It is quite possible that a knowledge of atmosphere may aid in the control of diseases. The widest field probably will be in the pathological application.

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SOME CONSTITUENTS OF DERRIS AND "CUBE"[1] ROOTS OTHER THAN ROTENONE

SINCE the introduction of derris root extracts as insecticides, rotenone has been considered mainly responsible for their activity. However, reports from entomologists and others interested in insect control indicate that derris extracts may contain little or no rotenone and still be effective sprays, and also that extracts from which rotenone has been removed as completely as possible are still effective. It may be assumed, then, that such preparations contain materials other than rotenone possessing insecticidal properties. In this connection it is significant that Greshoff,[2] Tattersfield and Roach,[3] Sillevoldt[4] and Durham[5] have isolated various products from derris root, some of which were toxic to fish or insects while others were not. None of these products, however, has been examined chemically.

Recently it has been shown that rotenone is present abundantly in the Peruvian fish poison "cube,"[6] extracts of which are used to some extent as an insecticide in South America. Like derris root, "cube" yields a large quantity of non-crystallizable material, which remains in the rotenone mother liquors.

In the course of a survey of fish-poisoning plants as sources of insecticides which is now being made in this laboratory, the non-crystalline extractives of derris and "cube" roots were studied to determine whether it was possible to obtain any material of definite composition that might be responsible for their physiological action upon fish or insects.

Without entering into details of the methods employed, which will be published elsewhere, it may be stated briefly that, when the non-crystalline material from all samples of derris root thus far investigated was dissolved in methyl or ethyl alcohol and treated with a small quantity of dry sodium carbonate or dilute sodium hydroxide solution, a number of well-defined crystalline compounds were obtained and that invariably three substances predominated. One of these, toxicarol, is a greenish-yellow substance which crystallizes in thin hexagonal plates that melt at 218°–20°. It is a monohydroxy dimethoxy compound, $C_{23}H_{22}O_7$. Another substance, with a pale green color, crystallizes in rodlike plates, having a melting-point of 171°. It is a dimethoxy compound, $C_{23}H_{22}O_6$, and is thus isomeric with rotenone. Recently toxicarol and this second compound have also been found in *Cracca* (*Tephrosia*) *toxicaria*.[7] The third substance crystallizes in short, thick prisms which melt at 198°. It is a dimethoxy compound, $C_{23}H_{22}O_7$, and is possibly tephrosine, which Hanriot obtained from the leaves of *Cracca* (*Tephrosia*) *vogelii*.[8] Although Hanriot reported the melting-point of tephrosine at 187° and assigned to it the formula $C_{31}H_{26}O_{10}$, his preparation was likely impure, consisting in all probability of a mixture of tephrosine and the 171°-melting compound, since the writer found that the leaves of *Cracca* (*Tephrosia*) *vogelii* gave a mixture of these two materials which had a melting-point of about 187°.

Besides the three substances just described a variable number of yellow or orange compounds were found in small quantities in the crude crystalline mixture, but since they are extremely difficult to separate in an analytically pure condition they have not as yet been investigated.

When the rotenone mother liquors from "cube" roots are submitted to the same treatment as described for derris, they also yield a crystalline mixture, which has proved to be either tephrosine (melting-point 198°) and the 171°-melting compound found in derris and cracca or a mixture of these two compounds and a yellow crystalline dimethoxy compound having a melting-point of 217° and the formula $C_{22}H_{20}O_6$.

The yields of these products, both from derris and "cube," are remarkably high. Some specimens of derris, which yielded less than 1 per cent. rotenone, gave by the alkaline treatment as much as 4 to 5.5 per cent. of the crude crystalline mixture, and the samples of "cube" thus far available yielded uniformly about 5.5 per cent. of a 2 to 1 mixture of tephrosine and the 171°-melting compound.

Further work is in progress upon these substances, but from the analytical data now available it appears that all these compounds, including rotenone, are more or less related, and that this small group of chemical compounds may be responsible for the toxic properties of many widely distributed tropical fish-poisoning plants.

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[1] Pronounced coo′ bay. Recently Killip and Smith, *Wash. Acad. Sci.*, 20: 73, 1930, identified the plant as *Lonchocarpus nicou* (Aubl.) D. C.

[2] M. Greshoff, *Pharm. Journ. and Trans.* (3), 21: 559, 1890.

[3] F. Tattersfield and W. A. Roach, *Ann. Appl. Biol.*, 10: 1, 1923.

[4] H. E. Th. Sillevoldt, *Ned. Tijd. Pharm.*, 11: 246, 1899; *Arch. Pharm.*, 237: 595, 1899; *J. Chem. Soc.*, A., 1: 109, 1900.

[5] Durham, reported in footnote 3.

[6] E. P. Clark, SCIENCE, 70: 478–9, November 15, 1929.

[7] E. P. Clark, in press.

[8] M. Hanriot, *Compt. rend. Acad. Sci.*, 144: 150, 1907; *Compt. rend. Soc. Biol.*, 62: 384, 1907.