**Detailed and provisional plan of my report**

**Adaptative male courtship behavior in the New Zealand fishing spider *Dolomedes minor* (Pisauridae)**

**Introduction – General context**

* Context on life history traits within reproductive behaviors, their inheritability and the way they are driven by sexual selection through fitness optimization theory [1].
* Definition of courtship, the morphological and behavioral traits it includes and how they are affected by mate and sexual selection [2].
* State that mate selection mechanism is widely described from the female perspective, as a consequence of an asymmetry between sexes in the energy they invest during reproduction. *e.g.* gametes limitation, parental care, *etc*. [3].
* Contrast this last statement: studies have shown the ability of males to adjust their investment in courtship and reproduction, depending on the female’s quality. Notably, males could assess the fertility of a female and thus adapt their ejaculation accordingly [4].
* Come to the fact that in this context, spider males need to also take into account that they are often cannibalized by the female and that they need to adjust their courtship to avoid such outcome. Thus, spider males might need to adapt their behavior and make trade-offs to waste less energy in a “bad female” but also to have less risk of being killed, especially before even being able to copulate in some cases.
* Add context on the fact that many studies have well described the courtship and reproduction behavior in spider taxa such as the *Lycosidae* or the *Salticidae*, but that little is known in the *Pisauridae* family. Also, that in spiders, courtship is often used by males to reduce females aggressiveness and risks of being cannibalized [5], [6].
* Add context on the *Dolomedes* genus, were females are known to be extremely aggressive toward males [7]. And finally lead to the New Zealand *D. minor* species, on which little is known [8].

**Scientific question and hypothesis**

* The purpose of this study is to assess if males of *D. minor* can evaluate the mating state of a female (virgin or already mated) and adjust their courtship behavior accordingly. This, as a trade-off between investing less in a less fertile female, and avoid being cannibalized, which would prevent them from finding other and more fertile mates.
* It is expected that males will spend less time in courtship with an already mated female, in order to spend less time and energy. But also, they might be more often cannibalized in those trials, as a result of less involvement in courtship, which would not be sufficient to overcome the benefice of eating the male, from the female perspective.
* Also, that they might exhibit some specific behavioral sub-sequences, that could lead to a quicker reproduction but also to a higher risk of being cannibalized (still in trials with already mated females).

**Material and Methods**

* Individuals’ collection on field was already made: explain how, where, the way they were stored and fed. Also explain how did we know that males and females used for the trials were virgin.
* Mating trials were already made and recorded: explain how mating trials were made, especially in order to have trials with virgin and mated females (2 different groups).
* Explain how the behavioral sequences during courtship were described (Definition of when courtship ends and stops; randomly selected trials to avoid biases from the examiner; construction of an ethogram based on the literature, especially on *Lycosidae*; utilization of BORIS software).

**Data analysis**

* Test the differences in courtship duration and rate of male survival, between the two groups by using simple tests of mean comparison.
* Potentially test the effect of females weight on the survival rate of males and the duration of courtship, between the 2 groups by using binomial generalized linear model [9].
* Summarize the behavioral sequences of the two groups into a matrix of transition probability between behaviors with the igraph network analysis on R [10].
* Use this same R package to produce a fluxogram (Network between identified behaviors) including the frequency of each behavior and the frequency of each transition between those behaviors. Significancy of values and differences between the two groups will be assessed with a permutation procedure [11].
* Use the fluxogram produced to identify behavioral sequences or pattern of escalation that may significantly lead to copulation or male being killed [12].

**Results**

* Produce a precise ethogram with description of all the different behaviors described.
* Represent the statistical comparison of courtship duration and outcomes (death or reproduction) between the two different groups.
* Present the results of the GLM for the effect of female masse in both groups.
* Produce a fluxogram for each group with frequency of each behavior and each transition between behaviors, and compare the significant differences between those groups.
* Describe the sub-sequences of behaviors identified and potentially stereotypically leading to male’s death or copulation (or maybe other observations such as female rejection).

**Discussion/Conclusion**

* If a significant difference was shown between the two groups (especially with less time spend in courtship with mated females), the selection of this behavior and its purpose might be directly linked and discussed in regard with the reproductive advantage it gives to males.
* If not, the fitness loss undergone by males when mating with an already mated female, could still be hypothesized as being explained by a lack of ability from males to assess the mated state of females, or the utilization of other adaptative behaviors (which might be observed, for example by removing plugs inserted by other males in the female’s genitalia, and discussed).

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