15 Watt Black Light Insect Trap

Operations Manual

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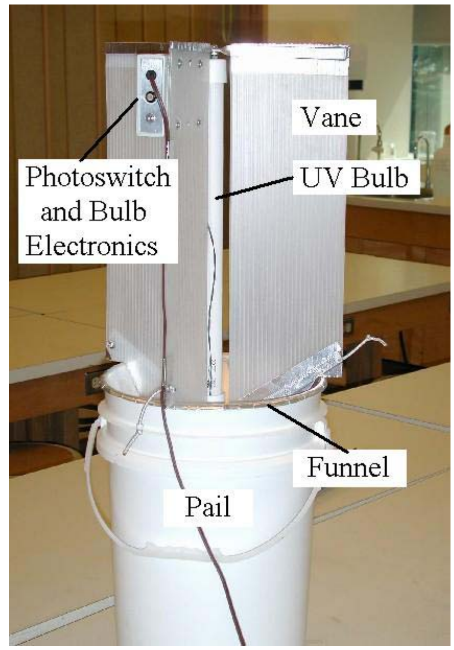
1. Introduction:

The trap considered in this manual was designed by David Lawrie, Gary Anweiler, Chris Schmidt and other members of the Alberta Lepidopterist's Guild, particularly Jim Troubridge. It is intended to be a simpler, more efficient and cost effective trap than those available commercially.



The trap operates on the principle that nocturnal insects are attracted to light, particularly light in the UV portion of the spectrum. The set up trap is shown at right. A 15 W UV fluorescent light bulb is located at the center of 3 plastic vanes. These vanes fit into a funnel that fits into a 20 liter plastic pail that serves as the collecting chamber. Flying insects are attracted to the light, collide with the vanes and fall through the funnel into the pail for subsequent collection.

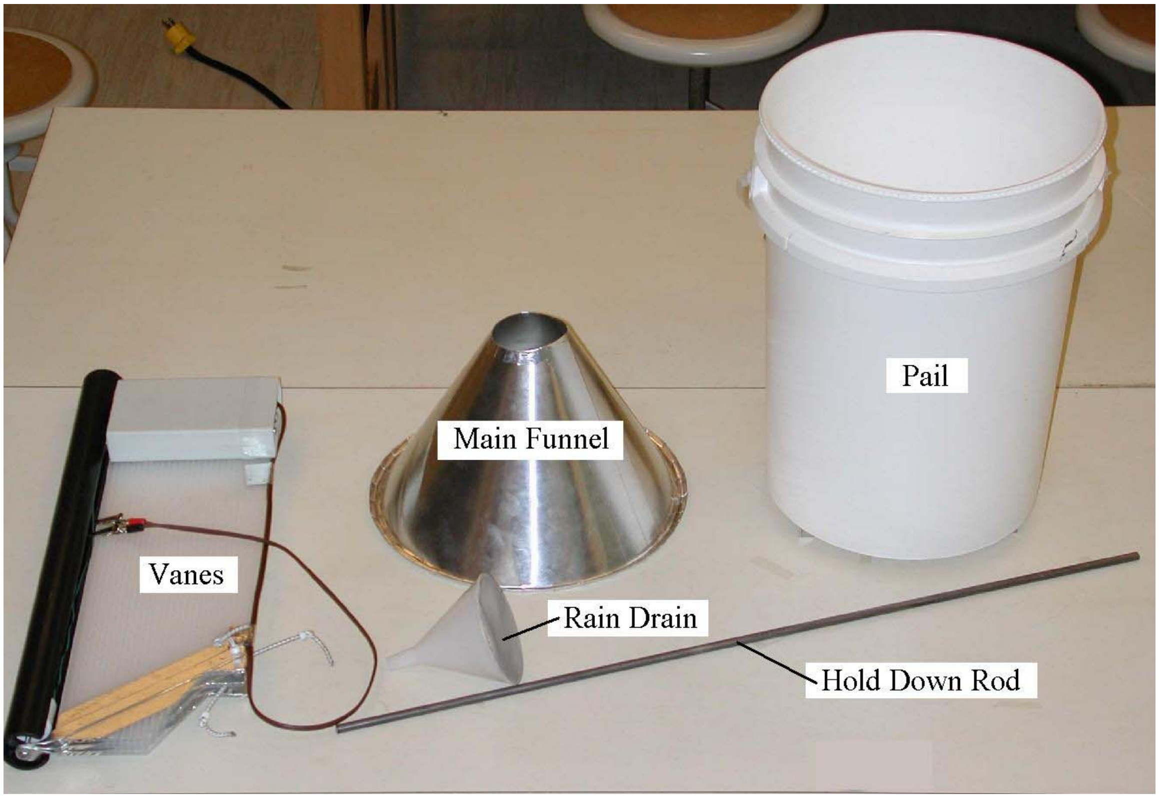
A smaller screen covered funnel located below the main funnel allows rain to drain through the trap.

