



Brian E. Whipker¹



Patrick Veazie^{1,2}



Ty Rich^{2,3}



Paul Cockson³



W. Garrett Owen³

Plants Gone Crazy!:

What is fascinating with fasciation?

What occurs when a 'normal' growing plant suddenly develops 'abnormal', flattened stem growth? The condition is called fasciation, and in most cases it is caused by a genetic mutation.

Wild and 'abnormal' stem growth is sometimes observed on a wide assortment of plant species and often 'prized' as ornamental character. This spring, we observed firsthand wild stem growth during a coleus trial evaluating over 100 cultivars at both the University of Kentucky and NC State University. We were surprised to find 'abnormal' growth on



© Brian Whipker

Figure 1. A close-up of a fasciated, flattened stem on a coleus plant. Photo: Brian Whipker

2021 Sponsors



Funding Generations of Progress
Through Research and Scholarships



P.L. LIGHT SYSTEMS
THE LIGHTING KNOWLEDGE COMPANY

Reprint with permission from the author(s) of this e-GRO Alert.

¹NC State University, Dept. of Hort. Science
bwhipker@ncsu.edu

²Undergraduate Researcher

³University of Kentucky

a plant we were growing in “tree-form” (topiary; Fig. 1). Growing coleus in a tree-form requires lower leaf and axillary shoot removal. A single shoot regenerated out of the lower stem region with a flattened stem (Fig. 2). This abnormal shoot growth of a flattened stem is referred to as fasciation.

What is Fasciation?

Fasciation is the development of elongated, flattened stems in plants. It occurs in a wide assortment of species, such as this weed observed during a hike (Fig. 3), sweet potatoes (Fig. 4), and even cannabis (Fig. 5; see June 2021 Cannabis Business Times article, <https://www.cannabisbusinesstimes.com/magazine/>).



© Brian Whipker

Over the years plant scientists and breeders have been amazed by fasciation. In 1903, Lumina Riddle published in the Ohio Naturalist a list of 53 different species affected by fasciation. White (1945) reported on the biology of fasciation and provided a wide assortment of interesting photographs that highlighted distorted growth. Iliev and Kitin (2010) report that over 107 plant families have been observed to naturally develop fasciation symptoms. So being fascinated with fasciation has been going on for over 100 years.

In most cases, fasciation is not advantageous to the plant because flower development can be negatively affected. However as ornamental plant growers, we often see beauty in the unusual and fasciation can have highly prized ornamental attributes. Crested cockscomb (Fig. 6) is a common form of celosia grown in greenhouses or as cut flowers. In addition, cacti with fasciation stems are grafted onto rootstocks and sold as houseplants (Fig. 7).

Causes of Fasciation?

Abiotic (non-infectious) factors such as a genetic mutation of the growing tip (meristems) are the primary cause of fasciation. A disruption of the plant’s meristem occurs as those cells multiply. This results in the production of elongated, flattened cells. These elongated cells continue to form as the plant grows into an obvious flattened stem. With genetically induced

Figure 2. An abnormal shoot regenerated out of the lower stem of a coleus being grown as a tree-form. Photo: Brian Whipker

fasciation, usually, only one branch or stem is affected as observed in Fig. 1. That portion of the plant can be pruned out.

There are also other less common causes of fasciation that include chemical applications (Fig. 8a), damage to the growing tip by insect or animal feeding (Fig. 3; Fig. 8b), or mechanical injury (Fig. 8c). Distorted growth can also occur with a boron deficiency (Fig. 8d) and planting plugs too deep in the container (Fig. 8e).

Another biotic (infectious phytoplasmas) mimic that results in a proliferation of growth is caused by *Rhodococcus fascians*. *Rhodococcus* infections are reported on a number species such as geraniums (Fig. 8f), and a great resource about this disease can be found on the Oregon State University Plant Clinic website (<https://bpb.oregonstate.edu/plant-clinic/plant-diseases/rhodococcus-and-agrobacterium>).

