

2007

The Linnean Tercentenary

Some Aspects of Linnaeus' Life

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4. Linnaeus' Floral Clock*

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Carl Linnaeus (1707-1778) observed over a number of years that the flowers of many plants opened and closed periodically and that these times varied from species to species. Arranged in sequence of flowering over the day, they constituted a kind of floral clock or *Horologium Florae* as Linnaeus called it in his *Philisophia Botanica* (Vienna, 1751): 274-275.

Linnaeus was of course ignorant of the response of plants to different day lengths (photoperiodism), but because of the latitude of Uppsala (60°N) many of the plants he selected were long-day species (adapted to short nights and daily photoperiods of 12 h or more). His list also includes species of the intermediate type, which produce flowers regardless of the day length. These day-neutral types (e.g. dandelion) are not so useful time keepers since their times of opening vary with the season.

This periodic opening and closing of flowers is brought about by the interaction of an endogenous rhythm and the day length (light/dark signal) and it appears that the plant is capable of measuring the time after which the light has come on. However, we have no knowledge of the receptors involved and all we know about the time measurement is that phytochrome is implicated. The actual mechanism for opening and closing certainly involves turgor changes in small groups of cells; these changes may further be influenced by temperature and humidity.

During the first half of the 19th century Botanic Gardens tried to construct floral clocks, but with no great success since many of the plants listed by Linnaeus do not flower at the same season.

Below is appended Linnaeus' *Horologium Florae* together with the English vernacular names where relevant.

For those of you who wish to check the time of day on your rambles through the countryside, remember that not only do the times of opening and closing of some of the

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OPENING OF FLOWERS AT UPSALA AND INNSBRUCK.

NAME OF PLANT.	AT UPSALA.	AT INNSBRUCK.	DIFFERENCE IN HOURS.
<i>Cichorium Intybus</i>	4-5 A.M.	6-7 A.M.	2
<i>Hemerocallis fulva</i>	5 "	6-7 "	1-2
<i>Sonchus oleraceus</i>	5 "	6-7 "	1-2
<i>Taraxacum officinale</i>	5-6 "	6-7 "	1
<i>Hypochaeris maculata</i>	6 "	7-8 "	1-2
<i>Sonchus arvensis</i>	6-7 "	7-8 "	1
<i>Lactuca sativa</i>	7 "	8-9 "	1-2
<i>Nymphaea alba</i>	7 "	8-9 "	1-2
<i>Anagallis arvensis</i>	8 "	9-10 "	1-2
<i>Arenaria rubra</i>	9-10 "	10-11 "	1

CLOSING OF FLOWERS AT UPSALA AND INNSBRUCK.

NAME OF PLANT.	AT UPSALA.	AT INNSBRUCK.	DIFFERENCE IN HOURS.
<i>Taraxacum officinale</i>	8-10 A.M.	2-3 P.M.	5-6
<i>Cichorium Intybus</i>	10 "	2-3 "	4-5
<i>Lactuca sativa</i>	10 "	1-2 "	3-4
<i>Sonchus arvensis</i>	10 "	12-1 "	2-3
<i>Sonchus oleraceus</i>	11-12 "	1-2 "	2
<i>Arenaria rubra</i>	1-3 P.M.	3-4 "	1
<i>Hypochaeris maculata</i>	4-5 "	6-7 "	2
<i>Hemerocallis fulva</i>	7-8 "	8-9 "	1
<i>Nymphaea alba</i>	5 "	7-8 "	2-3

flowers vary with the season (i.e. the month) but also with the weather (in rainy weather they may remain closed or their opening may be retarded) and with the plant's aspect (be it on the north or south side of a hill or on the valley floor or in the mountain glen). Finally, if you wish to make direct use of the times given by Linnaeus you will also probably have to make a correction for latitude (the further south you are of Uppsala the later in the day will the plants open and close).

Above is collated a few species whose times of opening have been recorded for both Uppsala and Innsbruck (13° South of Uppsala) by Anton Kerner 1895 in *The Natural History of Plants* 2: 215-218 (Transl. F.W. Oliver).

