heart has been very difficult and rather unconvincing when only morphological evidence has been used, as, for example, in the early work of De Vecchi[2] and the later studies of Andrei and Ravenna.[3] In our own studies these difficulties have not been entirely overcome. We have been able to use the more modern method of perfusion fixation to demonstrate more clearly the changes in the valves and in the endothelium of the mural endocardium and aortic intima. The propagation of the supposed pathogenic agent in embryonated eggs and its subsequent passage back to small mammals would appear to have confirmatory value and would seem to open the field for application of the newer technical procedures of virus study to the agent or agents which may be concerned in the causation of the rheumatic diseases.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

GRAPEVINE INJECTION APPARATUS[1]

THE plant-injection procedure for diagnosis of mineral deficiencies causing leaf abnormalities seems preferable in many instances over other types of treatments. Injection into the plant circumvents soil fixation of various ions, requires only a minimum of materials, and also gives assurance that the element in question is at least within the plant. The treatment of single branches provides closely comparable checks and reduces the number of plants necessary for diagnosis. Although foliage sprays have proved useful, there is less assurance of penetration and distribution, particularly in the case of the "nonmobile" elements. For instance, foliage sprays with zinc compounds on zinc-deficient grapevines have given transient and far less marked recovery than that from injections or from daubing the fresh pruning wounds with zinc solutions. The daubing procedure has generally given unsatisfactory results with cane-pruned vines. Injection of 5 ml of 25 per cent. zinc sulfate solution into the trunk has resulted in outstanding improvement in the appearance of zinc-deficient, cane-pruned Thompson Seedless (*Vitis vinifera*) vines. Various injection procedures have been used by Collison *et al.*,[2] Roach,[3] Rumbold[4] and Wallace,[5] who refer in turn to many other investigations.

Fig. 1 illustrates the apparatus. The screw is used to force the flat-faced, circular injection point into the wood until the taper at the back end forms a seal with the plant tissue. The solution is then pumped into the tracheal system of the xylem through a hole in the neck of the injection point.

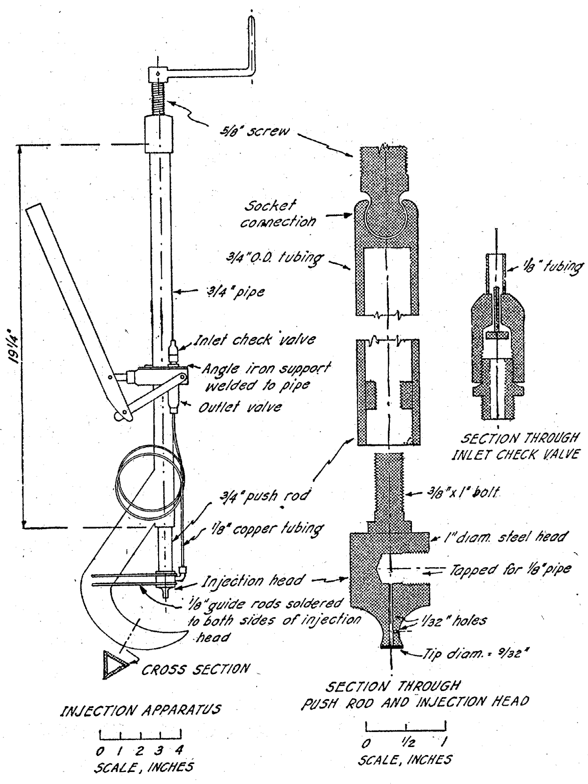

FIG. 1. Grapevine injector.

The injection head was turned from 1-inch soft round steel. The end face of the point is 9/32-inch diameter and is decreased at the neck to 8/32 inch. The neck and sealing face are turned on approximately a 1/4-inch radius. This design allows the solution to flow freely around the neck of the point, and the sheared tracheal ends are not under mechanical pressure which would tend to keep them closed. The

[2] Bindo De Vecchi, *Arch. de Méd. Expérimentale et d'Anat. Pathol.*, 24: 352–420, May, 1912.

[3] Guiseppe Andrei and Paolo Ravenna (translated by Richard Kemel), *Arch. Int. Med.*, 62: 377–387, September, 1938.

[1] Thanks are due to Mr. P. E. Symens for the design and construction of the hook and pump mounting.

[2] R. C. Collison, J. D. Harlan and M. P. Sweeney, *New York Agr. Exp. Sta. (Geneva) Tech. Bul.*, 192: 1–36, 1932.

[3] W. A. Roach, *Ann. Bot.*, n.s., 3: 156–222, 1939.

[4] Caroline Rumbold, *Am. Jour. Bot.*, 7: 1–18, 1920.

