A Unique Stem Structure in Bedstraw or Cleavers (Galium aparine)
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Abstract
Bedstraw or cleavers (Galium aparine L.) is a widespread weed of wet places and
roadsides and is distinguished by a unique trailing or vining habit. Although the stems
of bedstraw do not hein or produce tendrils as do true vines, bedstraw is able to ascend
above the canopy of other plants by using its barbed stem tissue to crawl up and over
neighboring vegetation. Scanning electron microscopy of stem segments revealed that
bedstraw has a unique stem structure with four prominent ridges, and with repeating
bark-like structures along the ribbed surface. These bark-like structures enable the stem
to anchor in other objects, allowing the bedstraw to ascend above other plants. The
internal anatomy of the stem of these plants is also unique. The mature stem pit is
hollow and is surrounded by a dense layer of fiber cells. A broad ring of xylary fibers is
found in the mature bedstraw stem that are involved in both support and water uptake.
Photosynthetic parenchyma is restricted to a few cell layers at the stem periphery and
more prominently in the ridges. Immunocytochemistry indicates that the walls of the
ridged tissues and the barbs are highly enriched in pectins compared to the other tissue,
perhaps enhancing the ability of these structures to stick to foreign objects. This unique
stem structure allows bedstraw to act as a pseudo-vine without twining or producing
tendrils.

Introduction
Bedstraw (or cleavers, catchweed, and numerous other common names) is a
common weed of pastures, waste ground, meadows, and fence rows. Despite its nearly
ubiquitous occurrence, bedstraw is a rather unusual weed in that, although not a vine in
the strictest sense of the term, it can ascend over other plants in the canopy much in the
way as do true vines. In many ways, the stems of bedstraw are much like Mother
Nature’s version of Velcro! One might call this habit “clingling” rather than vining. Little is
known about the anatomy of bedstraw, aside from one rather sketchy publication, which
would allow it to perform these functions.

In this study, we examined the internal and external anatomy of this unique weed by
light and scanning electron microscopy and their wall composition by
immunocytochemistry. These data indicate that the presence of distinct barbs along the
stem and leaf surfaces allow the bedstraw to attach to portions of other plants, akin to a
plant version of Velcro.

Material and Methods
Plant Materials
Bedstraw tissues were collected at several sites in Greenville, Stoneville, and Leland,
MS and were fixed in 6% glutaraldehyde in 0.05 M PIPES buffer (pH 7.4) for at least 2h.

Light Microscopy
Samples for light microscopy and immunocytochemistry were dehydrated in an
ethanol series and then embedded in LR White resin in 25% increments each day at
-20C. The samples were transferred to room temperature after samples had spent one
day in 100% plastic and rocked on a rotating shaker for 24h. Samples were transferred
to flat-bottom BEEM capsules and polymerized in a vacuum oven at 50C for
approximately 2h. Light microscopic sections (0.35um) were cut with a Reichert Ultracut
Ultramicrotome and were stained with Toluidine blue on a warming tray. Sections for
immunocytochemistry were serial sections from these same block faces, but were not
stained with Toluidine blue. For immunocytochemistry a number of polysaccharide
monoclonal antibodies were used to probe the sections and sites of antibody reaction
detected by immunogold with silver intensification (Vaughn 2003).

Scanning Electron Microscopy
Samples for SEM were dehydrated in an ethanol series and critical point dried and
coated with gold-palladium before observation with a JEOI 840 scanning electron
microscope.

Conclusion
Bedstraw has a unique combination of a highly barbed stem with a very light internal composition resembling a soda straw
that allows it to attach to virtually any object in its path and successfully ascend above them. Essentially, bedstraw has
become the plant version of Velcro, allowing it to stick to numerous objects. This strategy essentially gives the bedstraw all
the advantages of typical vines with perhaps less cost to the plant in terms of producing tendrils or twining stems. Moreover, this
strategy would also help in dispersing seed of the bedstraw as pieces of the plant stick onto the fur of animals and ensuring
their wide dispersal.