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NIACIN METABOLISM IN A SPICE *(CORIANDRUM SATIVUM)* AND A CONDIMENT *(TRIGONELLA FOENUM-GRAECUM)*

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Seeds of coriander *(Coriandrum sativum)* and fenugreek *(Trigonella foenum-graecum)* were sown in garden plots and the free amino acids - aspartic acid, tryptophan and niacin content was estimated at vegetative and reproductive stages. Aspartic acid and tryptophan decreased from vegetative to reproductive stages in *Coriandrum* and *Trigonella*. Niacin was present in both vegetative and reproductive parts of *Trigonella* but absent in *Coriandrum*. Reduction in trypotophan content was recorded in roots from vegetative to reproductive stages indicating its contribution to the formation of niacin.

Keywords: Aspartic acid; Condiment; Spice; Tryptophan.

Introduction

There is evidence to suggest that tryptophan may serve as a niacin precursor in green leaves.[1] Nicotinic acid is formed in higher plants and some bacteria from glycerol and aspartic acid also.[2] The present study has been designed to understand the metabolic relationships between niacin, aspartic acid, tryptophan and the possible precursor product relations in two different plants viz., a spice and a condiment which are rich in vitamins and minerals. Attempts were also made to correlate the relative concentrations in different parts of the plants in different stages to have an idea about the biogenic pathways of the said compounds.

Materials and Methods

Seeds of coriander *(Coriandrum sativum)* and fenugreek *(Trigonella foenum)* local varieties were sown in garden plots. The plant parts - roots, stems and leaves during vegetative stage and roots, stems, leaves, pods and seeds during reproductive stage were analysed. The free amino acids, aspartic acid and tryptophan were estimated following the method of Chowdhury *et al.*[3] The estimation of niacin was done by means of a colour reaction with cynogen bromide following the procedure of Harris and Raymond.[4]

Results and Discussion

A decreasing trend is noticed for aspartic acid and tryptophan in stem of Coriand*rum* from vegetative to reproductive stage. This is also noticed in the leaf of *Trigonella*. Aspartic acid and tryptophan decreased from vegetative to reproductive stage in almost all parts of *Trigonella* (Table 2). Tryptophan completely disappeared from the stem during reproductive stage. Niacin is observed in all parts of *Trigonella* both during vegetative and reproductive stages (Table 1). When the quantitative changes of aspartic acid and niacin were viewed from the angle of precursor - product relationship the

following points were revealed. There is a good relation in the root but no such relations exists in stem and leaf of *Trigonella*. There is a fall in the content of aspartic acid in root from vegetative to reproductive stage indicating its contribution to the formation of niacin (Table 2). The precursors of quinolinic acid are dihyroxyacetone phosphate and aspartic acid rather than glycerol-3-phosphate and aspartic acid.[5] In the present study there is a corresponding increase of niacin content in the root from vegetative to reproductive stage as envisaged. There is no such precursor product relationship between tryptophan and niacin either in the stem or leaf of *Trigonella*. The decrease of aspartic acid from vegetative to reproductive stage is followed by consequent increase of niacin as expected. However, there is no such relationship either in the stem or leaf of *Trigonella* (Table 1 & 2). There is a view that light dependent niacin synthesis may not be from tryptophan [6].In the present study aspartic acid and tryptophan of pod are comparatively more than seed indicating their contribution to niacin production in seed (Table 2). Thus there is a positive precursor-product relationship between niacin and tryptophan on the one hand and niacin and aspartic acid on the other. The interpretation of such a data appears to be best with difficulties at the first glance. A careful thought provides an unexpected insight into more than one pathway of biogensis of niacin in the same organism. Orchiods may synthesize niacin by a pathway similar to that of certain bacteria, fungi, birds and mammals, tryptophan-kynurenine-3 hydroxyanthranilic acid-quinolinic acid-niacin.[7] In the present study it may be that both pathways are operative in the root of *Trigonella* for the synthesis of niacin. However, to establish the absolute truth it is necessary to conduct detailed experiments preferably with labelled compounds including glycerol.

With regard to *Coriandrum* niacin is present in detectable quantities only in leaf and stem during vegetative stage and in the leaf during reproductive stage indicating some basic difference in the metabolism compared to *Trigonella*. The increase in niacin content in the root of *Trigonella* during reproductive stage may be partly due to downward translocation from leaf and the total excess niacin may be transformed into trigonelline. It may be suggested that the metabolic pressure built up by downward translocation of niacin in root is relieved by starting off a secondary metabolic pathway, channeling niacin by its conversion to trigonelline.

Table 1. Free niacin in *Trigonella* and *Coriandrum* in different organs during vegetative and reproductive phases. (Values are the means of three replicates)

Plant part and stage of development	Niacin content (mg/g dry wt.)
Trigonella	
Vegetative	
Root	2.525 ± 0.116
Stem	1.009 ± 0.050
Leaf	2.737 ± 0.112
Reproductive	
Root	4.159 ± 0.15
Stem	0.958 ± 0.04
Leaf	0.361± 0.02
Pod	0.872±0.03
Seed	4.262 ± 0.12
Coriandrum	
Vegetative	
Root	-
Stem	3.232 ± 0.11
Leaf	7.966 ± 0.31
Reproductive	
Root	-
Stem	-
Leaf	3.999 ± 0.16
Pod	-
Seed	-

Table 2. Changes in amino acids (mg/g fresh wt.) in *Trigonella* and *Coriandrum* during vegetative and reproductive stages. (Values are the means of three replicates)

Stage and part	Aspartic acid	Tryptophan
Trigonella		
Vegetative stage		
Root	62	57
Stem	65	80
Leaf	165	80
Reproductive stage		
Root	48	63
Stem	28	-
Leaf	58	40
Pod	88	205
Seed	*60*	
Coriandrum		
Vegetative stage		
Root	15	8
Stem	37	38
Leaf	25	40
Reproductive stage		
Root	15	17
Stem	24	25
Leaf	31	68
Pod	19	12
Seed	22	14

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