemistry. So far in this course, we have seen what Pharmacognosy and Phytochemistry are, along with their scope. We have delved into different sets of compounds and the plants containing them. For example, we studied tannins, alkaloids, resins, carotenes, and many other chemical classes.

Thereafter, we explored methods of evaluation, including physical, chemical, and biological approaches. Now, in this particular week, we will use technology to help us understand this subject further. Many of you taking this course are researchers, academicians, and students interested in pursuing in-depth knowledge of this subject. So this week, we will explore the tools the internet offers in the field of Pharmacognosy and Phytochemistry. In this first session, we will examine the application of natural product databases for plant searches.

Now, why is plant search important? For example, suppose you are interested in researching a plant. You come across a plant and wonder what compounds it contains. What exactly is this plant? Now, some plants have different species.

So how do I identify this plant without having proper botanical knowledge? Now, there are certain software or server-based engines that can help you do this. So how can we do this? Let's see them one by one. So a few places where you can search for your plant include databases such as Plants of the World Online, Just Talk Global Plants, Tropical, as well as the New York Botanical Garden Herbariums.

So let's see these software and let's see these engines and how they help us. So we'll go into the first engine, and that's 'Welcome to the World of Plants Online' or 'Welcome to the Plants of the World Online.' Now, here's what you do: suppose, for example, you want to pursue or are interested in one particular plant. This website carries numerous plant names. So we'll just see—maybe you just heard or read about one particular formulation that says, 'My formulation contains this plant.'



So what is this plant? Let me just see. Let me just Google it, and I'll just put the name of the plant in this website. So, say, for example, I'm interested in something called *Withania*. So I'll just quickly Google it.

And then the Plants of the World Online will tell you that if you're thinking of *Withania*, there are so many Withania species found globally. So then you have to see what exactly you are interested in. So there are about three pages. So you can just quickly browse through. So your Withania is not just about *Withania somnifera.*

As you can see globally, different species of *Withania* are present. Again, we go to the next one. We'll see the third page as well. So the good part about this website is that it is maintained by a wonderful library, the Kew Botanical Gardens, which is located in the UK. And in their botanical repository, they have numerous photographs as well as herbarium sheets.

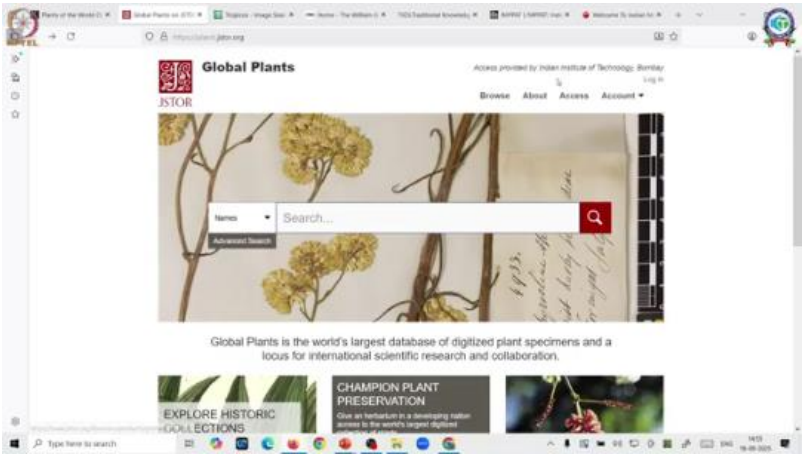
So including, you will see it on their website wherever they have the availability of the herbarium sheets. They have already been placed so that you don't have to search for

them exclusively. So let's click on any of them. I can see one here. See if this plant interests me.

So they have photographed it in its natural habitat, which is in Ethiopia. And it's also found in Somalia. That's where geographically you can see the occurrence of this plant. They'll give you an idea. And then some synonyms, which are often used to refer to this plant, such as *Withania somnifera*, which is also what we call Ashwagandha.

But here, the variety is different because it's a Somali plant; it is the variety somalensis. It will give you the whole taxonomy of this plant. That's why I said if you're curious, you have to search these databases, and you will come across the one that will give you the complete taxonomy, some publications about these plants, and any other data, including where you can find these plants in a herbarium or catalog. So you get a lot of data about each of these plants. Now we move to the next one.

