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A NOTE ABOUT THE DIFFERENCES BETWEEN DERRIS AND LONCHOCARPUS AS AN INSECTICIDE,

by

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Conclusion:

The former results of Dutch workers in the thirtier years about the difference between Derris and Lonchocarpus roots, are recently confirmed bij the investigations of the scientists of the Puerto Rico Experiment Station. Derris should be distinctly higher evaluated than Lonchocarpus (= Cubé) with same rotenone content.

Introduction.

The main sources of rotenone containing insecticides are leguminous plants of the two closely related genera : *Derris* and *Lonchocarpus*.

The genus *Derris* originates from Asia, *Lonchocarpus* is a south American genus. The ground roots of both nowadays are widely used as insecticides. The trade name of *Lonchocarpus* root is Cubé.

It was in the thirtier years, that the entomologists, anxious about the increasing use of toxic substances, f.i. arsenates and fluosilicates, for chemical control of insects, sought for more harmless stuffs. Then they found that *Derris* insecticides, very injurous to several species of destructive insects, were relatively harmless to man and domestic animals. But not all *Derris* showed to be useful ; some plants of the same species have a very strong insecticidal powder, while others have not. Then chemists detected rotenone as the poisonous substance in derris root.

High rotenone content gave high killing powder, while plants with low or indetectable rotenone percentage had far less value. From this time trade and use of *Derris* roots arrive at a more solid base: the rotenone analysis.

However, some time afterwards it appeared that rotenone was not the only toxious substance of the *Derris* root. Some samples, which contained only traces of rotenone, appeared to be reasonally poisonous also. Only roots, extracted with ether or chloroform, had lost all toxicity. The toxious substances, other than rotenone, existing at the ether extract, were investigated, but up till now no definite results are obtained. Some of these appeared to convert during analysis, so that formerly described substances seemed to be not existing at the intact root. Here it is that differences between *Derris* roots and *Lonchocarpus* roots appear.

From the beginning the trade of rotenone bearing roots was based on rotenone content, or on content of ether extract.

Then it appeared that chemical analysis and biological activity were not congruent.

Former investigations.

At the „Institute for the Indies" at Amsterdam (Netherlands) numerous samples of both *Derris* and *Lonchocarpus* roots were analysed for different trading companies. From these samples with known rotenone and ether extract content, several couples of a *Derris* root and a *Lonchocarpus* root were chosen, each with about the same chemical composition (Spoon, van der Laan, Smulders & Diakonoff 1937). Amongst these couples there were some with low rotenone content, and others with higher content. The roots, ground with the same mill to the same fineness,

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were diluted with talc at several concentrations and applied as a dust to three species of insects. The results were striking except one couple with very low rotenone content (2,5%), at all other cases the *Derris* partner of each was more affective than the *Lonchocarpus* one.

These differences stimulated also the chemical research. Already in 1930 Clark found that toxicarol (optical active, $C_{23}H_{22}O_7$), one of the substances which next rotenone are existent in the ether extract of *Derris*, does not occur at roots of *Lonchocarpus*. Rowaan & van Duuren (1938) confirmed these facts, but it appeared, that toxicarol was wholly inactive as an insecticide. But the mothersubstance of toxicarol, which was mentioned by Cahn, c.s. (1938) l-d-toxicarol, and by Rowaan protoxicarol, appeared to be reasonally toxious. Some ether extracts of *Derris*, mainly those with low content of rotenone, held much protoxicarol, up to 10 percent, but most extracts contains 8-55, mean 25%. These substances are lacking in *Lonchocarpus* root also.

It was Diakonoff (1937), who described a method of detecting the difference anatomically. The starch grains of both species show a remarkable differentiation, which may be used easily by chemists and druggists, as it is also practicable by surveying commercial preparations.

The existence of the differences in biological activity was not generally confirmed. Huckett & Hervey (1935), working with *Derris* and *Lonchocarpus* dusts of same chemical concentrations on some vegetable pests, found only slight differences with varying results.

Ginsbury & Granett (1935) found about the same aphicidal properties for samples of *Derris* and *Lonchocarpus* (= Cubé) root, containing about the same amounts of rotenone and total extractions. The important article of Roark (1938): „*Derris* versus Cubé" may be summarised as follows:

Examples are quoted of laboratory and field tests, which indicate that derris is more toxic to some insects than cubé of the same rotenone content, but that the two are equally toxic to others. The apparent superiority may be due to the finer particle size of derris and to its rotenone content being higher than is shown by methods of analysis hitherto used. Rotenone is difficult to extract from many samples of derris, but is readily extracted from cubé. All derris powder sold in the United States is milled there and thereby probably rendered finer than the half of the cubé that is ground abroad. Additional tests with accurately analysed cubé and derris of the same particle size must be made against a number of species of insects before their relative values can be truly ascertained. Under present conditions in the United States, any insecticidal superiority of derris over cubé is more than offset by the difference in prices. Moreover, the principal agricultural insect pests against which rotenone is used, such as the Mexical bean beetle (*Epilachna varivestis* Muls.), the pea *Aphid (Macrosiphum onobrychis* Boy.), and *Lepidopterous larvae* infesting cabbage, are as readily controlled by cubé as by derris of equal rotenone content.

