

## Effect of Repellents on *Hyalomma plumbeum* Panzer Ticks

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Assays and selection of effective tick repellents for human prophylaxis and protection against transmissible diseases, particularly the inadequately studied hemorrhagic fever, are of great interest.

Thus we investigated repellents against *H. plumbeum* ticks, which appear to be the chief vector of the CHF agent in Rostov Oblast, as reported by Perelatov and colleagues in 1964 and 1965. The first stage of the investigation was to study repellent properties of chemical preparations in the laboratory and to select the most effective preparations.

### MATERIALS AND METHODS

Small-scale tests in 1965 by the standard Gladkikh (1964) method gave uncertain results. The method was somewhat changed in 1966 after studying behavioral reactions and determining the tick movement rate.

*Dermacentor marginatus* Sulzer was used as the biological indicator. This tick readily attacks humans and is widely distributed in the focus area though less abundant than *H. plumbeum*. It was experimentally established that *H. plumbeum* move 3 times more rapidly (avg) than *D. marginatus* (1.34 cm/sec and 0.56 cm/sec, respectively).

The testing filter disc was somewhat enlarged to increase the repellent zone to 15 cm (not 6.5 cm as in the earlier method) from the center. Thus, the untreated ring surface was enlarged 3 times and the impregnated ring width was reduced from 8 to 2.5 cm.

The 19 preparations tested (in some cases the same preparation in a different concentration) were repudin, repelin-alpha, hexamidebenzamide, diethyltoluamid (DETA), P-2, P-162, P-203, P-228, P-320, ASDF-3, tabatrix, terpenol, diphenyloxide, 51-P-325, 5% lysol, 2% polychloropinene, 3% hexamide with 2% polychloropinene, and 50% hexamide with 2% polychloropinene and kyuzol.

In 42 tests, we used 3,639 45-195 day old laboratory reared ticks including 1,175 female and 1,078 male *H. plumbeum* and 758 female and 628 male *D. marginatus*. Both tick species were tested simultaneously. The test material was regularly introduced by a pipette on a filter paper disc in a proportion of 20 and 40 g/m<sup>2</sup>. The treated disc was placed horizon-

tally on the bottom of an enameled vessel which was placed near a window, the light source, so that the disc was regularly illuminated by daylight. Dimethylphthalate was used as standard material and the filter paper disc impregnated with alcohol as the control. Repellent properties were determined 30 min after introducing the material (i.e. the period necessary for complete drying). Separate observations on tick behavior were made by placing each specimen in the disc center and calculating time per 17.5 cm of tick movement. Ticks passing the barrier zone were placed again in the disc center 3 times. The observation period was 5 min. At least 5 females and 5 males of each species were used per test.

The following variable factors were recorded during the test: air temperature, humidity, and tick movement in relation to light and nutrition (experimenter) sources. The experimenter was opposite to the light source. During tests, laboratory air temperature fluctuated between 16 and 27°C and relative humidity from 83 to 90%.

### OBSERVATION RESULTS

No clear results were obtained from analysing the data on tick movement toward the light source. On a bright sunny day, ticks moved more frequently from the light source but on cloudy days they crawled more or less regularly in all directions. No significant differences were recorded in effectiveness indices of materials used in both proportions (20 and 40 g/m<sup>2</sup>). Thus, final results of tests were summarized.

Fig. 22 shows the time at which the ticks penetrate the repellent barrier; the time scale records are reduced on the right side of abscissa axis. From the data in this figure, it is seen that only 3.5% of *H. plumbeum* were unable to penetrate the repellent zone in exposure time tests of all materials (300 sec.). Half of the ticks covered the 17.5 cm distance in 15 sec. (avg), or 5 sec. less rapidly than in standard material tests and in controls. Most (80%) reached the zone border in 40 sec. When testing dimethylphthalate, only 0.9% reached this border. Other ticks moved with almost the same speed as those in the control; 73% crawled over the repellent zone in the 1st 15 sec. after being placed in the disc center.

For *D. marginatus*, it was found that 31.4% did not pass through the repellent zone, showing that the re-