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SHORT NOTE

A Short Note on an Artisanal Incubator for Fermentation of *Apis mellifera* Artificial Diets

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Abstract
Considering the importance of offering food supplementation to the swarms during dearth periods, we developed in this project an artisanal incubator for fermentation of supplementary protein diets for *Apis mellifera* bees, obtaining a fresh, nutritious and palatable product, made on the property, thus facilitating access to the beekeeper to this resource.

With the growing need for food supplementation of swarms, especially in periods of reduced food supply in the wild, it is important to provide technological resources directly to producers, so that they can produce on their property the food that bees need. Research reports the importance of nutritional supplementation, especially protein, when pollen sources in nature suffer significant reductions, colonies reduce their productivity due to their weakening (Saffari et al., 2010; Morais et al., 2013; Paiva et al., 2019). However, the fermentation of this food becomes a fundamental factor in the animal's acceptance and consumption, since this microbiological process makes the food closer to the beebread: more palatable and attractive (Ellis & Hayes Jr, 2009; Li et al., 2012).

For the fermentation process to occur satisfactorily, the control of factors such as temperature guarantee the performance of the fermenting microorganisms (especially of the genus *Lactobacillus* and *Pediococcus*) that find in the range of 27º to 32°C the ideal point for the fermentation of sugars (sucrose) present in the food, converting them into lactic acid (Kristensen et a.l, 2010; Kung et al., 2011). This process reduces the pH of the food to 3.8, conserving its nutrients and preventing the attack of spoilage organisms, especially bacteria of the genus *Clostridium*, capable of consuming the amino acids of the food, reducing its palatability and nutritional value (Shao et al., 2002; Schröder et al., 2013; Strauber et al., 2016). Thus, the food preserves its desirable characteristics, being consumed and used by the swarms, strengthening them and improving their productive performance, even in periods of reduced floral resources (Paiva et al., 2016; Paiva et al., 2019).

The availability of a simple and inexpensive equipment such as incubator allows the producer to ferment the amount of food needed and store it in perfect condition until it is used by

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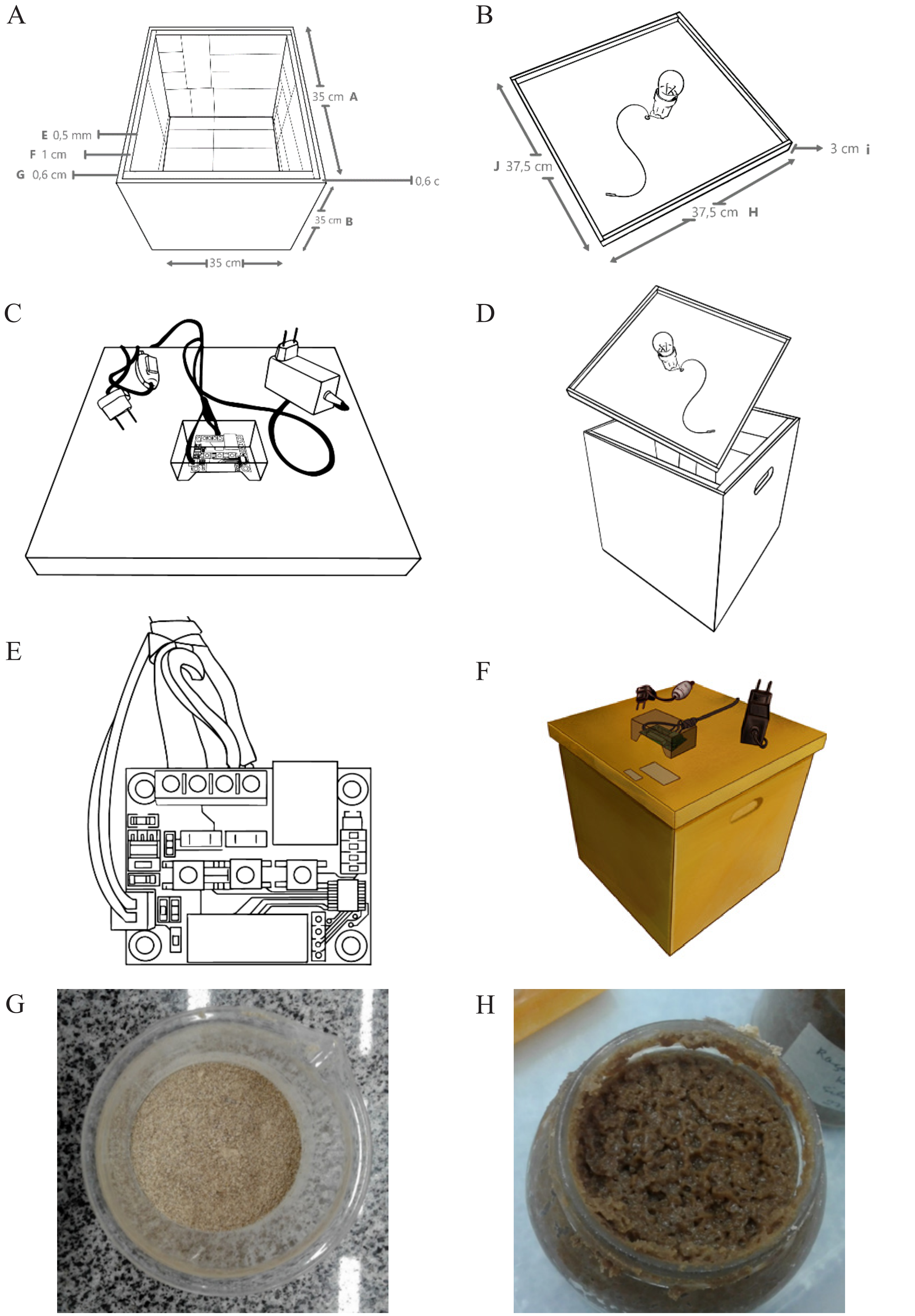