Conclusions

For greenhouse growers, fasciation can be a prized attribute. It occurs infrequently as we observed it on only 2 plants out of 3000 coleus we grew (0.067%), so it is an amazing discovery. As ornamental plant growers we are naturally curious about the abnormal growth, so it is to be expected that we are fascinated with fasciation.



Figure 3. In nature, fasciation can occur on weeds. Photo: Brian Whipker



Figure 4. A sweet potato plant that developed a fasciated stem. Photo: Brian Whipker



Figure 5. A broad, flat stem the developed out of terminal growth of cannabis. Photo: Brian Whipker

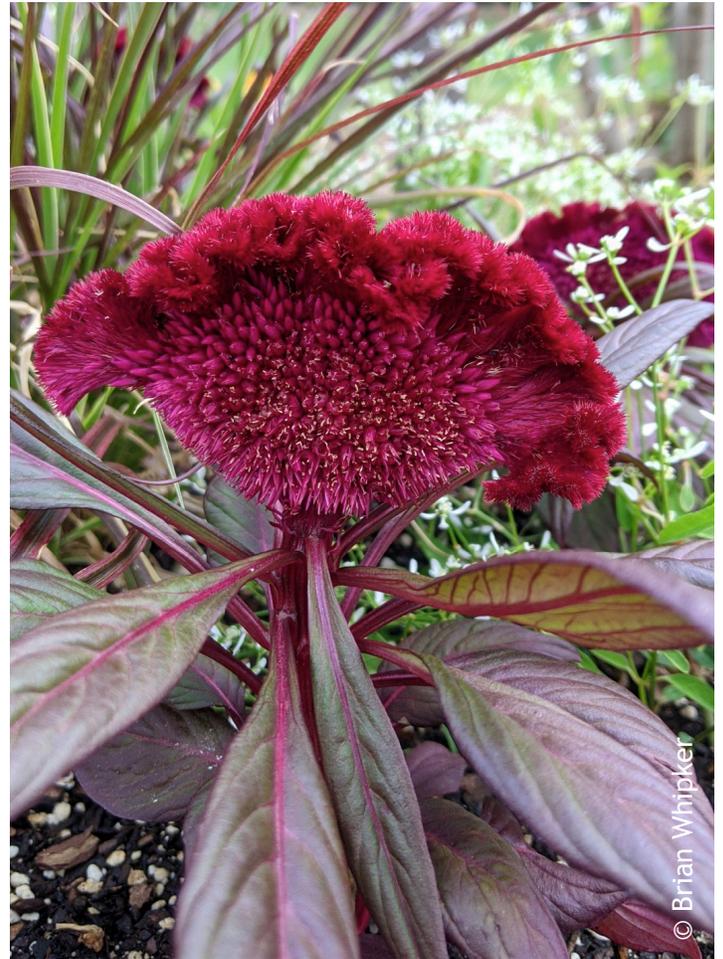


Figure 6. Crested celosia is a commercial example of fasciation grown by greenhouses and cut flower growers. Photo: Brian Whipker

References

Iliev, I. and P. Kitin. 2010. Origin, morphology, and anatomy of fasciation in plants cultured in vivo and in vitro. *Plant Growth Regulation*. 63. 115-129. 10.1007/s10725-010-9540-3. https://www.researchgate.net/publication/225560197-Origin_morphology_and_anatomy_of_fasciation_in_plants_cultured_in_vivo_and_in_vitro

Riddle, L.C. 1903. Fasciation. *The Ohio Naturalist*, 3(3): 346-348.

White, O.E. 1945. The biology of fasciation and its relation to abnormal growth. *J. of Heredity*, 36(1): 11-22.



