Evaluation of the efficacy of a new insecticide paint for malaria control. Part I: Bioassay tests on different surfaces against *Culex quinquefasciatus* over 12 months

B Mosqueira¹,  Finot L²,  
F Chandre², JM Hougard²,  
P  Carnevale² & S Mas-Coma¹  

¹ Departamento de Parasitología, UV, Valencia (Spain)  
² LIN-IRD, Montpellier (France)
Insecticide Paint - Cocktail

Chlorpyrifos (OP) + Diazinon (OP) + Pyriproxyfen (IGR)

Current widespread of insecticide resistance (PY)
→ even if the full effect of resistance is not known

Operational value vs. bednets & house spraying
→ even if it could have obstacles of its own

Question: Could the paint be effective in malaria & pest control in some settings?

• Ivory Coast (Phase I - Lab)
• Montpellier (Phase I - Lab)
• Benin (Phase II - Field)
PHASE I at LIN - Methodology

- Surface treatment & controls
- **30’ Bioassays** against OP resistant and susceptible *Cx. quinquefasciatus* strains
  - Immediate Mortality (at 60 min)
  - Delayed Mortality (at 24 h)
- **IGR Testing** against 30’ Bioassays surviving females
  - Egg-laying
  - Egg-hatching
  - Mortality at each stage
- **Distance Tests**
  - Delayed Mortality (at 24 h)
PHASE I at LIN - Results

• **Surface**: Porous vs. Non-porous

• **Concentration**: 1Kg/6m² vs. 1Kg/12m²

• **Mosquitoes used**: OP resistant vs. susceptible *Cx. quinquefasciatus* strains

Control mortality < 7%
Delayed mortality at T0 months against resistant and susceptible Cx. quinquefasciatus

All surfaces: mortalities different from control ($p < 10^{-3}$)
Cement one layer against resistant at 1Kg/12m$^2$ ($p < 10^{-2}$)
Most surfaces: mortalities different from control $(p<10^{-3})$

- cement (one layer) against resistant and susceptible *Culex*
- stucco treated at $1\text{Kg}/12\text{m}^2$ against resistant *Culex*
Immediate mortality at T12 months against resistant and susceptible Cx. quinquefasciatus

Quick killing of susceptible Culex after one year on non-porous surfaces ($p<10^{-3}$)
IGR testing at T0 & T9 months on cement (1 layer) against *Cx. quinquefasciatus*

### T0 - Cement (n=50)

<table>
<thead>
<tr>
<th>Sample</th>
<th>Egg number</th>
<th>% Egg-hatching</th>
<th>% Pupation</th>
<th>% Emergence</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1/NO Paint</td>
<td>2104</td>
<td>51.8</td>
<td>39.6</td>
<td>79.5</td>
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<tr>
<td>C2/ Paint NO Insecticide</td>
<td>2473</td>
<td>48.8</td>
<td>40.0</td>
<td>85.9</td>
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<tr>
<td>Insecticide at 1Kg/12m²</td>
<td>800</td>
<td>41.3</td>
<td>45.5</td>
<td>52.7</td>
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</tbody>
</table>

**T0:** Reduction in Egg number \(p<10^{-3}\), % Egg-hatching \(p < 10^{-3}\), % Emergence \(p=10^{-3}\)

### T9 - Cement (n=30)

<table>
<thead>
<tr>
<th>Sample</th>
<th>Egg number</th>
<th>% Egg-hatching</th>
<th>% Pupation</th>
<th>% Emergence</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1/NO Paint</td>
<td>1908</td>
<td>75.8</td>
<td>56.3</td>
<td>87.8</td>
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<tr>
<td>C2/ Paint NO Insecticide</td>
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<td>73.1</td>
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<td>84.4</td>
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<tr>
<td>Insecticide at 1Kg/6m²</td>
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<td>77.5</td>
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<td>65.9</td>
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<td>Insecticide at 1Kg/12m²</td>
<td>1156</td>
<td>70.9</td>
<td>59.9</td>
<td>86.6</td>
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</tbody>
</table>

**T9:** Reduction in Egg number \(p<10^{-2}\), % Pupation \(p < 10^{-3}\), % Emergence \(p=10^{-3}\)
Distance Tests

Delayed mortality at T0 months against susceptible *Cx. quinquefasciatus* performed overnight *(n≥55)*

Control vs. 40 cm 1Kg/6m²: p<10⁻⁶
Control vs. 100 cm 1Kg/6m²: p<10⁻²

Confirmed by Field Tests
Phase I - Findings

- High mortality on non-porous surfaces after 1 year
- Quick killing of susceptible mosquitoes on porous surfaces even after 1 year
- No marked differences between concentrations
- Longer efficacy of 2 layers vs. 1 layer
- Reduction of bio-availability on porous surface
- IGR efficacy on porous surfaces up to 9 months even when insecticide’s efficacy has disappeared
- Efficacy at a distance
Future Prospects

**Question:** Would the paint be an option in some settings?

Phase II: Field evaluations in Benin