than $920 per grant. In Class I, Mathematical and Physical Sciences, 135 grants were made in six different subjects for a total sum of a little more than $140,000; Class II, Geological and Biological Sciences, received 236 grants in fourteen different subjects for a total sum of $182,476; Class III, Social Sciences, received 26 grants in history and political science for a total of $20,632; Class IV, Humanities, received 81 grants in nine different subjects totaling $84,713. In addition to the 478 grants in these four classes there were seven miscellaneous grants, which could not be properly classified in any of the classes, for a total sum of a little more than $19,000.

In explanation of the inequality of distribution of research funds to the four classes it was pointed out that this distribution was roughly proportional to the number of applications from these classes; furthermore the committee on research has always attempted to make the grants to the most worthy applicants without reference to the classes or subjects represented.

The funds at the disposal of the Committee on Research are not sufficient to make long-continuing grants and consequently the policy has been to help start or finish worthy projects rather than to furnish continuing support; in only 68 cases have grants been renewed for a second time and only in 23 cases for a third. Likewise, it has not been possible to make grants to pay in whole or in part the salaries of members of the staff of any institution, nor in general to pay living expenses of applicants.

In all cases applicants are expected to specify the uses to which the grant will be put. In general each grant has been used for several purposes, but the principal uses may be classified as follows: assistants, technical, artistic, etc., 213 grants; apparatus and materials, 128 grants; travel and field work, 123 grants; living expenses, 14 grants, and publication, 6 grants.

Recipients are notified that in no case is a grant to be regarded as a gift or charity but rather as an investment in men and projects, which investment is expected to yield returns. No doubt there are many returns of a more or less intangible nature such as the personal education of the recipient, but the most tangible result of any grant is the promotion of knowledge through the publication of research. All grantees agree to furnish an abstract of the results of their researches for publication in the *Year Book* of the society. In *Miscellanea* for 1935 and 1936, there were published 25 such abstracts; in the *Year Books* for 1937, 1938 and 1939, 289 abstracts; and 47 full papers resulting from grants have been published in the *Proceedings* of the society, 6 in the *Transactions* and 3 in the *Memoirs;* while 118 reports of researches aided by grants of this society have been reported at its general meetings. In addition, grantees have reported 236 books and articles published elsewhere which have resulted in whole or in part from grants of this society. Thus practically all grants, except some of those made during the past year for which there has not been sufficient time to expect published results, are represented in these publications. In general this seems to be a fairly satisfactory return on the investments made in our grants-in-aid of research.

Twelve different members of the Committee on Research reported to the society their estimates of the value of the researches in the fields with which they were especially familiar, and as one member said of his own field they might be classed as good and not-so-good. This could probably be said of the grants in all the fields. It is difficult to say what proportion of all the researches could be classed as good, fair or poor, but it is probable that at least three quarters of all would fall in the first two categories. Perhaps this is as good a result as could be expected, considering the fact that the Committee on Research has been inclined to favor applicants who are in small institutions where facilities for research are not good. In all such cases the stimulus to investigator and institution has been an important result and the grant has been regarded as a trust and has been conscientiously used as such. On the whole it may be said that the research program of the American Philosophical Society has been a success and that our investments in men and projects have yielded satisfactory returns.

EDWIN G. CONKLIN

SPECIAL ARTICLES

SUGGESTIONS ON PLANT VIRUS NOMENCLATURE AS EXEMPLIFIED BY NAMES FOR CITRUS VIRUSES

SEVERAL systems of nomenclature for viruses have been advanced. The following suggestions have developed out of discussions with a number of my associates who have urged me to publish it for consideration. The following manner of naming the viruses, in my judgment, would combine the best features of Johnson's,[1] Smith's[2] and Holmes's[3] proposals, without the chief objections and difficulties in the application

[1] James Johnson, *Agr. Exp. Sta., Univ. of Wis. Res. Bull.* 76, 1927.

[2] Kenneth M. Smith, "A Textbook of Plant Virus Diseases," p. 101. Philadelphia: Blakiston Company, 615 pp., illus., 1937.

[3] Francis O. Holmes, "Handbook of Phytopathogenic Viruses." Minneapolis: Burgess Publishing Company, 221 pp., 1939.

and use of any one of these. It is virtually a simplified Smith's system without the confusion of numbers and Holmes's system without the generic difficulties. In view of our present imperfect knowledge we are not ready for genera in the ordinary concept.

