

# A Preliminary Study on the Distribution pattern of Amino Acids in Kerala soils\*

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Peat, forest and alluvial soils of Kerala contain high amounts of organic matter and consequently, organic nitrogen. An appreciable quantity of the total organic nitrogen of the soil is reported to be proteinaceous in nature. An understanding of the amino acid make-up of the hydrolysates of soil organic matter will give an idea of the nature of proteinaceous matter in it. Since no attempt has been made so far to identify the amino acid make-up of the organic matter hydrolysates of the major types of Kerala soils, a preliminary study was undertaken to determine the amino-acid content of these soils.

nitrogen was in the form of **alpha-amino-nitrogen**. In India, Biswas and Das (1954) have isolated certain amino acids from black, red, alluvial, laterite and peat soils and found that the amino compounds formed on acid hydrolysis are practically similar in all soils. On the contrary, Singh and Bhandari (1963) observed marked differences in amino composition of different soils of Rajasthan and they attributed this to the nature of the nitrogenous complex in those soils. Krishnamoorthy (1966) found that an increase in amino acid numbers with an increase in organic matter content in Madras soils.

## Review of Literature

Isolation of amino acids by Suzuki (1908), Robinson (1911) and Kivekas (1939) has led to the recognition that soil organic nitrogen is mostly proteinaceous in nature. Later, Kojima (1947) and Bremner (1949) showed that about one-third of organic

## Materials and Methods

Six soil samples representing the six main soil groups of Kerala, namely, laterite and red, forest and hill, sandy, alluvial, peat and black soils were taken from selected places. Details of the soil samples are furnished in Table I.

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TABLE I  
Details regarding soil samples

Sl. No.	Locality	Soil type	PH	Organic matter %	Total nitrogen %
1	Thodupuzha	Laterite and red	5.5	3.79	0.117
2	Munnar	Forest and hill	4.5	16.04	0.361
3	Cranganore	Sandy	6.0	0.81	0.034
4	Kumarakom	Alluvial	4.7	10.43	0.182
5	Madathil Kayal	Peat	4.1	25.17	0.287
6	Ambattampathy (Chittoor)	Black	6.5	2.56	0.088

**Identification of amino-acids** was done by using the chromatographic technique followed by Bremner (1950). Details of the technique are as follows:

One hundred grams of soil were refluxed for 24 hours with 6 N hydrochloric acid for hydrolysing proteinaceous materials. The hydrolysed mixture was filtered and the filtrate was concentrated several times *in vacuo* to remove hydrochloric acid. The residue was dissolved in water and the solution was brought to pH 7.0 by adding dilute sodium hydroxide solution. Hydrogen chloride was passed through the filtrate and the sodium chloride removed. The filtrate was concentrated to a small volume *in vacuo* and desalted in a RSCO Electric Desalter. Again the filtrate was concentrated *in vacuo*. The residue was dissolved in alcohol and taken up for chromatographic separation and identification of amino acids.

The chromatogram was run first with *n*-butanol in one direction, and then with phenol at right angles to the first position.

The chromatogram was dried overnight, and sprayed with 0.1 per cent ninhydrin in acetone. It was dried and the colour was developed at 60°C for five minutes. The spots were identified referring to the Rf values of known amino acids.

### Results

The distribution patterns of amino acids in the six representative soils are given in Table II.

Altogether twelve amino acids representing almost all the common groups like, aliphatic, aromatic and heterocyclic ones were identified. Forest and peat soils showed the maximum number of amino acids, namely eight each in both cases. The minimum number of amino acids, namely six each, were found in laterite, sandy and black soils.

Laterite soils showed the presence of six amino acids, namely glycine, alanine, aspartic acid, glutamic acid, phenylalanine, and tyrosine. Forest soils contained asparagine and proline, in addition to all six amino acids found in laterite soil. In.

TABLE II

Amino acid distribution in representative soils

Si, No.	Amino acids	Laterite soil	Forest soil	Sandy soil	Alluvial soil	Peat soil	Black soil
<i>I Aliphatic Amino Acids</i>							
A.	Mono amino mono carboxylic acids						
	1. Glycine		+	+			
	2. Alanine			+		+	+
	3. Serine					+	—
B.	Sulphur containing amino acids						
	4. Cystine						
	5. Methionine						
C.	Mono amino dicarboxylic acids						
	6. Aspartic acid		+	+	+		
	7. Asparagine		+		+		
	8. Glutamic acid	+	+	+	+		+
D.	Basic amino acids						
	9. Histidine						+
<i>II. Aromatic Amino Acids</i>							
	10. Phenyl alanine	+	+	+			
	11. Tyrosine	+	+				
<i>III. Heterocyclic Amino Acids</i>							
	12. Proline		+				
	Total		8				

NOTE:- + Sign denotes the presence of amino acid  
 — Sign denotes the absence of amino acid

sandy soil all the six amino acids, except tyrosine and proline, occurring in forest soil were found. Black soil showed histidine in addition to the presence of all the five amino acids listed first for laterite soil. Alluvial soil contained seven amino acids, namely serine, cystine, aspartic acid, asparagine, glutamic acid, histidine and

phenylalanine. In addition to the first five amino acids given for alluvial soils, peat soil contained three more amino acids, namely alanine, methionine and tyrosine.

**Discussion**

The maximum number of amino acids was found in forest and peat soils. The

**increase** in **amino** acid numbers with an increase in organic matter content is in accordance with the findings of Krishnamoorthy (1966).

Another interesting observation in this regard is the presence of sulphur containing amino acids only in peat and alluvial soils. This may be attributed to the peculiar nature of organic matter found in these soils associated with water logged conditions. However, detailed study in this regard is **necessary**.

Apart from these differences stated above, there was not much striking differences in the distribution pattern of amino acids in the six different soils. In fact the similarities were more striking than their differences. This is in accordance with the findings of Biswas and Das (1954) in certain Indian soils.

A quantitative study of the amino acids identified is essential to determine their significance in the total organic nitrogen content in Kerala Soils.

#### Summary and Conclusions

Twelve different amino acids have been **identified** in the acid hydrolysates of organic matter from six soils representing all the major soil types of Kerala. Most of the amino acids identified were from the aliphatic group. The difference in distribution pattern of amino acids was not very striking in these different soil types having varying pH, organic matter content, total nitrogen and other environmental conditions. The maximum number of amino acids was found in soils having high organic matter. Detailed quantitative analysis of the amino acids identified is essential to study their significance in total organic nitrogen of these soils.

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