ROSETTE PLANTS OF OHIO.

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Among the many forms of vegetation represented in Ohio, the rosette is not the least interesting and remarkable. There are about 155 species and varieties of plants in the State which exhibit this habit during some period of their life history and since many of them are very abundant and some are classed as bad weeds, they form a conspicuous and important part of the flora.

Rosette plants are characterized by a basal tuft or whorl of leaves which may be persistent (perpetual rosettes, as the common Dandelion) or may disappear as the plant reaches maturity (temporary rosettes, as the Mulleins and most other rosette-biennials). This basal tuft of leaves is due to a shortening (non-development) of the internodes of the stem, thus bringing the leaves close together. The amount of stem reduction may be approximated by counting the number of leaves in a rosette and comparing with the number of leaves on a flowering stem of the same plant. The stem forming the central axis of the rosette of Onagra biennis, the common Evening Primrose, will be found to bear 50 to 70 times as many leaves as the same space of flowering stem. In other words a stem length of 13 to 17 in. has been shortened to ¼ in.

The advantage of the rosette habit is chiefly in the protection which it affords from extremes of temperature and from drying winds, browsing animals, etc. The typical rosette rarely projects more than an inch or so above the ground and the leaves are usually spread out flat upon the surface. In Winter the rosette is well protected by even a light blanket of snow and is often partially covered by the debris of higher vegetation which has been cut down by frost.

In this latitude the majority of rosette plants are biennials, that is, plants which complete their life cycle in two years, spending the first year in getting a foothold, establishing a strong root system, and usually in storing up some reserve food material. The next year they start out vigorously on their lifework of producing seed. It is easily seen that the rosette habit is peculiarly adapted to the needs of a biennial during its first year's growth. It is compact, well protected for the Winter and the preservation of reserve food material is made easy. But for the all important work of the second year the rosette is not at all adapted. Now it is too compact, only a limited amount of foliage can be borne by the short stem, and not enough space can be given to the production of flowers and fruit. So the biennial abandons the rosette habit at the beginning of the second growing season and grows up into a tall, branching herb. Familiar examples are the Turnip,

Salsify, and Parsnip of the garden. The natural tendency of the rosette plant, in these cases, to store up food for the second year's growth is taken advantage of by gardeners and a valuable food plant results.

In the temperate zone, under the favorable conditions for plant growth that obtain in our State, not many perennials find it advantageous to retain the rosette habit beyond the critical period in their life history which lies between the sprouting of the seed and the establishment of a strong, underground stem or root system. At this period the rosette is replaced by an aerial, flowering stem as, for example, with the Canada Thistle, Carduus arvensis. This fact is noted by Prof. Lyster H. Dewey in Bulletin 27, Div. of Bot., U. S. Dept. of Agr. He says: "Canada Thistle is usually first introduced into new localities by the seed. The seed germinates and a rosette of leaves lying almost flat on the ground is first formed. * * The following year a flowering stalk branching at the top grows up to a height from one to three feet (20 to 100cm.) rarely higher."

Fig. 1. *a*, close rosette of Onagra biennis; *b*, open rosette of Geranium carolinianum; *c*, perpetual rosette of Tetraneuris acaulis.

The perennials which retain the rosette habit throughout their life history may be termed perpetual rosettes. In Ohio they are few in number and are mostly scapose or acaulescent plants as the Dandelion, Taraxacum taraxacum; English Daisy, Bellis perennis; Lakeside Daisy, Tetraneuris acaulis; and Plantain, Plantago sp.

One group of perpetual rosettes, however, is not acaulescent, having solved the problem of being low rosette plants and at the same time having aerial flowering stems. This is accomplished by the plant sending out lateral branches from the axils of its rosette leaves. These lateral branches grow outwards and upwards, flowering and fruiting freely but not enough to exhaust

the plant. Examples are the early Avens, Geum vernum; and Tooth-leaved Cress, Arabis dentata.

Under less favorable conditions the perpetual rosette is more abundant. In dry, tropical deserts, for instance, a certain specialized form of the rosette is very common. This is the succulent leaf type (Agave, Echeveria, Sempervivum, etc.) Also in Alpine and Polar regions the perpetual rosettes occur in great numbers.

A few annuals form a small and imperfect rosette soon after sprouting from the seed and before they send up an aerial stem, and at least two annuals in our Flora are acaulescent. These are Plantago aristata and Plantago virginica. Most of the advantages of a rosette habit are lost to an annual so that one may well believe that an annual rosette plant was once longer lived than it is now.

Rosettes may be termed open or close when the leaves are loosely arranged, as with the Cranesbill, Geranium molle; or crowded, as with the Evening Primrose, Onagra biennis. In a few cases the rosette is not basal but is located at the end of a leafy stem of some length as with the common sedum, Sedum ternatum. Rosettes of leaves are formed three or four feet above the ground, on the end of stems of Polymnia canadensis, and are brought down close to the surface in Autumn by the reclining stems. In this latitude, however, they do not survive the Winter.

