Pollen nutrition on the honey bee (*Apis mellifera* L.) health

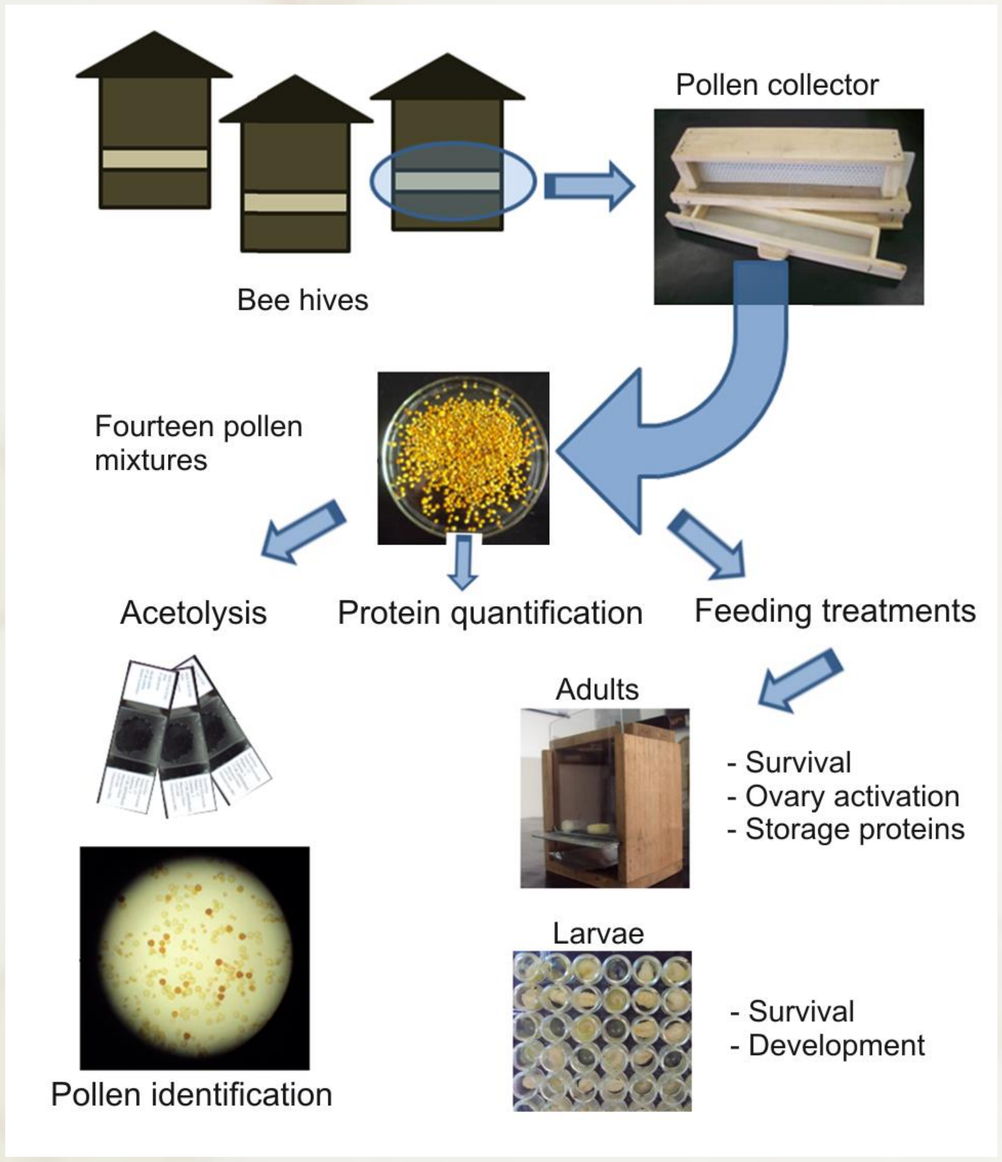
BRUNA E.D. FRIAS[1], JULIANA A. VELOSO[2], ANETE P. LOURENÇO[3]

Departamento de Ciências Biológicas- Universidade Federal dos Vales do Jequitinhonha e Mucuri, Diamantina-MG, Brazil
[1]brunadinizf@yahoo.com.br, [2] juazevedoveloso@hotmail.com, [3]aneteloureno@gmail.com

Introduction

The environmental nutrients available to honey bees are essential to their development and survival. Pollen is the main source of protein for honey bees, and its quality and digestibility are important factors for bee health. To better understand the effects of a pollen diet on honey bees, we tested fourteen pollen mixtures from a natural environment on queenless adult and larval health.

