Project Update August 2021

Data collection on the field

In January and February 2021, we performed the last field campaign of this study. In this stage, our objective was to evaluate whether the dispersion performed by black lion tamarin (BLT) could be considered non-random for a plant species, by giving advantage on the establishment of its seedlings. We had already built experiments in the home range of the three BLT groups using Ingá-feijão (*Inga marginata*) seeds in January 2020, and after 1 year we inspected them. Part of the experiments were built in the continuous forest of the Morro do Diabo State Park, in Teodoro Sampaio, and the other part in the riparian forest of the Rio Claro Farm, in Lençóis Paulista. In this stage, we performed 27 days and around 216 hours on the field.

We built the experiments following three treatments: (1) randomly dispersed seeds; (2) seeds dispersed by BLT and (3) non-dispersed seeds (control). In the home ranges of each group, for the treatments (1) and (2), we put three seeds of *I. marginata* in 20 different places. In the treatment (3), we put 20 seeds underneath three different trees of the same species. This way, we used 60 seeds/treatment and 180 seeds/area. All the seeds were collected and treated on the field, and the experiments were protected by vertebrate exclusion cages, measuring 15x15x10cm, built with wire mesh and fixed in the ground using metal stakes. To turn feasible the monitoring of the seedlings, we tied the seeds with a transparent nylon thread of 25cm and a coloured ribbon with a number which identifies it (Muñoz *et al*., 2011). In half of the treatment (2) experiments the seeds were buried, one at each depth (1, 3 and 5cm), in order to simulate a secondary dispersal event.

We opted to collect all the seeds directly from the BLT feces due to two purposes. Firstly, it would be difficult to collect the necessary number of seeds in order to build the experiments using the species of interest. Secondly, although the passage of the seeds through the digestive tract of the BLT could influence the germination, we considered this effect as minimum as shown in Fuzessy *et al.* (2016), which shows that primates that include insects in their diet do not have a significant effect on the percentage or time of seed germination.

Finally, we evaluated the microhabitats of seed deposition as function of the canopy cover and the burlap height. The availability of light through the canopy opening influence directly on the germination and growth of the seedlings (Howe *et al.*, 1985). The burlap by its time, influence both on the germination, by changing luminosity and humidity parameters, and on the seed predation (Schupp, 1998).

During the monitoring, we counted up the number of seedlings which survived and measured the height of each individual. Posteriorly, we compared these values between treatments and areas. As result, 77 *I. marginata* seedlings survived (Figure 1). The height of the seedlings was 16,47±0,42 cm (Mean±Standard Deviation) and 13,34±0,44 cm in the continuous forest areas, and 7,78±0,19 cm in the riparian forest area (Table 1).

Figure 1. Recruitment experiments of *Inga marginata* seedlings built in the home range of the three black-lion-tamarin group.

Table 1. Quantity and average height of the seedlings, without buried seeds and with buried seeds (1, 3 and 5 cm), in the home ranges of the three black-lion-tamarin groups

		Continuous Forest - Area 1	Continuous Forest - Area 2	Riparian Forest
Quantity of seedlings which survived	Not buried	1	3	8
	1 cm	1	4	4
	3 cm	10	9	9
	5 cm	10	9	9
Average height of the seedlings (cm)	Not buried	15	13	7
	1 cm	16	14.25	8
	3 cm	16.9	13.11	8.6
	5 cm	16.5	13	7.53

The microhabitats of deposition used by BLT showed higher canopy cover (F=26,69; *P*=<0,0001) and equal burlap height (F=0,76; *P*=0,38) than random microhabitats. The canopy cover was higher in the continuous forest (F=121,11; *P*<0,0001), as well as the burlap height (F=45,22; *P*<0,0001). No seedlings of the control treatment survived. The

survival rate of the random treatment was 3,88% (n=7), and of the directed treatment, without secondary dispersion, was 6,66% (n=6). In the directed treatment, with buried seeds, the survival rate was 30% (n=9), 93,33% (n=28) e 90% (n=27) for the seeds buried at 1 cm, 3 cm, and 5 cm respectively.

Although the dispersal by BLT seems to direct the rain of seeds for places with greater canopy cover, this does not seem to influence the recruitment of *I. marginata* seedlings. On the other hand, the presence of diplochory, that is, two phases dispersal (BLTs and dung beetles), may be determinant in the survival of the seedlings, especially for seeds buried from 3 to 5 cm. We hope these experiments could be replicated in the future with other plant species dispersed by BLT.

Scientific divulgation

Due to the Covid-19 pandemic, there were no presential activities since March 2020. The activities, which occurred remotely, included the presentation of the project for incoming students from the University of Taubaté (São Paulo, Brazil) and oral presentations (Figure 2) of part of this project results, in the Virtual Meeting of the Association for Tropical Biology and Conservation (ATBC) and in the XV Brazilian Congress of Ecology. At the ATBC Congress, I presented the following work: "The contribution of an endangered small-bodied primate species to the seed dispersal network in the Atlantic Rainforest". At the Congress of Ecology, that will occur in September, the work which will be presented (the presentation has already been recorded) is: "O papel do mico-leão-preto *Leontopithecus chrysopygus* em duas redes de dispersão desementes com contextos ambientais distintos".

