Differences In Taste Responses To Sugars By Different Age Group In *Apis Mellifera*

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Abstract

Electrophysiological responses obtained for cumulative gustatory responses to sugars were compared as function of age of a worker honeybee for *A.mellifera,* in local climate. The tests involved only the major naturally occurring nector sugars , such as sucrose, glucose and fructose. Response profiles for each sugar varied considerably within age groups of *A.mellifera* species . *A.mellifera* workers in their honey processing phase responded almost equally to sucrose and fructose , whereas to those either in their early nursing phase or commenced foraging , fructose was most stimulative sugar. Bees engaged in comb building were least responsive to sucrose.

Key words : *Apis mellifera,*gustatory,pollen,honey,glucose,fructose,bee,activity,comb

Gustatory receptors play an important role in assessing quality of food in insects, particularly in honeybees for nectar collection , feeding or honey storage. Over the past two decades, there have been many such attempts to hypothesize honeybee preferences for various nectar sugar compnents and their role in determining host preferences . Majority of the workers established superiority of sucrose over glucose and fructose. Electrophysiological studies also demonstrated a crossover in responses to glucose and fructose 1.4 *M*, indicating glucose inferiority at lower molarity. These hypotheses however, do not fit to many field observations as the bees also preferred nectars dominated with sugars other than sucrose. Honeybees in fact illustrate polyethism i.e. age dependent variations in their hive duties , development of glands vis-à-vis their nutritional requirements as per duty. In most of the earlier studies the test bees were mostly the workers taken at postocclusion stage and their further pre-conditioning to sucrose feeding may have been responsible for simultaneous conditioning of their high responses to sucrose. Earlier studies also manifested substantial changes in the taste profile of honeybees foragers with the kind of nectar to which the bees were conditioned in field. Since,age of workers bees in an important aspect in bee's nutrition , this study was thus aimed to elucidate primary age dependent variations in taste responses in adult worker bees to sugers in four different activity phases of *Apis mellifera* species.

Results and Discussion

Present study comprising four distinct age groups of three *mellifera* species, exhibited a clear difference in their flabellar responses to sucrose in little highest order only in their honey processing stage. Glucose effects in general were of next higher order with all the worker activity stages, except the nursing bees equally highest to both the monosaccharides in early and late phases of their age .Response repertoire with sucrose was of much lower order in general, except to the honey processing phase. There was an evidence for fructose to be most stimulatory in general to all the three species, followed by glucose and sucrose in decreasing order of their effectiveness. This contradicts earlier findings which put stimulation order as sucrose > fructose> glucose

to *A. Mellifera* workers in general. Jain recorded this order of sugar preponderance only at 0.1*M* concentration of these sugars with a variety of other bees species. Sucrose predominancy in honeybee taste was further contradicted by Jain by relating sugar responsiveness with the conditioning of worker bees to the type of nectar to which they were associated in fields. Poor response manifestation in the study to sucrose in nursing and wax producing bees further confirm the hypothesis. The worker bees in these activity phases encounter chiefly the monosaccharides in their honey diet. High sucrose responses in honey processing bees also evidence the impact of their interaction with sucrose in freshly collected nectar for processing honey. Differences in response to the same stimulate are not uncommon among insects of same or different species. Functional classification or response modality of different sensillae in fact is a function of the number of neurons present in each sensilla. The coding of these gustatory information by the state may occur in two ways. On one hand, all the setae may be functionally identical resulting in only the multiplicity of atterent information to improve the signal to noise ratio of the incoming message. On the other hand, functional differences may exist among various setae. Gustatory information transmitted in the study was the result of summed responses of the group of taste hairs present on the flabellar tip of worker bee. Honeybees being polyethic, are also likely to show anatomical and physiological changes in their receptors as it happen with the hypopharyngeal glands. Same has been found true in solitarious and gregarious phases of the locusts. The different state of sensillae could thus be a source of variation in total taste responsiveness of a bee flabellar at different age or the species. Other studies conducted earlier on bees or below flies also confirm differences in responsiveness between different morphological group of labellar taste hairs for sugars. Agren stated intergenic differences in flagellar sensillae and setae of *Colletes* and *Prosopis* bees. Jain and Puri also documented

TABLE-1-Response magnitude (mV) of gustatory receptors of Apis mellifera to three sugars with respect to stage of their activity

Interspecific and intergeneric differences in the viscosity of honeysac contents of various *Apis* and non-*Apis* species visiting alfalfa. The significance of these variations appear to be better explained in terms of partition coefficient ionic mobility hypothesis of Beidler. It stipulated the involvement of physical factors(Af, change in free energy) relating the magnitude of response directly to the numbers of ions or molecules causing membrane depolarization, until an optimum is reached. Species specific decline in response at higher concentration could possibly be assigned to dominancy of rejection response of their water receptors.

The significance of elctrophysiological studies has generally rested upon the view that chemoreceptive setae trigger a variety of behaviours including feeding behavior. Such studies on the function of individual chemoreceptive cells though are fundamentally important to characterize a setae, but taste as a modality appear better displayed only by the summed response profile of all receptors involved. Present as well as earlier results clearly suggest the need for more experimental comparisons of:(1) individual receptors response, and(2) whole flabellar neural input to determine the age dependent or the host dependent taste profile of a bee to ascertain their food preferences or host specificity for nectar or pollen

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