omitted by Dr. Eastman in his note upon the disputed eruptions of Vesuvius are L. Riccio, 'Bibliografia della eruzione vesuviana dell'anno 1631,' in *Arch. Stor. Napol.*, XIV., pp. 437 et seq., and the most exhaustive bibliography of Vesuvian eruptions that I know about, that compiled by Herr Furcheim (E. Prass, Naples, 1897). This latter is a work that took many years to complete.

As Professor B. Croce, of Naples, says, the terrible eruption of 1631 produced a great corpus of scientific and poetic literature concerning it. Perhaps the most noted of the literati who treated of it was Giambattista Basile (1575–?–1632) the celebrated author of the Pentameron entitled Lo Cunto de li Cunti, one of the chief monuments of Neapolitan dialect. One of the three sonnets which Basile composed upon the memorable occasion is a masterpiece of poetic visualization:

Con vomero di foco, alto stupore,
Mostruoso arator solca il terreno,
E il seme degl'incendii accoltoal seno
Vi sparge, e'l riga di fervente umore.
E, quindi, a fecondarlo in rapid'hore,
Di cenere ben ampio, ilrende pieno;
Onde, quanto circonda il mar Tirreno,
Messe raccoglie di profondo horrore.
Ma, se danno produce a noi mortali
Cotanto aspro Vesuvio; ond'ogni loco
Arde, nè scampo ei trova in mezzo al verno;
Pur raccoglier ne giova in tanti mali
Dal cener sparso, e dal versato foco,
Membranza de la Morte, e dell'Inferno!

In connection with this topic one ought not to omit mention of the eruption of 1794 as described by the historian and engineer General Colletta in his Storia di Napoli.

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SPECIAL ARTICLES

A PLANT-TUMOR OF BACTERIAL ORIGIN

THE number of vegetable galls known positively, *i. e.*, by exact experiment, to be due to bacteria, is not very great. The discovery of a new one of undoubted bacterial origin is, therefore, of considerable interest to plant pathologists, and may be of some interest to animal pathologists, especially to those interested in determining the origin of cancerous growths.

For two years the writers have been studying a tumor or gall which occurs naturally on the cultivated marguerite, or Paris daisy. It has been difficult to isolate the organism and to demonstrate it unmistakably in stained sections. Recently the bacteria (seen in small numbers in the unstained tissues on the start) have been plated out successfully. With subcultures from poured plate colonies, thus obtained, the galls have been reproduced abundantly and repeatedly during the last few months, the inoculations having been made by needle-pricks. From galls thus produced the organism has been reisolated in pure culture and the disease reproduced, using subcultures from some of the colonies thus obtained and puncturing with the needle as before. More than 300 galls have been produced by puncture inoculations. Under the most favorable conditions (young tissues) the swellings begin to be visible in as short a time as four or five days, and are well developed in a month, but continue to grow for several months, and become an inch or two in diameter.

In some of our experiments one hundred per cent. of the inoculations have given positive results (40 punctures out of 40 in one series; 62 punctures out of 62 in another), while the check plants have remained free from tumors, and also, in nearly every case, the check punctures on the same plant. In the two series just mentioned there were 110 check punctures on the same plants, all of which healed normally and remained free from galls. Old tissues are not very susceptible. The tumors grow rapidly only in young fleshy organs. The organism attacks both roots and shoots. It frequently induces abnormal growths on the wounded parts of young cuttings. Its power to produce hyperplasia is not confined to the marguerite. Well-developed small tumors have been produced in a few weeks on the stems of tobacco, tomato and potato plants and on the roots of sugar beets. More interesting economically is the fact that galls closely resembling the young stages of crown-gall have been produced on the roots of peach trees by needle-pricks, introducing this organism. In eighteen days these growths have reached the size of small peas, the checks remaining unaffected. It is too early, perhaps, to say positively that the cause of the wide-spread and destructive crown-gall of the peach has been determined by these inoculations, but it looks that way. Of course, the most that can be affirmed absolutely at this writing is that we have found an organism which when inoculated into the peach produces with great regularity galls which in early stages of their growth can not be distinguished from the crown-gall. The matured daisy galls also look astonishingly like the peach gall. Numerous experiments which ought to settle the matter definitely in course of the next three months are now under way. In the best series of experiments on peach roots (that inoculated from a standard nutrient agar culture five days old) 14 groups of needle-punctures (5 in each group) were made on nine trees, 13 tumors resulting. The fourteenth group was on a weak tree which did not leaf out, and might therefore be left out of the count. In that case we have 100 per cent. of infections. On the roots of nine young trees from the same lot, held as checks, 75 punctures were made, using a sterile needle, but no galls resulted. In another series of 9 peach trees inoculated at the same time as the preceding and examined on the twenty-third day, 75 per cent. of the punctures had yielded galls (9 tumors on 7 plants). These roots were inoculated by needle-pricks from a culture believed to be rather too old (glycerin agar streak 6 days), but the plants were set out again, and it is not unlikely that galls will finally develop on the roots of the other two plants. The plants, inoculated and uninoculated, were set, immediately after making the needle-punctures, in good greenhouse soil, in new ten-inch pots, and have been subject to the same conditions as to light, heat and water.

