

The study of initiation and development of Haustoria of *Cuscuta reflexa* roxb

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Abstract

Genus *Cuscuta* is a parasitic plant belonging to family Convolvulaceae. The genus consist of nearly about 150 sp. distributed throughout the world. *Cucuta reflexa*Roxb.is most common species found in India. As the plant is total parasitic, it depends on the host for water and nutrients. For absorption of food and water it produces parasitic roots also known as haustoria. There is scanty information regarding the initiation and gradual growth phases of haustoria in host tissues of *C. reflexa*. Current paper is related with the study of initiation, penetration and gradual growth of haustoria inside the host tissue by *C. reflexa*.

Keywords: *Cucuta reflexa*, Haustorial development

Introduction

Absorption of food material is a crucial part of life cycle of parasitic plants. To meet the need of food, species like *Cuscuta reflexa*Roxb. develop special modified roots known as haustoria. Development of haustoria is a physico-biochemical process between two different plants i.e. host and parasite. This process is incompletely described earlier. Nagar *et al.* (1983) ^[1] have mentioned the lack of information on haustorial penetration mechanism. So, there is scanty information regarding the initiation and gradual growth phases of haustoria in host tissues in *C. reflexa*. This is an attempt to study the haustoria of *C. reflexa* especially its initiation, penetration and gradual growth in host tissue.

Methodology

The samples of *C. reflexa* along with host were collected early in the morning from field. Various hosts and part of the plants including dicot as well as monocot stems, leaves etc. were randomly selected and fixed in FAA. Stems were used for hand cut sections and followed by double staining technique. As the microtome sections do not show proper orientation, hand cut sections were taken. Hand-cut sections were serially made at the junction point of host and parasitic stem. Different stages in different host were observed under light microscope for growth phases like initiation, penetration and growth of haustoria.

Result and Discussion

Haustorial development starts as the stem of *C. reflexa* come in contact with host parts. Initial studies in laboratories have shown that *C. reflexa* is not able to differentiate between living host plant and glass rod. This indicates that the initiation of haustoria development is an anatomical modification regulated by touch signal not chemotactic. Penetration of haustoria in host by *C. reflexa* is a rapid process and gets completed within few hours. Hand-cut sections show following events regarding the initiation of haustoria. Haustorial development starts with activation of cortical cell layer just external to pericycle layer. However, Koch (1874) ^[2] and Lee and Lee (1989) ^[3] reported that haustoria originate from middle layer of cortical cell in *C. australis* and *C. epilinum*. This

suggests that the initiation and development of haustoria varies as per the species. Similar kinds of observations are made by Lang Hong (2011) ^[4].

Cells of the cortex just external to the pericycle show distinct nuclei and dense cytoplasm (Fig. A). So, the layer is easily visible. This layer acts as a primordial layer for the development of haustoria and it starts to divide and form new cells of haustoria. The proliferation of cortical cells of *C. reflexa* stem is such that the cells which lie on the side of host plant shows activity around host stem. Complete surrounding cortical layer do not show such activity. As the *Cuscuta* stem makes helix/coiling in right handed manner with host cortical cells of inner side of parasitic plant stem show activity for haustorial development. The primordial cells undergo mitotic cell division to form a dome shaped cell mass. The dome consists of distinct meristematic region (Fig. B). The cells of the meristematic region undergo rapid division and grow further towards the host. This development leads to pushing of cells of epidermis, hypodermis and cortex. On the anterior side, these cells get compressed between dome and host (Fig. C). It leads to formation of a layer between host and parasite. On the lateral side of dome, cortical cells are pushed to embed the part of host. The host plant part which is partially embedded in cell mass of parasite is helpful for further penetration of haustoria in it. Lang Hong (2011) ^[4] have also observed that surface of stem of parasite is modified to form a tight seal with host. Similar kinds of observations regarding the change of epidermal cells during development of haustoria in *C. gronovii* at early stages are made by Heide-Jorgensen (1987) ^[5]. It is generally accepted that the penetration of haustoria is facilitated by mechanical pressure and enzymatically (Metcalf and Chalk, 1950) ^[6]. The cells of haustoria after entry in host engulf the vascular bundle of host partially or totally. The tip cell of haustoria becomes narrow and elongated which engulf the vascular bundle of host. The growth of haustoria continues and enters upto pith region in case of herbaceous plant. The haustoria show flask shaped structure in pith region of herbaceous host *Commelinabenghalensis* (Fig. D). Rao (1942) ^[7] and Herbert (1925) ^[8] have also mentioned that mature haustoria are

