

GEOPHILOUS PLANTS OF OHIO.

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Geophilous—meaning earth loving—is a term which has recently been applied to such plants as have some special adaption, which enables them to withdraw beneath the surface of the ground when adverse conditions, such as extreme heat and drouth, cold, etc., overtake them. Such adaptations may be classified as

Rhizomes,
Bulbs,
Corms,
Crowns.

Rhizomes are underground stems and like other stems may be simple or branched. The branched rhizome is, however, the most common form since it combines vegetative reproduction with the other advantages of a rhizome habit. The Brake Fern (*Pteris aquilina* L.) is an example of a much branched rhizome and Solomon's Seal (*Polygonatum biflorum* Ell.) of a nearly simple rhizome.

The stem of a rhizomatous plant may remain permanently underground, as is the case with all ferns except the tree ferns of the tropics. An annual stem is, however, usually sent to the surface and this may be a lateral branch from the main subterranean stem or it may be a continuation of the rhizome, in which case the next year's rhizome will be a lateral branch and thus the whole rhizome will be made up of a number of distinct segments. Various members of the Iris group are good examples of this. In at least one genus of Ohio plants—*Smilax*—there are some members having both a perennial woody stem and a well developed rhizome. It may be that these plants are leaving the rhizome habit and are taking up the woody stem habit.

Perhaps in most cases rhizome plants became such through the gradual covering of trailing stems. It is a protection and a saving of building material to a plant if its stems are trailing or creeping, still more so if they are covered by leaf mould or soil. If rhizome plants were once trailers there should be every gradation between the two and so we find. The Trailing Wahoo is a good example of this, since some of its stems are often covered by leaf mould or soil while others are on the surface or some inches above. Many of the Ericaceæ are in this transition stage between trailers and geophytes. The Wintergreen (*Gaultheria procumbens* L.) has a long, creeping stem which is often or usually covered by leaf mould. It roots freely and sends up perennial woody branches to the surface. It is hard to say in such cases whether the plant is geophilous or not.

Many geophilous plants of the rhizome type were doubtless once crown formers and here again we find a transition stage which contains every gradation between the two groups. The Compositæ are mostly crown formers, but some are true rhizome plants and some are transitional.

The advantages of a rhizome habit are very apparent. The first and most important advantage is the protection from frost which this habit affords. By taking up this habit many plants have been able to withstand a climate, which would otherwise prove fatal. The Alpine Willow is an example. Rhizomes are often storehouses for food and become swollen and distorted in consequence. Vegetative propagation is usually combined with the geophilous habit and with great advantage to the plant. In most cases a rhizome dies off at the back as fast as it grows in front so that any part of it lives a definite number of years. The individual segments of the Solomon's Seal, for instance, live from three to five years. In this way a branch soon becomes a separate plant. In some cases, however, the rhizome may live for many years and thus hundreds of seemingly independent plants may be connected beneath the surface of the ground. The Brake Fern (*Pteris aquilina* L.) is of this class and an entire hillside may be covered with a much branched specimen of this plant.

A plant which has no means of migration when it has exhausted the nearby food supply is manifestly at a disadvantage when compared with a progressive rhizome plant which moves every year into a new and fresh location. To be sure, the distance it travels may not be far but it is enough to remove the plant from an exhausted position and from its wornout and useless tissue. Thus this group of plants may be said to have found the secret of potential immortality, for, unless some catastrophe overtakes them, they may live indefinitely and remain young. It is interesting in this connection, to note how far some of these plants travel in a century. This may be calculated in a general way by measuring the annual growth in length of the rhizome. Solomon's Seal travels from twelve to twenty feet in this length of time, *Uvularia perfoliata* L. from eight to ten feet, *Onoclea sensibilis* L. from three hundred to five hundred feet, and others still farther.

The Iris group are exceptions, in that they travel in a circle. The reason seems to be that the lateral branches which continue the rhizome from year to year mostly arise on the same side of the terminal bud, so that each branch goes off at a slight angle to the former branch. The degree of angle determines the size of the resulting circle. One class of rhizome plants is very distinct and requires especial mention. This class may be termed upright or retrogressive rhizome plants. The upright rhizome may originate from a progressive rhizome, or from a crown former or in some other

way. *Trillium nivale* Riddell is in a transitional stage between the progressive and retrogressive classes, since the large rhizomes are upright and the young lateral branches are progressive until they have traveled some distance away from the parent rhizome, when they too, become upright. The lower Ferns (Ophioglossaceæ) belong to this class. The disadvantage of this habit is that the rhizome will soon grow out of the ground and be in a very exposed condition. To counteract this tendency the roots of these plants are usually strongly contractile and pull the rhizome down into the ground as fast as it grows out. Skunk Cabbage (*Spathyema foetida* (L.) Raf.) has an upright rhizome and root contraction is very marked. The very apparent disadvantages of the retrogressive or upright rhizome habit have made this class very few in number compared with the progressive rhizome class. In Ohio there are about 475 species of rhizome plants and less than twenty-five of these belong to the retrogressive class. This class is closely related to the corm plants, indeed, all that is needed to make the typical corm out of a retrogressive rhizome plant, such as *Trillium nivale*, is to shorten and make more definite the annual growth of the rhizome. The bulb is usually a very short, upright rhizome with many thickened scales. The bulb of *Lilium martagon* is of this kind but that of *Lilium canadense* is more closely related to the progressive rhizomes. The parent bulb sends out one or more thick rhizomes which grow outward if the bulb is at the normal depth, downward if the bulb is too near the surface of the ground and the new bulbs are formed by the shortening of the outer end and the growth and thickening of the scales of the rhizome.

Both bulbs and corms may be regarded as rhizomes modified to suit peculiar conditions, such as a long, dry, heated period alternating with a short, rainy period. A plant to survive under such conditions must be able to start up very quickly as soon as the rains come, and flower and mature its seeds before the drouth again overtakes it. A large amount of food material must be stored up by the plant in order to do this, and the food material must be kept from drying or burning up during the heated period. Bulbs and corms, protected as they usually are by dry and coriaceous coverings, answer these requirements and are usually abundant in localities where these conditions obtain. Bulb and corm plants are also well fitted to live in dense woods where the light is soon shut off in the Spring by the expanding leaves of the trees. They are able to spring up very early, flower and ripen seeds before the light is shut off. The food supply which enables them to do this is often protected by acrid or poisonous principals developed in the bulb or corm. Pepper-root (*Dentaria laciniata* Muhl.) and Jack-in-the-Pulpit (*Arisaema triphyllum* [L.] Torr.) are examples.

Crown plants, while not true geophytes, are often closely related to rhizome plants and may be regarded as transitional. They are formed by the freezing back of the upright stem to the surface of the ground, and the survival of the short stem beneath the surface until the next Spring when it sends out branches from adventitious buds. In this way several branches are sent up where there was one before, and, as this crowds and injures the plant, these branches usually move out some distance from the base of the parent plant before coming to the surface. The connection with the main stem is often severed, and thus many new plants are formed. All this rarely takes place in the Spring but has been shifted back to late Summer or Fall by the parent plant. Often a food supply is stored up for the young plants by the parent. *Helianthus tuberosus* L. is a good example.

Vegetative propagation is brought to its highest development in this class and they become our worst weeds.