Rosette plants exhibit some interesting adaptations for protection from cold, such as the geotropic curvature of the leaves and the development of red color. If a leaf of a rosette of Smooth Mullein, Verbascum blattaria, or of the common Teasel, Dipsacus sylvestris, be examined late in October it will be seen that it is pressed tightly against the surface of the ground, and if the entire plant is dug up and placed in a collecting case for a few hours the leaves will be found turned downwards so far that they are parallel with the tap root and form a cup around it. During the same season of the year the leaves of many rosette plants are quite red or purple. This is due to a substance known as anthocyan. It is the same red coloring matter that is present in the unfolding leaves and twigs of Red Maple, Acer rubrum, and Soft Maple, Acer saccharinum. Anthocyan changes some of the rays of light, which pass through it, into heat and is of much importance in the economy of the plant during the cold days of Autumn and Spring. The leaves of a close rosette are often arranged very nicely to prevent the lower being shaded. This is accomplished by a spiral arrangement and by the elongation of petioles of lower leaves.

It might be expected, in case of perpetual rosettes, that the plant would gradually grow out of the ground but this is counteracted by a shortening of the roots which pulls the plant back. Sometimes the rosette is pulled down so as to form a small pit, at

the bottom of which is the terminal bud. This can be well seen in case of the Dandelion in Autumn. Probably this serves to protect the plant from cold as well.

In making up a list, such as follows, one soon finds that a line must be drawn where none exists and that plants must be excluded that are very little different from some that are included. In any such group a series of gradations may be found that lead to one or more other groups. In these lists only those plants have been included in whose life history the rosette plays quite an important part.

LIST OF BIENNIAL ROSETTE PLANTS.

Alliaria alliaria
Arabis canadensis
Arabis brachycarpa
Arabis glabra
Arabis lyrata
Arabis laevigata
Arabis hirsuta
Arabis patens
Arabis virginica
Arctium lappa
Arctium majus
Arctium minus
Barbarea barbarea
Bursa bursa-pastoris
Cardamine hirsuta
Carduus altissimus
Carduus discolor
Carduus lanceolatus
Carduus muticus
Carduus odoratus
Carduus virginianus
Carum carui
Cichorium intybus
Cynoglossum officinale
Daucus carota
Digitalis lutea
Digitalis purpurea
Dipsacus sylvestris
Erysimum cheiranthoides
Erysimum asperum
Frasera carolinensis
Gaura biennis
Gaura parviflora
Gnaphalium decurrens
Gnaphalium purpureum
Lactuca canadensis
Lactuca floridana
Lactuca hirsuta
Lactuca sagittaefolia
Lactuca saligna
Lactuca scariola
Lactuca spicata
Lactuca spicata integrifolia
Lactuca virosa
Lappula virginiana
Lepidium apetalum
Lepidium campestre
Lepidium virginicum
Linaria canadensis
Lithospermum arvense
Lobelia leptostachys
Lobelia spicata
Lychnis coronaria
Mariana mariana
Oenothera lacinata
Oenothera rhombipetata
Onagra biennis
Onagra biennis grandiflora
Onagra oakesiana
Onopordon acanthium
Pastinaca sativa
Potenti la argentea
Potentilla canadensis
Potentilla monspeliensis
Potentilla paradoxa
Potentilla pumila
Ranunculus abortivus
Ranunculus micranthus
Ranunculus sceleratus
Raphanus raphanistrum
Raphanus sativus
Roripa palustris
Rudbeckia hirta
Salvia lyrata
Sisymbrium altissimum
Sisymbrium officinale
Sophia pinnata
Tragopogon porrifolius
Tragopogon pratensis
Verbascum blattaria
Verbascum thapsus.

ANNUAL ROSETTE PLANTS.

Adopogon carolinianum
Bursa bursa-pastoris
Camelina sativa
Crepis tectorum
Crepis virens
Draba caroliniana
Draba verna
Echium vulgare
Erigeron annuus
Erigeron ramosus
Erodium cicutarium
Geranium carolinianum
Geranium columbinum
Geranium molle
Geranium pusillum
Gnaphalium obtusifolium
Leptilon canadense
Plantago aristata
Plantago virginica
Stenophragma thaliana
Thlaspi arvense.

PERPETUAL ROSETTE PLANTS.

Adopogon virginicum
Arnoseris minima
Bellis perennis
Geum vernum
Hieracium pilosella
Houstonia coerulea
Hypochaeris glabra
Hypochaeris radicata
Lavauxia triloba
Leontodon autumnale
Leontodon hastilis
Plantago cordata
Plantago lanceolata
Plantago major
Plantago rugellii
Taraxacum erythrospermum
Taraxacum taraxacum
Tetraneuris acaulis.

PERENNIAL PLANTS WHICH FORM TEMPORARY ROSETTES.

Achillea millefolium
Antennaria fallax
Antennaria neglecta
Antennaria plantaginifolia
Antennaria parlenii
Antennaria parlenii ambigens
Antennaria parlenii arnoglossa
Campanula rapunculoides
Campanula rotundifolia
Carduus arvensis
Chrysanthemum leucanthemum
Erigeron philadelphicus
Erigeron pulchellus
Geum rivale
Geum strictum
Geum virginianum
Hieracium gronovii
Hieracium scabrum
Hieracium paniculatum
Houstonia ciliolata
Houstonia longifolia
Houstonia purpurea
Houstonia tenuifolia
Lobelia kalmii
Polemonium reptans
Rumex acetosella
Samolus floribundus
Saxifraga pennsylvanica
Saxifraga virginiensis
Sedum ternatum
Senecio aureus
Senecio balsamitae
Senecio obovatus
Valeriana edulis
Valeriana panciflora
Valeriana sylvatica.

Imperfect rosettes are formed by members of the following genera:

Viola
Hottonia
Sarracenia
Drosera
Rumex
Osmunda
Dryopteris
Aletris
Clintonia
Spathyema
Peramium
Pyrola
Parnassia
Alisma.