normally flask shaped structure in *Sanatalum album* of Santalaceae during initial stage. In severe infection the development of phloeo tracheids is also observed (Fig.F). The parenchymatous cells of haustorium modified into cell similar to xylem and phloem for absorption termed as phloeo tracheids. Lee and Lee (1989) [3] have observed functional haustoria of *C. australis* converting into xylem and phloem in host stem. Raven (1983) [9] mentioned xylem connection in *Cuscuta* might be helpful to derive organic compound from host. Similar kinds of

observations of phloeo tracheids were made by Rao (1942) [7] in another parasite *Santalum*. On the other hand, Lang Hong (2011) [4] reported that haustoria do not differentiate into xylem and phloem in *C.campestris*. Such tracheids are connection between vascular bundle of host with vascular bundle of *Cuscuta* (Fig. E). These tracheids show reticulate type of thickening (Fig.F). It is an adaptation in *C. reflexa* to obtain water and nutrients from host through haustoria.

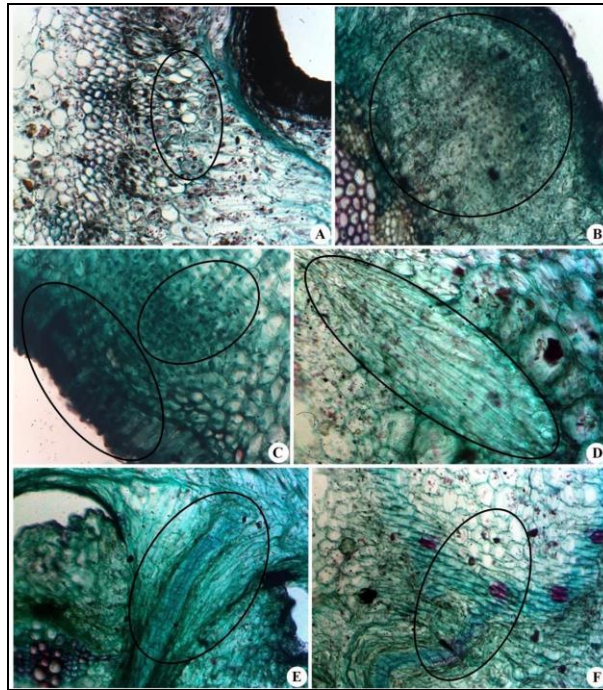


Fig 1: (a) Layer of meristematic region in cortex with distinct nuclei
 (b) Dome shaped meristematic zone
 (c) Compressed cells of *Cuscuta* system between meristematic zone and host earlier to penetration
 (d) Flask shaped haustorium in the stem of *Commelina benghalensis* plant
 (e) Phloeo tracheids produced by *Cuscuta reflexa* showing reticulate type of the thickening
 (f) Phloeo tracheids showing attachment with vascular bundle of *Cuscuta reflexa*

Conclusion

The development of haustorium is rapid process, get completed within few hours. Cortical cells external to pericycle acts as primordial cell to form meristematic region. Meristematic region divides mitotically and appears the dome shaped. The proliferation of meristematic region pushes the cells of epidermis, hypodermis and cortex of *Cuscuta* stem. Epidermal, hypodermal and cortical cells on anterior side, get compressed between dome and host forming seal around host. The penetration of haustoria is facilitated by mechanical pressure and enzymatically. The tip cells of haustoria become narrow and elongated which engulf the vascular bundle of host. The parenchymatous cells of haustorium get modified into phloeo tracheids. The tracheids show the reticulate type of thickening.

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