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### **Modification of Roots**

The modifications are the changes in shape, form or structure in an organ to carry out special function other than or in addition to the normal functions. Modification of roots are found in both tap roots and adventitious roots.

#### **Modification of Tap Roots**

The tap roots are modified for the function like storage, nitrogen-fixation and respiration.

##### **(a) Conical Roots :**

These are fleshy tap roots that resemble a cone (broad at the base and gradually tapering towards the apex), e.g., carrot (*Daucus carota*).

(b) Fusiform Roots The primary root is spindle-shaped. It is swollen in the middle and gradually tapers at both the ends, e.g., Radish (*Raphanus sativus*).

##### **(c) Napiform Roots :**

The primary root is almost spherical (pitcher-shaped) at the base and tapers abruptly at the lower end, e.g., – beetroot (*Beta vulgaris*),-turnip (*Brassica rapa*), etc.

##### **(d) Tuberous Roots :**

The primary root becomes thick and fleshy but do not attain any definite shape (irregularly-shaped), e.g., 4 O'clock plant (*Mirabilis jalapa*), Wild cucumber (*Echinocystis lobata*).

##### **(e) Nodulated Tap Roots :**

In this the secondary, tertiary and sometimes primary roots bear many small irregular swellings called root nodules which contain countless, minute nitrogen fixing bacteria of the genus *Rhizobium*, e.g., groundnut (*Arachis hypogea*), clover (*Medicago falcata*), pea (*Pisum sativum*), etc.

##### **(f) Pneumatophores :**

These are special roots that develop in mangrove plants (**grow in marshy areas**).

The **pneumatophores or aerenchyma or respiratory roots** grow vertically upward and are negatively geotropic.

They have minute breathing pores called pneumatophores or lenticels present on the tips of

vertical roots that help in getting oxygen for respiration.