INTRODUCTION
Malaria remains a serious public health problem in South Africa affecting 4 million people in the low altitude areas of the north-eastern parts of the country. The principal vector of malaria in this country is Anopheles arabiensis. In South Africa, resistance to pyrethroids and DDT have been reported and the potential for carbamate resistance has been detected in An. arabiensis. This resistance detected in the vector populations in South Africa has initiated a search for new insecticides which will be effective, safe and easily accessible at low cost. Larvicides are used as a complementary strategy to indoor residual spraying and have been suggested as a strategy for eliminating over-wintering larval populations.

In the present study, 381 crude plant extracts were investigated for their adulticidal and larvicidal effect on larva of An. arabiensis. These extracts were prepared from plants found in the southern African floral region. The goal of this study was to identify the most promising plant extracts for further research aimed at the discovery of new biologically active products that could be used as insecticides.

MATERIALS AND METHODS

Plant material
Plants were selected for evaluation based on their traditional use, which was obtained from literature sources. Samples consisting of roots, stems, leaves and fruit were collected separately from different localities throughout South Africa.

Extract preparation
Dried, ground material of the different plant components was extracted using organic solvents (dichloromethane, a 1:1 dichloromethane/methanol mixture, methanol) and water.

Mosquito rearing
Anopheles arabiensis maintained in a colony at the Medical Research Council were used to evaluate these plant extracts.

Adul ticidal test
The extracts were prepared as a 10 µg/ml solution in acetone and sprayed onto porcelain tiles. Blood fed 3 day old female An. arabiensis were exposed to the extracts to determine activity following the methods of WHO (1963). Deltamethrin was used as a positive control in the assays.

Larvicidal test
Thirty, third stage Anopheles arabiensis larvae were placed in a beaker containing 0.25 litres of distilled water. 1 ml of a 10 mg/ml acetone solution of plant extract was added to the container. Mortality was recorded after 24 hours exposure and at 24 hour intervals over a period of 7 days. The commercial compound, Temephos was used as a positive control in the assays. During the test, the larvae were maintained in the insectary under the conditions used for rearing mosquitoes.

RESULTS

The 381 plant extracts evaluated represented 79 taxa and 37 plant families. The extracts were obtained from different parts of the plant, namely roots, leaves, stems, fruit, flower, seeds, twigs and bark. The extracts comprised 94 dichloromethane, 119 dichloromethane/methanol (1:1), 38 methanol, 128 water, 1 diethyl ether and 1 essential oil.

For the adulticidal assays an 80% mortality of mosquitoes was regarded as potent activity. The results indicated that 5 extracts exhibited mortality between 40 and 59 per cent, demonstrating that only limited toxicity against the target species exists. One of these taxa has been selected for further development work. 334 extracts exhibited little or no activity with mortality between 0 and 19 per cent. Further work into the adulticidal effects of the remaining extracts was abandoned.

The susceptibility level of An. arabiensis larvae to the extracts of different plants was determined.

The results indicated that most of the taxa demonstrated varying degrees of larvicidal activity (Table 1). These were prioritised based on the percentage mortality, with 80 to 100% regarded as potent and 60 to 79% regarded as moderate activity.

<table>
<thead>
<tr>
<th>Table 1: Resultant mortality after exposure to various plant extracts tested at 40 µg/ml.</th>
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<tr>
<td>Concentration (µg/ml)</td>
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<tr>
<td>1-19</td>
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<tr>
<td>Aloe</td>
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<td>Macroystis</td>
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<td>Toddalia</td>
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<td>Vernonia</td>
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</table>

Four taxa were selected for further development and dose response studies were conducted at concentrations ranging from 0.004 to 40 µg/ml on these crude extracts (Figure 3). The resultant mortality at the various concentrations was found to be greatest in Aloe spp. Of significance, activity was seen at the lowest concentration of 0.004 µg/ml demonstrating that the Aloe spp extract has highly effective larvicidal properties at low concentrations.

CONCLUSION

The results show that a proportion of South African traditional medicinal plants do possess larvicidal activity however only limited adulticidal activity was demonstrated. Fourteen taxa demonstrated potent larvicidal activity with at least four species viz., Aloe, Macroystis, Toddalia and Vernonia demonstrating good dose response curves. These plants are the subject of further evaluation to elucidate the constituents responsible for observed activities.

REFERENCE