The next is the JASTA website. This is also a very similar website, which is used globally. Again, you can just try searching for the plant. I'll just put in the same one here. Say, for example, *Withania*

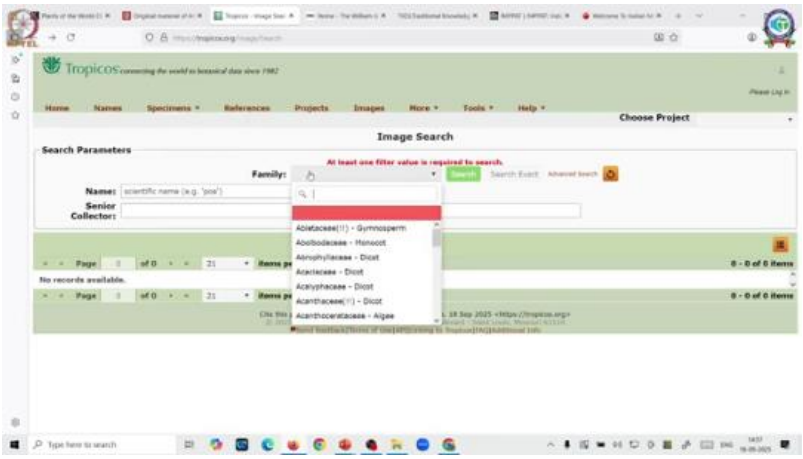


Let me see what this has to offer. So this one will also give me different details about this plant. So these websites are primarily to help me search for the plant. If it's Withania, what exactly or which variety of Withania do I want? Where does it occur?

What is the taxonomy of this plant? So this will help me at least shortlist my plant initially for the searches. This website interestingly has herbarium sheets for most of the

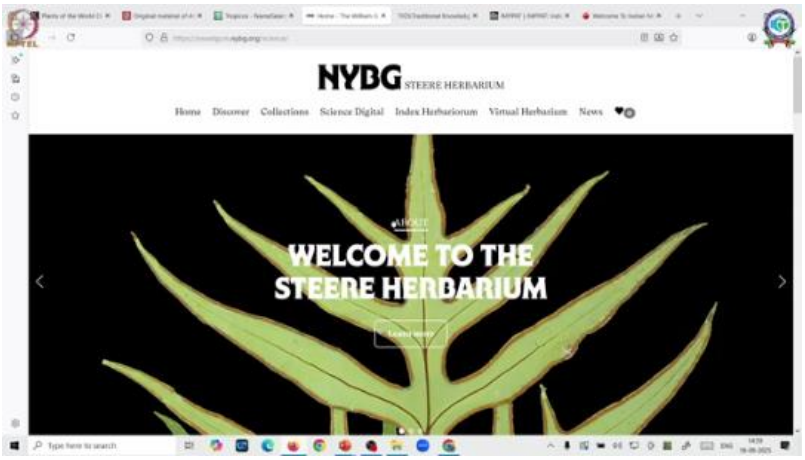
plants here. So you can see here different isotope's, different varieties. They are also seen here along with their synonyms and other names which are also used.

This is *Withania somnifera*. This is the one which is identified. You can just click here and you will come across a very good herbarium sheet which will help you identify this plant. Similarly, you can use another website which we just mentioned, and that is Tropics. Tropics again gives you help, or you can choose it by family.



See, for example, I'm seeing Acacia. So what all belongs to that particular family? You can search it by name or common name. See, for example, let's say, this plant. Let's search for it.

So it's a Lamiaceae family member, and you can see some details coming in. Now, simultaneously, we'll also search another website, and that is the New York Botanical Garden. Now, this New York Botanical Garden also provides numerous plants, but not only plants—it also provides a repository of fungi. So if you see, there are almost 7 million kinds of specimens, of which almost 4 million have been digitized here.



So you can actually visit the virtual herbarium and search for your plants here. So you can go by either family name, scientific name, geography, collector, or if you have the specific name, you can put the number, collection number, as well as the status. So you can just search here. And you can see the Withania in terms of the herbarium sheets. The New York Botanical Garden has almost 97 specimens.