Materials and Methods



Results and Discussion

Pollen diet analysis

Pollen diet for feeding adults and larvae.

	Diet	Most frequent pollen (%)	Protein percentage
Adults	Mix 1	Asteraceae (5 types) - 88.4	13.3
	Mix 2	Myrtaceae (3 types) – 54.3 Asteraceae (4 types) – 21.2	15.9
	Mix 3	Myrtaceae (3 types) – 45.0 Asteraceae (5 types) - 24.5	12.2
	Mix 4	Myrtaceae (2 types) – 44.2 Asteraceae (3 types) – 34.6	18.1
	Mix 5	Asteraceae (3 types) - 39.8 Fabaceae - 27.8 Cyperaceae - 27.0	8.4
	Mix 6	Moraceae – 67.3 Asteraceae (2 types)- 25.0	15.9
	Mix 7	Asteraceae (5 types)- 77.5	10.7
	Mix 8	Asteraceae (3 types) - 55.8 Fabaceae - 28.0	17.7
Larvae	Mix 9	Asteraceae (5 types) - 66.2 Cyperaceae (2 types) – 17.1	13.1
	Mix 10	Myrtaceae (2 types) - 43.6 Asteraceae (5 types)- 41.9	16.2
	Mix 11	Asteraceae (2 types) - 84.5	13.8
	Mix 12	Moraceae - 72.0 Malpighiaceae - 14.4	16.2
	Mix 13	Myrtaceae - 51.9 Asteraceae (4 types)- 42.1 Malpighiaceae - 3.9 Poaceae – 1.5 Lamiaceae - 0.4	15
	Mix 14	Cyperaceae - 96.4	12.6

Most frequent pollen types

1- Myrtaceae, 2- Cyperaceae, 3- Asteraceae

Results and Discussion

Adults

In adult queenless workers, mixtures that contain mainly Asteraceae pollen (mix 1, 5, 7 and 8) enhanced mortality, whereas bees fed a diet with mainly Myrtaceae (mix 2 and 4) and Moraceae (mix 6) exhibited higher survival rates, which suggests that these latter pollen types offer better nutrition quality and assimilation to the bees (Fig. 1). All pollen diets promoted ovary activation (Fig. 2), but the percentage of ovary activation was not related to the Vitellogenin and Hexamerin levels in the hemolymph (Fig. 3), which suggests that ovary activation may also depend on other nutrients.

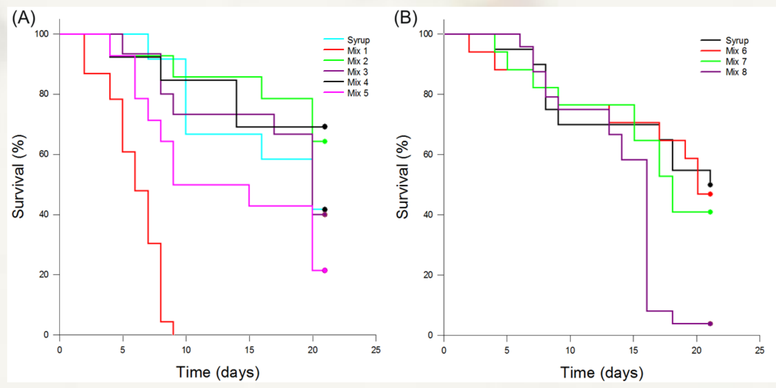
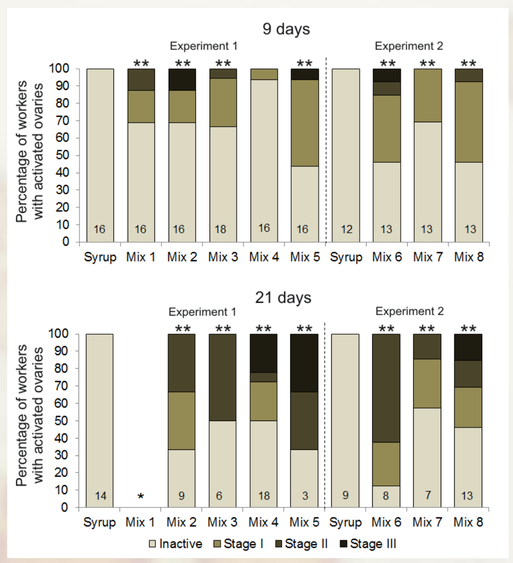


Figure 1- Effects of pollen mixtures on adult survival. Caged worker bees were fed syrup or one of the eight diet with pollen mixtures (mix 1 to 8) over 21 days. Two independent experiments were conducted: experiment 1 (A) with pollen mixtures 1 to 5 and experiment 2 (B) with pollen mixtures 6 to 8.



