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The Pit Latrine — Revived

BY

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The deep pit latrine is the most practical toilet system available to the unsophisticated peoples of the world. It is cheap to make, easy to use, requires little maintenance and the risks of soil and ground water contamination are minimal. However, the pit latrine has been described as only one degree better than no sanitation at all and, in certain conditions, worse than none at all, providing the best possible means for the transmission of disease. It has therefore been cast aside as a most undesirable facility to be replaced by other more complex waterborne systems which, in many cases, have proved to be equally undesirable.

There are two main disadvantages to the pit latrine, those of offensive odours and fly breeding. Various attempts have been made to overcome these problems, including the provision of coverplates, fly traps and the addition of chemicals but invariably these fail because of inadequate supervision. Ventilation pipes have been tried but, in the past, there were indications that venting served no useful purpose in tropical areas and this line of investigation does not seem to have been followed to any extent. However, a newly designed pit privy system, employing a ventilation pipe, appears to provide almost complete protection against flies and odours emanating from a deep pit without the use of water, chemicals or coverplates. This makes it particularly useful where water is scarce or difficult to obtain due to conventional waterborne sanitary devices. It is foolproof and may actually be safer than many waterborne methods of sanitation currently in use.

DESCRIPTION

The system depends for its success on the aerodynamic properties of an efficient fluepipe together with the instinctive behaviour of flies. If a fluepipe 150 mm in diameter and about 2.5 m high is fitted to a latrine slab over a sealed pit, the temperature difference between the inside and the outside of the flue will cause a convection updraught, drawing air and gases from the pit and thus causing a downdraught through the toilet aperture. The latrine superstructure thus remains free of foul air emanating from the pit. The efficiency is increased further if the outer surface of the pipe is painted black—the heating effect causing air to rise more rapidly within the pipe, especially in sunny weather. If there is a wind or noticeable air movement across the top of the pipe, a partial vacuum develops within the pipe, drawing air through the system, and thus venting can continue at night and also in cold weather. In order to reduce air turbulence and thus improve efficiency, the top of the pipe is elevated well above the level of the roof where there is a free airflow. The upper section of the pipe opens out to a diameter of 200 mm and is fitted with a fibreglass flyscreen. A complete asbestos ventilation pipe designed for this latrine is available commercially.

When the pipe is operative, flies from outside are attracted to the odours passing through the flyscreen, and not to the interior of the privy where they might infest the pit. Fly breeding is thus considerably reduced in the pit. Since flies emerging from pits travel towards light, they are likely to be attracted to light falling down the pipe if the superstructure is dark enough. Thus, if flies do breed in the privy system, they are trapped by the pipe and die of dehydration. The pipe thus performs three functions in that it draws out odours, prevents most of the fly infestation of the pit, and traps any flies that emerge. It is essential that the pipe is large enough to enable the system to breathe efficiently and that it allows sufficient light to enter the pit to attract any flies that breed there. Thus it operates purely on natural principles and looks after itself.

The privy consists of a reinforced concrete slab placed over a deep pit lined with bricks or cement. Two apertures are cast in the slab, one outside the superstructure for the pipe, the other within the superstructure for the squatting hole. The structure itself must be dark within

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and can be designed with a door (closed with spring hinges) or without a door in the shape of a spiral. A popular method of building the superstructure consists of plastering a corrugated iron mould which is removed after the cement has set and provides a very durable structure at little cost. (See Fig. 1.)

Fig. 1.—A ventilated dry privy at Chikurubi.

Although this latrine system works without water, the presence of water in the pit is very desirable since the rate of digestion of excreta is greatly increased. One version of this privy makes use of rain water to irrigate the pit. In this case the roof is made flat with the outer edge raised so that it collects water during the rains. This water is led through a downpipe within the structure, and enters the pit via the used aperture. In these prototypes the pit is plastered with cement to retain water, and thus behaves like a septic tank.

The ventilated privy works at its best when built as a single unit with one pipe serving one squatting hole over one pit. Other combinations have been tried but are not successful. Single units have their advantages in that they can be scattered within a village or compound so that no one unit is very far from any one family—they also offer more privacy than the communal block. As with all pit privies, care must be taken in locating the installations so they do not contaminate wells and other sources of drinking water.

An allowance was made for 0.087 cu.m. (3 cu. ft.) per person per year when estimating pit capacity, with most of the experimental pits being dug to between three and five metres in depth. Some pits were dug deliberately shallow and one operated perfectly when only 76 cm deep. Another unit was built in an area where the water table was known to rise to ground level. The slab of this structure was built 30 cm above ground level and, when the water reached the surface, the system still operated perfectly without odours or flies. The latrine, illustrated in Figures 1 and 2, is built almost entirely from local materials at a low cost (approximately $25 at the time of writing). Experiments performed at the Henderson Research Station and at Chikurubi demonstrate the effectiveness of the unit.
THE PIT LATRINE

EXPERIMENTAL RESULTS

1. Proportion of flies passing towards the vent pipe.

In this case a special trap was fitted within the vent pipe so that flies could ascend towards the flyscreen but collected in a side chamber if they died or came back down the pipe. A flytrap was also fitted over the aperture used for squatting. Flies were then released artificially from the base of the pit and the proportion of flies caught in the two traps was recorded.

