Quantitative analysis of free amino acids in bee preferred pollens.

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Abstract

Pollen contain all the essential nutrients required for growth and development of honeybees. In most pollen carbohydrates and proteins constitute the major dry matter. Crailsheim (1991) has reported that the adult worker honeybees feed upon pollen produce royal jelly for the queen bees, the brood, the drone and the adult workers of different age. Various workers have emphasized upon the importance of amino acids in insects both in feeding and their development (Doull and Standifer,1970;Fields *et al*.,1998).Amino acids are also reported to act as phagostimulants to certain insects (Allosp,1992).Amino acids are important constituents of pollen, which are said to determine the nutritive value pollens for honeybees. Serra Bonvehl *et al.,*(1986) reported the mean contents of free amino acid as 37.25mg/g. McCaughey *et al.*, (1980)reported that glutamic acid, aspartic acid and proline as the dominant amino acid.

Key Words: *Apis mellifera ,Apis dorsata,Apis florea*, *B.campestris, R. sativus*, *B.juncea ,H.annus , A.cepa*

Material and Methods

Free amino acid composition in fresh pollen of five crops viz. *B.campestris* var. toria, *R. sativus*, *B.juncea* var. yellow sarson, *H.annus , A.cepa* and pollen pellets collected by three *Apis* species foraging on these crops were analyzed. The pollen pellets weighting 100 mg were separately homogenized in 2 ml of 80 per cent ethanol (v/v) using a pinch of acid wash sand as an abrasive material. The homogenate was made to 10 ml by adding 80 per cent ethanol. The extract was used for estimation of free amino acids following the methods of Yemm and Cocking (1995), using citrate buffer and 1.0 ml of KCN-acetone-ninhydrin.

Results and Discussion

Quantitatiive analysis of free amino acid of pollen showed a range of 0.300-0.503 of amino acids in various pollen sources , collected in the form of bee pellets. It further showed presence of relatively lesser amount of free amino acid in bee preferred pollen such as B.*campestris* var. toria, *R.sativus* and B. *juncea* var. yellow sarson. Highest proportion of amino acid was in *H.annus* pollen. Comparison of amino acids in freshly available and bee collected pollen from *H.annus* further evidenced that proportion of free amino acids were reduced considerably in bee collected pollen pellets. Same was true with other hosts, but the proportion of reduction was much higher, possibly due to the presence of more amino acid in bee pollen pellets can also attributed to that of mixing of bee saliva and nectar in the pollen packing as pellets in to corbiculum, thus in reducing amino acid by weight in a pollen pellet. Various others workers mentioned pollen amino acids in the range between 0.66-0.77 per cent (Bell *et al*.,1983) and 0.84-1.78 per cent in garden plants (Dhingra and Jain 1995). Serra Bonevehl *et al.,*(1986) reported that mean content of free amino acids was 37.25mg / g. Pollen collected by different *Apis* species from the same crop however does not show much variation in the amino acid composition . Pollen

collected by bees from *B.campestris* var. toria and *R.sativus* that pollen pellets of *A.florea* contained lesser contents of amino acids (0.308mg and 0.370mg, respectively) than pollen pellets of *A.dorsata* (0.353mg and 0.404 mg, respectively). Pollen pellets of *A.mellifera* were found to contain further more amino acid contents (0.381mg) than *A. dorsata* (0.300mg) on *B. campestris* var. yellow sarson. General comparison of amino acid content in bee collected pollen revealed their highest proportion *in A. cepa* pellets of *A.dorsata* (0.503mg) and lowest in the pollen collected *by A.dorsata* from *B.campestris* var. yellow sarson (0.300mg). Free amino acid composition in fresh pollen of five crops viz. *B.campestris* var. toria, *R.sativus, B.campestris* var. yellow sarson, *H.annus*, *A.cepa* and pollen pellets collected by *three Apis* species foraging on these crops were analysed. Data showed wide variations in amino acids quality with in different crops , as well as among the bee collected pollen of same crop . On an average fresh pollen contained 1.100 mg of amino acid per 100 mg of pollen mass. Pollen pellets of *A.dorsata* contained 0.390 mg of amino acid and in other bee species it ranged in between 0.38mg to 0.418 mg per100 mg for various pollen hosts.

