Assignment #2: Griebel and Dawson 2020 Benefits of an anti-parasite in Tree Swallows
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The paper "Benefits of an anti-parasite treatment are influenced by within-brood size variation in Tree Swallows (*Tachycineta bicolor*)", of Griebel and Dawson 2020, is about the influence of the anti-parasite drug ivermectin in nestling susceptibility to larval blowflies (*Protocalliphora* and *Trypocalliphora* spp.) and how it can affect its morphological traits. For this study, three different treatments were applied in the nestlings: ivermectin injection (IVM-IVM), as the drug treatment of the whole brood, ivermectin plus sesame oil injection (IVM-control), as the mixed brood, and sesame oil injection (control), as the control treatment. The abundance of larvae was influenced by the hatching date and year, being reduced in the ivermectin and mixed treatments in comparison with control. Treatments had not a clear influence on the growth mass of nestlings. In conclusion, the study verified the individual and brood influence on parasite-resistance, as well as the efficacy of ivermectin against larval blowflies.

In figure 2, it is possible to visualize the relationship between the treatments and the hatching date, here standardized to be shown as years, instead of days, and in the growth rate mass of nestlings. The issue in this figure is that the individuals, represented by points, are too close to each other, making the visualization hard. Besides, the greyscale, maybe a norm of the journal, contributes to the difficulty of distinguishing the individual data. The regression lines are the elements helping the reader to identify that the only factor related to the hatching date is the drug treatment, for both brood groups (IVM-control and IVM-IVM).

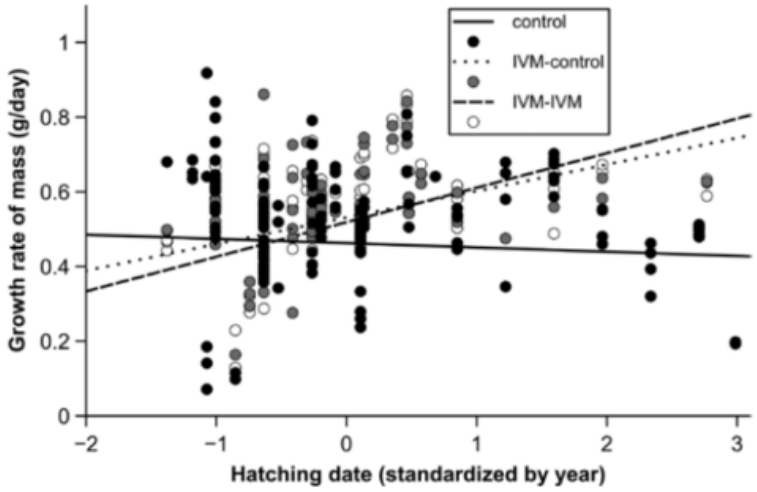

FIGURE 2. The effect of an anti-parasite drug treatment (ivermectin [IVM]) on the growth rate of mass of nestling Tree Swallows (*Tachycineta bicolor*) depended on the hatching date (standardized by year). Analysis by treatment level showed that there was no relationship between growth rate of mass and hatching date for nestlings from control broods (all nestlings received sham injections of pure sesame oil; solid line, black circles; n = 33 broods, 142 nestlings), whereas nestlings from IVM broods, regardless of whether they received oil injections (dotted line, gray circles; n = 39 broods, 84 nestlings) or IVM injections (dashed line, white circles; n = 39 broods, 87 nestlings), showed a positive relationship between growth rate of mass and hatching date.

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One alternative to distinguish the individual data is shown in the figure below (Figure Option 1). In this figure, the individual points are still overlapping, however, with the addition of the colors, we can have a clearer idea about the individual data relationship with the treatment applied. It is possible to notice, without the regression lines, that the hatching date is reduced in treated groups in comparison with the control broods.

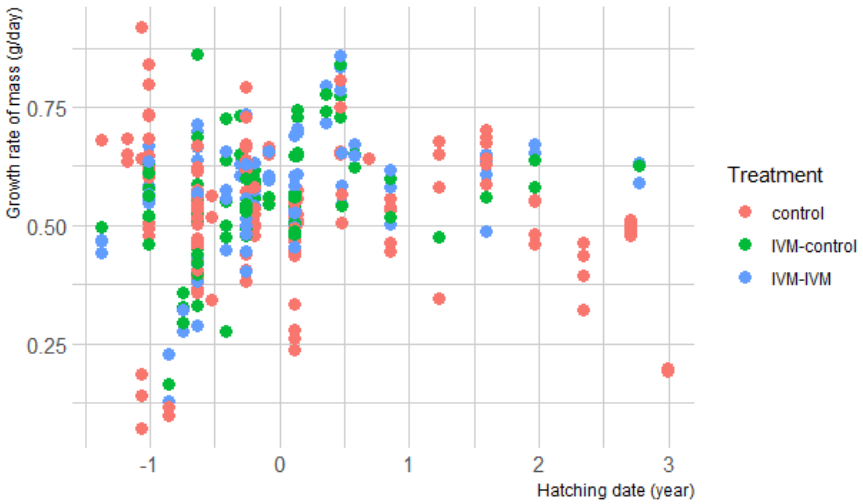

Figure Option 1. Relationship between ivermectin treatment (IVM) with the growth rate of mass of Tree Swallows (*Tachycineta bicolor*) and hatching date, standardized as years. Individual data show no relationship between growth rate of mass and hatching date in nestlings injected by sesame oil (control, pink dots), while nestlings from IVM (blue dots) and mixed broods (IVM-control, green dots) had earlier hatching dates.

