

find the important fact added that since for every ounce of solid excreta we have about 10 ounces of liquid, the total liquid excreted in a given time is worth about seven times as much as the total solid: so that as far as utilisation is concerned, the question which has to be solved is, how to deal with the liquid and its valuable constituent urea, or rather carbonate of ammonia, for it is as such that we find it in sewage.

The other point is the statement at the bottom of page 56, that "the analysis of the effluent water, after the sewage has been treated by the A B C process, is an analysis of the effluent water *solely*; whereas in almost every case where analyses have been made of the effluent water after the irrigation process, the effluent water has been diluted by at least double and sometimes three and four times its bulk, with perfectly pure spring and subsoil water." But then, how is it that the effluent water is, except during very wet weather, so very much less in quantity than the sewage sent on to the land? Mr. Justyne does not tell us this—we will tell him; it is because three-fourths, sometimes four-fifths, sometimes much more of the water has disappeared by evaporation from the leaves of the growing plants, and to a certain extent from the surface of the ground itself, so that to compare fairly the composition of the effluent water of the A B C process with that of an irrigated field, we must dilute the latter with distilled water until its bulk is equal to that of the sewage sent on to the land; even without this correction, the purity of the effluent water from irrigated lands has never been approached by any other method; with this correction, we think we may safely say that it is never likely to be approached.

Our author suggests that irrigation with the effluent water should be practised, when necessary, as a secondary and subordinate operation to the precipitation process; we submit that it has never yet been shown that it would not always be necessary to irrigate with this effluent water, both from a sanitary and an economical point of view, and it is plain that if to purify sewage, irrigation must be resorted to, any preliminary process which separates more than the offensive suspended matters, must be disadvantageous, by lessening the value of the liquid sent on to the land.

That the suspended matters should be to a great extent separated before the sewage is sent on to the land, we hold to be indisputable, but this should be done by some simple method, which leaves the sewage as *rich as possible* in dissolved manurial constituents.

In conclusion, from a chemical point of view, we object to reliance being placed on any precipitation process for the removal of its valuable constituents from sewage, and from a sanitary point of view we object to the effluent water from precipitation tanks being sent at pleasure into streams whose water is afterwards used for domestic purposes.

W. H. C.

OUR BOOK SHELF

The Honey Bee; its Natural History, Physiology, and Management. By Edward Bevan, M.D. Revised, Enlarged, and Illustrated by William Augustus Munn, F.R.H.S., &c. (Van Voorst, 1870.)

IN this new edition of Dr. Bevan's well known work, Major Munn has given a full account of all the improved

hives and methods of management, and of the most recent discoveries in the economy and physiology of bees. The old and the new matter are, however, so interwoven, that it is impossible for the reader to separate them; and as the original author and his editor both speak in the first person, we find ourselves continually at a loss to know whether we are reading "Bevan" or "Munn," except in those cases where some reference to dates enables us to decide.

An interesting experiment is detailed, proving that the business of a hive may go on a long time with perfect regularity without the presence of a queen. On the 13th June a swarm was put into a mirror hive. On July 1st, whilst the queen was laying drone eggs, she was taken away, yet the bees showed no agitation, but continued their work as usual. They formed several royal cells, and examined them continually to see if eggs had been deposited in them. All through the summer work went on as usual, honey being plentifully stored; but no attempt was made to raise a queen by artificial food, nor were the drones massacred. By the middle of November all the drones had died, and the working bees then began to diminish, and by December 31st they had also died. As all the workers had been born before July 25th, this gives about six months, or not much less, for the duration of their lives.

The fortifications and barricades of the bees against the incursions of the Death's Head Moth are said to be due to reason rather than to instinct, because it has been observed that they do not commence these fortifications on a first attack of the Sphinx, nor until they have been robbed of nearly their whole stock of honey. "This is a case in which the insect is taught by experience, and which admits, in all its particulars, of a direct comparison with human reason and contrivance. A colony that had been thus attacked one year, and was tardy in its defensive operations, having derived instruction from the past, constructed fresh ramparts speedily on the reappearance of the Sphinx three years afterwards, and thus guarded itself from an impending danger. Since the lives of the working bees do not extend beyond six or seven months, it is evident that the information of the colony above referred to must have been traditional, or else derived from a queen which had reigned over them three years previously." This "tradition" through some six or seven generations seems highly improbable, and that the knowledge of how to act was derived from a queen not less so. Do not the facts rather indicate that bees differ considerably in intellectual capacity, and that some hives contain directing bees more capable of acting promptly on the defensive than others?

Much information is given on the different kinds of foreign bees, and their peculiar modes of building. The importance of bees in fertilising flowers, and the use of nectar and of the colours of flowers as attractions, are fully recognised; but the recent discoveries of Darwin on this subject are not alluded to. So, in the discussion on the hexagonal form of the cell, the "circular" theory is opposed, and Mr. F. Smith is quoted against it; but the beautiful experiments of Mr. Darwin, as described in the "Origin of Species," with the satisfactory theory founded upon them, appear to be unknown to the author. "Darwin," it is true, is very frequently quoted, but it is always Doctor, not Charles, Darwin.

The book is illustrated by woodcuts of the various kinds of hives, and of the apparatus used by Apianians. There are also some very scratchy but characteristic engravings of the different kinds of bees and of their anatomy, and several coarse coloured lithographs of varieties of comb, royal cells, &c., all executed by Major Munn himself. Though with some deficiencies of style and arrangement, the work abounds with information useful to the bee-keeper, and interesting to the naturalist.

ALFRED R. WALLACE