

Confounded by Composites?--A Workshop and Information on Hawkweeds, Knapweeds, and Thistles

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WHAT IS A “COMPOSITE?”

The word “composite” is used to describe something made up of distinct parts, and was derived from the Latin *compositus*. Botanically speaking, composite refers to the plant family typified by many individual flowers arranged within a composite “head.” Of all plant families, this characteristic is most commonly found in the plant family Compositae (a.k.a. Asteraceae), and all species of this family may be correctly called “composites.” In addition to flowering in heads, composite family plants also bear one or more of the following characters:

1. Individual flowers are generally tube-shaped and small (usually < 1/4-inch long).
2. When present, anthers are usually loosely fused into a tube around the style.
3. When present, styles normally split in two near the tip. These forking styles are usually visible with magnification.
4. Fruits are achenes, usually hardened, with the seed borne loosely inside (think of a sunflower seed to get the idea).
5. Many species have milky sap.
6. Many species bear plumed seeds.

Remember: although an unknown plant specimen may possess one of these characteristics, that does not necessarily mean you are looking at a composite. It is the combination of several characteristics that defines the composite family.

HOW IMPORTANT IS THE COMPOSITE FAMILY?

The composite family is one of the largest of all plant families. Worldwide, over 15,000 species comprise Asteraceae. Based on this, you might expect that this family also contains a large number of weedy species. And you would be right. Most of the hundred-plus genera found in the Pacific Northwest include at least one weedy species, including many that have been declared noxious by Washington, Idaho, and Oregon, such as *Centaurea* (the knapweeds), *Hieracium* (the hawkweeds), and *Carduus/Cirsium/Onopordum/Cnicus/Silybum* (the thistles).

Asteraceae is well-represented in horticulture, with species ranging from asters to zinnias. Still, there are relatively few composite plants commonly grown as crops. Lettuce (*Lactuca sativa*) is the most common, but others include chicory (*Cichorium intybus*), sunflower (*Helianthus annuus*), Jerusalem artichoke (*H. tuberosus*), globe artichoke (*Cynara scolymus*), and safflower (*Carthamus tinctorius*).

HOW DO WE IDENTIFY THE COMPOSITES?

The current system of plant taxonomy is based primarily on reproductive structures—it is the flowers of the plant, more than any other character, that really define the species. Consequently, observing a plant's inflorescence is the best way to positively identify that plant.

As mentioned above, composites are typified by flowers borne in heads. Although most species bear clearly identifiable heads, others may not be as obvious. It is small flower size that makes this character often hard to discern. The common dandelion (*Taraxacum officinale*), for example, may produce 100 or more individual flowers all tucked into a single head the size of a quarter. The serious amateur botanist interested in identifying plants in Asteraceae will want to invest in a hand lens or magnifying glass to help distinguish differences in these tiny flowers.

Taxonomists refer to a head as an *involucre*, and the shape and size of that involucre is often the easiest character to observe when identifying composites. Involucre width and height are frequently mentioned in keys and ranges from about ¼ inch wide in common groundsel (*Senecio vulgaris*) to up to 3 inches across for musk thistle (*Carduus nutans*). So too, the shape, texture, and size of bracts on the involucre (which are called involucre bracts, strangely enough) can be helpful characters to examine. For example, knapweed heads appear very similar, but if bracts are tipped with comblike, black fringes, it is probably spotted knapweed (*Centaurea maculosa*), but if the bracts bear long, sharp spines, it is probably yellow starthistle (*C. solstitialis*), while bracts with short spines point toward diffuse knapweed (*C. diffusa*). Flower color is particularly helpful, especially when combined with vegetative characters (such as milky sap, aromatic foliage, or spiny leaves).

But it is the structure of the flower itself that is most often used by taxonomists to place composite plants into the various genera. There are two basic flower types within Asteraceae: *disk flowers* and *ray flowers*. Disk flowers have a tubular *corolla* arising from the top of the ovary (the corolla is the colored portion of the flower, consisting of 5 fused petals). The tip of the corolla tube often flares into 5 separate points. Ray flowers are similar except that the corolla, rather than being even across the tip, is modified into a long, strap-like structure called a *ligule*. The ligule bends upwards and away from its tubular base, and is often tipped by 2 to 5 teeth. In composite flowers with female parts, the corolla tube is usually overtopped by the forked style. The three flower combinations most common in the composite family are: (1) *discoïd* heads (composed exclusively of disk flowers), (2) *ligulate* heads (exclusively ray flowers), or (3) *radiate* heads (a mixture of disk and ray flowers).

