

Establishment of a Nationwide Surveillance Network for the Determination and Distribution of Insecticide Susceptibility of Malaria Vectors in the Philippines

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OBJECTIVES:

To establish a nationwide network to periodically monitor possible changes in insecticide susceptibility and distribution status among malaria vectors in malaria endemic regions in the Republic of the Philippines

Introduction...

Documented Cases of Resistance Among Disease Vectors in the Philippines

| Mosquito Species | Insecticides | Bibliography |
|---|---|---|
| <i>Aedes albopictus</i> (Asian tiger mosquito, Forest day mosquito) | BHC/cyclodienes DDT | WHO 1976 |
| <i>Anopheles filipinae</i> (Anopheles mosquito) | <u>BHC/cyclodienes</u> | WHO 1961 |
| <i>Anopheles flavirostris</i> (Anopheles mosquito) | <u>BHC/</u> <u>cyclodienes</u> | WHO 1976 Ungureanu 1964 |
| <i>Anopheles vagus</i> (Anopheles mosquito) | <u>BHC/cyclodienes</u> | Chow 1958 |
| <i>Culex quinquefasciatus</i> (Southern house mosquito) | <u>BHC/cyclodienes</u> <u>DDT</u> | Gjullin & Peters 1952 Acosta 1961 |
| <i>Xenopsylla cheopis</i> (Oriental rat flea, Tropical rat flea) | <u>DDT</u> | WHO 1976 |

Introduction

Insecticide use in Vector Control (Source: Infectious Disease Office, NCDPC-DoH 2002 & 2003), Malaria Control Program, Philippines.

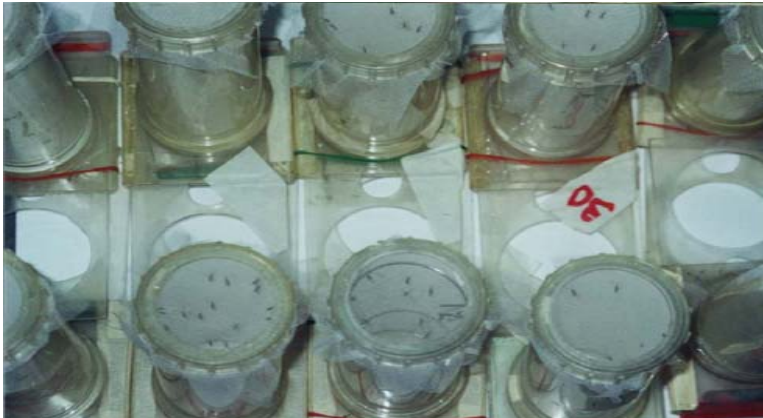
| Year | Compound | Formulation | Type Of Application | Target Vector Of Disease |
|------|--------------------|-------------|--|--------------------------|
| 2002 | Permethrin | EC | Space spray | Dengue |
| | Deltamethrin | WP/EC | Indoor residual spray / mosquito net treatment | Malaria |
| | Alpha-Cypermethrin | SC | Mosquito net treatment | Malaria |
| | Lambda-Cyhalothrin | WP | Indoor residual spray | Malaria |
| | Etofenprox | WP | Indoor residual spray | Malaria |
| | Temephos | GR | Larviciding | Dengue |
| 2003 | Permethrin | EC | Space spray | Dengue |
| | Deltamethrin | WP/EC/SC | Indoor spray / mosquito net treatment | Malaria |
| | Etofenprox | WP/EW | Indoor spray / mosquito net treatment | Malaria |
| | Lambda-Cyhalothrin | WP/EC | Space / indoor spray | Dengue |
| | Alpha-Cypermethrin | WP/EC | Indoor spray / mosquito net treatment | Malaria |
| | Temephos | GR | Larviciding | Dengue |

METHODS



Carabao-baited traps set to collect *Anopheles flavirostris* for Susceptibility Tests

Methodology...



