

Research reveals the science behind this plant's blue berries

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Lantana strigocamara in the Ramaley Greenhouse on the CU Boulder campus.
Credit: Patrick Campbell / CU Boulder

On a beautiful fall day in 2019, Miranda Sinnott-Armstrong was walking down Pearl Street in Boulder, Colorado when something caught her eye: a small, particularly shiny blue fruit, on a shrub known as *Lantana strigocamara*. While its tiny clusters of pink, yellow and orange flowers

and blue berries commonly adorn the pedestrian mall in spring, city workers were ripping these common *Lantanas* out to prepare for the winter season.

Sinnott-Armstrong, postdoctoral researcher of ecology and [evolutionary biology](#) at CU Boulder, quickly asked if she could take a specimen back to the lab. She wanted to know: What made these berries so blue?

Sinnott-Armstrong's results are now published in the journal *New Phytologist*. The study confirms *Lantana strigocamara* as the second-ever documented case of a plant creating blue-colored fruits with layered fat molecules. She and her co-authors published the [first-ever documented case](#), in *Viburnum tinus*, in 2020.

The two plants are among only six in the world known to make their fruits' hues using a trick of the light known as structural color. But Sinnott-Armstrong has a hunch there are more.

"We're literally finding these things in our backyards and on our streets, people just haven't been looking for structurally colored plants," said Miranda Sinnott-Armstrong, lead author on the new study. "And yet, just walking on Pearl Street, you're like, 'Oh, there's one!'"

Structural color is very common in animals. It's what gives peacocks' otherwise brown feathers their brilliant greens, and many butterflies their bright blues. But this optical illusion of sorts is much rarer in plants, according to Sinnott-Armstrong.



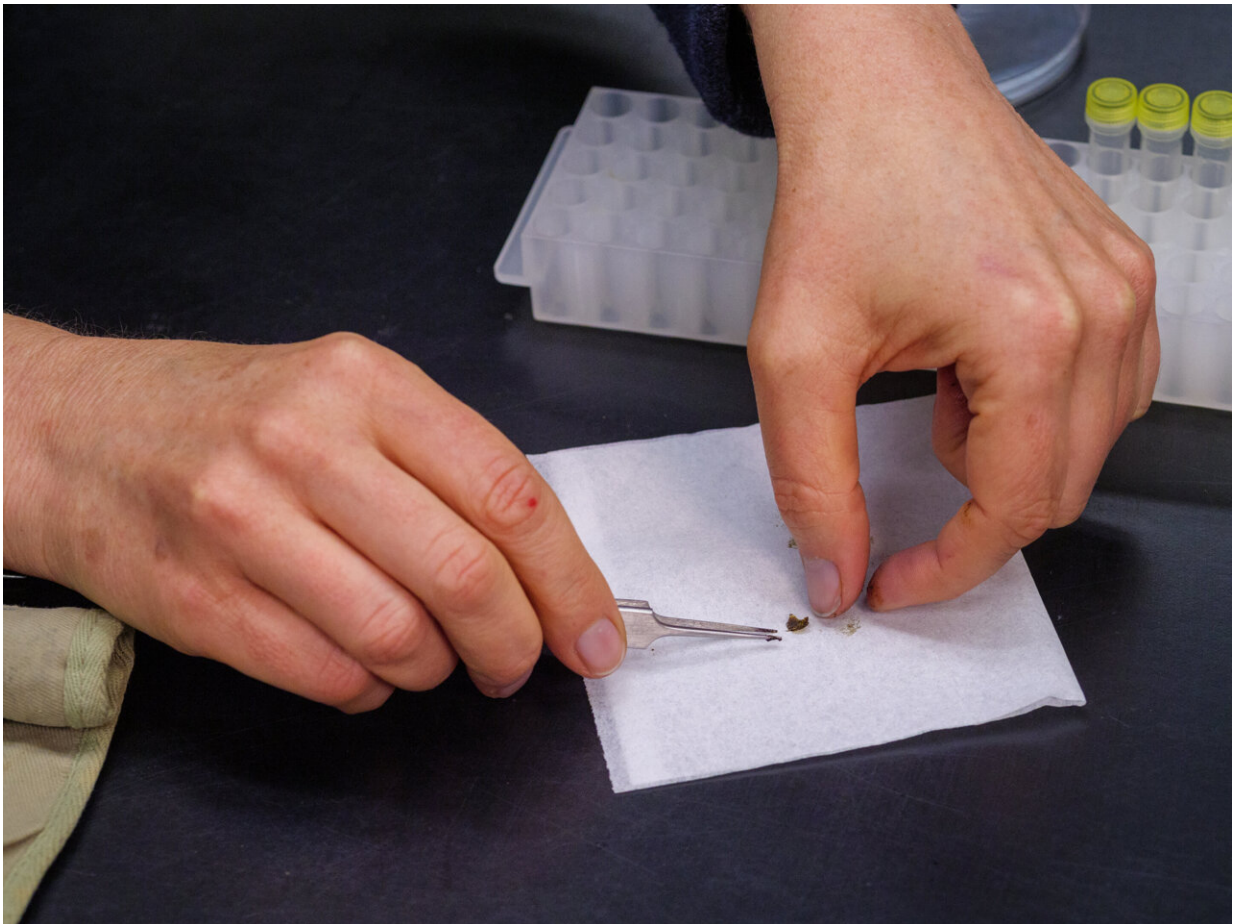
Stacey Smith, co-author on the publication and associate professor of ecology and evolutionary biology, peels the skin off of a Lantana fruit. Credit: Patrick Campbell / CU Boulder