Let's put this floral information into a more familiar situation. Picture a daisy. Daisies are radiate heads, with the center made up of many yellow or brown disk flowers. Encircling this cluster of disk flowers are the white ray flowers. It is these ligules that are used for the "she loves me/she loves me not"

procedure most of us have performed at one time or another, with perhaps somewhat unreliable results. Realize that you are plucking individual flowers rather than petals and you'll be botanically correct (although probably not particularly romantic).

Let's now turn our attention to the fruits of Asteraceae, commonly called seeds. As noted above, each fruit is an *achene*, which is a dry, somewhat hardened shell surrounding the loosely borne seed. Involucres of most composites open at maturity, allowing the fruits to fall individually (picture a dandelion). Sometimes the achenes remain bound tightly within a bur (as with cocklebur (*Xanthium strumarium*) and burdock (*Arctium minus*)), which easily attaches to clothing of passing humans as well as animal fur or feathers. Achenes are commonly plumed with a downy *pappus* (most thistle achenes bear a pappus) which aids in dispersal of seed via wind or water.

IDENTIFYING COMPOSITES USING A KEY

A plant key is designed to help the user quickly identify an unknown plant through the use of carefully selected choices. The choices often are in mutually exclusive pairs; that is, one plant can only be accurately described by one of the two statements. This is termed a *dichotomous* ("forking") key. For example, the contrasting statements may be "leaves grasslike" versus "leaves broad and toothed, not at all grasslike." For a given plant, then, only one term applies: either the plant has grasslike leaves or broad, toothed leaves, not both. But remember that plants are living things, and living things are always somewhat variable. To guard against possible error, always observe the character in question on several different organs or plants. By averaging your answers, you are more likely to choose the correct description.

Keys are often numbered and/or lettered to aid in matching the dichotomous statements, so the correct comparisons are made by the user. For example, when using the enclosed key, be sure to compare the statement at 2a (Seeds in a bur or bur-like fruit) with the opposing statement at 2b (Seeds not in a bur), or 10a (Heads < ¼-inch wide; stalks tall, leafy) with 10b (Heads more than ¼-inch wide; plants various).

Keys are powerful tools, but, like any road map, a key must be correctly used to arrive at the correct destination. A user who incorrectly answers the often technical choice is lost and will arrive at the wrong answer, or eventually arrive at a fork where neither statement accurately describes the unknown plant. Careful use of correct botanical information is a must to successfully key plants!

One last thing to consider about keys: they only allow you to identify species actually used when constructing the key. If, for example, you attempted to identify common teasel (*Dipsacus sylvestris*, a weedy species which flowers in heads but is not a composite) using the enclosed key, you would key the plant to Scotch thistle (*Onopordum acanthium*). Trying to key other species not used when constructing this key, even if they are in Asteraceae, might result in failure to find an accurate description at one of the forks, or in a different incorrect identification. So always compare your plant with a description and illustration or photo of the answer to eliminate the chance of incorrect identification. If, after several attempts, you still are not convinced that your specimen matches the description, try a different key (such as Vascular Plants of the Pacific Northwest) or send the specimen to an authority who can positively identify it. If you must, collect another specimen after it has matured and try again to identify it using a key using reproductive structures. In any case, *never be satisfied allowing your unknown composite to remain unknown!*

References:

- Abrams, L.R. 1955. Illustrated Flora of the Pacific States, Volume IV. Stanford University Press, Stanford, California.
- Bailey, L.H. 1949. Manual of Cultivated Plants. The MacMillan Company, New York.
- Cronquist, A. 1955. Part 5: Compositae. *In: Vascular Plants of the Pacific Northwest*. Hitchcock, C.L., A. Cronquist, M. Ownbey, and J.W. Thompson. Univ. of Washington Press, Seattle.
- Dennis, L.J. 1980. Gilkey's Weeds of the Pacific Northwest. Oregon State Univ. Press, Corvallis.
- Fernald, M.L. 1950. Gray's Manual of Botany. American Book Company, New York.
- Hitchcock, C.L. and A. Cronquist. 1973. Flora of the Pacific Northwest. Univ. of Washington Press, Seattle.
- Porter, C.L. 1959. Taxonomy of Flowering Plants. W.H. Freeman and Company, San Francisco.
- Ross, M.A. and C.A. Lembi. 1985. Applied Weed Science. Burgess Publishing Company, Minneapolis.
- Whitson, T.D. (ed.). 1992. Weeds of the West. Western Society of Weed Science in cooperation with the Western U.S. Land Grant Univ. Coop. Extension Services.

WHICH COMPOSITES ARE WE CONCERNED ABOUT?

