

*Echinacea atrorubens* Nutt.  
*Echinacea Atrorubens* Root  
*Echinaceae atrorubentis* Radix  
 Asteraceae

The roots of *Echinacea* species are widely used in North America and Europe for various types of infections and for their putative immunomodulating activity. *E. atrorubens* is not commonly traded directly as *E. atrorubens*. Rather, it often gets mixed up with wild *E. angustifolia* roots because of morphological and organoleptic similarities between the two species.

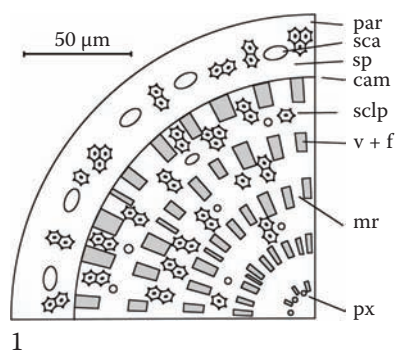
**Transverse section:** Dark brown epidermis of polygonal cells present in primary tissue; in older roots with secondary growth, cork is present; narrow outer parenchyma, with tangentially elongated ovate cells; secondary phloem consists of broad areas of crushed conducting tissue and small cells alternating with medullary rays containing much larger, often ruptured cells; secondary xylem is composed of vessels up to 70  $\mu\text{m}$  diameter arranged in narrow radial rows; the space between vessels is often filled with

fibers without phytomelanin coating; secretory cavities up to 160  $\mu\text{m}$  diameter are present in all parenchyma tissues; sclereids coated with black phytomelanin, approximately 40  $\mu\text{m}$  diameter and up to 300  $\mu\text{m}$  long, are mostly found in small groups in the outer parenchyma, secondary phloem, and medullary rays in the secondary xylem.

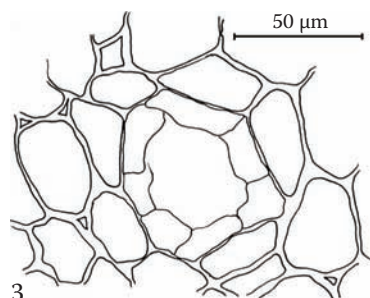
**Longitudinal section:** Sclereids form long strands; length of sclereids up to 300  $\mu\text{m}$ ; vessels with reticulate, scalariform wall thickenings or bordered pits.

**Powder:** Grayish brown with a faint but characteristic odor and slightly sweet, then bitter and astringent taste; fragments of colorless parenchyma; brown cork; and vessels, some of which are associated with fibers; sclereids are frequent and coated with phytomelanin, mostly in multiseriate groups; entire secretory cavities visible. Of all *Echinacea* species, *E. atrorubens* has the greatest abundance of phytomelanin-coated sclereids in the root powder.

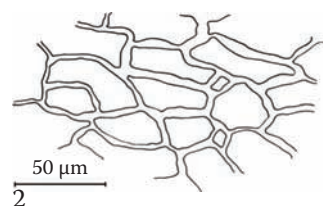
*E. atrorubens* is very similar to *E. angustifolia* and *E. pallida*, except that, within the secondary xylem of *E. atrorubens*, the strands of vessels and fibers are more frequent and the xylem rays are narrower.



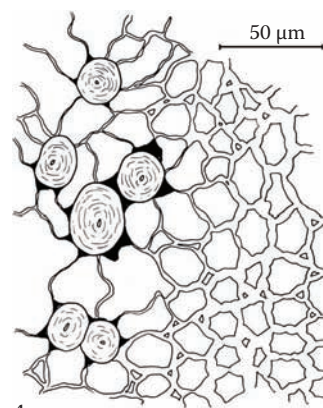
1



3



2



4