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SOME PROBLEMS IN THE GENETICS OF THE FUNGI[1]

By Dr. B. O. DODGE

THE NEW YORK BOTANICAL GARDEN

INTRODUCTION

NOT every one has had an opportunity, or the desire, to study the fungi critically. Most people, however, are more or less familiar with molds, mildews, mushrooms and yeasts. Those of you who were brought up in the country districts may remember how you enjoyed kicking over toadstools and puffing puffballs in each other's faces. The man who collects wild mushrooms in woodlands for food seldom thinks of them as plants. Botanists, on the theory that all living things must be either plants or animals, place the fungi in the plant kingdom. They say that if fungi ever had chlorophyll they have lost it through degeneration, and degenerates make little progress in evolution. It is a very common belief that the fungi are of little economic importance except as they cause decay and disease, and, since they show little evolution, their study would promise little as to throwing light on the great life processes. As a matter of fact, just to mention two examples, the fungi and bacteria are of incalculable value in building the soil and maintaining its fertility. Yeasts rival our boasted billion dollar corn crop, if we count the value of alcohol and other useful products of fermentation.

The old attitude is changing, as witness the interest in sex and genetics of fungi manifested during the past ten or fifteen years. This work will certainly be greatly facilitated in the next decade by the use of growth substances and sex hormones to bring into fertile cultures species of obligate parasites not now at all adapted for this type of genetic study. We may

[1] Presented at a general session of the Third International Congress for Microbiology, New York, September 6, 1939.

of limited quantity is to be analyzed, the apparatus can be clamped shut at the proper moment. A tuning fork whose frequency of vibration per second is 512 is placed over the upper end of the tube. By striking the tuning fork and raising and lowering the column of water, points of resonance (accentuation of the hum of the tuning fork) are found. The distance between two adjacent points of resonance is half of one wavelength. This distance times two, multiplied by 512 (the frequency of vibration of the tuning fork) equals the velocity of sound per second. A small correction, which is rarely significant, is made in the velocity for variation in laboratory temperature (Table 1);

TABLE 1

CORRECTION OF VELOCITY OF SOUND FOR VARIATIONS OF TEMPERATURE FROM 24° C

Velocity of sound, meters per second	to 650	750	850	900 and over
1° C. equals (meters per second)	± 0.5	±0.14	± 0.3	special corrections (see below)
Add or subtract with rise in temperature	subtract	subtract	add	add

Special corrections for velocities of 900 meters per second and over:

18° C.	19	20	21	22	23	24	25	26	27	28	29	30
–4.1	–3.6	–3.0	–2.4	–1.7	–0.9	0.0	+1.1	+2.2	+3.5	+5.0	+6.7	+8.5

"–" indicates substraction for correction to 24° C.; "+" indicates addition.

changes in the temperature affect the velocity by changing the density of the gases and by changing the amount of water vapor in the mixture.

The formula for the velocity of sound in a gas is

$$V = \sqrt{\frac{\gamma P}{d}},$$

where

V = velocity of sound in centimeters per second;

γ = Cp/Cv = ratio of specific heat at constant pressure to that at constant volume (γ for oxygen is 1.401; for nitrogen it is 1.404; for helium it is 1.66);

P = pressure in dynes per square centimeter; and

d = weight of gas in grams per cubic centimeter.

A chart (Fig. 2) has been constructed on the basis of computation of the theoretical velocity of sound for many different mixtures of helium, oxygen and nitrogen. In using the chart one can read horizontally from the experimentally determined velocity of sound, corrected for temperature, to the determined percentage of oxygen, which may have to be interpolated, thence vertically to the percentages of helium and nitrogen in that portion of the gas remaining after deducting the oxygen. In practice, a large-sized replica of Fig. 2 on graph paper is used.

No attempt has been made to control all the sources of error, most of which are small and may offset one another. It is possible to determine the velocity of sound with our apparatus with an accuracy of approximately ± 0.5 per cent. (range of variability) and to determine the percentages of helium and nitrogen in the whole mixture with an accuracy of approximately ± 1.0 per cent. (range of variability). The apparatus and method are intended for practical use in medicine or industry where this degree of accuracy is satisfactory. The apparatus is inexpensive, mobile, simple and easy to use.

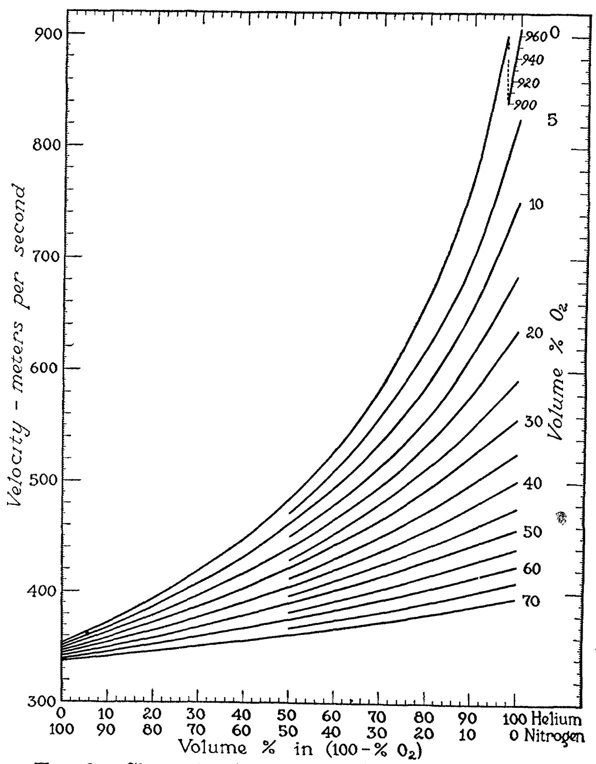

FIG. 2. Chart showing the velocity of sound at 24° C. in mixtures of helium, oxygen and nitrogen, saturated with water vapor.

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BOOKS RECEIVED

ARNOW, L. EARLE. *An Introduction to Physiological and Pathological Chemistry.* Pp. 555. 143 figures. Mosby. $3.50.

CHARLES, BROTHER H. *Biology.* Pp. viii + 408. Illustrated. Bruce. $1.72.

EALES, N. B. *The Littoral Fauna of Great Britain; a Handbook for Collectors.* Pp. xvi + 301. 24 plates. Cambridge University Press, Macmillan. $3.50.

EDDY, SAMUEL, CLARENCE P. OLIVER and JOHN P. TURNER. *Guide to the Study of the Anatomy of the Shark, the Necturus and the Cat.* Pp. vii + 100. 15 figures. Wiley. $1.50.

PARKER, JOHN B. and JOHN J. CLARKE. *An Introduction to Animal Biology.* Pp. 503. 163 figures. Mosby. $3.75.

WHITEFORD, G. H. and R. G. COFFIN. *Essentials of College Chemistry.* Second edition. Pp. 534. Illustrated. Mosby.