The Pacific Northwest is home to many species of Asteraceae. Many are natives; that is, they are species which originated in this region. Others are alien species, either brought in purposefully for agricultural, medicinal, or horticultural reasons (e.g., common tansy, cornflower, oxeye daisy) or accidentally as a contaminant in crop seed, ship's ballast, or some other imported commodity (e.g., prickly lettuce, annual sowthistle, bull thistle).

Alien composites are frequently weedy, defined as invasive and persistent species which interfere with human activities and are, therefore, undesirable. In this workshop, the focus is on identification of weedy composites. The following is a list of 36 genera of composite weeds in Washington.

Weed	Genus	Weedy Species	Distribution	Photo ^a
Yarrow	<i>Achillea</i>	<i>lanulosa</i>	common	42
Russian knapweed	<i>Acroptilon</i>	<i>repens</i>	common	92
Ragweed/Bursage	<i>Ambrosia</i>	<i>acanthicarpa, artemisiifolia</i>	common	44,46
Mayweed	<i>Anthemis</i>	<i>cotula</i>	common (east)	54
Burdock	<i>Arctium</i>	<i>minus</i>	common	56
Wormwood/Sagebrush	<i>Artemisia</i>	<i>absinthium, tridentata,</i>	common	58, 68
Lawn daisy	<i>Bellis</i>	<i>perennis</i>	common (west)	70
Beggarticks	<i>Bidens</i>	<i>cernua, frondosa</i>	common	72
Thistle	<i>Carduus</i>	<i>acanthoides, nutans,</i> <i>pycnocephalus</i>	occasional	74-78
Knapweed/ Starthistle	<i>Centaurea</i>	<i>cyanus, diffusa, maculosa, common</i> <i>pratensis, solstitialis</i>	82-94	
Skeletonweed	<i>Chondrilla</i>	<i>juncea</i>	common (central)	98
Oxeye daisy	<i>Chrysanthemum</i>	<i>leucanthemum</i>	common	100
Rabbitbrush	<i>Chrysothamnus</i>	<i>nauseosus, viscidifloris</i>	common (central)	102-4
Chicory	<i>Cichorium</i>	<i>intybus</i>	common	106
Thistle	<i>Cirsium</i>	<i>arvense, vulgare</i>	common	108-18
Horseweed	<i>Conyza</i>	<i>canadensis</i>	common	122
Hawksbeard	<i>Crepis</i>	<i>capillaris</i>	common (west)	---
Common crupina	<i>Crupina</i>	<i>vulgaris</i>	rare	126
Cudweed	<i>Gnaphalium</i>	<i>palustre, uliginosum</i>	common	128
Gumweed	<i>Grindelia</i>	<i>squarrosa</i>	common (central, east)	131
Sunflower	<i>Helianthus</i>	<i>annuus</i>	common (central)	134
Hawkweed	<i>Hieracium</i>	<i>aurantiacum, pratense</i>	occasional	143
Catsear	<i>Hypochaeris</i>	<i>radicata</i>	common (west)	144
Povertyweed/Marshelder	<i>Iva</i>	<i>axillaris, xanthifolia</i>	common (central)	146-8
Lettuce	<i>Lactuca</i>	<i>pulchella, serriola</i>	common	150-2
Nipplewort	<i>Lapsana</i>	<i>communis</i>	common (west)	154
Tarweed	<i>Madia</i>	<i>glomerata, sativa</i>	common (east)	160
Pineappleweed	<i>Matricaria</i>	<i>matricarioides</i>	common	162
Scotch thistle	<i>Onopordum</i>	<i>acanthium</i>	occasional	164
Ragweed/Groundsel	<i>Senecio</i>	<i>jacobaea, vulgaris</i>	common (west)	166-70
Canada goldenrod	<i>Solidago</i>	<i>canadensis</i>	occasional	174
Sowthistle	<i>Sonchus</i>	<i>arvensis, asper, oleracea</i>	common	178-82
Common tansy	<i>Tanacetum</i>	<i>vulgare</i>	common	184
Dandelion	<i>Taraxacum</i>	<i>officinale</i>	common	186
Salsify	<i>Tragopogon</i>	<i>dubius</i>	common (east)	190
Cocklebur	<i>Xanthium</i>	<i>spinosum, strumarium</i>	occasional	192-4

^aPage number in *Weeds of the West* (revised 1992).

