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Observations on the Leaves of Clovers at Different Times of Day

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This is the fourth of a series of bulletins on elementary science, which will be published at the Agricultural College. While they are prepared especially with the view of helping teachers in the common schools, they should interest every enterprising farmer and horticulturist, or any other wide-awake citizen. Enquiries for bulletins or information regarding this work should be addressed to

THE SECRETARY,
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Bulletin Number 1 was published on Dec. 25, 1897, and is entitled Observing and Comparing Beans and Peas Before and After Sprouting.

Bulletin Number 2 was published on Feb. 28, 1898, and is entitled Study of Wheat and Buckwheat Before and After Sprouting.

Bulletin Number 3 was published on March 22, 1898, and is entitled A Study of the Seeds of Timothy and Red Clover Before and After Sprouting.

OBSERVATIONS ON THE LEAVES OF CLOVERS AT DIFFERENT TIMES OF DAY.

I suggest that you do a few very simple things regarding a few plants which are very common in the State throughout all the growing season. Look carefully at several leaves of white, red or alsike clover at eight o'clock in the morning, one and five and eight p. m., and perhaps at other hours also, in warm weather or in cold, rain or shine, noticing especially the position taken by the three leaflets of each compound leaf, making careful notes, and drawings if you can make them, for a report when

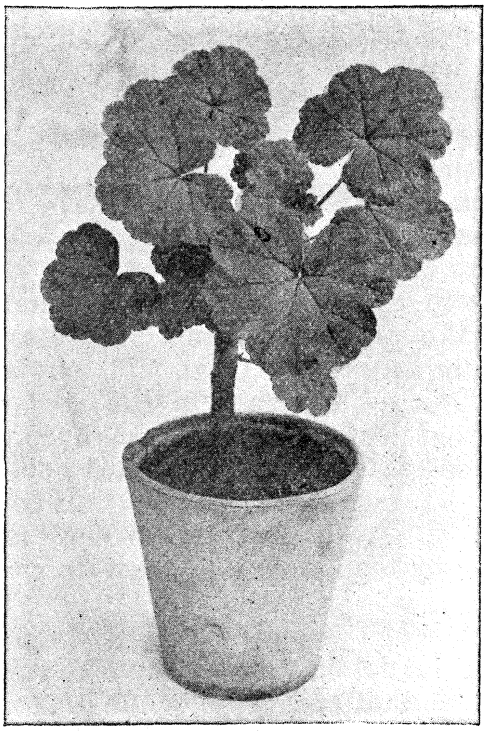


FIG. 33. A small geranium as it appeared in the south window.

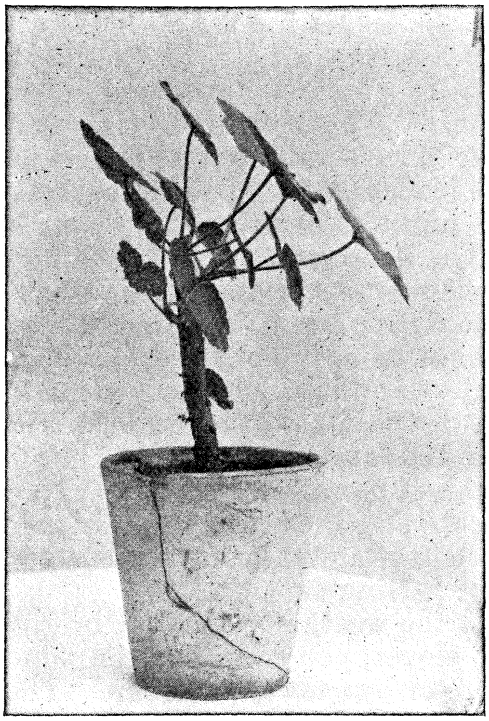


FIG. 34. The same plant as the previous one, turned half way around.

called on next day or the next week. Each pupil should take pride in making his or her own observations and notes and strive to learn some points not discovered by others. Perhaps some may also at the same time of day or evening give attention to the positions taken by leaves of other plants. After pupils have made their reports to the teacher and all have done the best they can on this subject, I shall be glad to receive any of

the reports the teacher thinks best to send, or a summary of them, and if any ask questions I shall do my best to answer them. Can any one tell how or why these leaflets of clover behave as they do?

