Unit 4 · Introduction to Floral Diversity

STUDY NOTES

WHAT NEB'S GRADE 11 EXAM ASKS

- **CDC's grid (2077):** Floral Diversity (Units 4–10 together): 18 of 75 marks; with Ecology and Vegetation a combined 26, at least 3 MCQs, 2 short and 1 long from them
- **The paper:** 11 MCQs × 1 · 8 short × 5 · 3 long × 8; 3 hours; 1 mark per expected point
- **MCQ (1 mark)**
  - domain of ancient prokaryotes of extreme places (Archaea)
  - who proposed five kingdoms (Whittaker)
  - the correctly written scientific name (*Panthera leo*)
  - kingdom from clues: eukaryotic, no pigment, consumer → Animalia
- **Short (5 marks, in parts)**
  - three domains explained; why Bacteria and Archaea were separated
  - common vs scientific name; binomial nomenclature and its rules
  - Whittaker's five criteria; why not use the common name (cauliflower)
  - most complex of bacterium, mushroom, apple tree, with reasons
  - status of Nepal's flora and its share of the world's

Key terms

Biodiversity: the variety of life on Earth; at three levels: genetic (within a species), species, ecosystem.

Floral diversity: the variety of plants: number of species, genetic variation within and between them, their roles in the ecosystem.

Domain: the highest rank, above kingdom.

LUCA: last universal common ancestor, the root of the tree of life.

Binomial nomenclature: naming each species with two words, genus + specific epithet (Linnaeus, *Species Plantarum*, 1753).

Generic name: the first word, the genus; **specific epithet**: the second word.

Endemic: found wild in one place only.

Biodiversity: three levels

- **genetic**: genes within one species (local rice varieties, Jumli Marshi)
- **species**: number and kinds of species (many rhododendrons on a hillside)
- **ecosystem**: kinds of habitats (sal forest, grassland, alpine meadow, wetland)

Three domains of life

- **Carl Woese** and colleagues, **1990**; from differences in **rRNA** sequences
- rRNA: in every cell (ribosomes), changes very slowly → similar sequence = recent split
- tree from **LUCA**: Bacteria branched off first; Archaea and Eukarya share a later ancestor

Feature	Archaea	Bacteria	Eukarya
cell	prokaryotic; many in extreme places	typical prokaryotes	eukaryotic
wall	no peptidoglycan (pseudopeptidoglycan, protein, polysaccharide)	**peptidoglycan** (murein)	cellulose (plants), chitin (fungi), none (animals)
membrane lipids	**ether** bonds	**ester** bonds	**ester** bonds
includes	methanogens, halophiles, thermophiles	eubacteria, cyanobacteria	Protista, Fungi, Plantae, Animalia
body	unicellular	unicellular, a few chains	uni- or multicellular
common antibiotics	not affected	sensitive	not affected

- streptomycin, chloramphenicol block **bacterial ribosomes**; penicillin stops **peptidoglycan** being made → kill bacteria, not us

Archaea closer to Eukarya (why split from Bacteria)

- rRNA closer to eukaryotes'
- RNA polymerase of many parts (bacteria's simple)
- DNA wound on **histones**
- protein making starts with **methionine** (bacteria: formyl-methionine)
- some genes have **introns**
- no peptidoglycan; not affected by streptomycin
- like bacteria only in being prokaryotic → once together in Monera; now two domains, as classification follows real relationships

Binomial nomenclature

- one name, one organism, the same worldwide: rice *Oryza sativa* (*Oryza* genus, *sativa* species)
- codes: **ICN** (algae, fungi, plants; ICBN until 2011), **ICZN** (animals), **ICNP** (prokaryotes; once ICNB), **ICVCN** (viruses)

Rules

1. Latin or Greek, or Latinized
2. two words: generic name, then specific epithet
3. genus: **capital** letter; epithet: **small** letter (even from a place: *Mangifera indica*)
4. **italics** in print; handwritten: each word **underlined separately**
5. genus one word, shortened to its initial once written in full (*E. coli*); epithet may be hyphenated (*Hibiscus rosa-sinensis*), never shortened
6. author after it, not italic: *Mangifera indica* L. (L. = Linnaeus)

Common name	Scientific name
local language; differs by place	Latin or Latinized; same everywhere
several for one organism, one for several	one accepted name, used for no other
no rules	rules of the codes (ICN, ICZN…)
shows no relationship	genus shows nearest relatives
dhan, rice	*Oryza sativa*

- cauliflower: *kauli* in Nepali; *Brassica oleracea* is one species = cabbage, cauliflower, broccoli, kohlrabi, kale; relative of mustard *Brassica juncea*

Five kingdoms (Whittaker, 1969)

Criteria

1. complexity of the cell: prokaryotic or eukaryotic
2. complexity of the body: unicellular or multicellular
3. nutrition: autotrophic or heterotrophic (absorbing: fungi; ingesting: animals)
4. ecological role: producer, consumer, decomposer
5. phylogenetic relationship: evolutionary history

	Monera	Protista	Fungi	Plantae	Animalia
cell	prokaryotic	eukaryotic	eukaryotic	eukaryotic	eukaryotic
body	unicellular, simple chains	unicellular	uni- (yeast) or multicellular	multicellular	multicellular
nutrition	auto- or heterotrophic	auto- or heterotrophic	absorptive	autotrophic	ingestive
role	producer, decomposer	producer, consumer	decomposer	producer	consumer
e.g.	bacteria, cyanobacteria	*Amoeba*, *Euglena*, *Paramecium*	mushroom, yeast, *Mucor*	*Spirogyra*, *Pinus*, mustard	tiger, starfish, snail

- many-celled algae (*Spirogyra*) in Plantae; one-celled ones in Protista
- domains sit **above** kingdoms: Monera = Bacteria + Archaea; the other four inside Eukarya
- most complex of three: **apple tree** (tissues, organs, photosynthesis) > mushroom (eukaryotic hyphae, no tissues) > bacterium (one prokaryotic cell)

Nepal's flora

- **0.1%** of the world's land; **3.2%** of its known flora, **1.1%** of fauna
- why: < 100 m (Tarai) to 8,849 m in ~200 km → tropical to alpine and trans-Himalayan belts; rain from wet east to dry rain shadow

Group	Species in Nepal	% of world
algae	1,001	2.5
fungi	1,822	2.6
lichens	465	2.3
bryophytes	1,150	**8.2**
pteridophytes	534	5.1
gymnosperms	26	5.1
angiosperms	6,973	3.2
total	**11,971**	**3.2**

- NBSAP 2014; later lists larger (fungi > 2,000, lichens > 700)
- richest: bryophytes (cool, misty middle hills), ferns, gymnosperms
- ~312 flowering plants endemic (284 in 2014); most at 3,800–4,200 m

COMMON MISTAKES

✗ *Panthera Leo*, or both words capitalized
✓ genus capital, epithet small: *Panthera leo*.

✗ a handwritten name underlined as one line
✓ underline each word separately.

✗ *R. Arboreum*
✓ *R. arboreum*: the epithet is never shortened or capitalized.

✗ Archaea have peptidoglycan walls
✓ no peptidoglycan; ether-linked lipids.

✗ Monera is a domain
✓ a kingdom; it holds two domains, Bacteria and Archaea.

✗ fungi are consumers
✓ decomposers that absorb food.

✗ three rice varieties = species diversity
✓ one species: genetic diversity.