The fluorescent bulb operates on approximately 150 VAC. An electronics package converts 12 VDC from a battery or other power source to the voltages required to operate the bulb.

There is also a photoswitch incorporated into the electronics package. This switch automatically turns the bulb on when the ambient light level falls below a certain value (i.e. sunset) and off when the level rises (dawn). This feature allows the trap to be setup during the day and collected at a later time with minimal battery drain. The sensitivity can be adjusted.

2. Set Up:

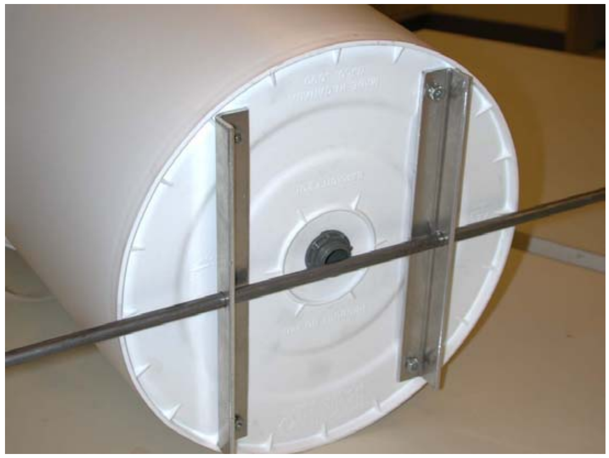
There are five main parts to the trap, shown in the figure below. All parts can be stored in the pail when the trap is not in use.



The rain drain fits into the plastic fitting located in the center of the pail as shown below:

Note that is a very good idea to put some sheets of paper towel, or even better, a circular sheet of newspaper cut to fit into the bottom of the pail, in the bottom of the trap at this point. This absorbs excess moisture and also gives specimens places to rest. This is particularly important on nights with light rain.

The hold down bar is used to provide extra stability in windy conditions if the trap is placed on the ground. It fits through the aluminum brackets on the bottom of the pail as shown:

