cal case of botulism. The onset in the duck is rapid with paralysis of the third eyelid and complete paralysis within one hour. Complete recovery may occur as early as the 24th hour, though 48 hours is the more common period.

Fraction A is volatile and escapes from an open vessel on prolonged boiling. It is very stable at room temperature and resistant to bacterial action as opposed to the thermo-labile fraction. Non-sterile, corked samples have been held for a ten-month period at room temperature without loss of toxicity.

It is unlikely that the A fraction ever exists in the free state in nature. Removal of this fraction from the toxin mixture as evolved by bacterial growth results in a remaining fraction which is no longer toxic by oral administration, though it is still toxic by injection. Restoration of the A toxin fraction regularly results in a return to toxicity by the oral administration of the mixture.

Fraction A is destroyed by strong alkali. This fact, coupled with the above findings, may account for the occasional collection of field samples, in semi-arid regions, which are toxic by injection in test animals but which are comparatively *non-toxic* by oral administration in normal doses. Complete separation of the two toxin fractions in nature has not been demonstrated. Reduction of fraction B to powder dryness by the lyophil process results in only partial loss of toxicity by the inoculation route.

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A DARKENING TECHNIQUE FOR INDUCING VIRUS SYMPTOMS IN MATURE AS WELL AS IN GROWING LEAVES

A RECENT article[1] on rapid transmission techniques for stone-fruit viruses was concerned with such devices as pruning, defoliation and girdling of growing plants for the purpose of shortening the incubation period. Incidentally, these techniques also offer promise for producing intensification of disease symptoms and for concentrating viruses in local areas.

Still more recently it has been discovered that the simple device of excluding light from the leaves into which one wishes to move the virus functions in a similar manner to the above but has the additional merit of inducing symptoms also on shoots and leaves that are not growing. To date only the virus of the Yellow-Red or X disease of peach has been tested, but it seems probable that the effects of shading will be generally applicable to other plant viruses.

Darkening the upper half of young rapidly growing peach seedlings for 2 weeks induced disease symptoms, sometimes within 4 weeks from the time the shades were installed. Similarly, darkening one of the branches on older seedlings which had completed their first season's growth induced symptoms within 6 weeks after the shades were installed. Although in these particular experiments the symptoms were not evident before 4 to 6 weeks after darkening, the shades need not be left on more than about 2 weeks and possibly the time of shading can be still further shortened. The growing seedlings were about 20 inches tall, branchless and each received a diseased bud midway on the stem. The older non-growing seedlings had either 2 or 3 branches and each received a diseased bud (sometimes with difficulty because of the cambium condition) near the base of the branches. Thus it was possible to darken either budded or unbudded branches. The shades, consisting of lightproof paper envelopes, had proper provision for ventilation and were held in place by clips attached to a stake.

The movement of the virus is apparently associated with the major movement of carbohydrate as pointed out by Bennett[2] for curly top virus movement in sugar beet and tobacco. Shading a portion of a plant stops photosynthesis in that part and favors the transport of carbohydrate into the shaded part, and if the entering food passes through a part of the stem containing the virus the latter apparently is carried along with the food. By placing the diseased bud somewhere between the shaded region and the food source, which in this case was unshaded leaves carrying on photosynthesis, it has been demonstrated that the virus was carried into the shaded leaves which were receiving food. Therefore, the fact that temporary darkening will induce entrance of the virus and the development of disease symptoms in non-growing as well as in growing tissues affords another important transmission technique to expedite investigations on plant viruses. Since darkening does not involve severe treatment of the plants nor necessitate new plant growth for symptom expression it should prove of value in many situations where pruning, defoliation and girdling can not satisfactorily be used or where it is difficult to induce the formation of new shoots.

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[1] E. M. Hildebrand, SCIENCE, 95: 52, 1942.

[2] C. W. Bennett, *Jour. Agr. Res.*, 54: 479–502, 1937.

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