

# Why do animals hide their warning signals? A paradox explained

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Spotted lanternflies (*Lycorma delicatula*) are relatively unnoticeable in resting posture (left). But when they are grabbed or attacked by the predators, they suddenly display red hindwings (right). Credit: C.K.Kang

Scientists have understood quite well why so many poisonous animals have brightly colored bodies - the colors send a message to the predators: " don't eat me, or you'll get sick and die". But why some toxic animals actually hide the warning colors from the predator's view, showing them only at the very last moment, when they are already attacked? How can a sudden display of bright underwings at the moment of capture help a distasteful insect, such like the spotted lanternfly (see Figure and movie clip). In the recent issue of *Frontiers in Ecology and Evolution* a Korean-

Polish team of behavioral ecologists have proposed a new explanation.

Hyun-Joon Cho and Changku Kang, then graduate students at Seoul National University, spent hours preparing artificial [prey](#) models and presenting them to wild oriental tits (*Parus minor*). The birds were presented with hand-made bitter prey models that looked rather dull, imitating distasteful cryptic insects on the typical natural background such like the spotted lantern flies resting on the tree bark (left figure). These bitter prey models were mixed with tasty models that were also dull but differently colored. At the beginning, the birds picked up the bitter prey and dropped them right after grabbing it. But after several days of the same experiments, the birds slowly learned to use the colors to distinguish the bitter prey from the tasty prey, and they finally learned not to pick up the bitter prey.

Some of the bitter prey models were cleverly designed such that the prey suddenly displayed conspicuous colour immediately after the bird grabbed the prey. This imitated the situation when the lanternfly opens its wings and presents red-white-black pattern on their hind wings in response to being attacked. This sudden display of conspicuous color dramatically speeded-up the learning process of birds. Only after a few experiences with the bitter inconspicuous prey with sudden display, the birds were able to distinguish these prey from other inconspicuous but tasty prey. Very quickly birds stopped picking up the inconspicuous bitter prey as if the sudden display made the learning much easier.

We learn faster and remember better those events that were associated with something unexpected, something noticeable. It seems that the same happens to [birds](#), and that some distasteful insects exploit this by using sudden displays. Because of the sudden displays, the predators quickly learn to discriminate the distasteful insects and those insects survive the encounters with predators.

"This strategy helps the distasteful prey in two ways" says Kang. "The predators that are sensitive to the toxins produced by the prey can quickly learn to avoid the prey. But, those rare predators that are not sensitive to the toxins have difficulty spotting the prey because of its relatively cryptic appearance". Either way the prey wins.

"The Laboratory of Behavioral Ecology and Evolution, together with collaborators from other disciplines at Seoul National University, is focusing now at the spotted lanternflies' display behaviour that helps these insects to avoid predation", comment Piotr Jablonski and Sang-Im Lee, the co-authors of the study.

**More information:** Changku Kang et al, Post-attack Aposematic Display in Prey Facilitates Predator Avoidance Learning, *Frontiers in Ecology and Evolution* (2016). [DOI: 10.3389/fevo.2016.00035](https://doi.org/10.3389/fevo.2016.00035)

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