Insects learn faster when they are rewarded with nectar

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Butterflies learn faster when a flower is rewarding than when it is not, and females have the edge over males when it comes to speed of learning with rewards. These are the findings of a new study, by Dr. Ikuo Kandori and Takafumi Yamaki from Kinki University in Japan. Their work, published online in Springer's journal *Naturwissenschaften - The Science of Nature*, is the first to investigate and compare the speed at which insects learn from both rewarding and non-rewarding experiences.

Learning is a fundamental mechanism for adjusting behavior to environmental change. In insects, there are three main types of learning: reward learning where insects develop a positive association between visual and/or olfactory cues and resources such as nectar; aversive learning where insects associate visual and/or olfactory cues with negative stimuli such as salt, shock and toxins; and non-reward learning where they associate the cues with the absence of rewards. To date, very few studies have explored non-reward learning in pollinator insects, including the butterfly *Byasa alcinous*.

In a series of four experiments, Kandori and Yamaki examined both the reward (nectar present) and non-reward (no nectar) learning abilities of the butterfly while foraging among artificial flowers of different colors. They also compared the reward and non-reward learning speeds.

They found that the butterfly learned to associate flower color, not only with the presence of nectar, but also with the absence of nectar. This demonstrates that the butterfly used both reward and non-reward

learning while foraging on the flowers. In addition, the butterfly learned quicker via reward learning than it did via non-reward learning; and females learned faster than males.

These authors conclude: "*Byasa alcinous* can find rewarding flower species more efficiently via both reward and non-reward learning. Insects may initially visit a certain flower by innate preference. If this flower is rewarding, they quickly increase their focus on that flower species through reward learning. If the flower species is unrewarding and common, frequent visits to that flower species enhances non-reward learning to avoid that flower species. The butterfly can then identify new rewarding flower species with a reduced loss of energy and time, if it avoids foraging on such abundant, innately attractive but unrewarding flower species."

More information: Kandori I & Yamaki T (2012). Reward and non-reward learning of flower colours in the butterfly Byasa alcinous (Lepidoptera: Papilionoidae). *Naturwissenschaften – The Science of Nature*; DOI 10.1007/s00114-012-0952-y

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