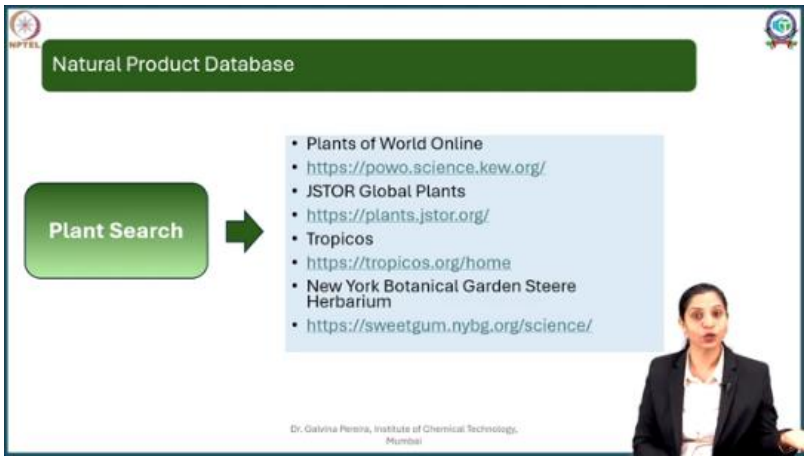
So you can see here there are different isotope's, and their collection dates are pretty old. So you can even trace old samples which have now been digitized. So this is the Indian one, *Withania somnifera*. This is the one which was collected in the U.S. Yemen.

So you have it from different geographical locations. The good part nowadays is that many of these botanical gardens are open to collaboration with botanists globally, and you can supply your herbarium sheets, which they'll upload on their portal. So that is how you can see that the herbariums of different countries are featured in this, and that helps the global research community in understanding the botany of these plants. So just taking a quick view of all Withania species we see here in

So there are many species of Withania, and your *Withania somnifera* specimens can be found across the globe, collected in Kenya, the U.S., and India. And what you can do is open them and try to compare. Are they similar or dissimilar? Any speciation or variation in terms of the size of leaves or any further variation has happened therein. So this is *Withania somnifera*, the same one collected from Egypt.

Again a *Withania somnifera* collected from Libya. So that's why they have a huge collection and definitely you can use this to see globally how *Withania somnifera* occurs and is there any difference. This is the one collected in Spain, Egypt. So since there are two, we'll just quickly try opening. Meanwhile, our tropic's has returned our search and you can see here it comes with the taxonomical details of the plant that we are searching in.

so this sites and there are numerous other sites some of them are paid some of them are freeware they'll help you so you just have to put in your query you want tulsi just put in your query as osimum you want your other species like your mint put in your query as mentha just see how many variants how many species of *osimum mentha* are present and that will help you fine tune your plant for research Not only that, as we go further, you will see that which are the ones which have been used in traditional medicine, which have been reported for their Phytoconstituents. And what you can do is you can search similar other species and check if the same set of Phytoconstituents are present in other species of them. So if Withania coagulants, does it also contain withaferin? If that's a question, you could search it through the software's.



Try to search the Phytoconstituents and then try to understand that yes, probably this also contains. So this species of Withania may also show the similar or slightly similar kind of pharmacological activity. Now, this was about your plant search. Moving further, what you can also do is, you know, we all have a very rich traditional medicinal systems. So

this traditional medicinal systems include your Ayurvedic medicines, your Siddha, Unani medicines and so on.

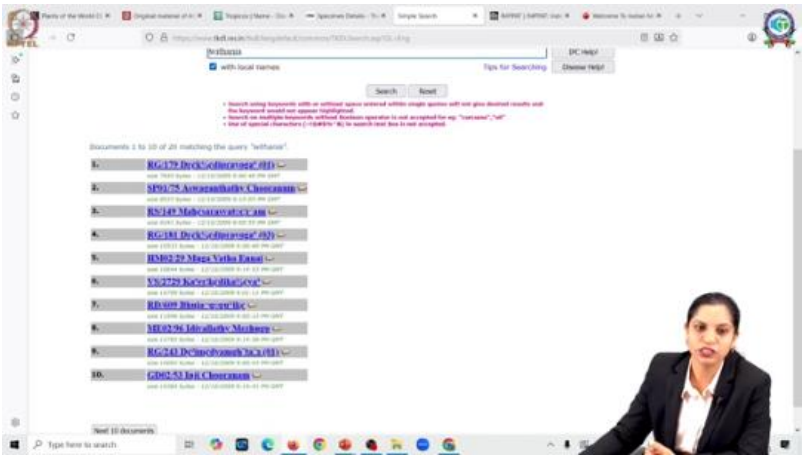
Many a time what happens is many of these traditional books have been written in vernacular languages. Many of these books are written in Sanskrit with current day knowledge. And, you know, very few of us know Sanskrit to that depth. Many of the books have been translated, but still this data remains. remains kind of hindered from the scientific community because of this language barrier and as a result many government initiatives have been taken to convert this into a kind of a digital knowledge.

