



Electrophysiological studies for gustatory responses to pollen lipids in honey bees

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Abstract

The feeding process in the insects consists of a sequence of activities that proceed the actual intake of food. These activities are responses to 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. Later assume particular significance in establishing food preferences or in identifying various food supplements for insects and other animals. Hrassingg and crailsheim (1998) reported that pollen consumption is also positively correlated with hypo pharyngeal gland development. Pollen is the principle and vital source of nutrients for bee growth, reproduction and rearing of brood. Nutritionally, all nitrogen during early adult life of a worker bee is derived from pollen proteins. Bees fed pollen free diet are unable to produce even venom (Kropacova *et al.*, 1968).

Free amino acids essentially contribute to both animal nutrition as well as act as phagostimulants in eliciting feeding. The fatty acid composition of pollen varies, not only with the flower species (Standifer *et al.*,1970) but also with pollen storage condition (Vander Vorst *et al.*,1980)

Keywords:*A.mellifera*,*A.dorsata*, flabeller,gustatory condition,incubator,oleic acid, sugars.

Materials and Methods

Response records were obtain following stimulation of the flabeller gustatory receptors with different lipids extract concentrations in sugar, involving *A.mellifera* and *A.dorsata* honeybees .Bees were collected and were kept unfed in a BOD incubator at 20°C – 25°C. Records were obtained with isolated bee head preparation following the whole flabeller response tip recording technique of Jain (1994)using a polyrite high gain ultra low noise AC amplifier and a recorder (input impedance 20 mega ohms), manufactured by M/S Recorders , India.

Responses were recorded by means of a fine glass capillary electrode (I.D.>100micro meter) containing both the test dose and an Ag-AgCl recording electrode. The high and low frequency filters as well as the 50-cycle AC

noise filter were set into eliminate noise. Recorder's sensitive were adjusted and calibrated for 10 mv spikes. Pressing bee head, extended the proboscis and the pin also served as an indifferent electrode. Each chemical stimulation lasted for a fraction of a second and a time gap of one minute was maintained in between successive stimulations. The preparation yielding erratic responses were discarded. Differences in spike amplitude (mV) over control were taken as variations in the stimulating effect of a stimulant. The lipid extracts obtained from radish, toria and onion pollen pellets were used as stimulants.

Results

The flabello gustatory responses of two honey bee species namely *A.mellifera* , *A.dorsata* recorded electrophysiologically to pollen lipid extracts , involving three major plant hosts such as toria, radish and onion pollens . Maximum stimulation effects with radish pollen extracted in methanol in *Apis mellifera* (38.33mv) , exhibiting an increase of 577.21 per cent over the control and 445.45 per cent gain ethanol extract . A comparison of these responses with various other pollen extracts in methanol only , revealed superiority of radish pollen lipids in yielding highest response spikes over onion and toria pollen lipids .

With *A.dorsata* bees the response file on stimulation with different pollen extract resembled all most to those with *A.mellifera* bees except with toria pollen lipids. In later case the stimulation gain over the controls was at maximum with lipid extracts obtained in chloroform : ethanol mixture and the next stimulation effects were evident both with chloroform and methanol extracts. Present study , showed maximum stimulatory effects of radish extract followed by onion and toria extracts. The radish lipids yielded 577.21 per cent high responses over the control in *A.mellifera* bees , whereas toria lipids were able to enhance effect by 153.33 per cent. Onion extract caused 455.43 per cent high stimulation. Same order of stimulation effect was evident for *A.dorsata* bees, indicating thus radish pollen as the superior most in phagostimulation over the other pollen host studied. Flabellogustatory receptor responses obtained with pure fatty acids such as oleic, linoleic and myristic acids in sugar solution although exhibited a dose dependent increase in response inhibition, maximum inhibition occurred with myristic acid, followed by linoleic and oleic acid at their 10 per cent test concentration.

Present study evidenced the possibilities of the presence of oleic acid along with the poor total nutritional value as a deterrent to bees.

Discussion

Like a phytophagus insect honeybees are able to discriminate flower type, which are or are not acceptable to visit for food collection. A common type of classification of various bee type include polylecty and oligolecty depending upon whether a bee species prefers to visit a variety of genera or species, or it remain restricted to only few related plant genera or species. A true monlecty in the sense that feeding is restricted to one plant species only also occur in bees. The role of lipids in pollen is attributed both in terms of as an attractive odour and nutrients inducing orientation towards the host. The simultaneous presence of phagostimulants and absence of deterrents further affect continuous feeding (Lindstedt, 1971). Schoonhoven (1968) suggested presence of optional combination and concentration of nutrients as a measure of food acceptability with regard to *Bombyx mori*.

A major difficulty to the apiculturist in finding a suitable substitute for pollen is possibly a result of lack of knowledge about specific attractants or phagostimulants.

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