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Texas A&M Study Abroad 1998- Dominica
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A Study of the Growth Habits of *Costus speciosus* Found on S.C.E.P.T.R.E.

Abstract

Costus speciosus, commonly known as the spiral ginger, is a beautifully unique tropical plant. Its exibhits an unusual spiraling of its red stems. After finding this species on the Springfield Plantation in Dominica I became intrigued with it. In this study I set out to determine the cause of the *C. speciosus* spiraling. I found colonies of the plant on two areas of the research station. I studied these, making observations and recorded measurements. From my limited data I was not able to answer my initial question. However, the information and speculations in this study will be a firm foundation for continuing research. In addition to my findings, I have included suggestions for further studies.

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Common Name: Spiral Ginger, Crepe Ginger
Scientific Name: *Costus speciosus* (J. Koenig) J.E. Smith
Family: Zingiberaceae or Costaceae
Origin: India

Introduction:

The spiral ginger is a visually striking and unique plant on the Springfield Plantation. Its unusual, spiral growth pattern is unlike anything in its surroundings. In this project I attempted to determine if there is a specific cause for the spiraling, if it is related to environmental factors or if it is a beneficial adaptation of the plant.

General Description:

C. speciosus is a perrenial terrestrial monocot that grows .5 to 5 m in heighth. It grows from a rhizome. The stems are thick and succulent growing either straight or helicoid and bearing or not bearing leaves. The stems are often red and older stems have a scale-like brownish-red bark on them. The leaves are elliptic with entire margins and pinnately veined. They are 12 to 25 cm in length and 3 to 6 cm in width. The upper surface of the leaf is glaborous and the lower is densely pubescent, giving the leaf a velvety feeling. They are in a spiral pattern around the stem.. The flowers are perfect, terminal on leafless shoots in a racemose spike. The corolla is tubular and 3-lobed. The flower is white with a yellow marking on the lip. There is a single, petaloid stamen and an inferior ovary. The fruit is an indehiscent, white, ellipsoid capsule with numerous seeds.

Medicinal and Economic Uses:

The leaves are boiled into a tea use to releive gas. The rhizomes are boiled and used as an astringent and a musilage. Spiral ginger is an important ornamental flower throughout the Caribbean.

Methods:

I searched several areas for the presence of *C. speciosus*. I did not find it at Middleham Falls, Syndicate Nature Trail, Cabrits National Park, Emerald Pool nor on the Trail from Titoue Gorge to the Valley of Desolation. So I limited my study to the Springfield Plantation where I found dense growth of *C. speciosus* along the Massacre Trail and on Mt. Joy. My first observations of this plant were purely curiousity and not focused for my research. On 1 June 1998 I made a second set of observations and clipped off a bud to later analyze. I recorded my third set of observations and took measurements on 3 June 1998. I selected ten plants at random and using a tape measure I measured the primary shoot, counted the number of secondary shoots, or branches, counted the number of spirals, noted elevation and wrote general, descriptive comments about each. I organized this data into two tables- Table 1 is for Mt. Joy and Table 2 is for the Massacre Trail. The onslaught of fierce tropical chiggers limited the number of observatons I was able to make and extent to which I was able to work with the plants.

Preliminary Observations:

I first noticed *C. speciosus* on 22 May 1998 on the Massacre Trail in a clearing just before the large buttress ficus. There is a dense clump of the plant on the left side of the trail. What made them immediately noticeable was the spiral growth pattern of its bright red stems and the large, velvety leaves in a line along the outside of the spiral. The 'spiral' is really in the shape of the letter 'e'. In all the plants I have observed, none spiral any tighter. The spirals appeared to grow low to the ground in tangled masses. I saw a large, white flower on a tall, brownish-red stalk among the short spirals. I did not think it was the same plant at first due to the very different growth habit, but with closer observation I discovered that it indeed was the same plant. My first thought was that perhaps there were seperate male and female plants of this species.

Recorded Observations:

1 June 1998:

Massacre Trail- There is a mixture of tall shoots, approximately 5 m, and shorter ones at about knee height. The latter were spiraled. I found a terminal bud on a tall, approximately 4 m, straight shoot bearing leaves in a spiraled pattern. I noticed two types of ants on the bud. Later these were identified (only as far as subfamilies) as a large Dolichoderinae ant and a smaller Myrmicinae ant.

3 June 1998:

These observations are shown on tables one and two.

Results and Discussion:

I believe the ants inhabiting the bud I collected do not play a significant role in the phenology of *C. speciosus*. The larger ant is a type of carpenter ant that is just a forager. The smaller ant is most likely feeding off the nectar glands in the tube of the corolla. From literature and observations of related plants, I believe *C. speciosus* to be pollinated by hummingbirds.

I discovered that the spiral stems of this plant are indeed not spiraling at all. When I first looked at the plant I described the leaf pattern as 'whorled'. Yet, the leaves are not truly whorled. In a true whorl three or more leaves make a circle around the stem. The leaves of the C. speciosus spiral around the straight shoots. However, on the spiral stems they appear in a straight, horizontal line around the outside of the spiral. From this, I have concluded that on straight shoots the stems are twisted. The helicoid stems are a result of the stem *untwisting* during its growth- straightening out the leaf pattern.