Figure 7. The distortion of fasciation is a commercially desirable trait among the ornamental industry as seen here with a grafted cactus. Photo: Brian Whipker

Fasciation Distorted Growth Mimics

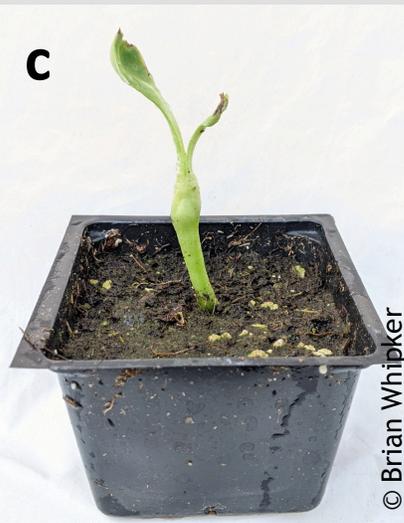


Figure 8. Distorted Growth Mimics of Fasciation.

- Herbicide drift can result in distorted growth on plants such as this tomato.
- In nature, insect feeding can result in weeds developing fasciated stems.
- Mechanical damage, such as loss of the growing tip during seed germination can result in distorted growth.
- A deficiency of boron can lead to distorted shoot growth.
- Transplanting plugs too deep can result in distorted shoot growth.
- Abnormal proliferation of cell growth with this scented geranium can result from the disease *Rhodococcus fascians*.



e-GRO Alert

www.e-gro.org

CONTRIBUTORS

Dr. Nora Cattlin
Floriculture Specialist
Cornell Cooperative Extension
Suffolk County
nora.cattlin@cornell.edu

Dr. Chris Currey
Assistant Professor of Floriculture
Iowa State University
ccurrey@iastate.edu

Dr. Ryan Dickson
Greenhouse Horticulture and
Controlled-Environment Agriculture
University of Arkansas
ryand@uark.edu

Thomas Ford
Commercial Horticulture Educator
Penn State Extension
tf7@psu.edu

Dan Gilrein
Entomology Specialist
Cornell Cooperative Extension
Suffolk County
dog1@cornell.edu

Dr. Joyce Latimer
Floriculture Extension & Research
Virginia Tech
jlatime@vt.edu

Heidi Lindberg
Floriculture Extension Educator
Michigan State University
wolleage@anr.msu.edu

Dr. Roberto Lopez
Floriculture Extension & Research
Michigan State University
rlopez@msu.edu

Dr. Neil Mattson
Greenhouse Research & Extension
Cornell University
neil.mattson@cornell.edu

Dr. W. Garrett Owen
Greenhouse Extension & Research
University of Kentucky
wgowen@ukv.edu

Dr. Rosa E. Raudales
Greenhouse Extension Specialist
University of Connecticut
rosa.raudales@uconn.edu

Dr. Beth Scheckelhoff
Extension Educator - Greenhouse Systems
The Ohio State University
scheckelhoff.11@osu.edu

Dr. Ariana Torres-Bravo
Horticulture/ Ag. Economics
Purdue University
torres2@purdue.edu

Dr. Brian Whipker
Floriculture Extension & Research
NC State University
bwhipker@ncsu.edu

Dr. Jean Williams-Woodward
Ornamental Extension Plant Pathologist
University of Georgia
jwoodwar@uga.edu

Copyright © 2021

Where trade names, proprietary products, or specific equipment are listed, no discrimination is intended and no endorsement, guarantee or warranty is implied by the authors, universities or associations.

Cooperating Universities

Cornell CALS
College of Agriculture and Life Sciences

**Cornell Cooperative Extension
Suffolk County**

IOWA STATE UNIVERSITY

**University of
Kentucky**



PennState Extension

**VT VIRGINIA
TECH**

UCONN

**MICHIGAN STATE
UNIVERSITY**



**College of Agricultural &
Environmental Sciences
UNIVERSITY OF GEORGIA**



**PURDUE
UNIVERSITY**

**NC STATE
UNIVERSITY**



**THE OHIO STATE
UNIVERSITY**



**DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System**

In cooperation with our local and state greenhouse organizations

MAUMEE VALLEY GROWERS
Choose the Very Best.



Metro Detroit Flower Growers Association



**CONNECTICUT
GREENHOUSE
GROWERS
ASSOCIATION**



**Indiana
FLOWER
GROWERS
Association**