1. Live female mosquitoes



2. Mosquitoes transferred to exposure tubes



3. Mosquitoes exposed to insecticide papers in tubes covered with dark cloth

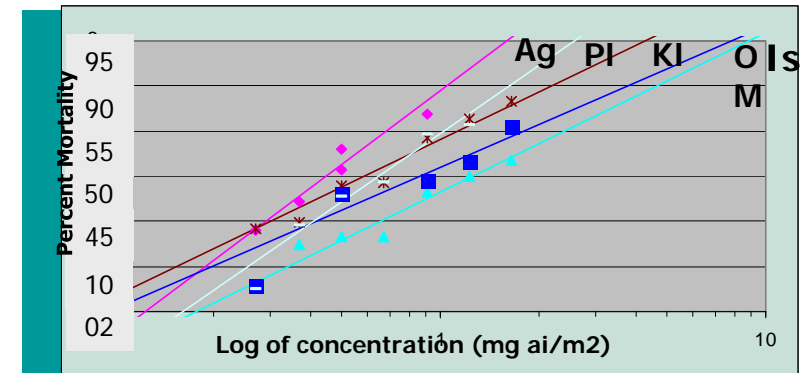
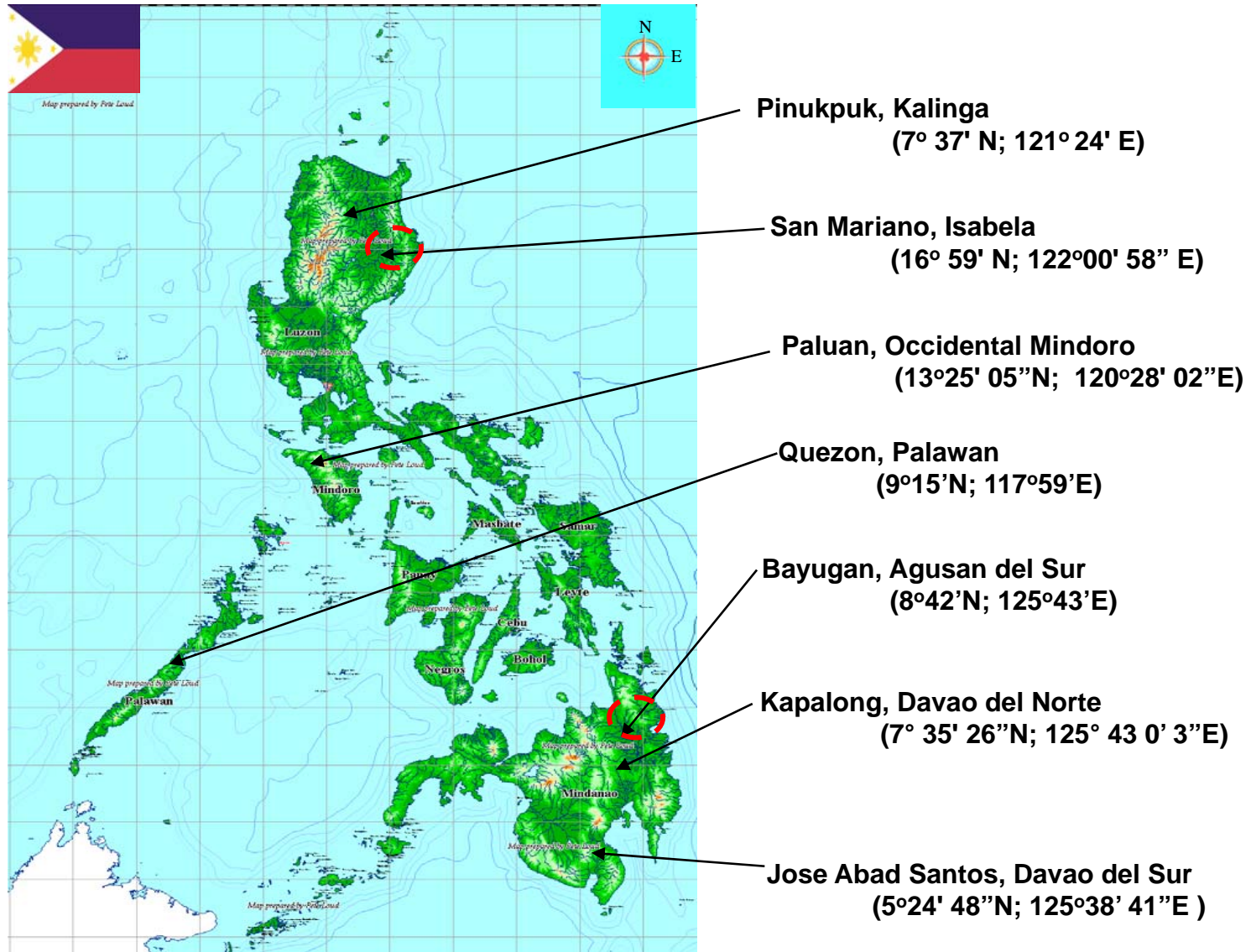


