

Short Communication

Formation of Homoserine in Germinating Pea Seeds

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In this laboratory homoserine was recently¹ found for the first time in green plants. Growing peas contained appreciable amounts of free homoserine.

We have now investigated the appearance of homoserine in pea seeds more closely, and its formation during germination of the seeds, and have found the following:

1. Homoserine does not occur either in a free state or bound in pea seeds. In the alcohol extract of finely ground seeds homoserine was not to be found paper-chromatographically (Fig. 1 a). Glutamic acid was quantitatively the most important amino acid in this extract; arginine, glycine, alanine, asparagine, aspartic acid, and serine appeared in smaller amounts. γ -aminobutyric acid, and some other amino acids were also present in small amounts. After total hydrolysis of the seeds homoserine was not to be found either.

2. In the alcohol extract obtained 24 hours after the seeds had been moistened (germination always taking place in the dark at about 20°C) a small amount of homoserine had already appeared (Fig. 1b). Glutamic acid was still, as in nongerminating seeds, the most abundantly appearing free amino acid. The amount of nearly all amino acids had increased very considerably. Glutamine also appeared in considerable amounts.

3. 48 hours after the seeds had been moistened, when the root already had a length of about 1 cm, the amount of homoserine had increased greatly. Glutamic acid, the amount of which had

further increased, as had that of many other amino acids too, was still superior in quantity, and next to it was serine.

4. After 72 hours of germination the amount of homoserine had increased even more (Fig. 1c). This amino acid was now the most abundantly appearing free amino acid. The amount of glutamic acid had decreased, taking second place after homoserine. The amount of serine was much the same as after 48 hours, and that of alanine and arginine considerably decreased. On the chromatogram there appeared two new spots "X" and "Y". Their nature has not yet been investigated.

5. After 5 days the amount of homoserine had still increased, and was now by far the most abundantly appearing free amino acid (Fig. 1d). Glutamic acid as well as serine had still decreased. The amount of the unknown "X" had increased considerably, whereas that of "Y" had decreased.

When the root and the young stem (epicotyl) were removed from the seed, homoserine was to be found in far greater amounts in the stem and the root than in the seed. The unknown "X" appeared mainly in the young stem.

6. After 10 days of germination the amount of homoserine was much the same as after 5 days, but after continual decreasing in the amount of the other free amino acids, the proportional amount of homoserine had still increased. The amount of serine had decreased very greatly, as had that of glutamic acid. There was no longer any trace of the unknown "Y".

7. After 15 days of germination the situation was generally much the same as after 10 days. Asparagine, however, had increased considerably occupying now second place after homoserine. The spot of the unknown "X" was about the same as after 3 and 5 days.

At present, it is not known from which precursor, or how, homoserine is formed during germination of the pea seed. Similarly, it is unknown what function homoserine has in plants. It can be the precu-

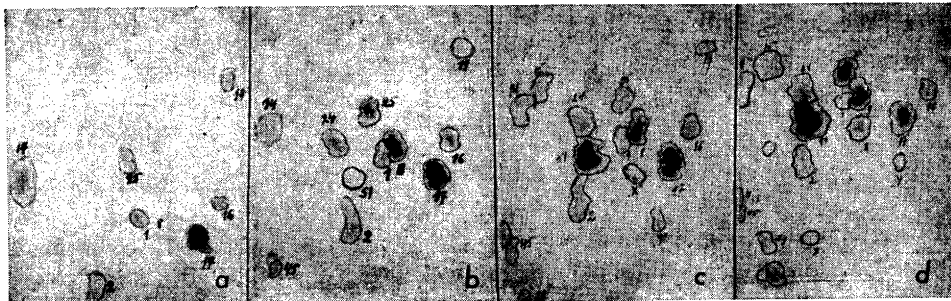


Fig. 1. Chromatograms prepared from alcohol extract of pea seeds before and after germination. Twodimensional chromatograms with solvents: 1. Butanol-acetic acid, 2. Phenol in NH_3 -atmosphere. 1 = gly, 2 = ala, 7 = tyr, 8 = ser, 11 = pro, 14 = arg, 15 = lys, 16 = asp, 17 = glu, 19 = glutathione, 24 = glu NH_2 , 25 = asp NH_2 , 29 = γ -amino-butyric acid, 45 = ethanolamine, 51 = homoserine, "X" and "Y" = unknown spots. Between 14 and 15 some histidine.

- a. Nongerminating pea seeds
 b. After 24 hours' germination
 c. " 72 " "
 d. " 5 days "

90 μg N was used for all chromatograms. The amino acids have travelled various distances on different chromatograms, because of the differences in time and temperature.

sor of threonine as well as of methionine, but the composition of the fraction of the free amino acids does not give any proof of this conception.

The same results were obtained from germination experiments performed in the light over a period of two days, and a similar experiment, performed in the dark. After 5 days, the amount of approximately all free amino acids in peas germinated in light was notably smaller than in those germinated in the dark, depending probably on CO_2 -assimilation and protein syn-

thesis. In addition the alcohol extract of the peas grown in light gives a new unknown spot between those of homoserine and arginine.

The work is still in progress, and will be published fully in *Physiologica Plantarum*.

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