- 22a Seeds plumed; leaves slender, sessile
 - 23a Plants from very short rhizomes/stolons; fibrous rooted..... hawkweed
 - 23b Plants without rhizomes/stolons; taprooted..... hawksbeard
- 22b Seeds not plumed; leaves broad, petiolate..... nipplewort
- 15b Sap watery
 - 24a Heads and upper stems sticky-resinous
 - 25a Involucral bracts hooked; heads > 1/4inch wide gumweed
 - 25b Involucral bracts flat; heads < 1/4inch wide..... tarweed
 - 24b Heads otherwise
 - 26a Heads daisylike, with obvious ray flowers
 - 27a Seeds with barbed spines beggarticks
 - 27b Seeds without spines
 - 28a Leaves ruffled in appearance; heads about 1/2inch wide tansy ragwort
 - 28b Leaves shallowly toothed; heads < 1/4inch wide goldenrod
 - 26b Heads not daisylike, without ray flowers
 - 29a Plants shrubby, woody at the base rabbitbrush
 - 29b Plants entirely herbaceous
 - 30a Heads borne singly; plants usually 12 inches tall or less
 - 31a Leaves finely divided; foliage pleasantly-scented..... pineappleweed
 - 31b Leaves only shallowly lobed; scentless common groundsel
 - 30b Heads in flat-topped clusters; plants usually > 3 feet tall..... common tansy
- 13b Flowers not yellow
 - 32a Flowers blue
 - 33a Sap watery..... cornflower
 - 33b Sap milky
 - 34a Seeds long-plumed..... blue lettuce
 - 34b Seeds with minute plumes..... chicory
 - 32b Flowers not blue
 - 35a Flowers white or mostly white
 - 36a Heads borne in tight, flat-topped inflorescence yarrow
 - 36b Heads borne singly
 - 37a Plants rarely more than 3 inches tall..... lawn daisy
 - 37b Plants usually taller than 3 inches
 - 38a Heads < 1/4inch wide; inflorescence elongate..... horseweed
 - 38b Heads larger, very showy, usually borne singly
 - 39a Heads daisy-like
 - 40a Foliage finely divided, foul smelling..... mayweed
 - 40b Foliage slightly lobed, not scented..... oxeye daisy
 - 39b Heads not daisy-like
 - 41a Involucral bract tipped by short spine diffuse knapweed
 - 41b Involucral bracts with dark fringes, not at all spiny cornflower
 - 35b Flowers not white

- 42a Flowers pink to red
 - 43a Plants rarely more than 3 inches tall.....lawn daisy
 - 43b Plants usually taller than 3 inches
 - 44a At least some leaves deeply lobed to divided
 - 45a Heads round with black-tipped involucre bractsspotted knapweed
 - 45b Heads slender with green involucre bractscrupina
 - 44b Leaves toothed but not divided
 - 46a Involucre bracts with smooth, brown, papery margins Russian knapweed
 - 46b Involucre bracts with dark fringes at the tips cornflower
- 42b Flowers lavender to purple
 - 47a Leaves spiny; true thistles
 - 48a Heads < 1/4 inch wide, not particularly spiny..... Canada thistle
 - 48b Heads larger, very spiny
 - 49a Heads about 1 inch wide; basal leaves up to 1 foot long
 - 50a Leaves with short, bristly hairs pointing towards the tip bull thistle
 - 50b Leaves otherwise hairy or smooth
 - 51a Heads narrow, borne in groups of 3-5 at stem tips Italian thistle
 - 51b Heads wider, borne in groups of 1-3 near stem tipsplumeless thistle
 - 49b Heads 2 to 3 inches wide; basal leaves up to 2 feet long
 - 52a Heads upright; involucre bracts long and slender.....Scotch thistle
 - 52b Heads nodding; involucre bracts broad musk thistle
 - 47b Leaves not spiny
 - 53a Sap milky
 - 54a Leaves grasslikesalsify
 - 54b Leaves broad and toothed, not at all grasslikeblue lettuce
 - 53b Sap watery
 - 55a Plants rarely more than 3 inches tall.....lawn daisy
 - 55b Plants usually taller than 3 inches
 - 56a Heads bur-like at maturity
 - 57a Involucre bract tipped by short spine diffuse knapweed
 - 57b Involucre bract a hooked bristle burdock
 - 56b Mature heads not bur-like
 - 58a At least some leaves deeply lobed to divided
 - 59a Heads slender with green involucre bractscrupina
 - 59b Heads round with black-tipped involucre bractsspotted knapweed
 - 58b Leaves variously toothed to entire, but not divided
 - 60a Involucre bracts with smooth, brown, papery margins Russian knapweed
 - 60b Involucre bracts with fringes at the tips
 - 61a Involucre bract tipped by short spine diffuse knapweed
 - 61b Involucre bracts not at all spiny
 - 62a Winter annual; all leaves < 1/4 inch wide cornflower
 - 62b Perennial; at least lower leaves > 1/4 inch wide meadow knapweed