So to understand our traditional medicinal drugs we can use software's or we can use search engines such as traditional knowledge digital library that is a TKDL We can use IMPPAT, that is the Indian Medicinal Plants, Phytochemistry and Therapeutics Database. And we can also use the Indian Medicinal Plants Database. Now, I have just highlighted pertaining to the Indian system of medicine as well as Indian plants. But if you see globally, globally, also numerous other search engines are available, which can help me.

Search similar kind of data pertaining to CAMPO system of medicine, your Chinese system, that is your TCM system of medicine and understand them as well. So let's try to browse through this particular servers or search pages and see if any information they can help us offer in this regards. So when I go to my TKDL, you will land up with this page that is the traditional knowledge digital library, which is maintained by the CSIR, that is Council of Scientific and Industrial Research. Now, many of this page. systems especially if you see Ayurveda, Unani, siddha and other system of medicines that is your swargaya is also maintained in this so if you see you can get data about TKDL what it is you can get data about its biopiracy sources of information you are free to give feedback and outcomes what we are interested here what specifically we are interested here is our

knowledge especially the TKDL search. Now when you do a TKDL search what you can do is just click on this you can have you know it's right now still being updated so currently as you can see as on this date it has about 1250 formulations you can just carry or click on a very simple search. Now this simple search can help you with search of plants which are used in Ayurvedic system of medicine. Now let's put the very same query here. I'll just try Vidanya.

I'm keeping both local names as well as keyword search. And as you can see here, it is returned to me with one such thing. Now, what is this script that you're seeing across? Now, this script, what you're seeing across are actually the preparations that contain Vidanya. So, you know, in your Ayurveda, Ashwagandha has been used.



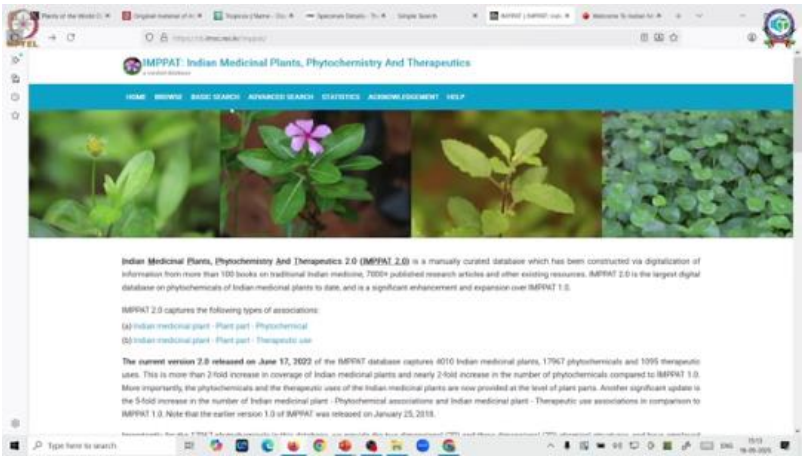
So, I click in. What happens is, like I said, because it's been translated digitally, many a times, many of the Sanskrit words are not picked up properly. So I am just seeing you can

see here asvasthya churnam. I am just clicking on it and as I click on it you can see this churnam formulations. So what is this churna made up of?

So Withania is definitely one it has ended up with. But apart from Withania, it contains numerous other things like your *Cytegium Aromaticum,* which is your clove, your *Sinimum Veti*, which is nothing but your Sinimum, you have Cardamom, all of them. It also comes up with the quantities of each of this drug present in the formulation. how to prepare this formulation and where exactly it is used so from this just by putting a query about a drug i know where all that drug is used which all preparations this drug is used and also in that preparation what is the quantity and what is the therapeutic indication so this is a software which tells you lot of about traditional medicinal preparations so if i see a plant say for example Ayurvedic plant, black pepper or Ashwagandha and I want to know where all it is used, this is one particular software which will come up with telling me, see there are 10 of this Ayurvedic formulation in which your ashwagandha has been used.

You click on that, you will come to know ashwagandha is used in combination with what and what is the dose of it. So I am just quickly closing this. Similarly you can just see other ones. It also gives you how ancient is the preparation. You can see it is 500 years old.

Again you can see the individual ingredients, the quantities of it, therapeutic indications, how it is prepared and the application part of it. So this is how your TKDL helps with the traditional knowledge search. Software which also helps me with this search is your IMPPAT. So if you go to this, this is the one, it's a curated database maintained for Indian medicinal plants. It gives you a knowledge about phytochemistry as well as therapeutics.