Fig 1. Details of the constitution of the artisanal incubator: A. Styrofoam and polyethylene lined box; B. cover with socket and lamp; C. thermostat and socket; D. Inner face of box and lid; E. digital thermostat; F. ready incubator; G. diet before fermentation and H. fermented diet.

the swarms. It can prevent nutrient loss and deterioration and offer to the bees a beneficial, fresh, efficient food as it would avoid stocking the product for very long periods, causing diet rejection(Carroll et al., 2017).According to this, the objective of this work was to create a facilitating artisanal incubator for beekeepers and stingless beekeepers interested in using fermented feed in their bee pasture, enabling the fermentation of bees feed and maintaining the temperature between 27º and 28º, reaching 30ºC. For this purpose, materials such as a styrofoam box (40x40x30cm) were used for the prototype. It was later replaced by a wooden box (35x35x35 cm) with a styrofoam coated lid and thermally insulated with carton packs lined with polyethylene and aluminum layers (used in milk or juice boxes), digital thermostat, porcelain socket; 15w light bulb; parallel wire; switch and socket (Figure 1). System operation occurs through the digital thermostat, which has a minimum and maximum temperature setting display with a relay on/off system, as well as a thermal sensor, which reads the ambient temperature, showing it on the display.

With set temperatures from 28°C minimum and 30°C maximum, the thermostat allows current to flow to the lamp when the sensor registers temperatures below the maximum. Thus, the lamp lights generating heat inside the box. When the sensor records a maximum temperature of 30°C, the system will no longer allow current to pass, so turning off the lamp.

After the incubator confection, four capped glass jars containing 100g of soybean meal, corn, sugarcane yeast, egg powder and vitamin-mineral premix feeds were inserted (Paiva et al., 2019). 40 ml of 50% sucrose solution and 0.5 mg of microbial inoculum (*Lactobacillus plantarum* and *Pediococcus sp*) were added to each flask to form a paste. These flasks were kept for 7 days, 14 and 21 days at 30ºC, with daily process monitoring until completion. The pH of the rations was measured on the 1st, on the 7th day, on the 14th and 21st day of the experiment, for follow-up.

After seven days, we observed that the rations fermented satisfactorily, presenting the formation of bubbles in the mass (due to the release of gases from microbial activity) and pH change (initial: 4.76; 7th day: 3.62; 14th day: 3.67 and 21st day, 3.77), the reduction of which is evidence of acid production by microorganisms from the fermentation of sugars. After the process was completed, 4g of feed were offered to 60 cage-confined worker bees, with 7 repetitions, for consumption of the fermented feed, which was well accepted by animals (Paiva et al., 2019).

Considering the context, we can conclude that the use of affordable and low cost materials has enabled the production of an efficient artisanal incubator, allowing the beekeeper to ferment and conserve supplementary protein food for bees, especially during periods of greatest pollen deficiency in nature. With this resource, the beekeeper can have an effective food available, minimizing losses and helping the swarms to maintain the beekeeping production.

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