A classification of submicroscopic entities, using many genera which are based merely on symptoms, is, it seems to me, of doubtful value in that it infers that we know more about these entities inducing these symptoms than we actually do know. It assumes certain close relationship between certain of these entities when, in fact, most of these relationships are still uncertain in general and in most cases totally unknown in any physical or chemical sense. On the basis of symptoms, the virus of psorosis in citrus could be placed in any one of four of Holmes's genera.

What seems at present most needed is an easily applied and simple rule for naming the viruses. In the flux of present research, significant names for use seem more important than systems of classification.

A simple way to accomplish this and combine the good features of the previously proposed methods is to use binomials as suggested by Bennett[4] but to derive the "genus" from the host plant, as do Johnson[1] and Smith,[2] and to use specific names, as does Holmes,[3] instead of numbers. In case viruses have already been described and tenable specific names have already been employed, these may be adopted.

The rule for the names of "genera," as indicated by examples given below, is plain, simple and easily applied. *Add the stem "vir" for virus (Latin neuter) to the Latin genitive of the genus of the host in which the virus was first discovered and recognized, dropping any final consonants that occur in this genitive.* To illustrate from viruses which have recently been named by Holmes, peach rosette virus becomes *Prunivir rosettae,* the raspberry-streak virus *Rubivir orientale,* the beet curly top virus *Betaevir eutetticola,* and potato yellow-dwarf virus becomes *Solanivir vastans.*

These "genera" tell one at once two things which are not evident in Holmes's genera: (1) that this "genus" refers to a virus as shown by the ending "vir" from the Latin virus; (2) that it was first recognized and shown by transmission to be a virus in a particular genus of plant. About the worst this rule can do is to make names like Medicaginivir or Chrysanthemivir, neither of which, however, is difficult to pronounce. It will also give many short names, as Zeaevir, Poaevir, Iridivir, Rosaevir, Pyrivir, etc. When the resulting "genus" might rarely have more than six syllables, the final syllable of the genitive may be dropped out. For example, for a new virus of Calceolaria, the derived generic name would be Calceolarivir instead of Calceolariaevir. All these may be considered as Latin neuter nouns.

[4] C. W. Bennett, *Phytopathology,* 29: 422–430, 1939.

Specific names of viruses already described may be added to such genera as far as these specific names are tenable, as indicated by the previously named examples. Some already proposed specific names in Holmes's system, however, may need to be replaced because of duplication that would otherwise result.

If authorities are to be cited for these virus names, these derived "genera pro tem" should not be considered in the ordinary taxonomic sense. Since these names are predetermined by the name of the host and since they carry their own meaning, necessary citations need be made only in relation to the names of species, as, for example, *Prunivir rosettae* Holmes[3] or *Prunivir rubiginosum* Reeves.[5] There would be no place for the term "new combination."

I suggest that no suspected virus be given a binomial name merely from observation of certain symptoms or effects in nature which resemble virus diseases until it has been conclusively proved that it is transmissible from plant to plant by budding, grafting, use of insect vectors, mechanical or other means.

Where there are well-marked distinct strains or varieties which need varietal names, these may follow the established botanical procedure. No varietal names, however, should be employed merely for virus strains showing more or less virulence or shownig more or less fluctuation in symptoms unless these produce other proven transmissible persistent differences that enable the virus varieties to be recovered again and recognized. To give varietal names based merely on observation of any of these slight differences in behavior will lead, it seems to me, to meaningless naming and confusion.

The advantages of this manner of naming would be:

(1) Simplicity and ease of application in our present imperfect knowledge of the viruses.

(2) Indication in the ending of the "genus" name that it is the name of a virus.

(3) Preservation in the name itself of the first-discovered host relationship of the virus, as in Johnson's and Smith's proposals.

(4) Avoidance of the confusion resulting from numbers, especially in the application of new numbers as is accomplished in Holmes's proposals.

(5) Avoidance of the implication of too certain a generic relationship between viruses producing certain similar host effects, pending more definite knowledge of these viruses.

(6) Furnishing immediate usage of definite predetermined "genera pro tem" which can be easily replaced without change of specific names by another set of genera, if need be, when sufficient knowledge of the viruses is forthcoming.

[5] E. L. Reeves, *Phytopathology,* 30: 789, 1940 (abst.).