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>No. released</th>
<th>Flies (pipe trap)</th>
<th>Flies (inner trap)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-21.4.75</td>
<td>Chikurubi</td>
<td>197</td>
<td>171</td>
<td>0</td>
</tr>
<tr>
<td>22-30.4.75</td>
<td>Chikurubi</td>
<td>1455</td>
<td>1 246</td>
<td>7</td>
</tr>
</tbody>
</table>

(0.5% of released)

2. Proportion of flies emerging from used aperture.

Flies were released artificially from the base of pits and the number trapped in flytraps fitted over the squatting aperture within the superstructure were counted.

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>No. released</th>
<th>No. trapped</th>
<th>% flies</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-21.4.75</td>
<td>Chikurubi</td>
<td>138</td>
<td>5</td>
<td>3.6</td>
</tr>
<tr>
<td>22-30.4.75</td>
<td>Chikurubi</td>
<td>1 406</td>
<td>66</td>
<td>4.6</td>
</tr>
<tr>
<td>2-6.5.75</td>
<td>Henderson</td>
<td>360</td>
<td>7</td>
<td>1.9</td>
</tr>
<tr>
<td>7-14.5.75</td>
<td>Henderson</td>
<td>170</td>
<td>4</td>
<td>2.3</td>
</tr>
</tbody>
</table>

3. Natural fly emergence from vented and unvented structures.

Four identical privies were built in a row, but only two were fitted with ventilation pipes, the other two, being unvented, behaved like normal pit latrines. These units were put into use for six months prior to the experiment. During the period October to December 1975, weekly counts of fly output were taken from one pair of structures at one time (vented and unvented) in order to enable the other pair to stabilise whilst in use. The traps were moved from one pair of privies to the other at monthly intervals.

<table>
<thead>
<tr>
<th>Period of trapping</th>
<th>No. trapped in unvented privy</th>
<th>No. trapped in vented privy</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 October to 5 November</td>
<td>1 723</td>
<td>5</td>
</tr>
<tr>
<td>5 November to 3 December</td>
<td>5 742</td>
<td>20</td>
</tr>
<tr>
<td>3 December to 24 December</td>
<td>6 488</td>
<td>121</td>
</tr>
</tbody>
</table>

Thus, during the period 8 October to 24 December, 13,953 flies were trapped from the unvented structure, whilst only 146 were trapped from the vented structure. The structures differed only in the presence or absence of the ventilation pipe.

DISCUSSION

These results show that the ventilated pit privy is effective at reducing flies, which were mostly Chrysomyia, a bluebottle belonging to the family Calliphoridae. Although the housefly, Musca domestica, is more important medically, the bluebottle has also been incriminated and its role as a disease carrier is well documented.

Fig. 3.—Seasonal output of flies from unprotected pit latrine at Henderson Research Station.

The fly output of an unprotected latrine is shown in Fig. 3 and reveals a distinctive annual cycle. Seasonal fluctuations of this type have been recorded in many parts of the world and often peak periods of fly emergence coincide with high transmission levels in several enteric diseases. There are many known cases where a programme of latrine improvement has led directly to a reduction in the level of typhoid, for instance, and the WHO places considerable emphasis on the provision of effective sanitation and water supplies as the first steps to be taken in a community where an improvement in the
state of public health is desired. It is vital in any effective sanitary system that human excreta is disposed of adequately enough to keep it away from any further human contact and away from agents that carry disease. This must be done in a manner which is acceptable to those people using the facility, and have the least possible chance of breaking down in conditions where it may be abused and left without maintenance for considerable periods of time. It is for these reasons that so many more advanced sanitary systems which are well known in developed countries have failed in unsophisticated areas.

Newly constructed pit latrines can act as breeding places for Culex fatigans if the water table is high, and this applies to the ventilated latrine described here, although to a much lesser extent. Unlike flies, mosquitoes are not necessarily attracted to light when they emerge from pits and do escape into dark structures. However, mosquito breeding in pits is usually confined to the first year of use when the water’s surface is still exposed to the air, thereafter the total coverage of digesting matter makes them entirely unsuitable as breeding places. Fortunately, culicine mosquitoes do not carry malaria, but they can become a nuisance at times of peak emergence.

The ventilated privy system described here is simple, cheap and effective and employs the forces of nature alone to overcome the passage of disease. By doing so it can be relied upon to maintain protection, without supervision for long periods of time. Properties such as these are very desirable and make the extra effort of digging pits deeper, wider or simply digging more of them certainly worthwhile. The ultimate aim, of course, would be to provide one privy for every family, a possibility which the present system may allow.

Acknowledgments

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References