Figure 2. Aphaecypermethrin log-dose probit lines from susceptibility tests conducted in selected provinces (Ag-Agusan del Sur, Is-Isabela, KI-Kalinga, OM-Oc Mindoro, PI-Palawan) in the Philippines.

4. Mortality data recorded and analyzed by Probit Analysis

Mapping of Insecticide Susceptibility of *Anopheles flavirostris* Using the Standard WHO (Tube) Test

Methodology...



Map of the Philippines showing the study sites for the monitoring of insecticide susceptibility/resistance.

Summary of susceptibility testing of Malaria vector species to various insecticides commonly used in vector control in sentinel sites from 2006 to 2007.

| INSECTICIDE | % MORTALITY AFTER 24 HOURS | | | | | | | |
|---|---------------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|----------------------|
| | 2 0 0 6 | | | | | 2 0 0 7 | | |
| | Capalong, Davao del Norte | Sn. Mariano Isabella | Paluan, Occ. Mindoro | Quezon, Palawan | Zamboanga Sibugay | Sn. Mariano, Isabela | Tabuk, Kalinga | Bongao, Tawi-tawi |
| Alphacypermethrin (3.06 mg ai/m ²) | 100 | 100 | 100 | 100 | 100 | --- | --- | --- |
| Cyfluthrin (0.15%) | 100 | 100 | 100 | 100 | 100 | --- | --- | --- |
| Deltamethrin (3.66 mg ai/m ²) | 100 | 100 | 100 | 100 | 100 | --- | --- | --- |
| Deltamethrin (0.05%) | 100 | 100 | 100 | 100 | 100 | 100 | 98 | 100 |
| Etofenprox (0.5%) | 100 | 100 | 100 | 100 | 100 | 96 | 90 | 93.33 |
| Lambdacyhalothrin (0.5%) | 100 | 100 | 100 | 100 | 100 | 96 | 97 | 96 |
| Permethrin (0.75%) | 100 | 100 | 100 | 100 | 100 | 100 | 96 | 97.33 |
| Pirimiphos-methyl (1%) | --- | --- | --- | --- | --- | 98 | 100 | 100 |
| Vector species | <i>An. flavirostris</i> | <i>An. flavirostris</i> | <i>An. flavirostris</i> | <i>An. flavirostris</i> | <i>An. flavirostris</i> | <i>An. flavirostris</i> | <i>An. flavirostris</i> | <i>An. litoralis</i> |

*WHO, (1998) Interpretations on the level of mortality: mortality <80%=resistant; mortality of 80-97% =suggest possibility of resistance but needs to be confirmed and mortality of 98-100% = susceptible.

SUMMARY CONCLUSION AND RECOMMENDATION

- Philippine *Anopheles flavirostris* is susceptible to the following compounds: alphacypermethrin, cyfluthrin, deltamethrin, etofenprox, lambdacyhalothrin, permethrin. Future tests to include representative OP.
- Monitoring of susceptibility must be done at least once a year, and should be an adjunct to all vector control programs to ensure efficacy.
- Utilization of biochemical assays in insecticide characterization may prove useful in the monitoring of susceptibilities of malaria vectors in the future.