measure responsible for failure. Further trials by these methods now seem unnecessary.

In the cases reported above the success of the penicillin method may be attributed to several factors. Resistance of *Trichomonas vaginalis* to penicillin in the concentrations reported above, the absence from the specimens of vaginal discharge of bacteria resistant to penicillin in these same concentrations, and the destruction of bacteria adherent to the sticky surfaces of the trichomonads perhaps played a large part in assuring successful isolation of the protozoa.

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DISCUSSION

ADDITION OF CARBON TETRACHLORIDE AND CHLOROFORM TO OLEFINS

FOR many years teachers of elementary organic chemistry have struggled valiantly to combat the persistent tendency of sophomores to write reactions of the following types:

$$RCH=CH_2+CCl_4=RCHClCH_2CCl_3$$
$$RCH=CH_2+CHCl_3=RCH_2CH_2CCl_3$$

It may, therefore, be of some general interest that these reactions can now be carried out in the laboratory without difficulty. The trick by which this result is accomplished is a simple one. All that is necessary is to add to the olefin an excess of carbon tetrachloride or chloroform and a small amount (about 0.02 mole) of diacetyl or dibenzoyl peroxide, and to heat the reaction mixture.

One or two examples of reactions which have actually been carried out may be of interest.

$C_6H_{13}CH=CH_2+CCl_4=C_6H_{13}CHClCH_2CCl_3$
n-octene-1 — 1,1,1,3-tetrachlorononane

$C_6H_{13}CH=CH_3+CHCl_3=C_6H_{13}CH_2CH_2CCl_3$
n-octene-1 — 1,1,1-trichlorononane

$H_2C=CHCH_2CH_2CH=CH_2+CCl_4=H_2C=CHCH_2CH_2CHClCH_2CCl_3$
Diallyl — 1,1,1,3-tetrachloroheptene-6

$H_2C=CHCH_2CH_2CH=CH_2+2CCl_4=Cl_3CCH_2CHClCH_2CH_2CHClCH_2CCCl_3$
Diallyl — 1,1,1,3,6,8,8,8-octacholorooctane

$H_2C=CHCH_2CH_2CH=CH_2+CHCl_3=H_2C=CHCH_2CH_2CH_2CH_2CCl_3$
Diallyl — 1,1,1,3,6,8,8,8,-octachlorooctane

In all the reactions cited the yields are good (better than 60 per cent. with carbon tetrachloride); the molecular weights and per cent. chlorine contents of the products agree with the calculated figures. In all instances, some material of higher molecular weight is also formed.

Strange as the reactions cited may appear, the explanation of their mechanisms is not too difficult. Essentially, they are free-radical chain reactions initiated by the free alkyl or aryl radicals generated in the reaction mixture by the decomposition of the organic peroxide. A somewhat schematized version of the steps in the reaction between carbon tetrachloride and the alkylene hydrocarbon $RCH=CH_2$ in the presence of acetyl peroxide is given below. Certain finer details are omitted for the sake of brevity.

$$(1)\quad CH_3\overset{O}{\overset{\|}{C}}O O\overset{O}{\overset{\|}{C}}CH_3 \xrightarrow{\text{Heat}} CH_3\cdot + CO_2 + CH_3COO$$
$$(2)\quad CH_3\cdot + CCl_4 \longrightarrow CH_3Cl + Cl_3C\cdot$$
$$(3)\quad RCH=CH_2 + Cl_3C\cdot \longrightarrow R\dot{C}HCH_2CCl_3\ (A)$$
$$(4)\quad R\dot{C}HCH_2CCl_3 + CCl_4 \rightarrow RCHClCH_2CCl_3 + \cdot CCl_3$$

The chain consists in the repetition of the cycle indicated by reactions (3) and (4). The formation of material of higher molecular weight is due to concurrent reactions such as

$$(5)\quad R\dot{C}HCH_2CCl_3 + RCH=CH_2 \rightarrow \begin{array}{l}RCHCH_2CCl_3\\ \quad\ \ |\\ \quad CH_2\dot{C}HR\end{array}$$
$$(6)\quad \begin{array}{l}RCHCH_2CCl_3\\ \ |\\ CH_2\dot{C}HR\end{array} + CCl_4 \rightarrow \begin{array}{l}RCH_2CH_2CCl_3\\ \ |\\ CH_2CHClR\end{array} + Cl_3C\cdot$$

For effective repetition of the cycle, the group R in the free radical (A) must be aliphatic.[1] Where R is aromatic (*e.g.*, as in styrene), reactions similar to (5) are favored, and the product consists mostly of higher polymers.

Other additions to olefins which involve an increase in the carbon skeleton are underway in this laboratory. It seems likely that such reactions will be widely applicable.

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[1] Kharasch, Kane and Brown, *Jour. Am. Chem. Soc.*, 63: 526, 1941.

