

Effects of Liquid Protein Diets on Honeybee Colonies

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Liquid protein diets have been avoided because honey from colonies fed with these diets is usually contaminated with additives other than sugars. Since harvesting honey is usually the major purpose of beekeeping, investigation into liquid protein diets has been neglected. However, in modern beekeeping, particularly in Japan, an increasing proportion of colonies is being hired for pollination, especially in glasshouses. These colonies do not produce honey and suffer from lack of protein sources. The present study developed a liquid protein diet for colonies under such conditions.

Diet Concentration

Bees in small cages (3 cm × 5 cm × 8 cm, 20 bees/cage) were fed yeast extract (YE) of different concentrations in a 50% sucrose solution. Higher concentrations caused higher mortality. There were no significant differences among groups fed 0–2.0% of YE. When the diets in choice experiments were placed in a colony as well as with caged bees, consumption of the diet was the same for the control as for YE concentrations under 2.0%.

Protein Sources

Consumption of eight types of soluble protein material (2.0 % in 50 % sucrose solution) was tested on bees in small cages. Peptone and yeast extract had highest consumption. Combining peptone and yeast extract in different ratios (2 % in total), the highest consumption was found in 2 % of peptone only. However, the combination of 1.5 % peptone and 0.5 % yeast extract was the most frequently chosen by bees in multi-choice tests.

Effect on Colonies in the Glasshouse

In order to test the liquid diet in practice, 2 % YE diet was fed to colonies in strawberry glasshouses. Colonies fed with the YE diet maintained egg-laying by queens and brood production during the period of pollen shortage whereas control colonies suffered decreased numbers of larvae due to cannibalism caused by malnutrition. Similarly, the 2 % protein diets (peptone or yeast extract) stimulated egg-laying and brood production of colonies confined inside a flight cage. The number of eggs laid and sealed

brood production were 13-21% and 58-70% higher in 2% protein diets.

Effects on Growing Colonies

In the spring season, the combined liquid diet (peptone 1.5% and yeast extract 0.5%: P+YL) and 2% YE were tested in outside colonies. Egg-laying and brood production were stimulated by the diets. Total sealed brood production in colonies fed P+YE was 28% greater than the control. The YE colonies showed a similar but lower effect on the stimulation of brood production.

Conclusion

In liquid form, concentration of protein source is best at 2% in 50% sugar syrup. Among protein source, peptone and yeast extract are preferred by honeybees. Peptone is almost pure protein whereas yeast extract contains vitamins and minerals that are nutritionally important. The combined diet of peptone and yeast extract (1.5% and 0.5%) was more effective than the diet with yeast extract alone. The recommended liquid protein diets are easy to prepare and feed. Practically, colonies hired for pollination or purposes other than honey harvesting can be fed this type of diet to prevent bees suffering from malnutrition.