As long ago as you can remember, you knew that all animals of the farm moved about of their own accord in every direction, but most likely you discovered that the plants you saw were unable to go from place to place, and you may not have thought it possible that a stem or leaf or flower should change its position while on the plant. Now that your attention has been called to it, you may remember the fact that the leaves and stems also, of a plant when placed close to a window bend toward the light, and if turned around, they will bend again toward the window. They bent so slowly that you couldn't see the motion, but they really moved just as surely as the hour hand of a clock moves.

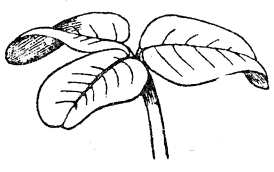
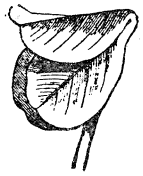


FIG. 35. a. Leaf of white clover as seen in the day time.



b. The same leaf as seen at night.

You have seen that the leaflets of clover repeatedly take different positions with reference to each other, even within the space of an hour or two, and perhaps you may have found out that the leaflets of some other compound leaves are able to change their positions.

You may have seen that the shape of each leaflet of clover was much the same at all times of day and night, but the very short and rather thick stem of each leaflet curved about causing the leaflet to take a different position, sometimes holding it out with one flat side toward the sun, sometimes with one edge to the sun, and usually all three leaflets of a leaf were brought snugly together on cool nights. The leaflets of some plants move upwards, some downwards, or they turn about by a slight twisting of the short stem. In many cases the leaflets move about in several directions, before getting into shape for the night or before getting back into the usual place for the day.

The botanist knows something about the structure of the stems of the leaflets of clover and knows what happens to cause the motion you have discovered, but it is rather difficult to make plain to young pupils and cannot be well explained in very simple language. We trust you may all understand it some day. Why do the leaflets get together in the cool of the day? Darwin and others found out that leaflets, if fastened by pins and kept spread out in cool nights with one side to the sky, were cooler and had more dew on them than others which crowded together. In cold nights pigs crowd together to keep warm, and so it is believed that the leaflets of clover bring themselves together to keep warm, at least to prevent getting very cool.

If the weather were very bright and hot when some of you looked at the clover, you saw that the edges of the leaflets in many cases turned more or less toward the sun. The reason for this seems to be to prevent damage to the leaflets from extreme heat falling directly onto the surface of the leaf. It also prevents a very rapid loss of moisture from the leaf.

This cuddling together after the manner of the leaflets of clover is often called the sleep of plants. Though the motion is most rapid when crowding together for the night, or when getting out in early morning for the day, still the leaflets at all times of day and night, as long as they live, are never perfectly at rest, but keep slowly jerking about, a very little at a time, even though there may be no motion of the air. The leaves of a young cabbage rise at night and fall by day, and even the thick leaves of

liveforever move very slightly; in fact, many experiments convince us that all growing leaves of all plants, even in still air, slowly move in various directions all the time, day and night as long as they live.

The action of light, heat or cold on the leaves causing the short thick leaf-stems to move makes it seem as though plants had nerves and could feel somewhat as can boys and girls and all animals, but no nerves have ever been discovered.

Hereafter, all of you will know that motion to some extent, is one of the peculiarities of plants as well as of animals.

I hope you will continue looking around to discover the positions taken by all sorts of leaves, and stems, and flowers, and not let the subject drop here. Keep notes in a book and make some drawings, and above all, tell others what you discover and try to induce them to take an interest in the work.

Here are two illustrations of a few more kinds of leaves from a number of different plants; in one the leaves are represented as usually seen in the middle of a pleasant day, in the other as they appear in cool nights. These drawings are taken from *The Power of Movement in Plants* by Charles Darwin.

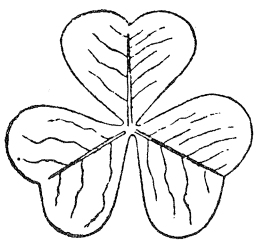


FIG. 36. a. Leaf of wood-sorrell as seen from above in the light of day.

b. The same as seen at night.

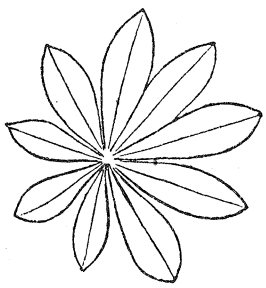


FIG. 37. a. Leaf of lupine as seen from above in day-light.

b. A side view of the same as seen at night.

