Personality interactions between animals may dictate outcomes in the wild

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Examining the varying personality types of multiple animal species at once—in addition to common single-species studies—could help biologists better predict ecological outcomes, according to a recent University of Pittsburgh study.

By observing the interplay in a common predator-prey system (the jumping spider and the house cricket), a team of Pitt biologists found that it was the interactions between the personality types of two species that best predicted survival outcomes—and not the personality types of either species alone. Their findings were highlighted in the September print issue of *Behavioral Ecology*.

"If we're interested in really understanding how individual personalities influence ecology, then we also have to acknowledge and accept that the personalities of many species or groups are also important," said Jonathan Pruitt, assistant professor of behavioral ecology in the Department of Biological Sciences within the Kenneth P. Dietrich School of Arts and Sciences.

The team began by tracking both species' activity levels to determine "personality" or behavior types. They started with the predator, collecting a population of spiders from Pitt's Pymatuning Laboratory of Ecology. The researchers charted individual spiders' activity within a five-minute span, seeing how far they could climb to the top of a vile. Their activity levels were measured, and the tests were repeated over four weeks to ensure that individuals' behavior was repeatable. The team

found that some individuals were consistently highly active, whereas other individuals of the same species were more sedentary.

The crickets, which were collected commercially, had a bit of a different test, given their prey status. With room to move in an open field, the Pitt biologists monitored the crickets' reaction times to a new place and their distance covered within five minutes. To ensure repeatability, this test was repeated over 10 days, once every other day. Like the spiders, the individual crickets exhibited different activity levels, where some individuals were highly active and others were more sedentary. The researchers then ranked the crickets' activity levels, grouping them in teams of six based on speed.

For a staged predator-prey cage match, the team placed six crickets "in the ring"—a container with enough natural airflow—against just one solitary spider. The ring was left alone for one week, and cricket mortality rate was measured daily. To accurately determine the crickets' precise cause of death, the team measured cricket mortality rate both in the presence and absence of spiders.

Using their collected data, the Pitt researchers modeled the behaviors of both species, hypothesizing potential outcomes. In addition to their behavioral data, they also took into account the spiders' and crickets' body mass, body conditions, and their individual responses to threats.

Their results closely matched the predictions of the locomotor crossover hypothesis—a theory positing that active predators tend to consume inactive prey, whereas inactive predators tend to consume active prey. Pruitt said this finding is actually surprising, given the possibility that the predators and/or prey could have changed their behavioral responses based on their foes' activity levels.

"This implies that the personality types of these spiders and crickets are

fairly rigid," said Pruitt. "If either species had been more flexible, they might have sensed the personality types present in their foe and shifted their strategy more strategically."

Their results show that the performance of the spiders depended neither on the average activity level of the spider nor the average group activity of the crickets. Instead, it was the interaction between the activity levels of both groups that predicted survival for the crickets and foraging success for the spiders.

"Our study is one of about four recent studies demonstrating the importance of studying the personalities of multiple species concurrently," said Pruitt. "If we had restricted our focus to only a single species, say the spider, we wouldn't have detected an effect of the spiders' personality at all. This is because, on average, both active and inactive spiders caught a similar number of prey. Only when we consider the personalities of the prey do we see that the performance of active versus inactive spiders depends on the activity levels of their prey."

Pruitt said that, taken together, the Pitt data emphasizes that there is value—or perhaps even a need—in broadening the focus of future personality studies beyond just single-species examinations.

"Studies about multiple, interacting species hold promise toward increasing our understanding of the ecological causes and consequences of behavioral variation, which we observe in virtually every animal population," Pruitt said.

More information: The paper, "Predator and prey activity levels jointly influence the outcome of long-term foraging bouts," was first published online June 17.
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