



# Solar Powered Ultraviolet Light Emitting Diode for CRB Pheromone Traps

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## Background

In laboratory experiments performed by colleagues in Hawaii it was discovered that adult coconut rhinoceros beetles (CRB) are attracted to ultraviolet light emitting diodes (UVLEDs) (Matt Siderhurst, USDA-ARS-PBARC, personal communication). The PBARC team designed and assembled prototype UVLED units to be attached to standard CRB pheromone traps. Two derivatives of these prototypes were tested in a field trial on Guam:

Type 1: The original prototype, manufactured by collaborators at USDA-ARS-PBARC, used a battery pack of eight AA alkaline batteries to power 4 UVLEDs. We added a 1 k ohm resistor to reduce current from 5.8 to 1.0 ma. with no apparent reduction in brightness. Thus the increasing battery life by at least 5 times..

Type 2: We converted solar powered lawn path lights by replacing the standard white LED with a single UVLED which had been sanded to make it diffuse and omnidirectional.

Traps equipped with a pheromone lure (oryctalure, ChemTica) and UVLEDs had a significantly higher trap rate than those without UVLEDs: 0.091 versus 0.033 beetles per trap-day, respectively

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( $p = 0.008$ ; t-test). Thus pheromone trap catch increased more than 3 times by addition of the UVLEDs.

It is interesting to note that traps equipped with UVLEDs, but no pheromone, caught only 0.004 beetles per trap-day, indicating that the UVLED is not acting as a typical insect light trap, but is acting synergistically with the pheromone.

## Specifications

Our solar powered UVLED devices are not currently commercially available. However, they are very easy to make: just a matter of replacing LEDs with ultraviolet LEDs in solar lawn pathway lamps (Figures 1-6).

I am able to manufacture solar UVLEDs through my consulting company (Moore Scientific, PO Box 5345, UOG Station, Mangilao, Guam 96923, USA) at a price of \$9.99 each.

## Ultraviolet Light Emitting Diodes

Ultraviolet light emitting diodes were purchased from [www.suntekstore.com](http://www.suntekstore.com). This company provided the following specifications:

This LED is super bright. It is suitable for color displays, indicators, diagnostic / analytical equipment and etc.

### **Description:**

High quality

Small and lightweight

10 pcs per package

### **Specifications:**

Emitting Colour: Ultraviolet

Size: 10mm

Lens Type: Water clear

Dominant Wavelength: 400-405nm

Luminous Intensity: 80-120MCD

Viewing Angle: 30 degree

Lead Soldering Temperature: 280-360°C for 3-4 seconds

DC Forward Current: 20mA

DC Forward Voltage: 3.2-3.4V

### **Package Includes:**

10 x 10mm UV LED

## Solar Lawn Pathway Lamps

These units can be purchased for less than \$5.00 each from local hardware stores or from online sources.

## Notes

1. On pan traps (barrel traps) we are now attaching UVLED units simply by pushing the base into the chicken wire (Fig. 10).
2. On vaned bucket traps built using vanes from AlphaScents, we mount the solar cell in a hole cut in the 'Chinese hat' (Fig. 8). A couple of wires are extended through the hole in the bottom of the clear plastic base and the UVLED is soldered to these wires and is held in place within a window cut into the vanes below the hole for the pheromone. It's a good idea to tie a knot in the wires inside the base to stop them from being pulled free.



Figure 1: Solar powered lawn pathway lamp.



Figure 2: Top part of solar powered lawn pathway lamp containing a miniature solar panel, rechargeable battery, white light emitting diode, on-off switch, and a circuit which handles battery charging and turns the LED on at dusk.



Figure 3: Materials required to replace the white led with an ultraviolet led. Short lengths of hookup wire, UVLED scuffed with sandpaper to make it diffuse and omnidirectional, and liquid tape for waterproofing.

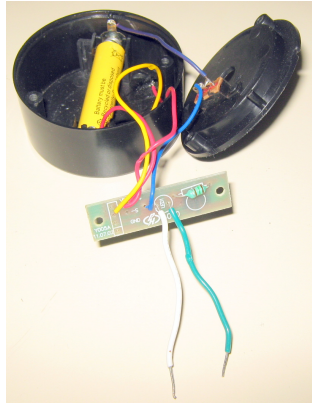


Figure 4: White led removed and hookup wire soldered in place.

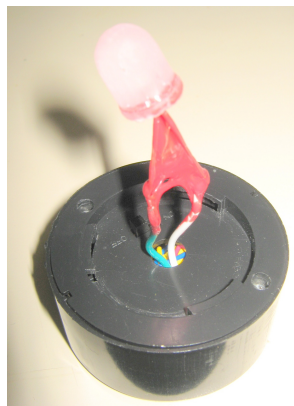


Figure 5: Ultraviolet led soldered to hookup wires and sealed with liquid tape.



Figure 6: Finished UVLED.



Figure 7: UVLED attached to vanes of a standard CRB pheromone trap.



Figure 8: UVLED attached to vanes of a improved CRB pheromone trap.



Figure 9: UVLED attached to a CRB barrel trap.



Figure 10: UVLED attached to a CRB pan trap. Alternate attachment method.