In line with this manner of naming, the following designations are proposed for the citrus viruses:[6]

Citrivir italicum (italicum = pertaining to Italy). The virus causing infectious mottling of citrus.[7]

Citrivir psorosis (psorosis, Latin genitive of *psorosis* = of the psorosis disease). The virus causing psorosis of citrus.[8, 9]

C. psorosis var. *vulgare* (vulgare = general, common). The virus of psorosis A, or the common scaly bark type.[8, 9]

C. psorosis var. *anulatum* (anulatum = with a ring). The virus of psorosis B, a distinctly different type from A.[8, 10]

Other forms which are believed to be due to varieties of the psorosis virus pending further evidence are "concave gum," "blind pocket," "crinkly leaf" of lemon and "infectious variegation."

There are still other virus-like effects in citrus in which viruses are suspected but about which insufficient knowledge regarding transmission is known to justify virus names at present. Some of these are leprosis of Florida and South America, cyclosis of Brazil and concentric ring blotch of South Africa. In this connection it should be pointed out that there is no known experimental evidence to justify Atanosoff in listing as virus diseases a number of other things on citrus. To list certain effects as virus diseases merely because they have no known causal agent serves no useful purpose and tends to fill the literature with misleading erroneous citations.

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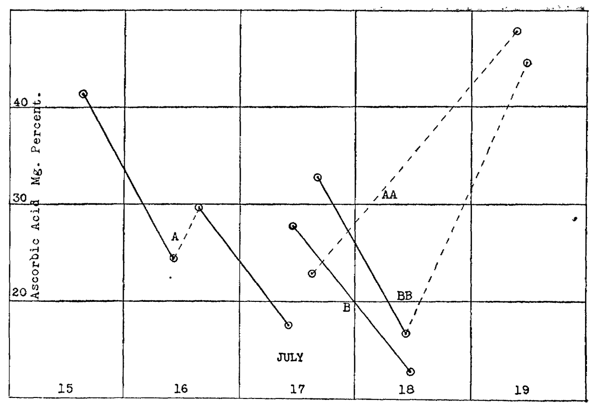
SOLAR RAYS AND VITAMIN C

In an attempt to correlate the ascorbic acid content of young tomato plants of different varieties with the Vitamin C content of the tomatoes they produce, we have discovered a striking relationship between solar irradiation and ascorbic acid content in the plants.

Tomato seeds were planted on June 4, 1940; 24 plants of each variety transplanted into separate flats on June 14. They were kept in the greenhouse until June 26, when the flats were placed in the open. Five flats (Group A) were brought into the laboratory on July 15 and five additional flats (Group B) on July 17, for ascorbic acid studies. On Chart 1, graphs A and B represent the values when single whole plants, cut off at the ground (about 10 g), were used as samples. For graphs AA and BB the upper portions of 3 to 5 plants (about 10 g), from just below the two upper side leaves, were used. Since variety showed no consistent effect, averages of the five varieties at each time of analysis are indicated. Between points connected by solid lines the flats were in the laboratory, with diffuse sunlight during the daytime, while between points joined by broken lines they were in the open on the roof.

Chart 1.



It is evident from Chart 1 that there was a rapid loss of ascorbic acid when the plants were kept in the laboratory over night, and a rapid recovery when the plants were exposed to direct sunlight.

This observation raises the question of the role of ascorbic acid in plant life, about which little is known in comparison with our knowledge of its functions in animal physiology. The loss of Vitamin C in market vegetables is commonly ascribed to atmospheric oxidation. The much more rapid losses in these growing plants suggests its use in some physiological process, with solar rays as essential to its production.

We also have evidence of a positive correlation between ascorbic acid and sugar in the ripe tomato fruit. Is it possible that ascorbic acid is a step in the formation of other carbohydrates? We present these data in the hope that others may carry such studies further, since they are beyond our province.

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INEFFICACY OF PANTOTHENIC ACID AGAINST THE GRAYING OF FUR

György and Poling have recently reported[1] the results of studies which indicated that pantothenic acid has a curative effect on the nutritional achromotrichia

[6] Because of limitations of space, at the suggestion of the editor the detailed descriptions of these viruses are omitted. These are being submitted to *Phytopathology*.

[7] T. Petri, *Bol. R. Staz. Pat. Veg.*, n.s., 11: 105–114, 1931.

[8] Howard S. Fawcett, "Psorosis: In Citrus Diseases and Their Control." 2nd ed., pp. 188 to 203. New York: McGraw-Hill Book Company, 1936.

[9] *Idem, Phytopathology*, 24: 659–668, 3 figures, 1934.

[10] *Idem, Phytopathology*, 28: 669, 1938 (abst.) and 29: 6, 1939 (abst.).

[1] P. György and C. E. Poling, Science, 92: 202, 1940.