Linnaeus' name	Current name	Common name	Open	Closed
<i>Tragopogon luteum</i> [648= <i>T. pratense</i> 1753]	= <i>T. pratensis</i> L.	Goat's-Beard; Jack-go-to-bed-at-noon	3 a.m.	
<i>Leontodon taraxacoid.</i> [628= <i>L. hispidum</i> 1753]	= <i>L. hispidum</i> L.	Rough Hawkbit	by 4 a.m.	
<i>Picris magna</i> [241.1= <i>P. echinoides</i> 1753]	= <i>Helminthotheca echinoides</i> (L.) Holub	Bristly Ox-Tongue	4-5 a.m.	
<i>Cichorium scanense</i> [650= <i>C. intybus</i> 1753]	= <i>Cichorium intybus</i> L.	Chicory; Wild Succory	4-5 a.m.	
<i>Crepis tectorum</i> 1753	= <i>Crepis tectorum</i> L.	[Hawk's Beard]	4-5 a.m.	
<i>Scorzonera tingitana</i> 1753	= <i>Reichardia tingitana</i> (L.) Roth		by 6 a.m.	

Linnaeus' name	Current name	Common name	Open	Closed
<i>Sonchus laevis</i> [[643] = <i>S. oleraceus</i> L.]	= <i>S. oleraceus</i> L.	Milk-or Sow-Thistle	5 a.m.	
<i>Leontodon taraxacum</i> 1753	= <i>Taraxacum officinale</i> Weber	Dandelion	5 a.m.	
<i>Crepis alpina</i> 1753	= <i>C. alpina</i> L.	[Hawk's Beard]	5 a.m.	
<i>Tragopogon columnae</i> [243.3 = <i>T. hybridum</i> 1753]	= <i>T. hybridus</i> L.	[Goat's Beard]	5 a.m.	
<i>Lapsana rhagadiolus</i> 1753 <i>glutinosa</i> [245.3 = <i>L. chondrilloides</i> 1753]	= <i>Rhagadiolus edulis</i> Gaertner		5 a.m. 5 a.m.	
<i>Convolvulus rectus</i> [38.2] = <i>C. tricolor</i> 1753]	= <i>C. tricolor</i> L.	[Bindweed]	5 a.m.	
<i>Hypochaeris pratensis</i> [631 = <i>H. maculata</i> 1753]	= <i>H. maculata</i> L.	Spotted Cat's Ear	6 a.m.	
<i>Hieracium fruticosum</i> [639 = <i>H. umbellatum</i> 1753]	= <i>H. umbellatum</i> L.	[Hawkweed]	6 a.m.	
<i>pulmonaria</i> [637 = <i>H. murorum</i> 1753]	= <i>H. murorum</i> L.	[Hawkweed]	6 a.m.	
<i>Crepis rubra</i> 1753	= <i>Crepis rubra</i> L.		6 a.m.	
<i>Sonchus repens</i> [642 = <i>S. arvensis</i> 1753]	= <i>S. arvensis</i> L.	Field Milk-Thistle	6 a.m.	
<i>belgicus</i> [244.1 = <i>S. palustris</i> 1753]	= <i>S. palustris</i> L.	Marsh Sow-Thistle	by 7 a.m.	
<i>Leontodon chondrilloides</i> [629 = <i>L. autumnale</i> L. 1753]	= <i>L. autumnale</i> L.	Autumnal Hawkbit	7 a.m.	
<i>Hieracium latifolium</i> [238.1 = <i>H. sabaudum</i> 1753]	= <i>H. sabaudum</i> L.	[Hawkweed]	7 a.m.	
<i>Sonchus lapponicus</i> [644 = <i>S. alpinus</i> 1753]	= <i>Cicerbita alpina</i> (L.) Wallr.	Blue Sow-Thistle	7 a.m.	
<i>Lactuca sativa</i>	= <i>Lactuca sativa</i> L.	Garden Lettuce	7 a.m.	
<i>Calendula africana</i> [274.2 = <i>C. pluvialis</i> 1753]			7 a.m.	
<i>Nymphaea alba</i> 1753	= <i>Nymphaea alba</i> L.	White Water-Lily	7 a.m.	
<i>Anthericum album</i> [267 = <i>A. ramosum</i> 1753]	= <i>A. ramosum</i> L.	[St. Bernard's Lily]	7 a.m.	
<i>Hypochaeris hispida</i> [240.1 = <i>H. achyrophorus</i> 1753]	= <i>H. achyrophorus</i> L.		7-8 a.m.	
<i>Lapsana rhagadioloides</i> [246.4 = <i>Hyoseris hedyppnois</i> 1753]	= <i>Hedyppnois rhagadioloides</i> (L.) Schmidt subsp. <i>cretica</i> (L.) Hayek		7-8 a.m.	
<i>Mesembryanthemum</i> <i>barbatum</i> 1753	= <i>Trichodiadema babrata</i> (L.) Schwantes		7-8 a.m.	
<i>Hieracium pilosella</i> 1753	= <i>H. pilosella</i> L.	Mouse-ear Hawkweed	8 a.m.	
<i>Anagallis rubra</i> [169 = <i>A. arvensis</i> 1753]	= <i>A. arvensis</i> L.	Scarlet Pimpernell; Shepherds Weather Glass.	8 a.m.	
<i>Dianthus prolifer</i> 1753	= <i>Petrorhagia prolifera</i> (L.) Ball & Heywood	Proliferous Pink	8 a.m.	
<i>Leontodon taraxacum</i> [see above]				8-9 a.m.
<i>Hypochaeris chondrilloides</i> [240.2 = <i>H. glabra</i> 1753]	= <i>H. glabra</i> L.	Smooth Cat's-Ear	9 a.m.	
<i>Malva helvula</i> [201.4 = <i>M. caroliniana</i> 1753]			9-10 a.m.	
<i>Arenaria purpurea</i> [376 = <i>A. rubra</i> 1753]	= <i>Spergularia rubra</i> (L.) J. & C. Presl	Sand spurrey	9-10 a.m.	
<i>Mesembryanthemum</i> <i>crystallinum</i> 1753	= <i>Mesembryanthemum</i> <i>crystallinum</i> L.	[Ice-Plant]	9-10 a.m.	
<i>Lapsana glutinosa</i> [see above]				10 a.m.