My data has proved to be fairly inconclusive in respect to the cause of the *C. speciosus* helicoid growth pattern and its effect on the plant's life cycle. However, my following speculations build a firm foundation for future research of this plant. From my initial and quick observations of the plant along Massacre Trail I hypothesized that the helicoid growth pattern was characteristic of young plants because all the spirals seemed to be growing close to the ground. After studying the plant more closely on Mt. Joy and taking numerical data my hypothesis lost validity. The plants on Mt. Joy were tall and many possessed the bark-like scales. Each are characteristics of mature plants. Most of these plants also displayed spiral growth. So the helicoid growth sould not possibly be restricted to immatures. Many of the plants on Mt. Joy were bent over from the weight of the spiral branches to nearly half their true height. The colony was thriving in and are with little canopy cover. From this, my belief was then that the spiraling is a phototrophic response. Yet again I found myself to be wrong after a closer study of the species on Massacre Trail. Here there were a numerous number of shoots with no branches, no scales, and no red coloring and reaching tall heights of 5 meters.

These shoots were light green with leaves running the entire length of the shoot in a spiral around the stem. These shoots were growing in direct sunlight. Where I had originally thought there were many young spirals growing close to the ground, I now realized they were branches of fallen shoots that became too heavy from their own branches and from the invading vines of other species. Each of these findings disproved my two previous hypothesis'.

From all this, the most resonable speculation I can make is that the many different types of shoot growth is a result of the rhizome root system. A rhizome is an underground storage root from which shoots grow from directly. It is much like a runner in that it grows horizontally beneath the soil and produces numerous shoots. So the shoot differentiation could be due to or related to different sections of the rhizome, different rhizomes or different stages of growth in the rhizome. It could also possibly be related to the amount of food the rhizome has stored up. The presence of flower and buds only on the Massacre Trail is a reflection of the age of the colony. The Massacre Trail had a heavily dense growth of *C. speciosus*, many very tall plants and there was a bud and flower present; so, it is most likely an older community of plants. Both plant communities on Mt. Joy and Massacre Trail were growing in clearings along a man made trail. From this it can be deduced that these plants do require more light than many rain forest vegetation to be successful and they appear to be characteristic of disturbed forests.

My data and observations were a success in that my primary intention was to learn more about the spiral ginger and its growth habits. They will also provide a good starting point for future research projects. However, they did not provide me with a reason for the helicoid growth of *Costus speciosus*.

Suggestion for Future Endeavors:

I think a good project would still be to discover why the *Costus speciosus* spirals. To do this there could be a more detailed study of the plant's growth environment, a study of the plant's chemistry and a closer look at the rhizomatous root system. A great experiment, given a substantial length of time, would be to grow the plant in different conditions to determine their effects, if any, on the spiral growth pattern. *C. speciosus* flowers mostly in the winter, therefore, then would be an ideal time for research. I also suggest researching the plant extensively before making a trip to study it. Most importantly, take proper chigger precautions before any attempts are made to hike through tall grass.

~Mt. Joy~ elevation: 430 m

Table 1	Height cm	Number of Branches	Number of Spirals	Comments
1	215	6	6	Primary shoot is straight w/scales. Bent over from weight of Branches. Branches are all spiraled & red.
2	287	9	9	Primary shoot is straight w/scales. Bent over slightly. Branches are all spiraled & red
3	220	6	6	Primary shoot is straight w/scales. Slightly bent. Branches are all spiraled & red.
4	121	1	1	Primary shoot is straight w/scales. Slightly bent. Single branch slightly spiraled & red.
5	141	0	0	Leaves in a spiraled pattern half way up primary shoot. No scales. Reddish shoot straight.
6	232	8	8	Primary shoot is straight w/scales. Bent over. Branches are spiraled & red.
7	205	9	9	Primary shoot is straight w/scales. Bent over. Branches are spiraled & red.
8	22	0	0	Short, single spiral. Red stem. Resembles branches of other plants.
9	297	8	8	Primary shoot is straight w/scales. Bent over. Branches are spiraled & red.
10	148	4	4	Primary shoot is straight w/scales. Branches are spiraled & red.

~Massacre Trail~ elevation: 350 m

Table 2	Height cm	Number of Branches	Number of Spirals	Comments
1	427	0	0	Primary shoot is straight, light green. Leaves in spiraled pattern all the way up.
2	440	0	0	Primary shoot is straight, light green. Leaves in spiraled pattern all the way up.
3	408	0	0	Primary shoot is straight & light green. Leaves are in a spiraled pattern all the way up.
4	416	0	0	Flower is growing terminally. Primary shoot is straight w/scales. Leaves are in a spiral pattern length of stem. Flower at the top
5	522	12	12	Primary shoot is straight, but fallen over from weight of Branches. Scales. Branches are spiraled & red.
6	367	10	10	Primary shoot is straight w/scales. Bent over. Branches are spiraled and red.
7	87	1	1	Primary shoot is straight. No scales. Only branch is spiraled & red.
8	265	9	9	Primary shoot is straight w/scales. Bent over. Branches are spiraled and red.
9	216	6	6	Primary shoot is straight w/scales. Bent over. Branches are spiraled and red.
10	243	5	5	Primary shoot is straight w/scales. Bent over. Branches are spiraled and red.

References

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