is readily transmissible to sweet pea *Lathyrus odoratus* in which small brown lesions appear on the main stem.[3] Severin[4] and Linn[5] reported lettuce yellows disease caused by aster (*Callistephus chinensis*) yellows virus which results in yellowing, blanching and curling of the inner leaves; margins of these curled leaves develop small brown spots. Other virus diseases recorded on lettuce by Smith[2] are Dandelion yellow mosaic, cucumber yellow-mottle mosaic, tomato spotted Wilt and 'Big-vein'. Symptoms of all these appear to be different from yellow mosaic disease of lettuce now described.

Division of Mycology and Plant Pathology, Indian Aricultural Research Institute, New Delhi,
July 27, 1948.

R. S. VASUDEVA.
S. P. RAYCHAUDHURI.
P. S. PATHANIAN.

1. Jagger, I. C., *J. Agric. Res*, 1921, **20**, 737–40. 2. Smith, K. M., *Virus Diseases of Farm and Garden Crops*, Littlebury & Co., Ltd., 1947, 56–58. 3. Ainsworth, G. C., *Ann. appl. Biol.*, 1940, **27**, 218–226. 4. Severin, H. H. P., *Hilgardia*, 1929, **3**, 543–71. 5. Linn, M. B., *Bull. Cornell Univ. Agric. Expt. Sta.*, 1940, **742**, 33.

A NEW BACTERIAL DISEASE OF *IPOMOEA MURICATA*

A NEW bacterial disease of *Ipomœa muricata* growing on the hedges and on the banks of river near Poona had been noticed for the first time in the rainy season of 1947. The disease is characterised by minute spots with bright yellowish areas which enlarge and involve a large part of leaves which become brown and brittle. Infection sometimes follows the veins and when severe, brings about distortion and wilting. Infection occurs through stomata or through vascular system and as such it resembles bean blight or cowpea blight. The pathogene has been isolated in pure state by ordinary plating method. The organism is new to science and hence has been assigned a specific rank.

Xanthomonas Uppalii sp. nov.—Rods with rounded end, $2 \cdot 2 \times 0 \cdot 9\,\mu$. Motile with a single polar-flagellum. Gram-negative. Non-capsuálated. Not acid fast. No spores. Mostly single. Gelatin liquefied. Fair, smooth, dull, filiform lemon-chrome growth on nutrient agar. Litmus in milk reduced. Nitrites, ammonia and indol not produced. Hydrogen sulphide produced. No growth in Uschinsky's, Cohn's and Koser's uric acid media. Acetyl-methyl-carbinol not produced. Good growth with no acid and no gas in dextrose, lactose, sucrose, mannitol, raffinose, salicin and xylose. Levulose, arabinose not utilised. Starch hydrolysed. Strict aerobe. Optimum temperature 30° C. Thermal death point about 51° C.

Pathogenic on *Ipomœa muricata* but not on *I. batata*, *Phaseolus vulgaris*, *Dolichos lablab* and *Vigna catjang*. A detailed paper will shortly be published.

Plant Pathological Laboratory,
College of Agriculture, Poona, M. K. PATEL.
July 22, 1948.

ROLE OF PROTOZOA IN THE PURIFICATION OF SEWAGE BY "DILUTION"

IN view of our earlier observations on the role of certain forms of protozoa (more especially *Vorticellids*) in the purification of sewage in artificial tanks[1,2] and under certain conditions of land irrigation,[3] it was of interest to study the occurrence and development of such forms in raw sewage before treatment. Examination of some 500 samples of sewage derived from different sources showed (*a*) that they generally contained cysts of the protozoa commonly found in the purification tanks; (*b*) that the sources of the cysts were traceable to washings containing soil, such as sullage and storm water, discharged into the sewers; (*c*) that when the sewage was 'weak', considerable numbers of active protozoa were present; and (*d*) that when the sewage was 'strong' or was diluted with discharges of alkaline or acid wastes in such proportions as to affect appreciably the pH value of the medium (or when the sewage contained certain other trade effluents), no active protozoan was seen.

Continued observations extending over a period of ten years at the Institute sewage works (dealing with domestic sewage) have shown that flow of 'weak' sewage in the sewers facilitated the development of protozoa, such as the species of *Vorticella*, *Epistylis*, *Paramœcium* and other smaller ciliates and flagellates, including *Amœba*; that the sewage samples collected at the works were occasionally found to contain nitrite in amounts ranging from traces to about 0·02 parts per 100,000.