Summary:

Comparison of amino acids in freshly available and bee collected pollen from *H.annus* further evidenced that proportion of free amino acids were reduced considerably in bee collected pollen pellets. Same was true with other hosts, but the proportion of reduction was much higher, possibly due to the presence of more amino acid in bee pollen pellets can also attributed to that of mixing of bee saliva and nectar in the pollen packing as pellets in to corbiculum, thus in reducing amino acid by weight in a pollen pellet. Serra Bonevehl *et al.,*(1986) reported that mean content of free amino acids was 37.25mg / g. Pollen collected by different *Apis* species from the same crop however does not show much variation in the amino acid composition

References:

Allospp, P.G.(1992) Sugars ,amino acid and as corbic acid as phagosimulant for

larvae of *Antitrogus parvulus and lepidiota negotoria (*Coleoptera Scarabaceidae): *J.Econ. Entamol* 85 (1): 106-111.

Basualdo,M.,Bedascarrasbure,E.,Dejong,D.(2000)Africanized honeybees *(Hymenpotera:Apiadae)* have a greater fidelity to sunflower than *European bees.J.Econ.Entamol*.93(2):304-307.

Chen,P.S.(1966) in *Advances in Insect physiology* ,Vol 3,J.W.L Beament, J.E Treherne and V.B Wigglework (eds.) New York: Academic prees.p.56.

Crailsheim ,K, Stolbrg,E (1989) Influence of diet , age and colony condition upon intestinal proteolytic activity and size of hypopharyngeal glands in the honeybee *(Apis mellifera L.) J.Insect Physiol*.35 (8): 595-602.

Crailsheim ,K.(1991) Interadult feeding of jelly in honeybees *(Apis mellifera L.)colonies .J.Comp Physiol* 161B: 681-689.

Dhingra,H.R and Jain, K.L.(1995) in Pollination biology: Environmental factors and pollination R.C.(ed.). Hisar:Rajendera Scientific publisher. P.56-57.

Doull,K.M Standifier ,L.N(1970) Feeding responses of honeybees in their hive.*J.Apic* .Res. 9(3):129-132.

Fields,P.G., Lessard ,f.F., Lavenseal , L.,Febvary ,G.,peypelut,L.,Bonnal, G.(1998) The effect of cold acclimation and deacclimation on cold tolerance,trehalose and free amino acids levels in *Sitophilus* granaries and cryptolestes ferruginerrs (Coleoptera).*J.Insect Physio*l.44:955-965.

Florkin,M.and Jeuniaus,C.H.(1964) in Handbooks Series in Nutrition and food, vol.3,M.Rocksfein(ed.). New York: Academic Press.p.109.

Free,J.B.(1993) Insect pollination of crop plants,2nd ed.London:Academic .p.540.

Gilliam,M.,McCaughey,W.F,(1972) Total amino acid in developing worker honey bee *(Apis mellifera L.) Experientia* .28:142-143.

Kaufled ,N.M.(1980) chemical analysis of Louisiana pollen and colony conditions during a year. *Apidologie*.11:47-55.

Leu,P.F.,Dixon,S.E(1967) pollen lipids attractive to honey bees.*Can.J.Zool.*45:595.

Lotti,C.Anelli, G.(1970) Free amino acid in pollen, Gliamino aidiliberi dei pollini. *Industrie Agrarie*.8:239-245.

McCaughey,W.F.,Gillia,M.,Standifer ,L.N.(1980) Amino acids and protein adequancy for honey bees of pollen from desert plants and other floral sources.*Apidologie* 11:75-86.

Miles, P.W.(1969) Incorporation and metabolism of cysteine in the haemolymph and saliva of a plant bug. *Austral.J.Biol.Sci* 22:1272.

Serra Bonvehl,J.,Gonell,G.J.,Gomez, p.A.(1986) Study of the composition and Physio-chemical characteristic of bee collected pollen.*Alimentaria* 23(176):63-67.