Tests of Screening Effectiveness Against Insects

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During the war a new mesh of wire window-screening was introduced, and over 60,000,000 square feet have already been manufactured. This screening has 18 warp (length) wires and 14 filler (width) wires to the inch in place of the standard 16 warp and 16 filler wires to the inch, resulting in rectangular rather than square mesh openings. Employing the same machinery, an appreciable increase in output was attained by converting from the 16 × 16 to the 18 × 14 mesh, because the warp wires were fixed and the shuttle putting in the filler wires required only 14 instead of 16 strokes to the inch.

It was also thought that the 18 × 14 mesh gave better protection against insects while utilizing about the same quantity of wire per square foot of screening. Tests were therefore run to determine quantitatively the comparative effectiveness of the 18 × 14 and 16 × 16 mesh as well as of other mesh sizes of screening having both square and rectangular openings. The wire of all screening was of standard diameter (0.011 inches).

The test insects included the common housefly, *Musca domestica*; the common southern house mosquito, *Culex quinquefasciatus*; the malaria-transmitting mosquito, *Anopheles quadrimaculatus*; and the yellow-fever carrier, *Aëdes aegypti*. Undersized *A. aegypti*, produced by overcrowding and underfeeding the larvae, were also tested. Outdoor tests were made to test effectiveness of some of the screening samples against small, light-attracted insects such as leaf hoppers, gnats, and tiny moths.

The adult insects were introduced into screened cages, 12 × 4 × 2 inches, which were placed in gauze-covered jars. After 48 hours the insects were gassed, and those inside and outside the screened cages counted.

M. domestica, *C. quinquefasciatus*, and *A. quadrimaculatus* were not able to penetrate any of the screening used in these tests. The per cent of both normal and undersized *A. aegypti* escaping from the screened cages is given in Table 1.

It is seen that there was no difference in passage of the normal-sized insects through the 18 × 14 or 16 × 16 mesh screening. Although there was an apparent difference between the 18 × 14 and 16 × 16 mesh in the tests of the undersized *A. aegypti*, this difference was directly in line with the actual rather than the nominal mesh size of the screening. For the mesh sizes used in these tests the percentage escaping appears to be related to the longest dimension of the individual mesh openings (the diagonal) rather than to the shape of the openings alone, and gives a smooth curve when plotted as a function of the length of the diagonal. This might be anticipated from the fact that a mosquito, being an animate object, would attempt to find the direction of greatest clearance, the diagonal, in passing through the mesh opening. While the diagonal of 18 × 14 mesh screening is 0.0023 inches longer than that of the 16 × 16 mesh screening, the difference is not considered great enough to be of practical significance in screening effectiveness.

TABLE 1

Mesh (warp × filler wires/inch)		Length of diagonal of mesh opening (inches)	Per cent escaping
Nominal	Actual		
A. aegypti—Normal size			
18 × 18	18 × 18.7	0.0616	0 ± 0
18 × 18	18 × 18.4	0.0622	3 ± 3
18 × 18	18 × 17.6	0.0639	5 ± 2
18 × 16	18 × 15.5	0.0697	13 ± 3
16 × 16	16 × 16.2	0.0723	14 ± 3
18 × 14	18 × 14.3	0.0739	14 ± 3
18 × 12	18 × 12.5	0.0822	41 ± 6
14 × 14	< 14.2	0.0847	55 ± 6
A. aegypti—Undersized			
18 × 18	< 18.7	0.0616	6 ± 2
18 × 14	< 14.6	0.0728	28 ± 6
18 × 14	< 14.4	0.0736	32 ± 8
16 × 16	< 15.0	0.0759	50 ± 6

Since only f female mosquito bites and transmits disease, it wa f interest to determine how effective screening wa against females and males. Of a sampling of proximately 1,500 *A. aegypti*, 35 per cent were fem s and 65 per cent males. Of all the females prese 14 ± 3 per cent penetrated the screening, while of males present, 17 ± 4 per cent passed through the ening. The difference was not significant.

In order to determine the effectiveness of screening against the small, light-attracted insects prevalent during the summer months, large, screened cages $1\frac{1}{2} \times 1\frac{1}{2} \times 1\frac{1}{2}$ feet were placed out of doors and a small electric light suspended in each. Under the light was placed a large sheet of sticky paper to capture the insects that penetrated the screening. It is noted that for insects of this size, as well as for the mosquitoes, the insect penetration appeared to be related to the length of the diagonal of the mesh openings. As has been found in actual practice, the 18 × 18 mesh screening gave much better protection against these insects than did the 16 × 16 mesh.

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