

## VASCULAR PLANT MORPHOLOGY LABORATORY 11

---

### Gnetophytes

Gnetophytes are the most highly derived group of living “gymnosperms”, and are the most closely related living group to flowering plants. Most botanists consider them to be a monophyletic group that first appeared in the Triassic, become common in the Cretaceous, and then declined in floristic importance from the upper Cretaceous to the present. There are three living genera of Gnetophytes, *Gnetum*, *Ephedra* and *Welwitschia*, and each has a distinctive morphology and architecture of the sporophyte. A recent issue of the International Journal of Plant Sciences (edited by W.E. Friedman, 1996) has been devoted to the Gnetophytes, and is a good source of detailed information and of literature about the group.

Gnetophytes share numerous derived characters with the flowering plants. These include potentially bisporangiate reproductive structures that are similar to flowers in some respects, net venation in the leaves, **syndetocheilic stomata** (see page 416 in Gifford and Foster, 1989, if you need to refresh your memory about these stomata), vessels in the xylem, sieve tubes in the phloem, and reduced gametophytes. They have compound cones that are somewhat similar to those of conifers, but in the gnetophytes both pollen and ovulate cones are compound. Also, the fertile parts of the gnetophytes (ovules and pollen sacs) are borne at the tip of the secondary shoots, rather than on sporophylls (as in conifers).

We have little lab material for the gnetophytes, so this lab will be rather short. Nevertheless, look over what we do have carefully, so you will gain an appreciation for these remarkable plants.

Examine sporophyte plants of *Gnetum*, *Ephedra* and *Welwitschia*, and become familiar with the organography of the sporophytes. What is stem, what is leaf, what is roots? If no living plants of *Welwitschia* are available, examine these features in the literature that is provided (i.e., Bornman, 1972; Friedman, 1996).

How are the leaves arranged on these plants? Is leaf arrangement similar in all three genera? Can you identify net venation? Can you identify *Gnetum* as a “gymnosperm” from its vegetative features?

Examine the *Gnetum* plant for the presence of cones. Are there pollen cones, or ovulate cones: either or both? Can you identify *Gnetum* as a “gymnosperm” from its fertile parts.

Examine the pickled cones of *Ephedra*. Are these pollen cones or ovulate cones? Consult page 465 of Gifford and Foster (1989) to help clarify what you have. Identify **bracts**, **bracteoles**, and pollen sacs or ovules. How are the pollen sacs or ovules borne in these cones?

Now examine a pickled cone of *Gnetum*. Note the whorled and fused collar of bracts that subtends the secondary shoots. Ovules or pollen sacs occur at the tip of the secondary shoots. The text book calls the secondary shoots that bear the pollen sacs “microsporangiphores”. Are these homologous to the sporangiophores of *Equisetum*? Consult page 473 of Gifford and Foster (1989) if you need help identifying the parts.

### **Literature**

Bornman, C.H. 1972. *Welwitschia micrabilis*: paradox of the Namib Desert. Endeavour 31: 95-99.

Friedman, W.E. (Ed.) 1996. Biology and evolution of the Gnetales. International Journal of Plant Sciences 157 (No. 6, Supplement): S1-S125.