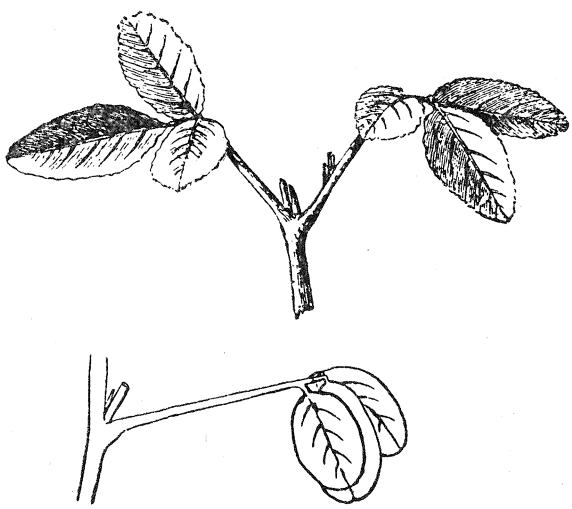


FIG. 38. a. Leaf of plant of yellow melilot as seen from above in the day-time.

b. The same, inside view at night.

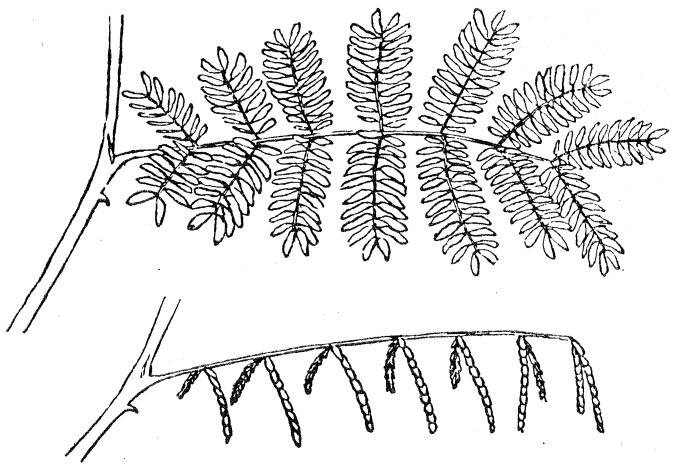


FIG. 39. a. A compound leaf of sensitive plant as seen by daylight. b. The same leaf as seen at night.

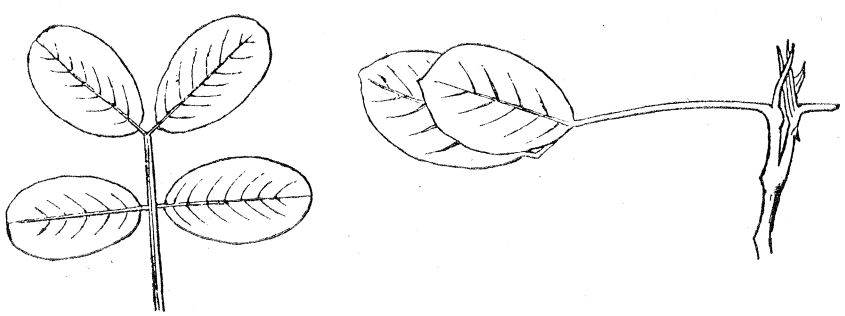


FIG. 40. a. Leaf of plant of the peanut as seen from above in the light of day. b. The same at night in side view.