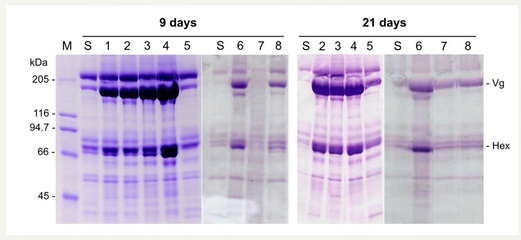


Figure 3- Effects of pollen mixtures on adult storage protein levels. Vg and Hex protein expression in the hemolymph of caged adults fed syrup or one of the pollen mixtures (mix 1 to 5 in Experiment 1 and mix 6 to 8 in Experiment 2) after 9 and 21 days of treatment.

Figure 2- Effects of pollen mixtures on ovary activation. Percentage of workers with inactive or active ovaries (Stage I, II and III) in queenless bees fed syrup or pollen mixtures (1 to 8) after 9 and 21 days of treatment. ** indicates that the percentage of bees with activated ovaries was significantly different compared with the Syrup group (χ^2 test; $p < 0.05$).

Larvae

The larvae did not show the clear changes that were observed in adults. Nonetheless, greater mortality and development delays were observed in larvae fed Asteraceae pollen -mix 11- (Fig. 3), whereas Cyperaceae -mix 14 - pollen was most appropriate for larval development (Tab. 1).

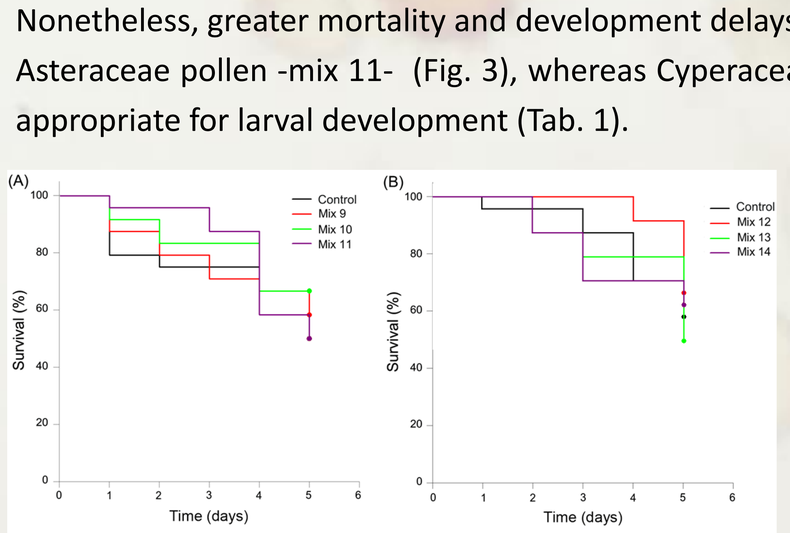


Figure 5- Effects of pollen mixtures on larva survival. Larvae were fed one of the six diets with a pollen mixture (mix 9 to 14) or the control diet over five days. Two independent experiments were conducted: experiment 1 (A) with the pollen mixtures 9, 10 and 11 and experiment 2 (B) with the pollen mixtures 12, 13 and 14.

Table 1- Weight and development of larvae fed a control diet or a diet with a pollen mixture (mix 9 to 14) in two independent experiments.

	Diet	Weight (mg)	Percentage of larvae with silk threads
Experiment 1	Control- no pollen	84.7±43.4	6.2%
	Mix 9	82.7±30.9	14.3%
	Mix 10	105.9±27.1	12.5%
	Mix 11	81.8±28.0	0%
Experiment 2	Control- no pollen	107.0±26.9	21.4%
	Mix 12	100.6±11.1	31.2%
	Mix 13	93.1±18.3*	25%
	Mix 14	100.9±11.7	40%

*indicates significant difference compared to control (Kruskall-Wallis-Dunn´s; p<0.05).