That crown-gall of the peach is due to a myxomycete the writers have never been willing to admit, because the inoculation experiments described by Professor Toumey do not clearly establish such fact. He saw often in the tissues of the galls what he interpreted to be the protoplasm of a slime mold mixed in with the protoplasm of the host plant, and he obtained sparingly what he supposed to be the fruiting bodies of this organism on the cut surface of the galls. He made, however, only two series of inoculations with the spores of his *Dendrophagus globosus,* four trees in the first case and six trees in the second, one developing the disease in the first instance and two in the second. Why did not the other seven trees contract the disease when the spores were thrust into the wounded tissue? He did not fully exclude the possibility that the three infections were due to some other cause accidentally introduced on his needle point. The *Dendrophagus* sporangia furnishing spores for the inoculations grew not on culture media but on the cut surface of a gall (an infectious substance). What if a few bacteria had been carried up from the surface of the gall, contaminating the surface or interior of the sporangia? Then the needle might occasionally have introduced two organisms into the wounds instead of one, as believed, and the unsuspected one might have been the cause of the disease. This supposition is not excluded by any of Professor Toumey's experiments.

The fact remains well established, however, by experiments of various persons: Thaxter, Halsted, Selby, Toumey, Smith, Von Schrenk and Hedgcock, etc., that when minced galls are buried in the earth near the roots of sound trees, the latter develop galls. The disease is therefore a communicable one, but the cause, in spite of much study by many persons, is still in dispute.

For the organism causing these tumors the name *Bacterium tumefaciens* is proposed with the following brief characterization: *B. tumefaciens* n. sp., a schizomycete causing rapid multiplication of the young tissues of *Chrysanthemum frutescens, Prunus persica,* etc., the result being the production of tumors or galls. The organism is motile, especially in young cultures; it is non-gas-forming and aerobic (twelve days) with all of the sugars and alcohols tried (dextrose, saccharose, lactose, maltose, mannit and glycerin). It is white on standard nutrient agar and potato and in peptonized bouillon. In tubes of bouillon it grows best at the top, producing a stringy ragged rim easily separable on shaking. It does not cloud bouillon heavily. The surface colonies on agar, 25° C., are small, round, smooth and rather dense. In agar streak cultures the organism is inclined to pile up along the track of the needle rather than to spread widely. It is inclined to be viscid on agar, after three days. It gradually blues litmus milk, throwing down the casein by means of a lab ferment, or at least not by the production of any acid, finally the litmus is reduced. It does not liquefy standard nutrient gelatin (fifteen days) and does not grow in the thermostat at blood heat (agar, bouillon). In young agar streak cultures it is a medium-sized, short rod, with rounded ends, often in pairs with a plain constriction, the elements usually being 1μ or less in diameter and two to three times as long as broad. The one to three flagella are polar. It is not yellow on any medium, or green fluorescent, nor does it brown the agar. It is rather short-lived on agar. It does not grow in Cohn's solution and does not infect olive shoots. It occurs principally at the bottom of the tumor rather than uniformly distributed in its tissues. It is best isolated from that part of the stem where the tumor joins the healthy tissues. There are slight indications of metastasis. Non-pathogenic yellow organisms are frequently obtained on plates made from older portions of the galls.

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April 4, 1907

NOTES ON ORGANIC CHEMISTRY

CATALYTIC ACTION OF ETHER AND OF TERTIARY BASES ON THE CLAISEN CONDENSATION AND ON THE FORMATION OF GRIGNARD'S REAGENT

Since its discovery the Claisen condensation has excited a considerable amount of interest, not only on account of the compounds which can be obtained by its means, but also because of the rather complex changes which attend its progress and which are far from being understood. In its simplest form, the reaction consists of the elimination of one molecule of alcohol from equal molecules of an ester and an aldehyde or ketone, and it proceeds under the influence of sodium or sodium ethylate. Thus, for example, acetone, CH_3-$COCH_3$, and ethyl oxalate, $C_2H_5OCOCOOC_2H_5$, under the conditions mentioned, readily form ethyl acetoneoxalate, $CH_3COCH_2COCOOC_2H_5$, and alcohol, C_2H_5OH.

In the course of some work on which we have been engaged for a number of months, we have found that the Claisen reaction is very greatly accelerated by the addition of small quantities of ether or of a tertiary base, such as pyridine or quinoline, the reacting materials being dissolved in low boiling ligroin. We have shown that this accelerating action is not due to the fact that any of the intermediate sodium compounds have a solubility in such a mixture, materially different, from their solubility in pure ligroin. In short, the ether and the bases act as typical catalytic agents. We believe that these observations put the Claisen reaction in an entirely new light.

About eighteen months ago it was found by Tschelinzeff,[1] that the formation of Grignard's reagent,

$$Mg<^{X}_{R},$$

($X =$ halogen; $R = C_2H_5$, C_6H_5, etc.) is also influenced in the same manner by the presence of ether or of a tertiary base. We have confirmed this result and have made some new observations of our own. There is thus, experimentally, a very striking parallel established between the Claisen condensation and the formation of the Grignard reagent. The object of this note is to call attention to our results, which we think have some general interest. A fuller account of the subject, together with a description of the experiments

[1] *Ber. d. Chem. Ges.*, **37**, 2081, 4534; **38**, 3664 (1905).