Study of phagostimulatory effects of free amino acids in honey bees.

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Abstract

Honeybees are well known to engage in highly preferential selection of the plant species whose flower they exploit for harvesting nectar, pollen or both at the same time. These are known to readily discriminate within various plants, selecting or tending to neglect others (Dhingra and Jain, 1995). Pollen is of vital importance to honeybees as it is the major source of nitrogenous food. Pollen is the ultimate source of carbohydrates, proteins, lipids and amino acids to all the species of family *Apidae.* Honeybees being Polylectic in nature are attracted to a variety of flowers. There have been so far many attempts to discover differences in pollen nutrients from various species. In most pollen, carbohydrates and proteins constitute the major matter. The nutritive value of pollen however in different plant species varies considerably (Singh, 1996). Honeybees also exhibit differences in feeding preferences and survival when fed pollen of different plant species (Schmidt *et al,* 1995). A few plant species even do not attract honeybees inspite of fact these yield sufficient pollen (Dhingra and Jain, 1995). Certain plants in the vicinity of agriculture crop to be pollinated by bees may thus prove more attractive to the bees; as a result many targeted crop will appear neglected for pollination. There has been many such studies reporting the problem of plant competition or identifying non-crop plants competing with beneficial crop for visit by pollen collecting honeybees (Olsen *et al,* 1979). Despite the fact that honeybees feed up on specific or a variety of pollen as food, there has been much been much difficulty in finding suitable substitute for pollen. Poor acceptability of pollen substituent may result in part due to lack of proper nutrients or the phagostimulants. Inspite of the fact that many reports are available on pollen composition of various bee preferred plant hosts as well as the bee collected pollens, information on what makes pollen most attractive or what pollen component particularly the amino acids contributes to pollen collection in honeybees is still obscure. Robinson and Nation (1968) concluded that pollen had a phagostimulatory effect on adult worker bees and suggested the presence of neutral lipids or free amino acids. Schmalzel (1980) has hypothesized that amino acids in pollen may act as phagostimulant alone or in concerned with the other substances for recoganization and pollen by *Apis.* Among the local flora, contain oil seed crops as toria (*Brassica campestris L.),* Indian mustard (*Brassica juncea L.*), sunflower (*Helianthus annus L*.) and some vegetable crops like radish (*R.sativus*.), onion (*Allium cepa* L.) etc. are of great importance to apiculturists. These crops exhibit differential attractivility for pollen collection to honeybees (Usha and Jain, 1996). It thus becomes imperative to make a qualitative analysis of the phagostimulatory effects of some of major pollen components of these hosts. This study was thus aimed with the primary objective to analyze response repertoire of different bee species towards pollen amino acids and their impact upon feeding bees on sugars.

Materials and Methods

In order to determine relative efficiency of major amino acids in pollen feeding 5 uM stock solution of 14 major amino acid (glycine , leucyine,isoleucine, valine, phenylalanine, tyrosine, cystine, methionine, proline, lysine, arginine, histidine, aspartic acid and glutamic acid) were prepared in 10 per cent ethanol .0.5 ml of stock solutions was mixed in 5ml of 40 per cent sucrose solution. Petridishes containing above solutions were covered with metallic net piece, weighed and kept in feeding cage. Twenty young bees were released in each cage and cages were placed in a BOD incubator at 1^0 C for 72 h. The weight of petridishes recorded thrice, after every 24 h of their feeding. Sucrose solution alone was used as control.

RESULTS

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Percent feeding was calculated thrice after every 24 h. Data given in clearly showed that after 24 h of their feeding, highest percent feeding for proline , followed by glycine and arginine and least per cent feeding was for histidine and leucine. Feeding at the end of 48 h was highest of glycine, followed by proline . After 72 h of their feeding, highest per cent feeding was again noticed for proline, followed by glycine and aspartic acid. Least feeding was of histidine and leucine. Data further evidenced that amino acids mixed with sucrose solution were preferred more to sucrose solution alone.

Responses of pure sugars

Present study comprising three *apis* species, exhibit a clear difference in their flabellar responses to sugars. *A.mellifera, A.florea, and A.dorsata* workers showed responses of highest magnitude to sucrose at 50 per cent concentration. Responses repertoire with glucose was of much lower order in all the three *Apis* species. There was an evident for sucrose to be most stimulatory in general to all the three species, followed by fructose and glucose in decreasing order of their effectiveness.

DISCUSSION

Honeybee nutrition is of interest in the context of study of their behavior, ecology, evolution as well as their practical management for honey production and crop pollination. Nutritionally, all nitrogen during the early adult life of a worker bee is derived from pollen proteins. Hrassingg and Crailsheim (1998) reported that pollen consumption is also positively correlated with Hypopharyngeal gland development. Bees fed pollen free diet are unable to produce even venom (Kropacova *et. al*, 1968). There was an evident for sucrose to be most stimulatory in general to all the three species, followed by fructose and glucose in decreasing order of their effectiveness. The feeding process of all the insects infact consists of a sequence of activities that preceed the actual intake of food. These activities are responses to the stimulation effects of certain diffusible substances in the food or the sources. Such substances include attractants, causing insect orientation towards food and phagostimulants that elicit feeding. In this study *A.mellifera* workers have been observed preferring sucrose solution mixed with amino acid more than the sucrose solution alone.Baker and Baker(1977) noted that amino acid could contribute towards the taste of nector, help a forager to maintained flower specificity

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