"GALL-FLOWER" OF THE FIG, A MISNOMER

IN the Greek literature of 2,000 years ago it is recorded that in Greece and in other parts of the Near East an insect called "psen" or "psenes" inhabited the fruit of the wild fig tree, that the figs from such trees were suspended in domesticated fig trees to insure the setting and maturing of the fruit. It is also recorded that the Greek peasants suspended in their fig trees galls taken from the elm in the belief that the insects that emerged from such galls served the same purpose as those from the wild figs.[1]

This mistaken use of the true plant gall and the fact that the short-styled pistillate flower of the fig inhabited by the fig insect (*Blastophaga psenes*) has a swollen appearance may be the basis for the use of the misnomer "gall-flower."

Dr. Ivan M. Linforth, University of California, Berkeley, informs us (in lit.) that in the Greek "psenes" translated by Sir Arthur Hort as "gall insects" there is nothing to suggest that the insects in question had anything to do with galls.

The misconception concerning the relation of Blastophaga to the fig still persists, as witness the statement by Imms[2] that "the eggs of this chalcid are laid in the ovaries of the caprifig and give rise to galls therein."

In 1882 Solms-Laubach[3] reported that the female flowers of the fig are transformed by the puncture of fig insects into flower galls ("sie werden durch dessen Einstich in Blüthengallen verwandelt"). He stated definitely that these flowers represent a gall formation comparable to that of various other known types of galls such as Verbascum and the "Radenkörnern" of wheat. Solms-Laubach[4] also studied various species of *Ficus* in Java and found that the fruits of some trees possessed flowers especially adapted to oviposition by fig wasps. These degenerated or differentiated female flowers he called gall flowers (Gallenblüthen) which seemed to have lost their ability to produce seed. Caprifigs contained these gall flowers almost to the exclusion of any female flowers.

Then we find that King[5] described five kinds of flowers occurring in fruits of the genus *Ficus*—male, pseudo-hermaphrodite, neuter, fertile female and gall flowers. His own name for the fifth kind was originally "insect-attacked female flowers," but he later adopted the "shorter and more suitable" name used by Solms-Laubach.

In 1896 Gustav Eisen[6] wrote as follows:

> The gall flowers, which occur in abundance in all caprifigs of all crops, are in reality nothing else than female flowers which have been transformed in order to accommodate the requirements of a small wasp, the *Blastophaga psenes*. These gall flowers are not able to produce seed, though in general aspect they resemble the female flower. . . . That the gall flower is a degenerated female flower is certain, as in some varieties it yet depends upon chance which flowers are to be gall flowers and which are to remain female flowers. Those pierced by the wasps develop into galls, those which are not pierced remain female flowers. In our present caprifig, the female flowers, even if pierced by the ovipositor of the Blastophaga, will never become gall flowers.

At this point we may state that in the light of our present knowledge there are only two kinds of pistillate flowers in figs, long-styled flowers found in edible figs, and short-styled flowers found in caprifigs. All pistillate fig flowers are potentially fertile; if pollinated and fecundated they all may produce viable seed. The Blastophaga oviposits in the short-styled flowers, an act which precludes growth of a pollen tube through the stylar canal. No investigator has yet reported the presence of a larva and an embryo in the same ovary of a fig flower. Some short-styled flowers which escape Blastophaga oviposition may be pollinated and develop fertile seed. The above-mentioned authors do not give the exact morphological differences between the female and so-called gall flowers of the caprifig. We maintain that they are not different but identical.

The purpose of the present paper is to show that the terms "gall fig" and "gall flower" are both inaccurate and misleading. A gall fig has been defined as a caprifig because of the fig wasps which were supposed to develop within galls produced in these figs. The dictionary definition[7] of gall flower is: "The degenerate pistillate flower found in certain varieties of the cultivated fig. These flowers can not develop seed, on account of their aborted ovaries." Our contention is that this definition is incorrect, that the pistillate flowers are not degenerate, that every flower has the capacity to develop a seed, and that there is rarely if ever any abortion of the embryo.

The misconception about fig flowers may be clarified by a proper understanding of the word gall. This is defined as a swelling or excrescence on a plant produced by some other organism. A gall is seldom, if ever, of any value to the host plant and may be decidedly injurious. In the short-styled pistillate flower of a fig there is no swelling or excrescence resulting from the presence of any stage of Blastophaga in the ovary. An insect-inhabited flower can not be distinguished by its form from an uninhabited flower. Furthermore, there is a symbiotic relationship between the Blastophaga and the fig, the former having a home and food supplied it, and the latter depending upon the insect for pollination of its flowers.

The usual result of pollination of a fig flower is formation of an embryo and eventually of a mature achene. An unpollinated fig flower, either long-styled

[1] E. Theophrastus, "Enquiry into Plants," 2 vols. New York: G. P. Putnam's Sons. Engl. translation by Sir Arthur Hort, 1916.

