GIBBERELLINS, ITS DISCOVERY AND PHYSIOLOGICAL EFFECTS
INTRODUCTION

Gibberellins (GAs) are plant hormones that regulate various developmental processes including stem elongation, germination, dormancy, flowering, flower development, and leaf and fruit senescence. GAs are one of the longest-known classes of plant hormone. It is thought that the selective breeding (albeit unconscious) of crop strains that were deficient in GA synthesis was one of the key drivers of the "green revolution" in the 1960s, a revolution that is credited to have saved over a billion lives worldwide.
DISCOVERY

- The discovery of gibberellins is quite fascinating and dates back to about the same period when auxins were discovered, but it was only after 1950 that they came into prominence. A young Japanese scientist Kurosawa had been trying to find out why the rice seedlings infected by the fungus *Gibberella fujikuroi* (asexual stage *Fusarium monoliforme*) grew taller and turned very thin and pale.

- These are the symptoms of ‘Backanae disease’ (meaning foolish) which is known to Japanese for over a century. In 1926, he succeeded in obtaining a filtered extract of this fungus which could cause symptoms of the Backanae disease in healthy rice seedlings. In 1935, Yabuta isolated the active substance which was quite heat stable and gave it the name gibberellin.
CHEMISTRY & STRUCTURE

- All known gibberellins are diterpenoid acids that are synthesized by the terpenoid pathway in plastids and then modified in the endoplasmic reticulum and cytosol until they reach their biologically-active form. All gibberellins are derived via the ent-gibberellane skeleton, but are synthesised via ent-kaurene. The gibberellins are named GA1 through GAn in order of discovery. Gibberellic acid, which was the first gibberellin to be structurally characterized, is GA3.

- As of 2003, there were 126 GAs identified from plants, fungi, and bacteria.
Gibberellins are tetracyclic diterpene acids. There are two classes based on the presence of either 19 or 20 carbons. The 19-carbon gibberellins, such as gibberellic acid, have lost carbon 20 and, in place, possess a five-member lactone bridge that links carbons 4 and 10. The 19-carbon forms are, in general, the biologically active forms of gibberellins. Hydroxylatio also has a great effect on the biological activity of the gibberellin. In general, the most biologically active compounds are dihydroxylated gibberellins, which possess hydroxyl groups on both carbon 3 and carbon 13. Gibberellic acid is a dihydroxylated gibberellin.
All the different types of gibberellins, known so far, bear the gibbane skeleton. The individual members differ with each other in their side attachments of various groups like ---OH, ---COOH etc. The structure of GA1 and GA3 is mentioned below.

**Gibberellin A1 (GA1)**

**Gibberellin A3 (GA3)**
ANTIGIBBERELINS

A large number of chemical substances are known to inhibit the biosynthesis and activity of gibberellins in plants. These chemicals are known as antigibberellins.

Examples are
1) AMO-1618
2) CCC-β
3) Phosphon-D
4) B-995
TRANSPORT

- Unlike the auxin, transport of gibberellins is non-polar.

- It moves from one part to the another in the phloem, similar to the transport of carbohydrate and other organic substances.

- GA is also translocated in the xylem, due to the lateral movement between two vascular bundles.
PHYSIOLOGICAL EFFECTS

- Stem elongation, due to cell division and cell elongation induced by GA.
- Dwarfism reversal
- Bolting and flowering: very well discussed in your practical classes.
- Parthenocarpy: eg. Tomato, apples, cucumbers
- Seed germination: eg. *Lactuca sativa, barley* etc. can germinate even in complete dark.
- Breaking of dormancy
- Cell division in cambium
- Cold treatment substitution
- Synthesis of hydrolytic enzymes like α-amylase, protease in aleurone cells of barley.
COMMERCIAL APPLICATIONS

- Seed dormancy must be broken for seeds to germinate, and this can be done by using **gibberellins**.
- **Gibberellins** are **used** in the production of seedless fruit such as seedless grapes, which are normally sprayed with **gibberellin** to increase the size of each grape.
- Induce parthenocarpy (seedless fruits).
- Affects positively on fruit setting.
- **Gibberellins** are sometimes used to increase the amount of a- amylase in germinating barley (*Hordeum vulgare*) which is used in production of malt for brewing industry.