DNA barcoding of medicinal/commercially important plants

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
DNA barcoding of medicinal/commercially important plants	**2**	**NIL**	**NIL**	**2**	**Class XII**	**NIL**

Learning Objectives

The Learning Objectives of this course are as follows:

- To give laboratory based first-hand training in various steps involved in DNA barcoding.
- To gain computational laboratory (Bioinformatics) based hands-on-training for DNA barcoding.
- To understand the importance of medicinal/herbal plants in Ayurveda, Unani, Siddha and Homeopathy and other commercially important plants.
- To gather knowledge of the potential adulterants and their harmful effect in medicinal/herbal/commercially important plant formulations as well as herbal trade.
- To gain experience in the management for identifying herbal plant parts vs their potential adulterants.

Learning Outcomes

By the end of the course, the students will be able to:

- Learn DNA barcoding technology.
- Apply DNA barcoding technique in identification of herbal plant/parts and commercially important plant/parts from their potential adulterants.
- Familiarize with the applications of medicinal/herbal plants in Ayurveda, Unani, Siddha and Homeopathy.
- Identify and understand about potential adulterants of medicinal/herbal plant formulations as well as in herbal trade.

Skill development and job opportunities

After completion of this course students may be

- Employed in various herbal plant-based companies.
- Employed in various trade companies related to medicinal/herbal plants.
- Setup a laboratory for DNA barcoding and provide the DNA barcode for herbal plants/ commercially important plants and generate employments.

SYLLABUS 60 hours

Unit 1: Medicinal/Commercially important plant parts and their potential adulterants. 8 hours

Overview of Medicinal/herbal plants and other commercially important plants and their parts, applications of medicinal plants and plant parts such leaves, bark, flower, roots etc. in Ayurveda, Unani, Siddha and Homeopathy. Adulteration in the herbal formulations and herbal trade, applications of DNA barcoding in distinguishing plants/parts/powder from their potential adulterants.

Experiments:

1. Collection of selected medicinally important plant parts/commercially important plant parts and their potential adulterants for DNA isolation.
2. Visit a herbal garden/industry.

Unit 2: DNA barcoding 36 hours

Overview of DNA barcoding, Plant, chloroplast and mitochondrial genomes and genes, structure of nucleic acids, DNA denaturation and renaturation kinetics, melting temperature (Tm) of DNA, primer designing, potential loci for DNA barcoding, DNA sequencing methods.

Experiments:

3. DNA isolation of selected medicinal plant part and other commercially important plant parts and their potential adulterants using CTAB and other methods.
4. Qualitative analysis of isolated DNA using Gel electrophoresis.
5. Qualitative (A^{260}/A^{280}) and quantitative analysis of DNA using *UV-VIS* Spectrophotometer.
6. PCR amplification of loci for plant DNA barcoding using specific primers.
7. Analysis of PCR product by Gel electrophoresis.
8. PCR amplified product sequencing.

Unit 3: Bioinformatics for DNA barcoding 16 hours

Introduction of biological databases, The Barcode of Life Datasystems (BOLD), Medicinal Materials DNA Barcode Database (MMDBD) https://rdccm.cuhk.edu.hk/mherbsdb/, Primer designing tools, The Basic Local Alignment Search Tool (BLAST) and its application in DNA barcoding, Sequence alignment and construction of tree.

Experiments:

9. Biological databases including DNA barcode databases.
10. Primer designing for DNA barcode using primer 3 plus and other tools.
11. Analysis of DNA barcode sequence using The Basic Local Alignment Search Tool (BLAST).
12. Sequence alignment and construction of tree

Recommended Books:

1. W. John Kress and David L. Erickson (2012) DNA Barcodes: Methods and Protocols. Humana Totowa, NJ. https://doi.org/10.1007/978-1-61779-591-6.

2. Subrata Trivedi, Hasibur Rehman, Shalini Saggu, ChellasamyPanneerselvam, Sankar K. Ghosh (2020) DNA Barcoding and Molecular Phylogeny, Springer Nature Switzerland AG 2020, Springer Cham. https://doi.org/10.1007/978-3-030-50075-7
3. Shaheen, Shabnum/ Ramzan, Sehrish/ Khan, Farah/ Ahmad, Mushtaq (2020) Adulteration in Herbal Drugs: A Burning Issue. ISBN 10: 3030280365, ISBN 13: 9783030280369, Publisher: Springer Nature

Examination scheme and mode:

Evaluation scheme and mode will be as per the guidelines notified by the University of Delhi.