Fig. 1. Production of male organs on a genetically female plant following the application of α (2-chlorophenylthio)propionic acid

on those plants which had been sprayed with solutions of α (2-chlorophenylthio)propionic acid; three plants showed this effect, not all of which had received the maximum spray treatment.

In the following year an experiment was designed specifically to test whether the stage in growth of the plant at which the spray was applied was an important factor in relation to male flower development. The spraying was carried out as before with a 500 p.p.m. solution, and in a row of about 30 plants a different plant was sprayed at two-day intervals, beginning on July 2 and continuing until the beginning of August. The plants not sprayed were left as controls.

When the flowers developed it was seen that a large number of male flowers had developed on those plants sprayed on July 2 and 4; there were fewer on the plant sprayed on July 6, and practically none on those which were sprayed afterwards. The plants sprayed on July 8 and 10 showed slight deformities of the cones, but those plants which had received the later sprayings showed no abnormal effects and could not be distinguished from the controls.

Heslop-Harrison, in reviews of conditions governing sex expression in flowering plants^{2,3}, describes changes of sex resulting from treatments with the plant growth substance 2:4-dichlorophenoxyacetic acid or with the plant growth hormone indoleacetic acid. It seems possible that the weak growth properties of α (2-chlorophenylthio)propionic acid may operate in inducing the responses reported here. In this connexion, however, it is important to note that in all cases reported previously, growth substance treatment caused a change from male to female flowering whereas the changes reported here have been from female to male.

It is of interest that the experiments quoted in the literature where sex changes appeared were carried out with short-day flowering plants; the suggestion has been made, however, that long-day plants may not follow the same pattern⁵, it having been observed that spinach tended to produce male flowers under short-day conditions.

Heslop-Harrison has suggested that photoperiodism may be related to natural auxin concentration; if this is the case with spinach, then either auxin concentration is lowered under short-day conditions or the initiation of male flowers arises from high auxin-levels. While the former possibility is unlikely, the latter supposition is difficult to correlate with the findings

that with other plants, application of growth substances leads to the formation of female flowers.

The present experimental results with hop plants throw light on this problem if it be assumed that, as long-day plants, the hop and spinach behave similarly with respect to both day-length and applications of growth substances. A distinction may then be drawn between a long-day and a short-day flowering plant; in the former, high auxin-levels might promote the growth of staminate structures whereas in the latter, high auxin levels might promote pistillate structures.

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STATISTICS

Structural Relations in Component Analysis

IN a recent communication, Hey and Hey¹ have described Berkson's postulate of the 'controlled variable' as unjustified and his mode of analysis as invalid. After correspondence with Hey and Hey, we feel that it is their criticisms that are not valid; had they been, they would have applied equally to the whole of regression theory. In particular, they do not seem to attach sufficient weight to the need for a careful specification of the reference distribution with which the observations are to be compared.

In our communication² to which Hey and Hey refer, we included Berkson's method in a list of several which can be appropriate in various circumstances; we should perhaps have stated more clearly that differing experimental conditions necessitate differing analyses, and that no one method (not even that of least squares) has overall applicability. We did point out that in some versions of the structural relations problem, the method of least squares has been shown to lead to inconsistent estimates; so that in all but the simplest cases consistency and efficiency have to be justified *de novo*.

The problem considered by Hey and Hey¹ of fitting v linear relations to a set of n -dimensional observations all subject to error is essentially equivalent to component analysis, for which see, for example, Girshick³ or Kendall⁴; and has been treated explicitly in econometric contexts, for example, by Tintner⁵.

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