could be similar to the appearances one would expect to find in humans suffering from Perthes' disease[5]. A Perthes-like appearance has been produced in rats on a lathyrogenic diet[6].

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J. MALCOLM CAMERON

Department of Pathology
(University of Glasgow),
Glasgow Royal Infirmary.

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Root Parasitism in Santalaceae

THE Santalaceae are a family of some 250 species of mostly root semi-parasites. Although parasitism has been known in some species of this family, the existence of parasitism in the New Zealand representatives, *Exocarpus bidwillii* Hook. f. and *Mida salicifolia* A. Cunn., was not definitely known until recently[1]. Since then the parasitism of *E. bidwillii* has been examined in greater detail. The investigation has revealed many features not previously known concerning the parasitism of the plant and of the structure and development of its haustorium.

Like many santalaceous parasites, *Exocarpus* attacks a wide range of host plants and even roots of the same species. Occasionally also young haustoria are found attached to dead plant remains such as leaves, present in the surface soil layers. In the structure of its haustorium *Exocarpus* displays the general features of santalaceous haustoria, namely, cortical folds, collapsed layers and inverted conical flask-shaped form of the vascular tissue. Other characters it shares with only one or two other santalaceous haustoria. The presence of granules in the tracheary elements of the body of the haustorium is a feature which *E. bidwillii* only shares with *E. cupressiformis*[2] in so far as the Santalaceae are concerned. These granules only occur in the body of the haustorium and are not found elsewhere in the plant or in the vessels of the sucker. Their presence in the expanded part of the vascular tissue of the body suggests they may possibly be connected with the mechanism of the haustorium.

With the possible exception of *Buckleya quadriala*[3] and a few other santalaceous haustoria, the mature haustorium of *Exocarpus* differs from most haustoria in that it is a long-lived organ which exhibits secondary growth. According to Rao[4] most santalaceous haustoria are short-lived and seldom develop secondary tissues to any extent. In one striking feature the haustorium of *E. bidwillii* is distinct from all described haustoria of the Santalaceae. Whereas in santalaceous haustoria the sucker is usually described as a simple wedge or disk-like organ embedded in the tissue of the host root, that of *Exocarpus* is complex, consisting of a number of finger-like sucker branches extending along within the host root. In cross-section each sucker branch is wedge-shaped and deeply embedded in the host xylem. The development of the haustorium from shortly after initiation to the establishment of the mature organ was also followed. Haustoria arise laterally on *Exocarpus* roots in the primary state of growth, and develop chiefly from cortical tissue. They are exogenous in origin, there being no rupture of cortical tissue as with lateral roots.

Apart from ascertaining the nature of parasitism in *E. bidwillii*, the results of this work also suggest that some of the earlier work on santalaceous parasites was incomplete and that the conclusions and comparisons drawn may not be valid. This applies particularly to what is described as the mature haustorium. Where penetration is reported to be only superficial, as was originally described for *E. bidwillii*, further investigation might show that the haustorium investigated is merely a stage of development. Since young haustoria are usually more numerous and conspicuous than old, an insufficient examination of the root system has probably been responsible for immature haustoria being described instead of the mature organ. The assumption that most santalaceous haustoria are short-lived organs developing little secondary tissue could also be re-evaluated. Most santalaceous parasites are woody plants, and since their nutrition is apparently dependent in part on parasitism it seems peculiar that this demand should be satisfied by short-lived organs which seldom become intimately associated with host tissue for any length of time. Such a condition would scarcely appear to be successful parasitism.

B. A. FINERAN

Department of Botany,
University of Canterbury,
New Zealand.

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Application of Gibberellic Acid to Strawberry Plants at Different Stages of Development

GIBBERELLINS are known to play an essential part in the metabolism of the strawberry plant from which they have been isolated chromatographically[1]. By spraying plants with gibberellic acid in the winter Singh *et al.*[2] advanced harvesting times by three weeks and increased yields. In the United States, Smith *et al.*[3] gave autumn applications which advanced fruit ripening by several days without affecting yields. Guttridge[4], however, reported that when gibberellic acid was administered in the autumn, fruit yields were reduced in Scotland.

To examine further the effect of different application times solutions of 12·5, 25, 50 and 75 p.p.m. gibberellic acid, to which had been added 'Agral 90' wetter, were sprayed over triplicate randomized plots of one-year old Royal Sovereign plants on March 6, April 13, or May 30 and at all combinations of these times. Plants were sprayed to run-off with volumes varying from 7 to 20 ml. of solution depending on the size at time of application.

On May 18 all treatments had accelerated flowering to an extent increasing with concentration and at the higher concentrations and multiple applications marked changes had occurred in the growth habit of the plants, the flower clusters being more numerous and borne on elongated peduncles extending well above the foliage. As 1962 was a year of late frosts many of these early flowers were killed.

The crop was harvested by picking three times weekly from June 27 until July 20 and numbers of fruits and their total weights were recorded. Total crop weights per treatment for the first two pickings and for the total harvest of 11 pickings are shown in Table 1.

Ripening was accelerated by several days, particularly at the higher concentrations of gibberellic acid, and the effect was greater with repeated applications. Total yields were not significantly improved but the number of berries increased with increasing concentrations up to 50 p.p.m., but tended to decrease with falling yields at 75 p.p.m. Sizes of fruits were normal with single applications of 50 p.p.m. or less and with the 12·5 p.p.m. concentration in the March–April and April–May applications. With the higher doses fruits were undersized, and, at the double and triple applications of 50 and 75 p.p.m., were noticeably elongated and substandard.