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What does hummingbird coloration tell us about competition?

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Abstract

UPPER READING LEVEL

Have you ever wondered why animals of the same species look different from each other? Think of the impressive tail and call of a rooster compared to the duller hens. Well, usually there's a reason those differences have evolved.

We examined white-necked jacobins to learn more about their coloration. Some of the females of this hummingbird species have a fancy coloration pattern like the males do. The males of this species are aggressive and socially dominant. Other birds think the fancy females are males and leave them alone to feed. We wanted to know if the fancy females just look fancy or if they are actually better competitors.

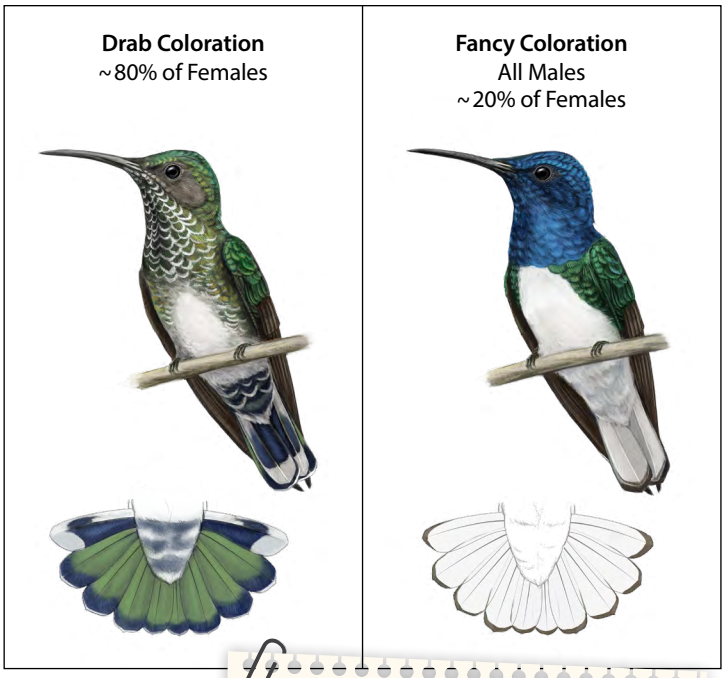
We found that fancy females are mimicking male coloration patterns. Otherwise they are more like other female jacobins. This is the first time we've seen females mimicking males to get the advantages of a socially dominant form.

Introduction

Animals look different. Their appearance gives them unique characteristics and behaviors. It also allows them to survive in their environment. Often there are two or more different forms within a species. This is called **polymorphism** and could include different coloration patterns, different shapes, or different behaviors. A familiar example is that males and females of a species often look different (**sexual dimorphism**). Another example of polymorphism is when only one of the sexes has multiple **coloration** patterns or **morphologies**. The other sex only has one form. This is called **sex-limited polymorphism**.

Most research on sex-limited polymorphism focuses on males that have multiple forms. This is commonly a result of **sexual selection**. Males try to attract females with a variety of bright colors and flashy displays. We know a lot less about sex-limited polymorphism where females have multiple forms.

Interestingly, some hummingbirds show female-limited polymorphism. A few species even have some females that mimic the fancy coloration of males. **Mimicry** happens when one organism looks or behaves like another. This gives



Female and male white-necked jacobin hummingbirds. **Illustration:** Jillian Ditner

them some kind of advantage. For example, coral snakes are venomous and have a distinctive red, yellow, and black banded coloration pattern. Milk snakes have evolved with a similar coloration pattern, but they are not venomous. Predators avoid the milk snake. They look the same as the coral snake, so predators think they are venomous.

We know that fancy hummingbird females get more access to food because they look like aggressive males. No one wants to pick a fight with a good competitor, so they leave the fancy females alone to eat.

We wanted to know, though. Do the fancy females behave more like males or more like other females? Are they actually better competitors than drab females? Or are they just faking it with their coloration patterns?

Methods

We looked at white-necked jacobin hummingbirds in Panama to answer our questions. Female white-necked jacobins have two coloration patterns: drab and fancy. About 80% are a dull greenish-brown (drab), but 20% have a blue head and white neck and tail (fancy). The fancy females look exactly like the males.

We looked at three different types of information:

1. Morphology – We caught 436 birds and measured traits like mass, wing length, and wing width. We recorded their coloration. We also took blood to determine their sex.
2. Flying ability – We captured 210 birds and measured how much weight they could lift when flying. We also looked at the ratio of their body weight to their wing area. These characteristics both help hummingbirds turn and speed up while they are flying.
3. Feeding strategies – We tagged hummingbirds with radio tags. We recorded how often they visited feeders at our study sites. We used a model to help us figure out if their behavior was **territorial** or non-territorial.

All three affect a hummingbird's ability to compete with each other while chasing each other in the air. We used statistics to find out if there were any differences between drab and fancy females. We also looked for any differences between males and females.

Results

Other than color, we couldn't tell the difference between the two types of females. They had similar mass, wing length and width. The difference between females based on flying ability was also too small to be important (Figure 1). In contrast, males had larger wing lengths and widths than females. Males could also lift more weight and had a greater bodyweight-to-wing area ratio than females.

Which hummingbirds were more similar in their lifting ability?