Experiments were carried out by diluting raw sewage in varying proportions and keeping these diluted samples in shallow basins (in glass basins of diameter 3¾″ and depth 2¼″, and in porcelain troughs of diameter 8½″ and depth 4½″) and by examining the contents of the basins at frequent intervals for the micro-organisms and the oxidation changes. It was observed that in the 'weak' and diluted samples of sewage large numbers of protozoa developed. The predominant forms of protozoa were *Vorticella* sp. and *Paramœcium* sp., the former generally predominating in the earlier stages (upto about 36 hours); and in the later stages (after about 72 hours) other forms of protozoa, such as *Acineta* sp. and *Stylonychia* sp., also developed. A brownish deposit or sludge was found to be formed more especially in the basins which contained considerable numbers of protozoan cells; when the supernatants in the basins were decanted off and fresh water was added to the settled sludges, increasing amounts of nitrite and nitrate were produced. Thus it is of considerable interest to note in this connection that while the numbers of protozoa that develop in a given volume of sewage depend upon the amount of organic matter and dissolved oxygen

TABLE I

Observations on the protozoal activity in freely exposed samples of 'weak' and diluted sewage
(Results of chemical analyses expressed as parts per 100,000)

Sewage-dilutions	At start	24 hrs. after dilution			48 hrs. after dilution			72 hrs. after dilution		
	Oxygen absorbed from potassium permanganate in 4 hrs.	Oxygen absorption in 4 hrs.	Nitrite nitrogen (N)	No. of active protozoa per c.c. of the mixed liquor (mostly *Vorticella* sp.)	Oxygen absorption in 4 hrs.	Nitrite nitrogen (N)	No. of active protozoa per c.c. (*Vorticella* sp. and *Paramœcium* sp.)	Oxygen absorption in 4 hrs.	Nitrite nitrogen (N)	Protozoa
1 Sewage only ..	4·52	2·80	Nil	4,000	1·76	Nil	600	1·64	Nil	Practically no active *Vorticella* sp. but considerable numbers of *Paramœcium* sp. and other forms. The protozoa in basins 5 and 6 were comparatively few.
2 Sewage+water 4 : 1 ..	3·36	2·08	,,	2,500	1·44	,,	300	1·20	,,	
3 Sewage+water 3 : 2 ..	3·12	1·52	,,	2,000	1·08	,,	200	0·96	Traces	
4 Sewage+water 2 : 3 ..	1·76	0·92	,,	1,500	0·80	,,	100	0·72	0·004	
5 Sewage+water 1 : 4 ..	1·12	0·48	Traces	600	0·48	Traces	40	0·44	0·020	
6 Sewage+water 1 : 9 ..	0·64	0·40	,,	60	0·36	,,	20	0·32	0·004	

Domestic sewage was employed for the above series of experiment. At the start of the experiment there was no active protozoan and there was no nitrite in the medium. The water used for dilution was distilled water stored in glass bottles; the amount of dissolved oxygen in this water was comparable to that in tap water.

The amounts of sludge formed in the different basins were directly proportional to the amounts of sewage matter present at the start; the sludges in all the cases appeared more or less brownish.

in the medium, the progress of nitrification is mainly dependent (within limits) on the amount of available oxygen which should be more than what is actually necessary for the maintenance of the aerobic organisms (Table I).

Similar experiments were carried out by diluting heat-sterilised sewage with distilled water and by introducing cultures of the protozoa and bacteria (as already indicated[1,2]) into the diluted samples; the results showed that the protozoa were much more efficient than the bacteria in bringing about the clarification and oxidation of sewage.

The above observations show the importance of certain ciliate protozoa, such as *Vorticella* sp. and *Paramœcium* sp., and excessive amounts of dissolved oxygen in the purification of sewage by 'dilution'. The evidence on the protozoal activity is of considerable value in explaining the mechanism of the dilution method of sewage disposal on which a large volume of literature has indeed accumulated.[4,5] It may be of particular interest here to refer to the recent note of Fowler[6] embodying some observations which he made long ago, while in Germany in 1913, on the importance of *Vorticella* in determining the extent of purification of sewage when discharged into river.

S. C. PILLAI.
Department of Biochemistry, R. RAJAGOPALAN.
Indian Institute of Scienee, M. I. GURBAXANI.
Bangalore, V. SUBRAHMANYAN.
July 22, 1948.

1. Pillai, S. C., *Curr. Sci.*, 1941, **10**, 84; *Ibid.*, 1942, **11**, 437. 2. Pillai, S. C., and Subrahmanyan, V., *Nature*, 1942, **150**, 525; *Ibid*, 1944,, **154**, 179. 3. Pillai, S. C., Rajagopalan, R., and Seshachar, B. R., *Curr. Sci.*, 1947, **16**, 254. 4. Letts, E. A., and Adeney, W. E., 'Report on the pollution of estuaries and tidal waters', Royal Commssion on Sewage Disposal, Fifth Report, 1908, Appendix VI. 5. Adeney, W. E., 'The dilution method of sewage disposal,' Cambridge Public Health Series, 1928, Cambridge University Press. 6. Fowler, G. J., *Science and Culture*, 1947, **12**, 405.

AN APPEAL

THE Zoological Society of Bengal will publish a six-monthly list of papers published by the Zoologists in India, Pakisthan, Burma and Ceylon in each issue of the *Proceedings of the Zoological Society of Bengal* from September 1948 onwards. The Society earnestly seek the co-operation of all the Zoologists of the above dominions in the matter and request them to send copies of reprints of their papers to the Hony. Secretary of the Society at 35, Ballygunge Circular Road, Calcutta 19.