But in the interest of today's session, we'll just delve into the phytochemical search herein. So you can see both the phytochemical associations are also there. The therapeutic uses are also there. So I can search for therapeutic use or I can search for phytochemical association. So let's here again put the same query and try searching what it has to offer us.

So if you say Withania, I have not specifically said Withania, I have not said coagulants or somnifera. So it has come up with this search, saying that this particular plant, the plant part of which contains withaferin. So you can see there are almost 153 entries and what all compounds it contains. So your withanolides are present in your somnifera, linoleic acid is present in your coagulants and so on. So this will give you mostly the set of phytoconstituents which are present in your drug.

And in terms of therapeutic use, if I just put here fever, I'll just make things simple. I'll just put in fever and let's see what it has to offer. So it will give you a list of all Indian traditional medicinal plants which have been used in fever. So it is good for people who are working in the pharmacological domain. Say, imagine you have to prepare a new formulation for fever.

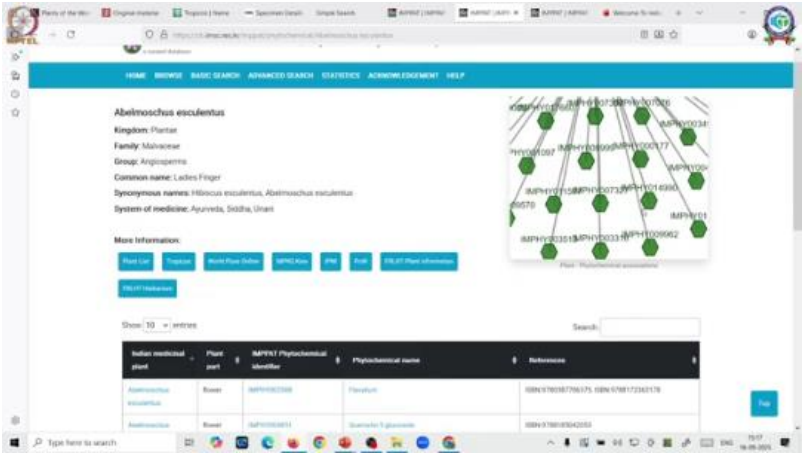
Or prepare a new combination for fever. These are all the drugs that have been used in Ayurveda, Siddha, and Unani medicine. Especially the Indian medicines for your fever treatment. So, you can check this out. Check out their mechanism of action.

Now that you also know how to find the phyto constituents. Simultaneously, you can prepare combinations of any of these. And that can be useful in your research. So, these are all—you can see there are almost 177 pages. So, you can imagine how many Indian medicinal plants have been applied for the management of fever here.

So, this is your phytochemical. You can even check here for phytochemical association. So, say, for example, you know a plant. I am just putting the first one, Ebel Moschus. So here you get what is called the phytochemical association.

Now, what is this? Once I check in a plant, say *Abelmoschus esculentus*, in that case, it will give me the taxonomy. It will use it or it will tell you. See here, the same software we checked, the Q1s, World Flora Online, Porticos, the same ones, and you can see it has created a curated diagram. Now, what this curated diagram is: in the center of this is a plant, and at the edges, what you see as those green dots are actually the compounds present here.

Now, these compounds have been annotated by a number. So, the moment you click on it, You will see what compound is present. So every node there, every green dot out there, is actually a phytomolecule associated with that plant. So this is the kind of diagram that will summarize all the phytomolecules present in this plant.



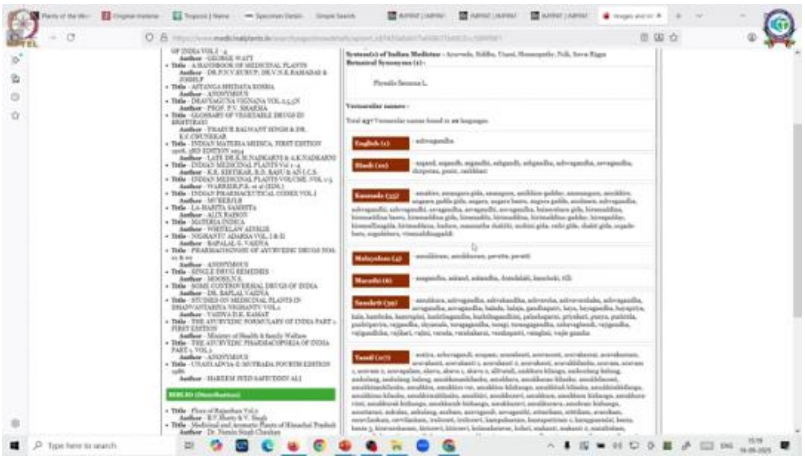
So with the help of this software, you know what the plant is, and you know all the phyto-constituents it contains. You can reverse your query, saying, 'This is the disease. What all Indian medicinal plants have been used in the system?' and I can go back to that.