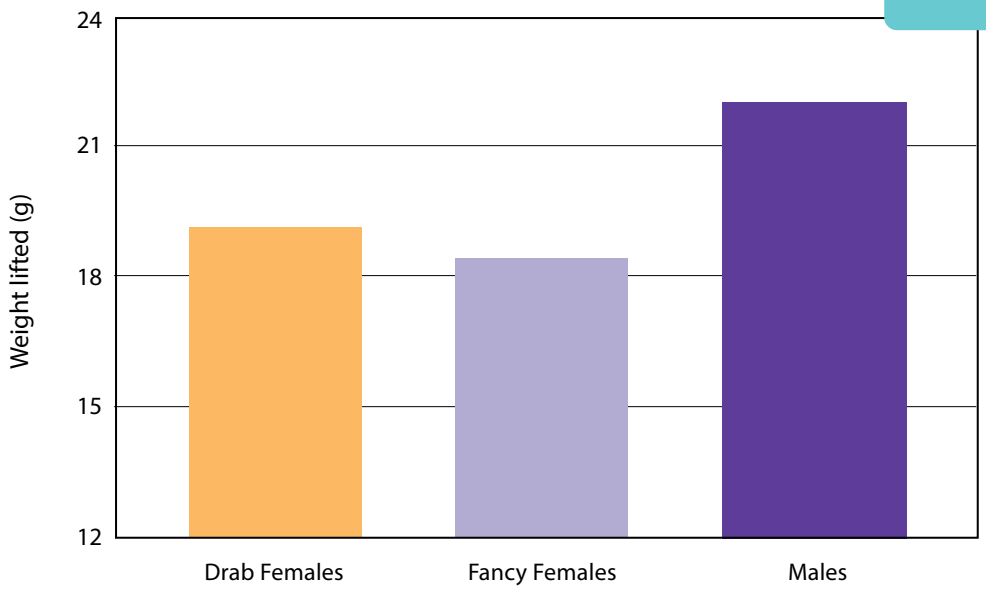


Figure 1: Weight lifted by white-necked jacobins with different coloration patterns. The amount of weight a bird can lift shows their potential to be competitive over food.

We saw that both males and females had non-territorial feeding strategies. They visited a large number of feeders. Some males also visited a small number of feeders a lot of times. This is a territorial feeding strategy.

Discussion

Our results show that fancy females are mimicking males. They don't have the same morphology or behaviors. They are more like drab females. Males have qualities that make them more competitive in the air. Our feeding study also shows that some male hummingbirds are territorial. Males compete for food and try to prevent other birds from accessing feeders. Males are more aggressive than females. This makes them **socially dominant**.

Fancy females are harassed less because they look like aggressive males. This means they get to eat more food instead of being chased away. Hummingbirds have the highest metabolic rate of any animal for its size. Getting enough food is really important. Fancy females don't have to have bigger muscles or greater strength to get more food. They just have to look like males!

This is the first time that we have seen a female-limited polymorphism that mimics the colors of the socially dominant male. In the future we'd like to study the genetic basis of this polymorphism. There may be differences between the different forms that we can't see or measure easily. This could help us understand the evolution of polymorphism and variation in organisms.

Conclusion

Hummingbirds are amazing birds. They can be found as far north as Alaska and as far south as Chile. If you live in the Americas, you can set out your own feeders to watch the hummingbirds in your neighborhood. If not, you can still set out bird feeders and keep track of any behaviors you notice. Do you see different species of bird visiting your feeders? Do you notice any aggressive behaviors? Are there any birds that seem to be territorial? Also, make sure to have fun and enjoy your bird watching!

Glossary of Key Terms

Coloration - the arrangement of colors on the outside of an organism.

Mimicry - the evolution of organisms looking like each other. This can occur between two species or within the same species.

Morphology - the form of an organism. This includes the outward appearance of an organism like colors, shapes, and textures. It can also include internal structures like bones and organ systems.

Polymorphism - two or more different forms within a species.

Sex-limited polymorphism - when two or more forms within a species only appear in one of the sexes. The other sex only has one form.

Sexual dimorphism - when the males and females of the same species look different. This could include differences in coloration, size, or ornamentation.

Sexual selection - a mechanism of natural selection where one sex chooses mates of the other sex. This usually relates to competition for access to mates and sex-selected polymorphism.

Socially dominant - describes an individual at the top of a hierarchy within a group. This is based on group interactions. Socially dominant individuals can sometimes exclude others from important resources like food.

Territorial - a group of behaviors that allow an organism to protect a specific area from other individuals. These behaviors include making sounds, displaying aggression, leaving scents or marks, or actually chasing other individuals away.

Check your understanding

1 What is polymorphism? What are some examples of polymorphism that you can think of?

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2 What three broad categories of things did we collect data about? What did we compare using this data?

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3 What are the two hypotheses that we tried to test with our data? Which hypothesis was supported? How would our data have looked different if the alternative hypothesis was supported?

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4 We found that male hummingbirds exhibited both non-territorial and territorial feeding strategies. What would a non-territorial feeding strategy look like? What about a territorial feeding strategy? Describe these strategies based on the number of feeders that hummingbirds visited and how often they visited those feeders.

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