To create its unique color, these blue fruits use microscopic structures in their skin to manipulate light and reflect the wavelengths our eyes perceive as blue, giving it a distinctive metallic finish. Pigmented color does the opposite, absorbing select visible wavelengths of light. This means structurally-colored berries have no color within themselves; if you were to squish them, they would not stain blue.

In fact, if you peel the skin off a Lantana [fruit](#) and hold it up to the light, it looks completely translucent. But if you place it against a dark background, it looks blue again, due to the nanostructures on the surface responsible for reflecting the color.

The evolution of color

What's especially unique about *Lantana strigocamara*—besides the fact that the color blue is quite scarce in nature, especially in fruits—is that it creates this structural color in its skin using layers of lipid molecules, or fats.



Stacey Smith, co-author on the publication and associate professor of ecology and evolutionary biology, peels the skin off of a *Lantana* fruit. Credit: Patrick Campbell / CU Boulder

Viburnum tinus is the only other plant known to do the same thing, and *Lantana* and *Viburnum* last shared a common ancestor more than 100 million years ago. Meaning, the two plants evolved this shared trait completely independent of one another.

"It puts us on the hunt for other groups where this happens, because we know it can be done multiple ways," said Stacey Smith, co-author on the publication and associate professor of ecology and evolutionary biology.

The researchers also chat often about why such a thing would evolve. Does structural color provide an [evolutionary advantage](#)?

Some theorize that structural color could help with seed dispersal. While there are very few known structurally colored plants, they are globally widespread. *Lantana* itself is invasive in many parts of the world, especially in tropical regions. It's possible that the metallic, shiny nature of the fruit provides strong contrast with surrounding foliage, attracting animals to eat them and disperse their seeds, according to the researchers.



Lantana strigocamara in the Ramaley Greenhouse on the CU Boulder campus.
Credit: Patrick Campbell / CU Boulder

"But just being blue and sparkly might be enough for an animal to think it's decorative," said Smith.

The researchers noted that many birds, especially in Australia, like to use structurally colored fruits to adorn their bowers and attract mates. Humans, interestingly, may also be contributing to the spread of *Lantana* for the same reason.

"The fact that they made their way into horticulture suggests that we are

susceptible to the same things are that other animals find attractive about them," said Smith. "We're like, oh, look at that sparkly, cute thing. I should put that in my garden."

Another possibility is that the thick, fatty layer which creates this unique color is a protective mechanism for the plant, providing defense against pathogens or improving the structural integrity of the fruit, said Sinnott-Armstrong.



Stacey Smith, co-author on the publication and associate professor of ecology and evolutionary biology, in the Ramaley Greenhouse at CU Boulder. Credit: Patrick Campbell / CU Boulder



Stacey Smith, co-author on the publication and associate professor of ecology and evolutionary biology, peels the skin off of a Lantana fruit. Credit: Patrick Campbell / CU Boulder

The color blue itself could also be a clue.

Pigmented and structural color are not mutually exclusive in plants, but perhaps plants stumbled across structural [color](#) as a way to make blue because it's not as easy to create in other ways, she said.

Some researchers in Silvia Vignolini's lab at the University of Cambridge—where Sinnott-Armstrong is currently based—are now

trying to make colored paints, fabrics and more out of [structural color](#), by better understanding the assembly of cellulose nanocrystals in colored fruits.

Researchers hope to learn more about the possible evolutionary prompts for this mechanism, as more structurally colored fruits are discovered.

"They're out there," said Sinnott-Armstrong. "We just haven't seen them all yet."

Co-authors on this publication include: Yu Ogawa, Université de Grenoble Alps; Gea Theodora van de Kerkhof, University of Cambridge; and Silvia Vignolini, University of Cambridge.

More information: Miranda A. Sinnott-Armstrong et al, Convergent evolution of disordered lipidic structural colour in the fruits of *Lantana strigocamara* (syn. *L. camara* hybrid cultivar), *New Phytologist* (2022). [DOI: 10.1111/nph.18262](https://doi.org/10.1111/nph.18262)

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