The next software we tried is the Indian Medicinal Plants Database. Now again, this is an interesting database that will help you curate medicines for Ayurveda, Siddha, and Unani systems of medicine. So I will just quickly check or search in Ayurveda.

I can go by botanical names; I can go by vernacular names. Again, let me type the same query just so that you can compare all the software. So it is telling me when I put a query for Withania, you remember the Q database and many other databases have different varieties. But if you see the traditional medicinal Indian database, it just comes up with two: Withania coagulants and Withania somnifera. Withania somnifera is your ashwagandha.

And if you remember, Withania coagulants is often referred to as paneer phool, which is nowadays consumed by diabetic patients. So let's click on Withania somnifera. And what do you come across? You come across numerous vernacular names of this plant. So this particular database gives you a very curated list of all the names that have been used for ashwagandha in different Indian languages.

So it is not that in Kannada it's just been called by one name. You can see here. Depending upon the dialects, this software kind of curates. So even in Kannada, it has about 35 names. In Hindi, it has 10 names.

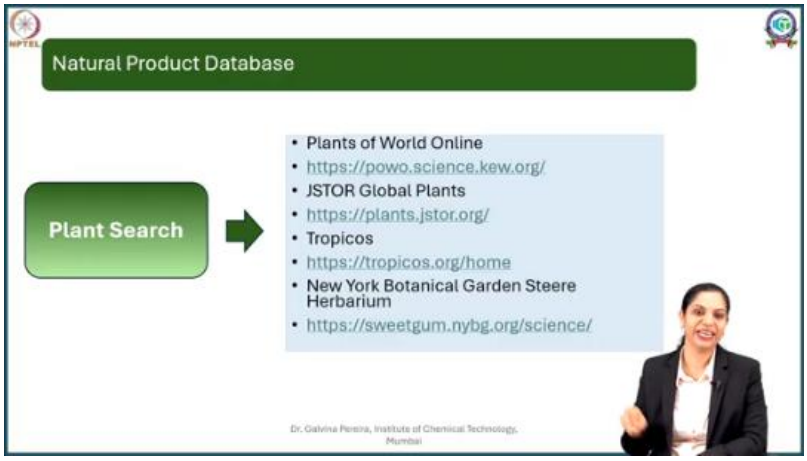


In Tamil, you can see the names. It has about 117 names. Now, one more interesting part of it is I can see the Ayurvedic identity and the shlokas. Now, what are the shlokas? I can just pick up one plant and see what Ayurveda has to say about it.

Say, for example, I pick up agaru. So, it gives you the kind of note which is there about that plant in the Ayurvedic script. So, what does it say? Agaru is katu, tikt in rasa. So, in properties, ushna, in various, nigda, in guna.

So, you know, Ayurvedic medicines are characterized by their rasa, virya, guna, and such properties. So all the properties of these plants are already given here. If you are searching in terms of Ayurvedic properties, you can take a look here. Maybe let's see some other plants, say for example, vasaka. You can see vasaka is a kashaya, so you take a juice of it. In properties, you can say it pacifies your kind of breath, especially your kapha, which is what it elevates. So all these properties which are there in Ayurvedic scripts can be used or found via this database. So, quickly summarizing today's session.

So what you can see or what we did today is We saw a few plant search databases. These plant search databases help me identify a plant for my research. If I am curious, I just have to raise my plant query in these databases. They come up with taxonomy.



They come up with herbariums and possibly their geographical locations. Some of them give a little depth about compounds, but many of them are actually more botany-oriented databases. After that, we came across what are called traditional medicinal drugs and formulation-based databases. This included many Indian databases, which we discussed here. That is your Traditional Knowledge Digital Library, your IMPPAT database.

And then you had your Indian Medicinal Plants database. So we have many such other databases, but much of this will help you find a good plant for your therapeutic application, as well as if you know a plant, what therapeutic applications does it have? So with this, we end our session. So thank you, everyone, for your time. © transcript Emily Beynon