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ENY-709

Many Plants Have Extrafloral Nectaries Helpful to Beneficials[1]

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Most everyone is aware that flowers commonly produce nectar that is important in encouraging pollination as well as providing food for hummingbirds and insects. However, few people are aware of the extrafloral nectaries (EFN), nectar-producing glands physically apart from the flower (Figures 1 and 2), that have been identified in more than 2000 plant species in more than 64 families. EFN glands may be located on leaf laminae (Figure 3), petioles (Figure 4), rachids , bracts, stipules, pedicels (Figure 5), fruit, etc., and their size, shape and secretions vary with plant taxa. Ants often use EFN (Figures 6 and 7) and many fascinating studies are available that report the interactions of ants with EFN and herbivores.

Figure 1. Extrafloral nectaries secreting nectar on the stems of young elderberry plants.

Figure 2. Extrafloral nectaries on stalked structures on elderberry leaves.

The composition of the gland secretion is about 95% sugar with the other 5% consisting of a wide array of amino acids and other important nutrients. EFN content differs from floral nectar, varies by taxa, and may or may not flow in a daily pattern. Two functions for the EFN have been hypothesized: as an excretory organ for the plant to rid itself of metabolic wastes or to attract beneficial insects for plant defense (Figure 8). Of the plant species with EFN that have been studied, the majority of the results, although not

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all, have supported the plant defense function. It is well documented that many insects use EFN and it is easy to observe beneficial insects such as ladybird beetles feeding on EFN. Many species of ants are found in association with plants having EFN and are thought to be manipulated by the plant using its EFN. Interestingly, a great many species of vines have EFN and the evolution and selection for EFN is hypothesized to occur as a direct result from the ants using the vines frequently as natural pathways into the forest canopy.

Figure 3. Extrafloral nectaries on the leaves of passionflower.

Figure 4. Extrafloral nectaries (lobes) on peach.

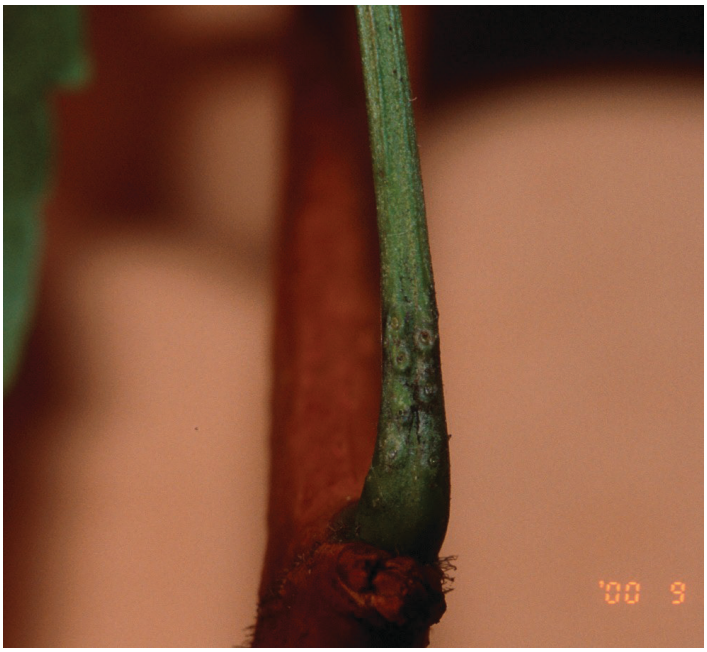

Figure 5. Extrafloral nectaries (pits) on the petioles of trumpet vine.

Figure 6. A large species of ant using the EFN of elderberry in north Florida.

Figure 7. Extrafloral nectaries with visiting ant on common vetch.

Figure 8. A ladybeetle, *Coccinella septumpunctata* and a lacewing larva feeding on the EFN on a flower bud of peony.

