and in four of these most of the fruits had the passage from calyx to core through which spores of fungi penetrate to produce mouldy core closed by the bases of the styles and, in some instances, by formation of new tissues.

Delicious types include a number of solid red, partial red, and striped strains and work is being continued with a view to selecting those combining good colour with other desirable characters such as keeping quality and flavour.

Similar work is being undertaken with the varieties Cox's Orange (of which several colour-types are fruiting), Sturmer, Jonathan, and Northern Spy.

Pruning Experiments.

At Appleby a test of heavy spur-pruning before both the "on" and the "off" years of bearing has been laid down in an endeavour to overcome the biennial-bearing habit of the Dunn's Favourite.

A series of weekly thinnings, from blossoming till six weeks after petal-fall, is also being tried on the same variety during the "on" season, as this treatment has been reported elsewhere as inducing regularity of cropping.

An attempt is being made to convert some Cox's Orange trees from a lateral-bearing habit to a spur-bearing habit, with spurs arising directly from the leaders. Under this system in England the variety does not exhibit a biennial character.

Several modifications of the standard method of pruning the Jonathan are being tried out to see if it is possible to build up a different type of framework that can be more easily sprayed, thinned, picked, &c., without interfering with cropping capacity or fruit quality.

Plant-protection Experiments.

I. *Entomological Studies.*

(*a*) *Biological Control.*—Studies of the life-cycles of woolly-aphis and its parasite, *Aphelinus mali*, have been continued by the Cawthron Institute. Experimental colonies of woolly-aphis were established in December, 1938, for the purpose of following the seasonal cycle throughout the year. An exceptionally dry summer and early autumn was followed by heavy rains in late autumn and by exceptionally cold spells in the winter, so it is doubtful whether the results of the seasonal-cycle studies of woolly-aphis can be accepted as normal.

Seven generations of the aphis were obtained during the period December, 1938, to June, 1939. The last generation hibernated as nymphs, which were not observed to feed; on warm days they wandered about, but during cold periods they remained motionless. Owing to severe weather in July all the nymphs under observation died. Field studies likewise showed low survival of hibernating nymphs, though eggs were noticed. In the following spring, hibernating nymphs matured in October and then commenced to build strong colonies.

The first adults of the parasite *Aphelinus* made their appearance during the first week in September, 1938, and steadily increased during the summer of 1938-39. The parasite suffered a set-back during the following winter and, like the aphis, made a poor start in the spring.

(*b*) *Chemical Control.*—The Plant Diseases Division has continued experiments on the following insect pests:—

(i) Red-mite: Derris sprays, consisting of ground derris root, in various concentrations gave only partial control, and it is considered that derris product of this type cannot be regarded as suitable substitutes for summer oil.

(ii) Leaf-hopper: Tests indicated that derris sprays were effectual against this pest, and further work on a field scale will therefore be undertaken next season.

(iii) Bronze beetle: Records of injury caused by this insect have shown a progressive decrease in infestation over the past three years, resulting partly from reduction in carry-over numbers effected by use of arsenate sprays, and partly from killing of larvæ by summer cultivation.

II. *Mycological Studies.*

(*a*) *Mouldy-core.*—The data obtained in previous work on mouldy-core by the Cawthron Institute have been reassembled, and further culture work has been undertaken to elucidate several points connected with the species-limits in the Fusarium group of fungi.

Investigations carried out on this disorder by the Plant Diseases Division are linked with the varietal work, and results have been noted above.

A co-operative study was carried out by the Physical Testing Laboratory and the Fruit Research Officer to determine whether the presence of mouldy-core in the Delicious apple could be detected by the use of X-rays. Although a fair measure of success attended the actual detection of the trouble, the time involved and the cost of plant were found prohibitive.

(*b*) *Eye-rot.*—A disease known in Nelson as "eye-rot" or "dry eye-rot," common in Jonathan and Cox's Orange varieties, has been responsible for the rejection of fruit from export because of the danger that the fungus responsible, *Botrytis cinerea*, might continue growth.

To ascertain if the fungus in the lesions was viable, two cases of infected fruit were held in cold storage for five months and fruits were then forwarded to the Plant Diseases Division laboratory for culturing. All cultures remained sterile, indicating that the fungus was no longer present. Subsequently a further lot of samples, of the Gravenstein variety, was forwarded, and this was held for fourteen days in moist chambers at room temperature. No growth was secured from any of the