Linnaeus' name	Current name	Common name	Open	Closed
Lactuca sativa [see above]				10 a.m.
Scorzonera tingitana [see above]				10 a.m.
Mesembryanthemum neapolitanum [129.10 = <i>M. nodiflorum</i> 1753]	= <i>Cryophytum nodiflorum</i> (L.) L. Bol.	[Ice-Plant]	10 11 a.m.	
Crepis alpina [see above]				11 a.m.
Tragopogon columnae [see above]				11 a.m.
Soncus laevis [see above]				Noon
Sonchus lapponicus [see above]				Noon
Hypochaeris chondrilloides [see above]				1 p.m.
Malva helvula [see above]				1 p.m.
Dianthus prolifer [see above]				1 p.m.
Hieracium latifolium [see above]				1-2 p.m.
Crepis rubra [see above]				1-2 p.m.
Hypochoeris hispida [see above]				2 p.m.
Hieracium pulmonaria [see above]				2 p.m.
Sonchus belgicus [see above]				2 p.m.
Lapsana rhagadioloides [see above]				2 p.m.
Mesembryanthemum barbatum [see above]				2 p.m.
Arenaria purpurea [see above]				2-3 p.m.
Leontodon chondrilloides [see above]				3 p.m.
Calendula arvensis [712 = <i>C. officinalis</i> 1753]	= <i>C. officinalis</i> L.	Pot Marigold		3 p.m.
Mesembryanthemum neapolitanum [see above]				3 p.m.
linguiforme 1753				3 p.m.
Hieracium rubrum [238.3 = <i>H. aurantiacum</i> 1753]	= <i>H. aurantiacum</i> L.	[Hawkweed]		3-4 p.m.
Mesembryanthemum crystallinum 1753 [see above]				3-4 p.m.
Calendula africana [see above]				3-4 p.m.
Anthericum album [see above]				3-4 p.m.
Alyssum alyssoides [<i>Alyssoides</i> T.]	= Identity uncertain			4 p.m.
Hypochaeris pratensis [see above]				4-5 p.m.
Hieracium fruticosum [see above]				5 p.m.
Nymphaea alba [see above]				5 p.m.
Papaver nudicaule 1753				7 p.m.
Hemerocallis fulva [88.1α = <i>H. lilioasphodelus</i> 1753]	= <i>H. lilioasphodelus</i> L.	[Day-Lily]		7-8 p.m.