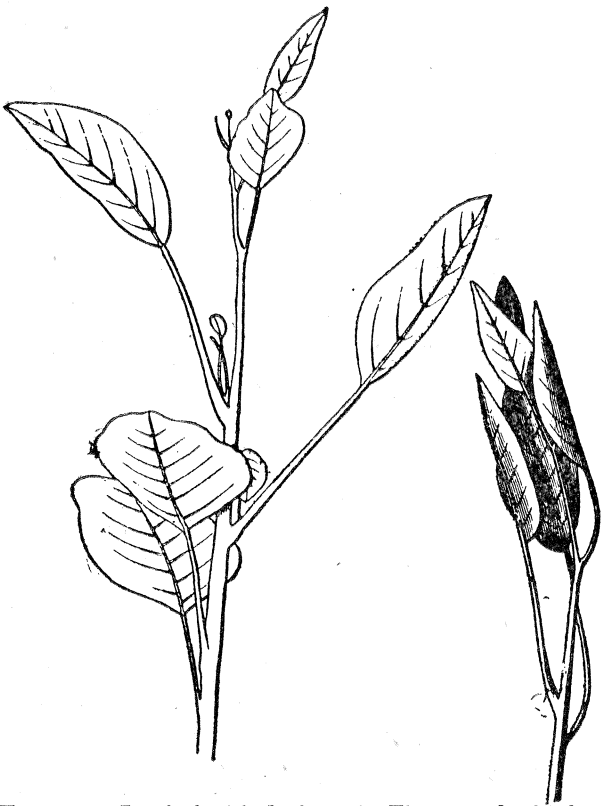


FIG. 41. a. Leaf of a kind of tobacco as seen in daytime. b. The same leaf asleep at night.

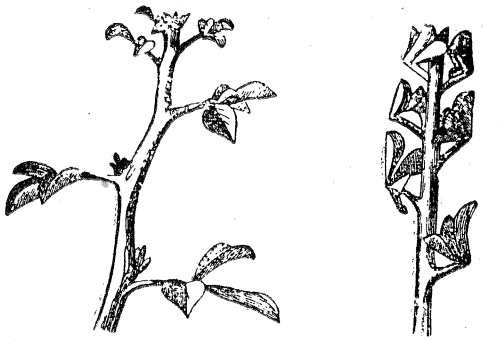


FIG. 42. a. Leaves of a plant nearly related to alfalfa or lucerne as they appear in daylight. b. The same as seen by night.

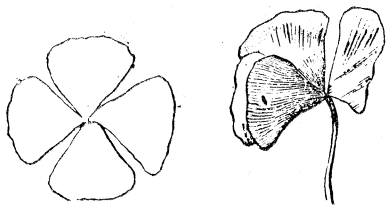


FIG 44. a. Leaf of a kind of pepperwort, *Marsilia quadrifolia*, as seen during the day. b. As seen when beginning to go to sleep.

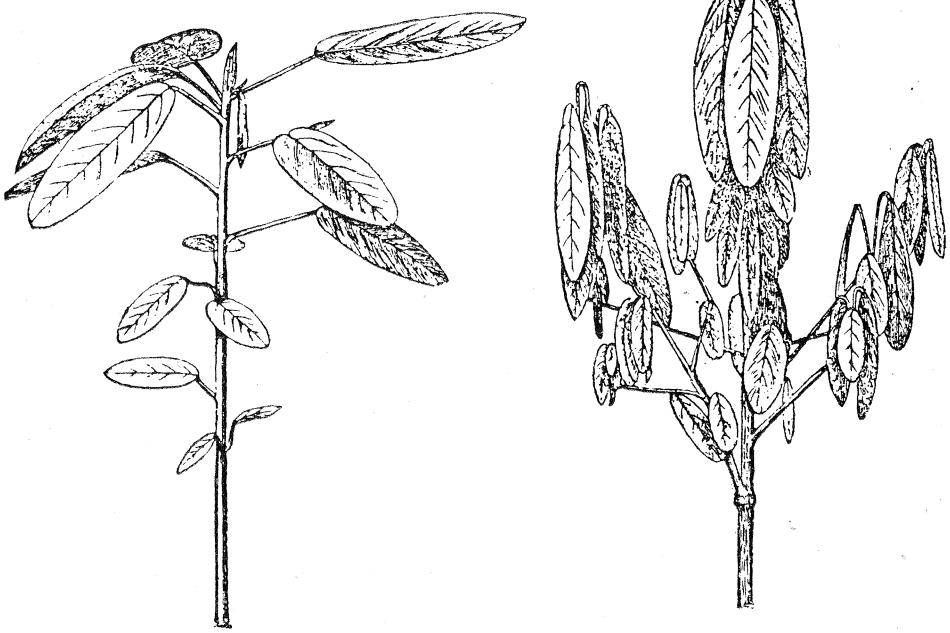


FIG. 43. a. Leaves of a foreign tropical plant, *Desmodium gyrans*, as seen during the day. b. The same leaves as seen during night.