PIPECOLIC ACID AS AN INDICATOR OF DISTURBED AMINO ACID METABOLISM IN THE INFECTED RICE, POTATO AND TOBACCO PLANTS

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In the paper chromatographyc amino acid analysis of leaf extracts from *Piricularia*-infected rice an unknown substance was demonstrated by us (PÁLFI, 1964, 1965). This substance, after development with ninhydrine and fixation with copper nitrate, gave a blue colour instaed of a red one, characteristic for the amino acids. The unidentified compound was therefore named „blue substance". The appearance of this „blue substance" is always associated with a high concentration of glutamine, asparagine and free amino acids indicating a disturbed protein synthesis (PÁLFI, 1965; SEHGAL, 1964). In the course of the isolation of the „blue substance" the leaf extracts were inoculated with bacteria in order to remove the amino acids. None of the four species of bacteria used (*Sarcina lutea*, *E. coli* Olll, *Serratia marcescens*, *Bac. subtilis* ATCC 6633) absorbed the „blue substance" while they consumed 90 per cent of the amino acids hampering isolation of the „blue substance", after 5—7 days of incubation. This means that the „blue substance" is not toxic and not an amino acid-antagonist. Analysis of the samples of the culture medium inoculated with bacteria showed that the amino acid leucine, glutamine and asparagine were assimilated most intensively. After the amides valine, methionine, threonine, serine and aspartic acid were best consumed by the cultures.

After enrichment with the aid of bacteria the „blue substance" was identified as pipecolic acid. This rare amino acid was demonstrated by COULSON (1955). We ascertained that the piperidine ring in the pipecolic acid also gives blue ninhydrine-reaction. We demonstrated pipecolic acid also in potato, tobacco, paprika, soy bean, wheat and sorghum diseased with viruses or bacteria. It can be seen in Fig. 1 that pipecolic acid is present only in the leaves of the infected rice, potato and tobacco. It cannot be demonstrated in the leaves of the healthy control plants. Fig. 2 shows that pipecolic acid runs up to the highest R_f value in the second dimension. Pipecolic acid had been demonstrated in diseased plants (SEHGAL and BOONE, 1964) and in plants with P deficiency (FAM and PLESKOV, 1963), but its importance was not recognised. It follows from our data that pipecolic acid may be considered as an indicator of the

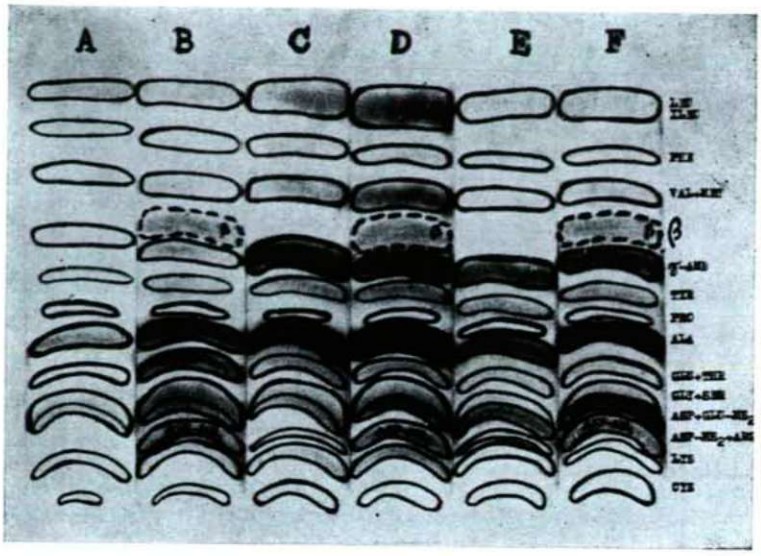

Fig. 1 Chromatograms of extracts from healthy and diseased plants. A = healthy rice; B = rice affected by *Piricularia oryzae;* C= healthy potato; D= potato affected by leaf roll virus; E= healthy tobacco; F= tobacco affected by mosaic virus. Butanol — acetic acid-water. β = blue spot, pipecolic acid.

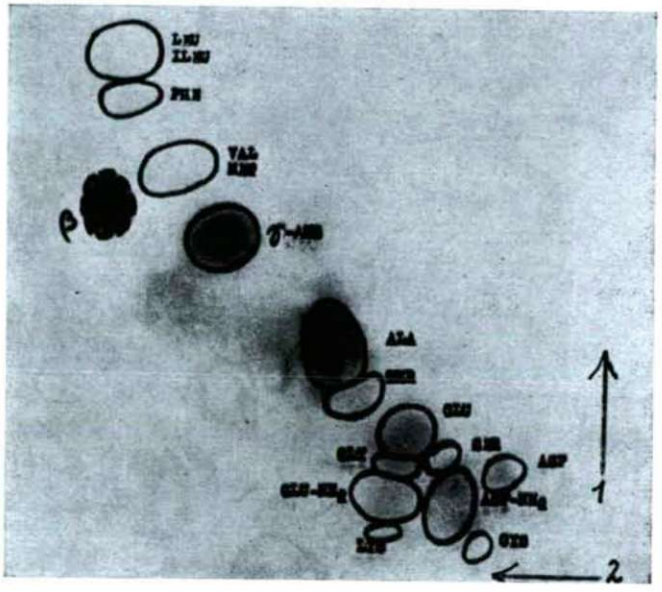

Fig. 2 Chromatogram of extract from mosaic virus infected tobacco. Butanol — acetic acid — water; Phenol — water. β = blue spot, pipecolic acid.

abnormal physiological condition of plants or of the disturbed amino acid metabolism. We have investigated the role of pipecolic acid for trhee years in rice plant. It was found that under conditions predisposing to disease or in case of artificial infection there is less pipecolic acid in the leaves of resistent sorts. Consequently, in plants growing under provoking conditions the determination of pipecolic acid contents may be used for the selection of resistant varieties (PÁLFI et al. 1966).

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