**Methods**

We fitted a generalized linear mixed regression model to the binary preening data (with leaves vs. without leaves) to test for effects of season (dry vs. wet), sex (male vs. other), wetness of leaves (dry vs. wet), and time of the day, to assess the probability of preening with vs. without leaves. Season, sex, and wetness of leaves were included as binary categorical predictive variables and time was treated as a numerical predictive variable (hour of the day at the preening event, ranging from 6am to 11am). To account for the fact that the frequency of observed preening events varied substantially between observation points, we included point ID, ranging from 1 to 30, as a random factor (random intercept) in our model. Statistical significance of coefficients was assessed using likelihood ratio tests.

For a number of variables, which we measured, we had no clear apriori hypotheses, including the species of the birds, the weather variables (rain, sun), and the temperature. These variables were not included in the model, but instead visualized their associations with preening with vs. without leaves.

The statistical analysis was conducted in R. Packages janitor (Firke 2020), tidyverse (Wickham et al. 2019) and patchwork (Lin Pedersen 2020) were used for data cleaning, analysis and plotting. Package lme4 (Bates et al. 2015) was used to fit the model.

**Results**

The generalized linear mixed model fit showed that effects of season (p< 1e-9 ) and daytime (p<1e-9 ) were statistically significant. The effects of wetness of leaves (p=0.08) and sex (p=0.38) were not statistically significant, however, including wetness of leaves improved the model fit (in terms of log-likelihood and deviance).

Preening with leaves occurred predominantly in the breeding season and was concentrated in the early morning hours in all four observed species (Fig. 1A, 1B). Preening without leaves was more evenly distributed across the entire morning and occurred mainly in the non-breeding season (Fig. 1B). Both sexes showed the behavior of preening with leaves with similar frequency, which was also confirmed by the mixed model. There were species differences in the preening patterns between the seasons (Fig. 1A). For example, medium ground finches preened predominantly in the breeding season and almost exclusively with leaves, whereas warbler finches preened mainly without leaves in the non-breeding season.

Preening with leaves and wet leaves co-occurred in the breeding season and both variables showed the same daily trend (Fig. 3). Rain was omnipresent in the breeding season, which led to frequent wet vegetation (correlation between rain and wet leaves was r=0.77, correlation between season and rain was r=0.70).

The average temperature was cooler in the breeding season than in the non-breeding season (15.4°C vs. 20.8°C), and preening with leaves therefore occurred at cooler mean temperatures.

Sun? Something else missing?

A.



B.



Fig. 1: Preening without vs. with leaves, plotted against season, and sex (A.) daytime (B.) for the four observed species.



Fig. 2: Preening events with and without leaves, separately for breeding and non-breeding seasons, when leaves were dry vs. wet.

A.



B.



Fig. 3: Preening with leaves (A.) and wet leaves (B.) plotted against daytime, separately for the breeding and non-breeding seasons. In the breeding season, these two variables show the same daily trend.



Fig. 4: Temperature for preening events without vs. with leaves, for breeding and non-breeding season.

**References**

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