[5] T. Wallace, *Jour. Pom. and Hort. Sci.*, 13: 54–67, 1935.

outward sealing flare is short (about 1/8 inch long) in order to present a large surface area and thus prevent the point from being driven in any further than necessary for sealing. The entire turned section is only 1/2 inch long, so that chiefly the outer tracheae (which seem to function most effectively in solution conduction in the grape) are injected. The head and nut of 3/8 × 1-inch S.A.E. bolt were ground down to go inside the 3/4-inch O.D. Shelby steel tubing used for the push rod. The nut was welded into the tubing through vee cuts in the tubing. The top of the bolt was sweated (with bronze) onto the center of the back end of the injection head. The hole in the face of the injection tip was covered by sweating (with solder) on a piece of hard brass sheet entirely covering the face. The radial hole in the neck serves for the outlet.

The screw is part of a 4-inch Stearns wood clamp with 6 threads to the inch. The female screw was cut from the clamp, fitted into the end of a 3/4-inch pipe coupling and brazed in place. The face of the ball socket on the end of the screw was cut down to 5/8-inch diameter and welded to the end of the push rod.

The hook is hollow and, in general, is triangular in cross section. The inner lining is 3/16 × 1 1/4-inch strap iron. The vee back is of 1/8-inch-thick stock. Patterns for the curved sections of the back were made by cutting cardboard to shape. The rounded hook section does not cause appreciable injury to the grapevine trunk; however, the present design is unsatisfactory for tree injection, as the hook injures the bark tissues too much, probably due to the higher pressure necessary to force the point into the harder wood and to the varietal difference in bark tissues. A 2-inch wide, vee-shaped hook providing two points of contact is suggested, if the device is to be used on trees. The hook is welded onto the 3/4-inch pipe, as in the 2-inch section of 1 1/2 × 1 1/2-inch angle iron supporting the pump. Guide rods were bent to shape and soldered to the injection head to prevent the head from turning and twisting off the 1/8-inch copper tubing.

The pump is part of a high-pressure, lever-action, grease gun.[6] The pump cylinder is bolted to the support by a cap screw into the original inlet, and by a male 1/8-inch tubing coupling, which served both as a supporting screw and inlet (in place of the original cap screw). A shellacked fiber gasket did not hold the pressure involved, so the pump cylinder was sweated with solder onto the angle iron support.

The valves consist of rubber discs 5/16-inch diameter by 1/8-inch thick (cut from a rubber stopper) tightly fitting on the shafts against the heads of 3/32-inch diameter nails. The nails (cut to a suitable length) extend into the 1/8-inch port holes, which also serve as valve-stem guides. The original attachment tip (coupling) and the check valve provided suitable valve seats and housings. No spring is used on the inlet valve, but a bronze spring replaces the original steel spring of the outlet valve.

A 250-ml dispensing burette mounted on a ring-stand and connected with rubber tubing serves for calibration of the discharge. The bore of approximately 0.4 inch and 7/8-inch stroke of the pump described injects about 1 3/8 ml per stroke. If many injections with a single solution are to be made, a hot water bottle serves as a convenient portable reservoir. The pressure used in the injection will need to be regulated by experience, as the vine trunk may be readily split or the seal broken by too high pressures.

A brass (or other corrosion-resistant material) pump and fittings would be desirable; however, the iron may be largely protected by washing out corrosive material and pumping a dilute chromate solution through the instrument each time after use.

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A NEW HERBICIDE, 2,4 DINITRO 6 SECONDARY BUTYL PHENOL

MOST herbicides in current use suffer from certain disadvantages. Because of its poisonous properties, sodium arsenite is no longer very popular. Sodium chlorate solution is hazardous because when dried on clothing or vegetation it is highly inflammable. Moreover, supplies of these chemicals have been restricted during the war. Certain petroleum fractions, including diesel fuel, smudge pot oil and stove oil have become rather widely used as herbicides. With the increased demand for oils in the war, however, such use is being restricted and may be entirely cut off.

Recent studies on a series of dinitro compounds of the substituted phenols indicate that they may furnish herbicidal chemicals having properties more desirable than those mentioned above. Such compounds are proving valuable insecticides,[1,2] and certain ones show promise as herbicides.

The sodium salt of dinitro-*o*-cresol is already in wide use as a selective herbicidal spray on cereals, flax and onions. It was early found that the addition of ammonium sulfate or a strongly acid salt such as sodium bisulfate would greatly increase the toxicity of this herbicide. Such addition was termed "activation." The ammonium salt of dinitro-*o*-cresol proved as toxic as the activated sodium salt. When sodium

[6] K-P Manufacturing and Sales Company, 1706 Linden Avenue, Minneapolis, Minnesota.

[1] J. F. Kagy, *Jour. Econ. Entom.*, 34: 660, 1941.
[2] G. C. Decker, *Jour. Econ. Entom.*, 36: 658, 1943.