California Manroot Tendrils: A Gallery of Photographs Illustrating Attachment and Ascent

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Introduction

Manroot, also known as California Cucumber and Big Root, is a perennial vine of the California chaparral. It is conspicuous in late winter and early spring sprawling over shrubs and trees, with numerous yellowish or white flowers and softly spiny seed pods that turn brown and prickly when ripe. The vines soon die back, leaving the host free to capture its share of sunshine. Manroot is among the first plants to appear as ground cover in late winter after a wildfire has burned away the overgrowth.

Less conspicuous are the tendrils — the subject of this study — that stretch out from the vine in coils, attaching the vine to supporting stems and branches. You can find similar tendrils on pumpkins and watermelons, members of the Cucumber family, *Cucurbitaceae*.

The species of Manroot featured here is *Marah fabaceus*, common in the Coast Ranges and Sierra of Northern California. Other similar species grow elsewhere in California. They are called Manroot or Bigroot because the tuberous root grows in size over the years until it can weigh as much as 600 pounds in extreme cases and, as an imgainative legend has it, acquire the shape of a man.

It is the tendrils of the Manroot that pull the vine onto a supporting shrub and by spring-action offer resistance to detachment in stormy weather. A lead tendril—upon grasping a stem—can pull and guide the tip of the vine closer to the stem, aiding ascent. This photo essay displays Manroot tendrils in ways that reveal them as mechanical aids in attachment and climbing.

First growth in February: A trailside eruption

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Figure: Over a dozen Manroot leaders are shown, spreading outward and weakly upward from a common root. The tuberous root must be well developed to supply energy for this abundant growth. The foliage in the mature vine will produce more starch for an even more vigorous start-up next year.

Another trailside eruption

Figure: Numerous Manroot leaders are shown sprouting from a root buried beneath leafy annuals. The heads of these leaders will revolve at the pace of a minute hand until they find a supporting structure to climb upon, or they will continue trailing along the ground.

The "Root"

Figure: A tuber of the species *Marah macrocarpus*, also known as Cucamonga Bigroot. Dug up at a construction site in northern San Diego County. Tubers that accommodate to rockier soil can develop highly irregular shapes. Broken leaders dangle from the upper left. Two prickly ripened seed pods appear at lower left.

Manroot leaders seeking a structure to climb

Figure: Too weak to rise to full height, *decumbent* (weakly inclined) Manroot leaders grow forward. The filamentous tendrils on the upper ends of the leaders are slightly arched and revolve imperceptibly. On contact with a support of suitable size and texture, the tip of a tendril grasps the support.

Coiling tendrils help pull the leaders up

Figure: Once the tip has grasped a support by wrapping around it, the rest of the tendril begins to coil and contract in midair, drawing the vine closer to the support, guiding and pulling the leader upward. Three attached tendrils are shown, two tightly coiled. Female (*pistillate*) flowers have emerged at the base of flower stalks; male (*staminate*) flowers will emerge higher on the stalks later, avoiding self-pollination.

Three rising leaders

Figure: Unattached tendrils showing multiple branching. Some lower tendrils have attached to dead twigs and are ineffective, but with continual random outreach, successful attachments are likely in the presence of a nearby shrub.

Closeup of a rising leader

Figure: With a suitable shrub nearby, tendrils on this leader are likely to encounter a point of attachment and guide the vine into the shrub. Branching stems of the vine will then be attracted to sunlight, and the vine will grow onto the outer surface of the shrub securely fastened by tendrils. The whiteness caused by tiny invisible hairs is known to botanists as *pubescence*.

Into a bramble

Figure: The two leaders seen here have found their way upward, guided and upheld by attached tendrils.

The inevitable reversal in coiling

Figure: This tendril has a *reversal* in the sense of coiling, visible over the finger. Charles Darwin studied tendrils extensively and explained that because the two ends of a tendril are anchored when it begins to coil, it must twist equally "clockwise" and "counterclockwise", inducing an intermediate reversal in the direction of coiling. There may be more than one reversal in the coils of a tendril, but there must be an equal numbe of coils in each direction to cancel the twists in each direction.

