

ever, is the fact that the amount of energy required to produce a given amount of retardation when the sperm was irradiated then used to inseminate an unirradiated egg was quite different from that required when the egg itself was irradiated. Thus in typical experiments a dosage of 50 ergs per mm² of incident energy given the sperm produced pronounced retardation, the first three divisions of the eggs inseminated with such sperm occurring two hours after the controls. A dosage of only 100 ergs given the sperm causes a delay of about 3 hours. A dosage as low as 300 ergs, given the sperm, causes irregular and abnormal development of the eggs inseminated with such sperm. On the other hand, a dosage of 50 ergs per mm² given the eggs caused only barely perceptible delay in division and a dosage of 816 ergs per mm² caused a retardation of the first three divisions of only about 1½ hours. The eggs will tolerate even 3,000 ergs per mm², cleaving slowly to form embryos.

These results indicate clearly the greater susceptibility of the sperm and therefore of naked nuclei to ultra-violet radiations. The nuclear material is present in the egg, but the radiations must pass through a thick layer of cytoplasm before reaching the nucleus. The greater resistance of the egg may be dependent upon the protection afforded by the cytoplasm to the nucleus. The radiations are unquestionably destructive to the cytoplasm⁵ as well, but cytoplasmic injury is apparently less effective in retarding cell division than is injury to the sperm nucleus.

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A SPECIES OF AZOTOBACTER TOLERANT TO HIGH ACIDITY

ONE of the prominent characteristics of the aerobic, nonsymbiotic nitrogen-fixing bacteria, known as *Azotobacter*, is their sensitiveness to acid reactions. There is quite general agreement that pH 5.8 to 6.0 is the acid limit for growth in the absence of fixed nitrogen.¹ As stated by Burk and associates,² "The limit of fixation at pH 6.0 has been universally observed by all investigators." Even though *Azotobacter* has occasionally been recovered from mineral soils as acid as pH 4.5 and was reported as having been found in peat of pH 3.6,³ there is no evidence that any of the isolated species of *Azotobacter* are able to develop upon nitrogen-free media which are more acid than the above-mentioned limit. Burk and associates^{2,4} reported that the respira-

tory mechanism of *Azotobacter* is irreversibly destroyed by prolonged exposure to reactions below pH 5.0.

It is therefore of interest that there is a species of *Azotobacter* which grows and fixes nitrogen in very acid media. This organism was isolated from acid soils (pH 4.9 to 5.2) of India by P. K. De and has been cultivated in laboratory media for several years.⁵ It develops well in nitrogen-free liquid media and upon agar slants from the acid limit which appears to be close to pH 3.0 up to at least pH 9.0. The organism develops well in nitrogen-free media similar to those commonly used for the well-known species of *Azotobacter*. Sucrose and glucose are readily utilized. During incubation for several weeks in a medium with an initial pH 3.1 and containing 1.5 gm of glucose, 9 mgm of nitrogen were fixed. Where the initial pH was 3.0, 3 mgm of nitrogen were fixed. Nitrogen fixation was greater between pH 3.8 and 8.0.

The acidity of the medium increases somewhat during development of the organism; the change in pH is greater in the alkaline and neutral media than in media which are close to the limiting acid reaction. During growth in media containing nitrate nitrogen the pH rises slightly, whereas in the presence of ammoniacal nitrogen the pH dropped from pH 6.5 to 3.5; this can be ascribed to the assimilation of the ammonium and nitrate nitrogen.

The unusual tolerance of the new organism to extreme acidity clearly distinguishes it from any of the previously described species of *Azotobacter* and indeed from practically all known bacteria. It appears to be at least as acid-tolerant as the anaerobic, nitrogen-fixing bacteria.⁶ In fact, there are only exceptional species of bacteria which are able to develop at more acid reactions. Whether or not the acid-tolerant *Azotobacter* is widely distributed in soils or will develop in soils over as wide a range of reaction as in artificial media remains to be ascertained.

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HIPPOBOSCID FLIES FROM NORTH AMERICAN DOVES

G. R. COATNEY'S note in *SCIENCE* for September 16, 1938, on the possible carrier of dove *Haemoproreus*, may be supplemented with the following information.

Microlychnia pusilla (Speiser) is probably the most widely spread hippoboscid fly of doves. It is a strictly

⁵ Giese, *Biol. Bull.*, 75: 238, 1938.

¹ S. A. Waksman, "Principles of Soil Microbiology," 2nd ed. Williams and Wilkins Company, Baltimore, 1932. P. L. Gainey, Proc. and Papers of First Int. Congr. of Soil Sci., Washington, D. C. 3: 107-117, 1928.

² D. Burk, H. Lineweaver and C. K. Horner, *Jour. Bact.*, 27: 325-340, 1934.

³ J. K. Wilson and B. D. Wilson, N. Y. (Cornell) Agr. Exp. Station, Memoir 148, 1933.

⁴ D. Burk, *Ergebnisse der Enzymforschung*, v. 3: 23-56, 1934. D. Burk and H. Lineweaver, *Jour. Phys. Chem.*, 38: 35-46, 1934. D. Burk, C. K. Horner, and H. Lineweaver, *Jour. Cell. and Comp. Phys.*, 1: 435-449, 1932.

⁵ A description of this organism will soon appear in *Soil Science*. In this report the organism is described as a new species of *Azotobacter*.

⁶ W. H. Willis, Iowa Agr. Exper. Sta., *Res. Bul.*, 173, 1934.