

soil thus affecting its fertility. A few workers including Darwin,<sup>1</sup> Griffith,<sup>2</sup> Joachim & Kandiah,<sup>3</sup> Pendleton,<sup>4</sup> & Kalshoven<sup>5</sup> have studied the changes brought about by earthworms and termites selecting individual groups for their investigation but a review of the literature indicated that no comparative study of the changes brought about by them under similar environmental conditions and on the same land has ever been reported so far. The present communication deals with such a comparative study.

The material for this investigation was collected from a plot of land from a garden attached to the residential bungalow of the senior author. The samples were collected in August which recorded the heaviest rain-fall this year in Kanpur. The plot carries an old lemon tree with a trunk which is almost dead; the termite *Odontotermes* sp was found building its nests on this, ants were observed busy building their hills at the base of the same tree and the plot which carried weeds was full of earthworm casts. Samples were carefully collected from the centre of activity of the three organisms along with a composite sample of soil from different places in the plot which is about 1/10th of an acre. The air dried samples were then analysed by the standard methods.

The following table contains the analytical data:—

Determinations	Control Soil	Earthworm Casts	Termite Galleries	Ant Hills
pH ..	7.30	8.15	7.83	7.51
% Moisture on air dry soil ..	2.68	2.24	2.62	2.66
% Loss on ignition ..	3.29	4.35	3.14	3.94
% HCl-Insolubles ..	81.22	81.55	79.10	81.63
% Fe <sub>2</sub> O <sub>3</sub> ..	3.08	3.80	3.92	3.64
% Al <sub>2</sub> O <sub>3</sub> ..	6.79	4.65	6.76	7.25
% CaO ..	1.16	1.93	1.01	1.44
% MgO ..	0.58	0.47	0.73	0.44
% K <sub>2</sub> O ..	0.059	0.145	0.754	0.674
% P <sub>2</sub> O <sub>5</sub> ..	0.093	0.139	2.75	0.133
Total Exch.				
Bases (M.E.)	14.81	21.51	14.48	16.83
Exch. CaO ..	13.10	19.00	12.30	14.80
" MgO ..	0.025	0.056	0.020	0.015
" K <sub>2</sub> O ..	1.68	2.45	2.16	2.01
" P <sub>2</sub> O <sub>5</sub> ..	0.0023	0.0043	0.0011	0.0040
% C ..	0.536	1.980	0.576	0.880
% N ..	0.068	0.1918	0.1022	0.1260
% *Organic Matter	0.922	3.299	0.990	1.513
C/N ..	6.19	10.32	5.63	6.98

\* Organic Matter = Organic Carbon × 1.72

All the three increased the pH with the greatest shift by the earthworms. This is apparently due to the largest accumulation of lime in worm casts. The biggest loss on ignition of earthworm casts is in keeping with their highest organic matter content. The termite *Odontotermes* sp. active in this soil did not increase the availability of minerals as reported

by certain workers.<sup>6</sup> On the contrary it decreased the exchangeable bases with a serious decrease in lime and phosphorus. Similar decrease was recorded by Griffith<sup>2</sup> in Uganda and by Joachim & Kandiah<sup>3</sup> in Ceylon. Ants though second best in increasing the availability of minerals are much inferior to earthworms which increased the availability of minerals to considerable extent.

The Organic matter is increased nearly three and half times by the earthworms, one and half times by the ants with no increase by the termites. The availability of nitrogen in these soils is under investigation. On the whole of the three organisms studied, earthworms helped most in increasing the fertility of the soil followed by ants.

*Odontotermes* was of no consequence either in raising the organic matter status of the soil or in increasing the availability of minerals.

The details of the investigation will be published elsewhere.

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## DIPHTHERIA TOXIN IN SUBMERGED CULTURE WITH AERIATION

JENNINGS AND LINTON<sup>1</sup> obtained vigorous growth of *V. Cholerae* by utilisation of high percentage of sugar in a dilute broth by uniform and continuous aeration. Application of this principle was tried by us for production of diphtheria toxin. Recently Linggwood and Fenton<sup>2</sup> have published their observations on diphtheria toxin formation in submerged culture obtained by continuous shaking process.

A modification of Pope's medium was used by us for the experiments. Different quantities of glucose and maltose were tried. Park William Eight strain was used. Cultures were kept at 34-35° C. and continuous aeration was carried out by bubbling air through them. Toxin formation was optimum after 72 hrs. On the whole the results were comparable to those obtained by us in modified Pope's medium by the usual process. Activated charcoal appeared to improve toxin formation to some extent.

Details are under investigations.

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