LETTERS TO THE EDITORS

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Vitamin C and Chromosome Number in Rosa

WE were interested in Dr. Darlington's note[1] dealing with the possible correlation between polyploidy and vitamin C content in Rosa, since we supplied a not inconsiderable amount of the material upon which the chemical determinations of Pyke and Melville[2] were based. Moreover, these examinations were made upon the same series of plants as we[3] had used in cytological investigations carried out some years ago. Naturally, when Pyke and Melville were good enough to send us the results of their work on our material, we made attempts to link their figures with the known chromosome numbers of the bushes concerned. This proved a complete failure, for such correlation as existed lay obviously between the period of ripening of the species involved and the proportion of ascorbic acid it bore; the earlier the form ripened, the higher the vitamin content. This observation we[4] have already published elsewhere.

We are thus in a position to state that even the two *Rosa mollis* forms with a percentage of ascorbic acid much higher than the average, *R. mollis* var. *typica* and *R. mollis* var. *fallax*, are most certainly not high polyploids but uniformly tetraploid. Of all our local roses, these exact bushes were the first to ripen their fruit this year (August 15). Next in order of maturity in this area followed *R. coriifolia*, *R. Afzeliana* (= *R. glauca* Vill. = *R. glaucophylla* Winch) and *R. Sherardi* bushes, all of which were known to be pentaploid. Finally, the season is closing with the various microforms of *R. canina* and *R. dumetorum*, again plants shown by us to possess a chromosome complement of 35. A brief consideration of these facts in connexion with Dr. Darlington's table will confirm our views.

This brings us to other points in that table which call for comment. On the basis of data supplied by us to Tischler[5], Dr. Darlington quotes figures which mask the true position. In the table, with a limiting footnote, *R. mollis* appears as an octoploid; that degree of polyploidy was attained by one single aberrant seedling in a batch which was otherwise tetraploid. It can be stated definitely that, with this exception, all *Rosa mollis* material tested by us, from Northumberland, Durham and Cumberland in England and from Haddington, Perth, Angus, Fife, Moray and the Isles of Bute and South Rona in Scotland, was endowed with 28 chromosomes. Thus the suggested linking of octoploid *R. mollis* with its high ascorbic acid yield falls to the ground. Similarly, the hexaploid count given by Dr. Darlington for *R. Sherardi* originated with one individual seedling; otherwise, the whole of our preparations of that species from the north of England and the Lowlands, Highlands and Islands of Scotland were pentaploid.

Again, it should be pointed out that Dr. Darlington's use of a composite Caninæ group, with its Eucaninæ, Rubiginosæ and Villosæ elements indiscriminately mixed up, tends undoubtedly to obscure genetic relationships; surely, for a proper understanding of the genetic implications, the Eucanine *R. canina* and *R. dumetorum* ought to have been separated from the Rubiginosæ, including *R. rubiginosa*, *R. micrantha* and *R. agrestis* and from the Villosæ, represented by *R. tomentosa*, *R. Sherardi* and *R. mollis*.

Further, in Dr. Darlington's table there is a curious omission of two species listed by Pyke and Melville with their appropriate ascorbic acid values; these are the two Eucanines, *R. stylosa* (pentaploid), with an abnormally low percentage of vitamin C, and *R. Afzeliana* (also pentaploid) with a high content.

The inclusion of these two species emphasizes still more strongly the lack of correlation between vitamin C levels and the degree of polyploidy manifested by members of the genus Rosa.

J. W. HESLOP HARRISON.
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[1] Darlington, C. D., NATURE, **150**, 404 (1942).
[2] Pyke, M., and Melville, R., *Biochem. J.*, **36**, 336 (1942).
[3] Blackburn, K. B., and Harrison, J. W. Heslop, *Ann. Bot.*, **35**, 159 (1921).
[4] Harrison, J. W. Heslop, *Vasculum*, **27**, 17 (1942).
[5] Harrison, J. W. Heslop (1934) in Tischler, *Tab. Biol. Per.*, **11**, 281 (1936); **12**, 1 (1936).

THE correlation between the vitamin C content of rose hips and chromosome number, pointed out by Darlington, is one of several correlations we have observed in the course of our investigations. The principal correlations are:

(1) *Latitude.* The mean vitamin content of all samples of British roses taken for short intervals of latitude rises with a high degree of regularity from south to north. That is to say, species common in the north are high in vitamin C whereas those of the south are relatively low.

(2) *With time of ripening.* For the genus as a whole, the species ripening early in August when grown in the London area are richest and those ripening either earlier or later have less vitamin C. Length of day may be the governing factor here, and probably it is linked up with the latitudinal correlation.

(3) *With chromosome number.* In addition to the British roses, hips of about forty foreign species for many of which chromosome numbers have been published have been analysed. Mean vitamin C values for each stage in polyploidy indicate a general upward trend for increasing degrees of polyploidy. This appears to be linked with the latitudinal variation since Hurst[1] has shown that, in general, diploid roses have a southern distribution and the degree of polyploidy increases northwards.

(4) *With the taxonomy.* Species placed together in the accepted classification of the genus are generally similar in vitamin C content. Thus species in the section Cinnamomæ possess high vitamin contents, those in the Pimpinellifoliæ and Synstylæ are relatively low, while the Caninæ are intermediate. The correlation with the systematic grouping is the strongest we have observed, and is of particular interest in so far as our independent investigation of this biochemical character strengthens the view that the classification is 'natural' in the evolutionary sense.

A fuller discussion of these aspects of our investigations will be published elsewhere.

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[1] Hurst, C. C., "The Mechanism of Creative Evolution" (1933).