

BBX32 PROTEIN – SCIENCE & TECHNOLOGY

NEWS: Researchers at IISER Bhopal have revealed how a single protein, BBX32, helps plants time their emergence from underground into the light—a crucial step for successful seedling growth.

WHAT'S IN THE NEWS?

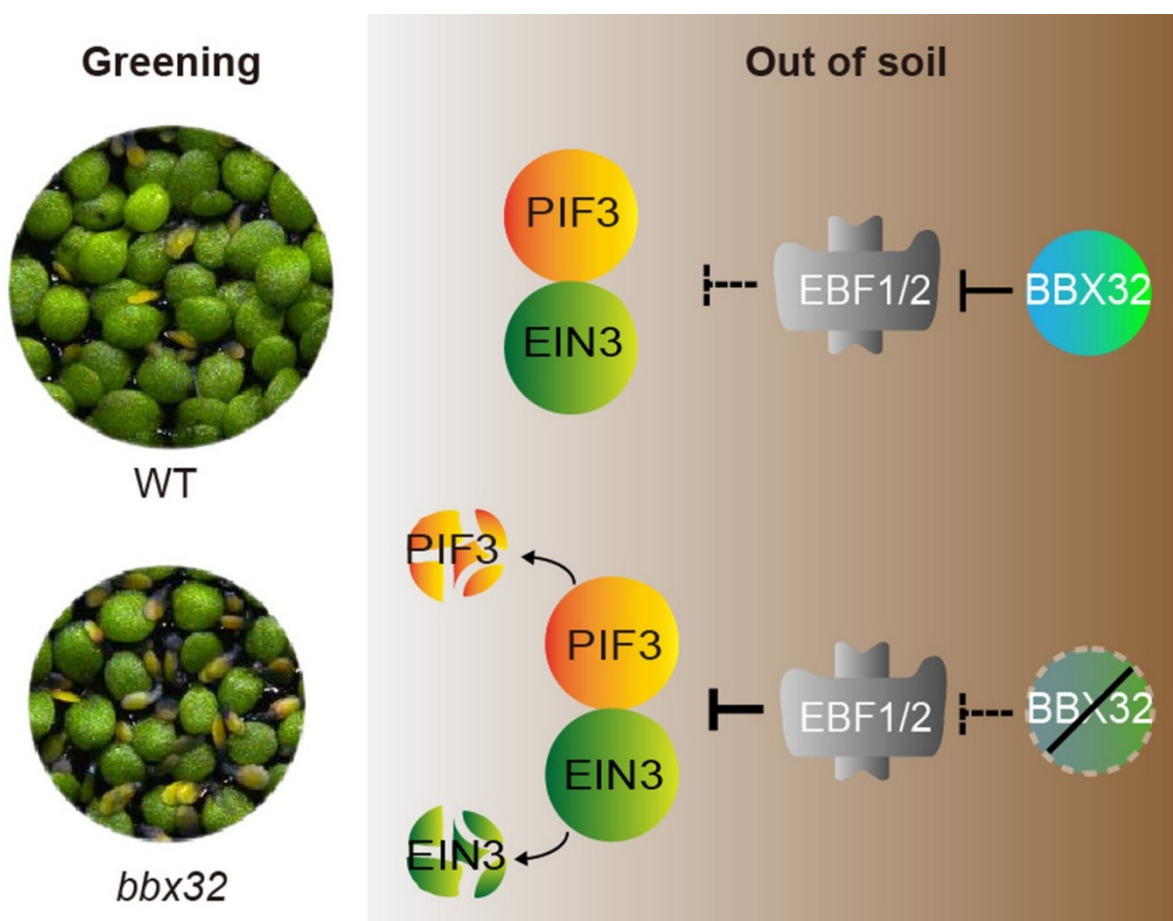
Key Discovery

Role of BBX32:

A protein called **BBX32** in plants plays a critical role in regulating the **timing of the opening of the apical hook**, a curved structure that protects the shoot tip as the seedling emerges from the soil.

Importance of Hook Timing:

- If the hook opens **too early**, the tender shoot tip may get damaged by soil particles.
- If it opens **too late**, the growth of the seedling may be hindered or stunted.



Function of the Apical Hook

Protective Structure:

The **apical hook** is a curved structure formed by the seedling's stem, which **safeguards the delicate shoot tip** during its emergence from the soil.

Light-Dependent Behavior:

The hook stays closed while underground and **opens only when exposed to light**, ensuring that the shoot tip is only uncurled once it is above the soil surface.

How BBX32 Works

Maintains Hook Closure:

BBX32 helps to **keep the apical hook closed for a longer period**, offering prolonged

protection to the emerging seedling.

Activated by Ethylene:

BBX32 is **activated by the plant hormone ethylene**, which accumulates when the seedling is underground.

Protected by Light:

Light exposure prevents the breakdown of BBX32, ensuring that it remains active when needed during early development.

Molecular Interaction and Gene Regulation

BBX32 and PIF3 Interaction:

BBX32 enhances the activity of **PIF3 (Phytochrome-Interacting Factor 3)**, a transcription factor.

PIF3 Activates HLS1:

PIF3 in turn activates the gene **HLS1 (Hookless 1)**, which is directly responsible for **maintaining the closure of the apical hook**.

Dependency on PIF3:

If **PIF3 is absent or non-functional**, BBX32 cannot perform its role in keeping the hook closed, leading to premature opening.

Factors Regulating Hook Opening

Ethylene's Role:

Ethylene **delays hook opening** when present in high concentrations underground, adapting seedling growth to environmental conditions.

Light's Role:

Once the seedling emerges from the soil and encounters **light**, it alters BBX32 stability, triggering **hook opening at the appropriate time**.

Significance of the Study

Signal Integration:

The study reveals how plants **coordinate hormonal signals (ethylene) and environmental cues (light)** to make **precise developmental decisions**.

Adaptive Growth:

BBX32 accumulates only under specific conditions—**darkness combined with ethylene presence**, and **transiently under early light exposure**—ensuring optimal timing of growth.

Agricultural Potential:

Understanding the role of BBX32 can lead to the development of **genetically enhanced crops** capable of **emerging more effectively from compact or dense soils**, improving crop resilience in harsh growing environments.

Source: <https://www.thehindu.com/sci-tech/science/how-does-a-plants-first-shoot-rise-safely-through-soil-into-daylight/article69644610.ece>