[2] A. D. Imms, "A General Textbook of Entomology," 727 pp. London: Methuen and Company.

[3] H. G. Solms-Laubach, *Abhandl. K. Ges. Wiss. Göttingen*, 28: 11, 22, 1882.

[4] H. G. Solms-Laubach, *Bot. Zeitung*, 43 (33–36): 15, 1885.

[5] George King, *Ann. Royal Bot. Gard. Calcutta*, part 1, page V, 1887.

[6] Gustav Eisen, *California Acad. Sci. Proc.*, Ser. 2, Vol. 5: 916, 937, 1896.

[7] *Webster's New Intern. Dict.*, 2nd ed., p. 1028. Springfield: G. and C. Merriam Company, 1934.

or short-styled, may develop an achene-like, empty ovary already designated a *cenocarp* by Condit.[8] For such an ovary when inhabited by *Blastophaga psenes* we propose the name, *psenocarp*. A psenocarp differs from an achene in that Blastophaga occupies the position of the embryo.

It seems clear to us that the term "gall flower" should be omitted from future publications or, if used, be accompanied by a suitable definition. In redefining it the following statement should suffice: Gall flower, a term erroneously applied to short-styled fig flowers inhabited by fig insects; such flowers are normal and show no swelling or excrescences typical of galls. See Psenocarp.

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A GUMMOSIS OF CITRUS ASSOCIATED WITH WOOD NECROSIS

STUDIES during the past seven years at the Lower Rio Grande Valley Experiment Station have disclosed that the most prevalent and most serious citrus tree disease in this section is a type of gummosis; and that the gumming arises from cracks in the bark overlying and connected with irregular bands of necrotic wood, the greater part of which lies well beneath the outer wood layers. Reference has been made to this disease in annual reports of the Texas Agricultural Experiment Station.

Cross sections through a gumming branch disclose the end views of the necrotic bands of wood lying often an inch or more beneath the surface, irregular in thickness (varying from one fourth to two inches) and varying in width from a fraction of an inch to several inches, sometimes extending to three quarters or more of the circumference. Longitudinal sections show that the longitudinal extension of the necrotic band is usually several times the lateral spread. Spread is both upward and downward in the trunk or branch.

Affected wood is firm, and only slightly darker in color than normal wood, except that the advancing border region is a more or less salmon pink, becoming brighter in color soon after exposure to the air. Histologic studies of transverse and longitudinal sections through the wood in the peripheral pink region disclose the presence of hyphae of extremely small diameter and of what appear to be spores of equal diameter budding off their tips. The organism is suggestive of an Actinomyces in appearance. Its advance through the tissues is both inter- and intracellular, and in medullary rays as well as in longitudinal wood fibers. Aside from the spore-like bodies mentioned, no fungus fruiting bodies of any kind have been found consistently associated with the organism. The dead wood, however, in the older necrotic regions, is invaded by secondary organisms, chief among which is *Diplodia natalensis*.

[8] Ira J. Condit, *Hilgardia*, 6(14): 459, 1932.

Numerous attempts to isolate the primary organism in pure culture on ordinary organic nutrient culture media and on synthetic media have thus far failed. Inoculations into healthy branches, following the usual preparatory aseptic measures, using pink border wood as the inoculum and placing it well into the wood in a chisel wound, have in most cases brought about typical spreading necrotic bands in the wood, followed by gummosis. It would seem to be clear that this citrus tree disease is parasitic in origin. Points of entrance into the wood have been found in unprotected pruning wounds, particularly those large in diameter and with cracks or "checks" a half inch or more in depth; in branches broken by a storm; in wood injured and cracked by freezing; and in bark injuries made by the shoes of pickers and pruners. Spread is at times rapid. A spread of one and one half feet downward in thirty days occurred in one case under observation.

Exploratory excavations of affected trunks, to learn the extent of the path of spread, have disclosed that downward spread appears to stop at the line of bud union between the root stock and the top. The sour orange root stock would thus appear to be immune. The disease occurs commonly in sweet orange, grapefruit and the Meyer lemon.

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WHY THE RAINBOW AND THE CORONA NEVER ARE SEEN IN THE SAME CLOUD

NEARLY every good book on general physics explains (very inadequately, as a rule) how the rainbow is formed by the action of water drops on incident light from the sun or the moon, and some of them explain how the corona or small rainbow-colored ring around the sun or moon also is caused by water drops, but why, then, one never sees a rainbow in the corona-producing cloud appears always to be left to the reader to figure out for himself, which, presumably, he generally forgets to do.

Well, anyhow, the reason is that while a rainbow must be produced by the same cloud that shows the corona, it is too broad and indistinct, owing, as explained in Humphreys' "Physics of the Air" and elsewhere, to the minuteness of the drops to be clearly discerned. Perhaps, though, it might occasionally be glimpsed by persons of keen vision on looking at the right place (where the topmost portion of the usual