BRIEFER ARTICLES.

A Plant Heliostat.—The *Malva borealis* Wall. is a very common weed in cultivated ground throughout Southern California. It is an annual that quickly springs up in rich, tilled soil that is at all neglected. This "Malva," as it is appropriately called, is an almost constant stimulus to better culture, and stands ready to possess the soil, for a time at least, so soon as the harrow, gang-plow or hoe ceases to make frequent visits. The large areas in walnut groves, orange orchards, open fields for grain growing, and even along the roadsides, occupied by this weed, made any observations as to its habits an easy task. The most interesting characteristic of this mallow, which was noticed, is the heliotropic power possessed by the foliage. The round-cordate, neatly crenate and more or less five to seven-lobed leaves follow the sun during its daily course, and present their upper surfaces to the descending rays. The position of the blades is facing eastward in the morning, and as the day advances the laminæ turn to the south and become more nearly horizontal. During the afternoon the blades approach the vertical position, and at sunset they face the western sky. In short, the malva leaves are living heliostats. This heliotropic movement is much more uniform in the leaves of young plants than in those that have grown old and woody. Over an area entirely covered with the malva plants that are about six inches high, and before any flowering stems have begun to shoot upward, the peculiarity of the leaves above noted is strikingly manifest to any person, however blunt his powers of observation, when once his attention is called to the matter.

A series of observations was made upon the movement of the leaves to determine, if possible, the portion of the blade that is most active in the turning, and also to discover the method of the return from the evening position to that assumed in the morning. By pushing small wooden stakes into the soil, and thus marking the position of a leaf at any given time, together with the use of strings tied upon the leaves, the changes could be determined. Frequent observations were required at all times of the day and far into the night. It was found that the point of torsion was located just below the blade in a short portion of the upper end of the petiole. At this place, averaging a line in length in the most active leaves, the petiole is of different color and texture from the remaining lower portion of the long petiole. The fibro-vascular bundles here converge from their several strands into one central tough thread, and the surrounding soft tissue is similar to that of a pulvinus in nyctotropic and sensitive plants. The exterior of this portion of the petiole is of a reddish brown color. The blade effects its daily turning at this place, and when night comes on it returns to its morning position by retracing the path taken during the day. In no case was there any indication of any attempt to make an entire revolution. The backward movement begins as soon

as the sun is set; in fact the following of the sun is not so pronounced after 3 o'clock (and earlier on dark days) as up to that hour. It seems as if the sun drew the leaf around by its own attraction, and the blade moves back to its point of rest when the force is withdrawn. There was no evident daily motion observed in the remaining portion of the long petioles. It is true that they varied their position from time to time, but with no regularity. Petioles on the eastern side of a plant remain more nearly horizontal than those located elsewhere. Those upon the north and south sides are more upright, with a tendency to point eastward. The western leaves are nearly upright, so that the blades may be able to catch the direct rays of the morning sun. At night there is an evident falling of the petioles as if to assume a position of rest, while the blades become nearly horizontal at the same time. By 9, or at most 10 o'clock in the evening the plant reached its position of repose, and an hour or more before the sun's morning rays can strike the plant the blades are all in position. Three distinct views of a malva patch may be obtained at any time when the sun is shining. If the view is, so to speak, from the sun, that is, in the direction of the rays of light, only the upper surfaces of the leaves are seen; if toward the direction of the sun, the under surfaces are in view. The difference between the shades of green of these two views is very marked. A third view is at right angles to the sun's rays, from which point the leaves are only seen by their edges, which are inclined from the perpendicular, the angle depending upon the height of the sun at the time of observation. Upon a dark, stormy day the heliotropism of the leaves is in a large degree suspended.—BYRON D. HALSTED, *Botanical Laboratory, Ames, Iowa.*

Leaf Prints.—Several years ago I devised a method of taking leaf prints of marked beauty, and a specimen of the work recently sent to Dr. Gray elicited the reply: "'Tis a new way; better send account of it to BOTANICAL GAZETTE," etc. I do so, prompted by the belief that the method may be of actual usefulness to the botanist as well as a refining recreation for those who love nature "on general principles." There will be needed for the work: 1. A small ink roller, such as printers use for inking type. 2. A quantity of green printer's ink. 3. A pane of stout window glass (the larger the better) fastened securely to an evenly planed board twice the size of the glass. A small quantity of the ink is put on the glass and spread with a knife, after which it is distributed evenly by going over in all directions with the ink roller. When this has been carefully done, the leaf to be copied is laid on a piece of waste paper and inked by applying the roller once or twice with moderate pressure. This leaves a film of ink on the veins and network of the leaf, and by placing it on a piece of blank paper and applying considerable pressure for a few moments the work is done, and when the leaf is lifted