References

Fuzessy, L. F.; Cornelissen, T. G.; Janson, C. & Silveira, F. A. O. (2016). How do primates affect seed germination? A meta-analysis of gut passage effects on neotropical plants. Oikos. 125: 1069–1080.

Howe, H. F.; Schupp, E. W.; Westley, L. C. (1985). Early consequences of seed dispersal for a neotropical tree (Virola surinamensis). Ecology. 66 (3): 781-791.

Schupp E. W. (1988). Factors affecting post dispersal seed survival in a tropical forest. Oecologia. 76 (4): 525-530.

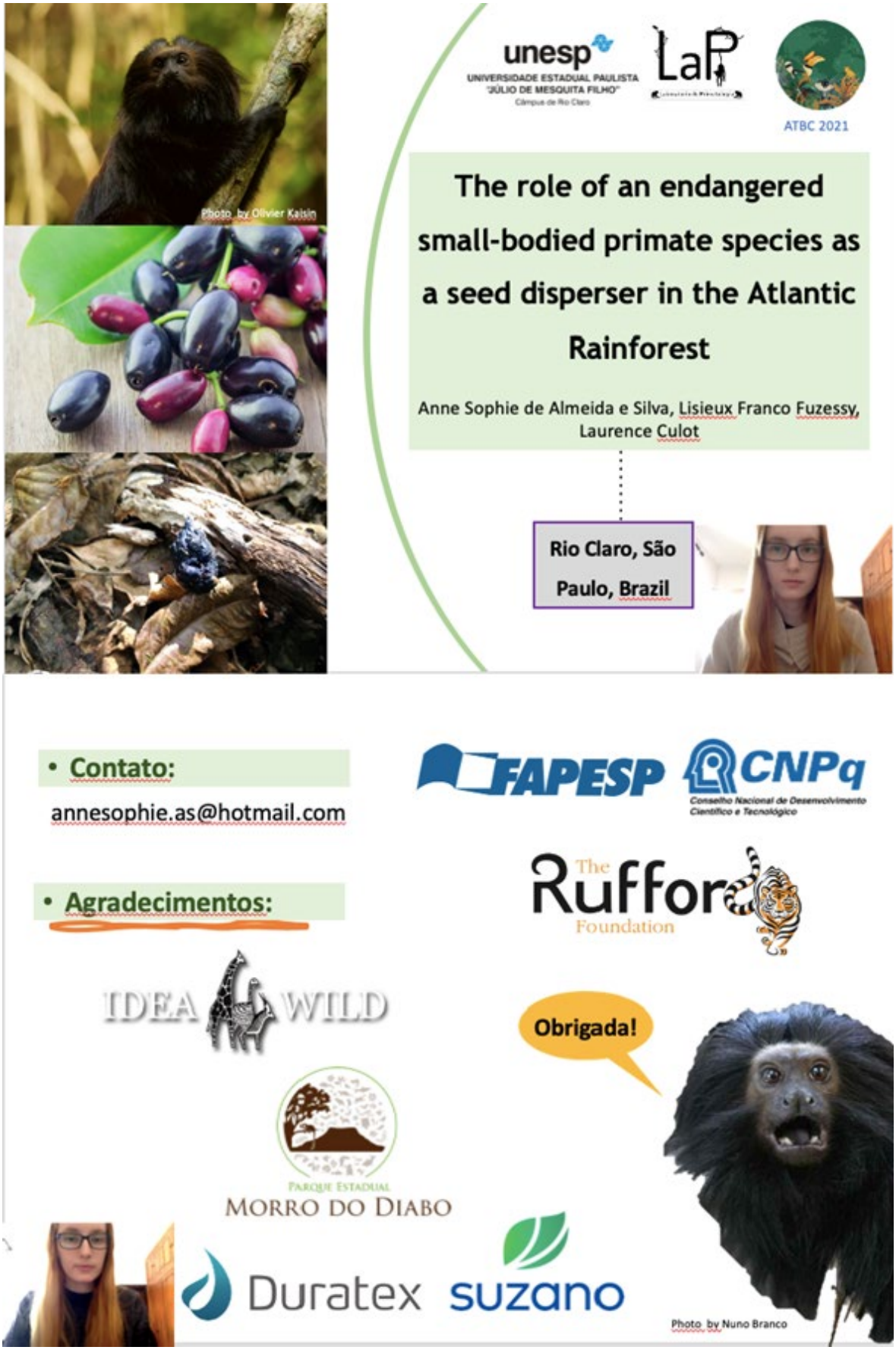

Figure 2. Presentation of part of this project results at the ATBC 2021 and at the Brazilian Ecology Congresses