Up to 1948 N. F. Howard et al. advise for using rotenone insecticides to control the Mexican Bean Beetle either *Derris* or Cubé.

Georgi (1939) describing the marketing aspects of Derris and of its chief competitor, Cubé Root, states that „a definite statement regarding the relative toxicities of derris and cubé must be postponed until the results of tests with accurately analysed samples of the same particle size against a number of species of insects are available".

Recent investigations.

However, Jones & Smith (1936) concluded that the approximate chemical

evaluation of the toxicity has to be for *Derris:* rotenone + rotenone-less extract × 0,5, but for Cubé: the same × 0,4. Also prices of *Derris* were higher.

After the war the Puerto Rico Experiment Station started much work on *Derris* and *Lonchocarpus*. Some samples of *Derris* root, imported from Malaya, comparised with samples of *Lonchocarpus* root of different sources, showed both chemically and biologically (tests on house flies) significant better results with *Derris* samples than with *Lonchocarpus* (Jones, Gersdorff & Mc Govran 1946). The authors suppose the colorimetric determination of rotenone plus rotenoids to be the best chemical estimate of the toxicity of the samples. However, they conclude also that this results by this method varied considerably from the biological evaluation, which was done with house flies.

In further publications (Jones, Pagan and co-workers 1949) the problem was worked out. Next house flies also larvae of the Mexican Bean Beetle were used as a test insect for evaluation of the relative toxicity of these samples. In general, *Derris* had a higher insecticidal value than *Lonchocarpus* and the authors strongly suggest, that both insecticides should be evaluated and treated separately.

References :

Cahn, R. S., R. F. Phipers and J. J. Boam : The total Composition of Derris Extract. *Journal Society Chemical Industry 57 (1938): 200-209.*

Clark, E. P. : Toxicarol. A Constituent of the South American Fish Poison Cracca (Tephrosia) toxicaria. *Journal American Chemical Society 52 (1930): 2461.*

Diakonoff, A. : Het onderscheiden van Derris- en Lonchocarpuswortel en de onderscheiding van hun wortelpoeders. *Pharmaceutisch Weekblad 1937, No. 29. 9 pp.*

Georgi, C. D. V. : Marketing Aspects of Derris and of its chief Competitor, Cubé Root. *Malayan Agricultural Journal 27 (1939): 3.*

Ginsbury, J. M. and Granett : Derris and Cubé and Root. *Bulletin New Jersey Agric. Exp. Sta. 481 (1935).*

Howard, N. F., L. W. Brannon and H. C. Mason : The Mexican Bean Beetle in the East and its Control *U. S. D. A. Farmers Bulletin 1624 (1948).*

Huckett, H. C. and G. R. R. Hervey : Recent Developments in the Use of Arsenical Substitutes for vegetable Pest Control in New York. *Journal Economic Entomology 28 (1935): 602.*

Jones, H. A. and C. M. Smith : Derris and Cube. Approximate chemical Evaluation of their Toxicity. *Soap 12 (1936): 113, 115, 117.*

Jones, Merrian A., W. A. Gersdorff and E. R. McGorvan : A Toxicological Comparison of Derris and Lonchocarpus. *Journal Economic Entomology 39 (1936): 281.*

Jones, M. A., C. Pagan, E. R. McCovran, W. A. Gersdorff and P. G. Piquett: A further toxicological Comparison of Derris and Lonchocarpus. *Journal Agricultural Research 78 (1949): 191.*

Pagan, C., and A. J. Loustalot : Comparison of chemical Values with the toxicological Rotenone Equivalent of Derris and Lonchocarpus Roots. *Journal Agricultural Research 78 (1949): 197.*

Roark, R. C. : Derris versus Cube. *Soap 14 (1938): 111.*

Rowaan, P. A. and A. J. van Duuren : Over de analyse van Derris- en Lonchocarpuswortels en de samenstelling van hun extracten. *Chemisch Weekblad 35 (1938): 755.*

Spoon, W., P. A. van der Laan, C. M. L. Smulders en A. Diakonoff: Het verschil in werkzaamheid van Derris- en Lonchocarpuswortel en de onderscheiding van hun wortelpoeders. *Berichten v/d afd. Handelsmuseum v/h Koloniaal Instituut, Amsterdam 110 (1937) 2 pp. en Indische Mercuur 60 (1937): 259, 275.*