Passion flower, *Passflora* spp., partridge pea, *Cassia* spp., hairy vetch, *Vicia* sp. and elderberry, *Sambucus* spp., are common Florida plants with large EFN on the leaves and/or stems that are easy to find. Most cultivars of peach (and *Prunus* spp. in general) have EFN on the leaves, although a few (e.g. 'GoldPrince' and 'JunePrince') do not. The occurrence of EFN appears to be controlled by a single gene in most plant species. EFN offer an important supplemental food source for beneficial insects and some pest species (Figure 9) particularly during extreme weather conditions such as drought and other times of the year when prey are scarce. EFN may be valuable if not critical components in the ecology of landscapes. A great many opportunities exists to further our understanding of EFN in landscape systems as much remains to be understood about the roles EFN play.

Figure 9. Lovebugs feeding on the EFN of elderberry.

Some Plant Families with EFN

Fabaceae, Rosaceae
Euphorbiaceae, Bignoniaceae
Asteraceae, Malvaceae
Salicaceae, Cucurbitaceae
Caprifoliaceae, Apocynaceae
Liliaceae, Convolvulaceae

Some Species with EFN in Florida

Abutilon (Indian mallow)
Ailanthus altissima (silk tree)
Allamanda schottii
Aphelandra (tropical herb or shrub)
Callicarpa (beauty berry)
Campsis radicans (trumpet creeper)
Chamaecrista fasciculata (partridge pea)
Catalpa speciosa (indian bean)
Cattleya orchids
Cissus rhombifolia (ivy)
Clerodendrum (tube flower)
Costus (spiral ginger)
Crotalaria pallida
Croton spp.
Curcurbits
Dioscorea bulbifera (air potato)
Fraxinus spp. (ash)
Fritillaria spp. (N. Am. lily)
Gossypium hirsutum (cotton)
Helianthus spp. (sunflower)
Helianthella quinquenervis (W. N. Am. herb)
Hibiscus sp.
Hoya sp.
Impatiens balsamina
Ipomoea pandurata (morning glory)
Osmanthus spp. (devil weed)
Oxypetalum spp. (S. Am. shrub)
Paeonia spp. (peony)
Passiflora incarnata (passion flower)
Pennisetum spp. (tropical grass)
Phaseolus spp. (beans)
Polygonum spp. (knot, smartweed)
Prunus spp.(peach) most of 431 species have
Pteridium aquilinum (bracken)
Ricinus communis (castor bean)
Robinia pseudoacacia (black locust)
Salix sp. (willow)
Sambucus nigra (elderberry)
Smilax spp. (green briar)
Thunbergia grandiflora (blue trumpet vine)
Viburnum opalus var. *americanum*

Vicia sativa (vetch)
Vigna unguiculata (cowpeas)

Location of Some EFN

Ailanthus: leaf margins
Allamanda: leaf axils
Callicarpa: adaxial surface near veins at leaf base
Cassia: petiole
Cissus: stipule
Costus: outer surface of floral bracts
Crotalaria: flower stalk
Croton: petiole
Curcurbits: lamina, pedunular bracts, abaxial surface of calyx
Fraxinus: glandular trichomes on lower leaf surface
Gossypium: leaf or flower bracts
Helianthus: flower bracts and phyllaries
Hibiscus: sunken, elongate cavity part of midvein adaxial surface
Hoya: upper leaf surface
Impatiens: petiole and leaves
Ipomoea: lower leaf surface, petiole, pedicel just below junction with sepals
Osmanthus: glandular trichomes on lower leaf surface
Passiflora: petiole, bud and flower bracts
Phaseolus: on the cushion-like compressed lateral branches on the inflorescence axis
Prunus: distal part of leaf petiole/leaf blade
Pteridium: stipe and fronds
Ricinus: leaf and inflorescence
Robinia: stipules
Salix: leaves
Sambucus: stipules
Smilax: tiny, flattened on lower leaf surface
Thunbergia: sepals
Viburnum: lower leaf surface near petiole
Vicia: stipules
Vigna: stipules and inflorescence stalk

References for Further Reading

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