■ Parasitic Adaptations of Plants (Cuscuta as Example)

Parasitic plants are a fascinating group that depend wholly or partly on other living plants (hosts) for nutrition. Unlike autotrophic plants, which prepare their own food through photosynthesis, parasitic plants develop specialized adaptations that enable them to attach to hosts and extract water, minerals, and organic nutrients.

One of the best-known examples is *Cuscuta*, commonly called dodder. It is a **total stem parasite** that lacks chlorophyll and depends entirely on its host for survival. This study guide explores the unique adaptations that make *Cuscuta* such a successful parasite.

■ Morphological and Anatomical Adaptations of Cuscuta

- Haustoria: Specialized absorbing organs that penetrate the host's vascular tissue for water, minerals, and food.
- Reduced or absent leaves: Energy conserved by avoiding investment in photosynthetic tissues.
- Yellow, leafless, twining stem: Supports attachment and maximizes host connections.
- Weak or absent root system: Roots soon replaced by haustorial connections.

■ Physiological and Growth Adaptations

- Complete loss of photosynthesis due to absence of chlorophyll.
- Relies entirely on host phloem for carbohydrates and xylem for water.
- Seedlings elongate rapidly to reach a host before stored food is exhausted.
- Guided by chemical cues from host plants (host tropism).

■ Reproductive Adaptations of Cuscuta

- Produces many small, clustered flowers capable of self- and cross-pollination.
- Seeds are abundant, with tough coats ensuring long dormancy.
- Seed dormancy allows survival until a suitable host is found.

■ Integration of Features

The success of *Cuscuta* lies in the combination of:
- **Structural adaptations** (haustoria, twining stem, loss of leaves/roots)
- **Physiological dependence** (loss of photosynthesis, host-derived nutrition)
- **Reproductive strategies** (abundant seeds with dormancy)

Compared to normal autotrophic plants, *Cuscuta* shows extreme reduction of independent structures and total reliance on its host.

■ FAQs on Parasitic Adaptations (Exam-Oriented)

3 Marks Questions

- Define parasitic plants with an example.
- What are haustoria? Mention their role in Cuscuta.
- Why does Cuscuta lack leaves and chlorophyll?
- State one function of the twining habit.
- What happens to the primary root of Cuscuta seedlings?
- Mention one reproductive adaptation ensuring survival.
- How does Cuscuta locate its host?

6 Marks Questions

- Explain the structural adaptations of Cuscuta.
- Discuss the dual role of haustoria in anchorage and nutrition.
- Describe reproductive adaptations of Cuscuta.
- Compare root systems of autotrophic plants vs. Cuscuta.
- Explain how structural + physiological features ensure dependence.

10 Marks Questions

- Describe in detail the morphological, anatomical, physiological, and reproductive adaptations of Cuscuta.
- “The survival of Cuscuta is based on extreme reduction of its own structures and complete dependence on the host.” Evaluate.

■ Conclusion

Cuscuta demonstrates how plants can evolve extreme parasitic strategies for survival. With its haustoria, twining stem, reduced leaves, physiological dependence, and reproductive efficiency, it is an excellent model for studying plant parasitism. These adaptations highlight the fascinating diversity of survival strategies and ecological interactions among plants.