More than one reversal is possible

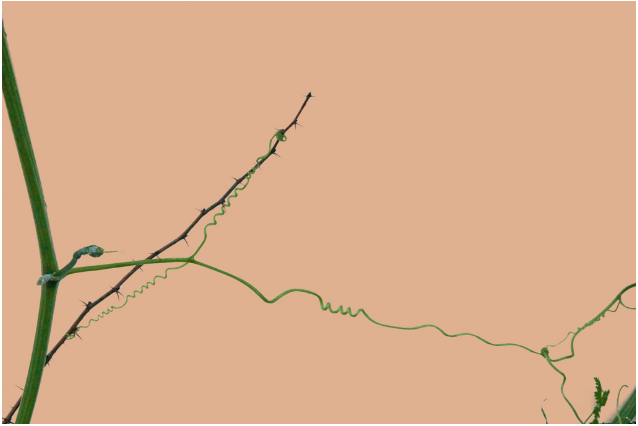

Figure: A Manroot tendril can have more than one branch. Here one *primary* and two *secondary* branches stretch out like a cross. The background clutter was subtracted from this image to aid in seeing the geometry. There are two reversals on the primary branch, one on the lower secondary and possibly two barely discernible on the other secondary branch.

Irregular unattached coils

Figure: At the lower left of this photo, the two secondary branches of the tendril whose primary branch stretches from lower left to upper right, were stunted by ineffective attachment.

A tendril loosened by a broken branch

Figure: This mature tendril is no longer stretched tight, possibly because the twig it grasped was broken. The single reversal is clearly visible in the right quarter of the image.

A tendril loosened by a broken branch

Figure: Same image as previous, but in black-and-white. As before, the mature tendril is relaxed, possibly because the twig it grasped was broken. The single reversal is clearly visible in the right quarter of the image.

Clutching a twig

Figure: This tendril has either just attached to its support, or was blocked from pulling its vine closer to the support by an unseen obstacle.

Spiral geometry 1

Figure: A tendril's secondary branch runs diagonally across the frame. Faster growth of the *dorsal* (outward) side and slower growing *ventral* (inward) side of the tendril forced it into this striking form. Note the other secondary wrapped tightly around the base stalk, climbing upward. The downward primary clutches a lower twig. Note at upper right the emergence of a solitary female flower near the base of a flower stalk, and the early budding of multiple male flowers farther up the same stalk.

Spiral geometry 2

Figure: Close view of symmetric coils and one reversal. There are always equal number of coils going "clockwise" and "counterclockwise." The twists in one direction balance the opposite twists. A *reversal* separates the two directions. Coiling contracts the span of a tendril to as little as one third its original length, drawing the vine closer to a support, and the spring-action of the coils absorbs shocks in stiff winds.

Pulling upward

Figure: Unseen tendrils above the anterior portion of this vine at upper-left have pulled the vine upward, dragging with it the tendril shown attached to a stem. Coils become narrower toward the tip in accord with the decreasing diameter of the tendril toward the tip.

Where to find more information

Charles Darwin's essay on tendril-bearing plants is classic and is still available in reprint: *The Movements and Habits of Climbing Plants*, 2nd crctd ed, 1882.

The characteristics and distribution of *Marah* species, in particular *Marah fabaceus* featured in these slides, can be found in any of the major manuals of California flora. The most current and complete is:

The Jepson Manual: Higher Plants of California by James C. Hickman (editor) and Willis Linn Jepson, 1993.

Online, see *The Jepson Online Interchange—California Floristics* at `http://ucjeps.berkeley.edu/interchange.html`.

A discussion of the "pulling power" of tendrils is available with this Gallery at an associated URL: *Can a Manroot Tendril Pull its Vine Closer to a Support even as the Tendril increase in Length?*

Further references

Manroot is a characteristic plant of the California chaparral and associated floristic communities. For general information:

Introduction to California Chaparral by Ronald D. Quinn and Sterling C. Keeley, 2006.

Fire, Chaparral, And Survival In Southern California by Richard W. Halsey, 2008.

California Chaparral: An Elfin Forest by Winfield Scott Head, 1972.

For botanical terminology, these are excellent:

Plant Identification Terminology: An Illustrated Glossary by James G. Harris and Melinda Woolf Harris, 2001.

The Cambridge Illustrated Glossary of Botanical Terms by Michael Hickey and Clive King, 2001.

Photographs and Contact Information

These slides are online at:

www.mikeraugh.org/WildThings

The photos in these slides are low-resolution thumbnails of Philip Grote's high-resolution originals.

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