Another alternative is to analyze data through a principal component analysis (PCA). Figure Option 2 shows a classical PCA graph, where variance was united before the analysis, while Figure Option 3 considers the cos2 values, used as an estimation of the quality of the representation. By adding colors in Figure Option 3, we can notice, even more clearly than shown in Figure Option 2, that sampling year (2016 and 2017) and the growth rate mass contribute to another order of components (not shown), as well as the percentage of each variable contribution to the principal components. The main variable contributing to component 2 is the hatching date, clearly separated into two groups, the control, and the treated (IVM-control and IVM-IVM treatment) nestlings.

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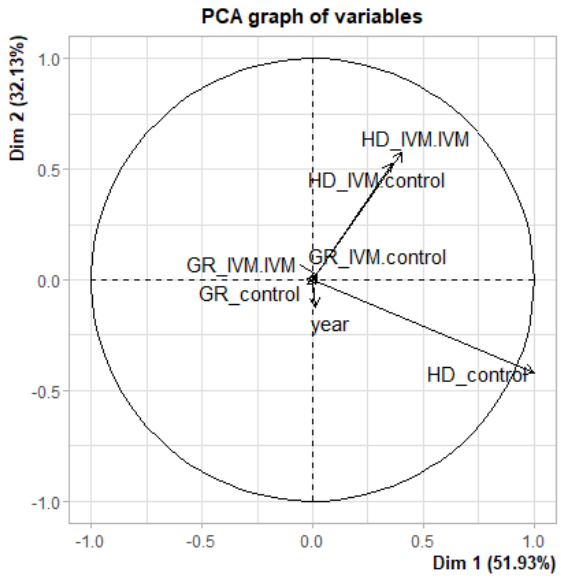

Figure Option 2. Principal Component Analysis (PCA) of the contributions of the growth rate mass and the hatching date, standardized as years, of Tree Swallows (*Tachycineta bicolor*), considering the ivermectin (IVM.IVM), and mixed (injected with ivermectin and sesame oil, IVM.control) broods, and the control group, injected with sesame oil (control). The main variable contributing to component 2 is the hatching date, clearly divided in control and treated (IVM-control and IVM-IVM treatment) broods.

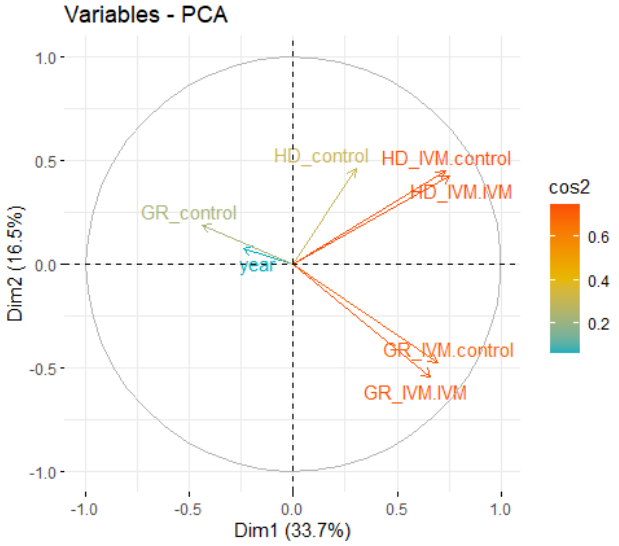

Figure Option 3. Principal Component Analysis (PCA) of the contributions of the growth rate mass, and hatching date, standardized as years, of Tree Swallows (*Tachycineta bicolor*), submitted to two different treatments (ivermectin, IVM.IVM, and mixed, ivermectin and sesame oil, IVM.control), as well as the control broods, injected with sesame oil (control). The main variable contributing to component 2 is the hatching date, clearly divided in control and treated (IVM-control and IVM-IVM treatment) broods. Gradient colors represent the cos2 values of the PCA, used as an estimation of the quality of the representation, which contains the percentage of contribution of the variables to the two principal components.

Paper cited: Griebel IA, Dawson RD (2020) Benefits of an anti-parasite treatment are influenced by within-brood size variation in Tree Swallows (*Tachycineta Bicolor*). *Auk* 137 (2): 1–14