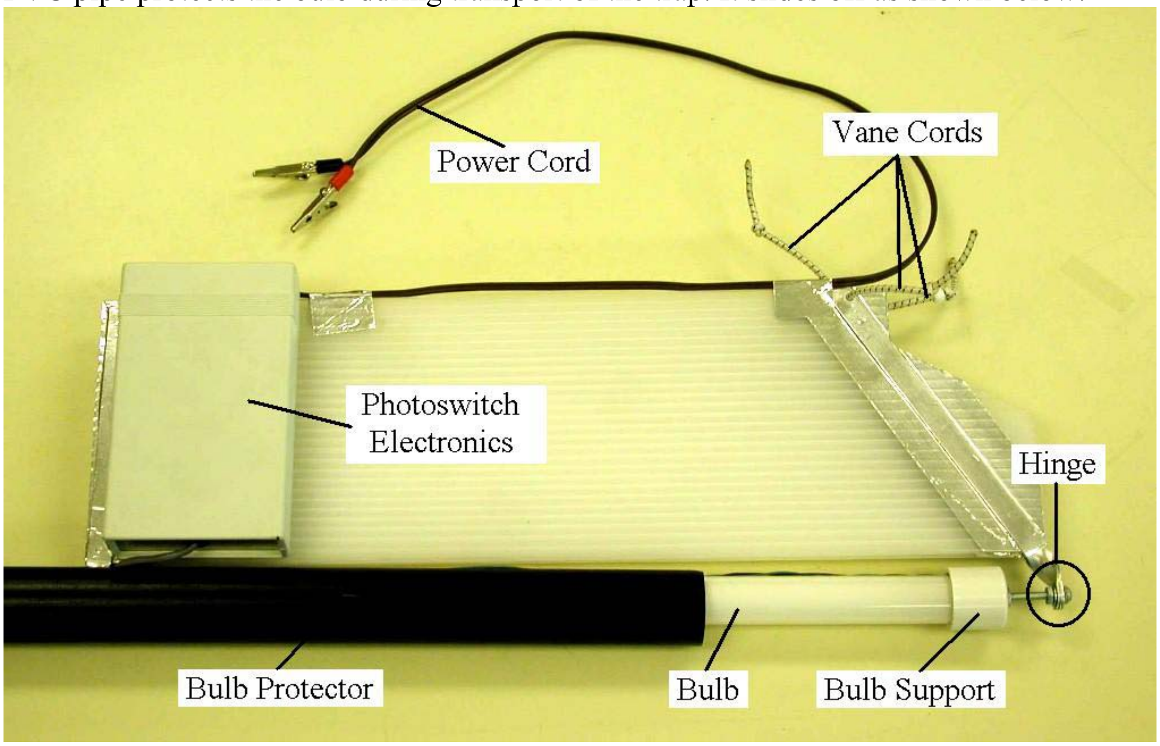


Rocks or the battery used to run the trap can be placed on the parts of the bar extending from the sides of the pail. The hold down bar is not always needed and in some cases it may be more effective to hang the trap from a tree branch (See section # 7).

The main funnel is placed into the bucket as shown:

The vane assembly is set on top of the funnel and holds the trap together.

The vanes are the most complicated part of the trap. There are three vanes hinged about the bulb supports. The vane cords are used to attach the vanes to the pail. A section of PVC pipe protects the bulb during transport of the trap. It slides off as shown below:



Once the bulb protector is removed, the vanes are opened so that they are approximately 120° apart. The vanes are then set into the funnel as shown at right. There are slots cut into the lower rim of the pail and the vanes should be aligned with them. See below.

The vane cords have a knot and a small plastic bead on them. The vanes are attached to the pail by pulling on the vane cord, from below the knot, and fitting the cord into the slot cut into the pail. The bead should be above the knot, but below the slot in the pail. The bead is used to prevent abrasion of the vane cords.

This is a bit tricky of an operation, and a little practice is needed. The vanes should first be aligned with the pail slots, then with one hand on the top of the vanes to provide support, the other hand pulls on the vane cord and maneuvers the bead and knot into place. The process is reversed to remove the vanes. Note that the vanes tend to "tip-over" with only one or two vane cords in place.

The trap is now assembled. All that remains is to connect the power cords to a suitable power supply. The power cord alligator clips are colour coded:

Red = Positive Black = Negative

The wire itself is also coded, the ribbed wire is positive and the smooth wire is negative. A typical set up is shown below:

3. Basic Operation

The trap may be run anywhere (Permits are required for various parks and natural areas – Check first) and anytime. Best results are usually from dusk until a bit after midnight in Alberta. Warm, humid, cloudy nights with a slight breeze usually give best results. Generally the largest catches are found in June, July and August, but sampling at other times is of interest since not all species are flying at the same times.

The basic operation is simple. The trap is assembled as described above connected to a suitable power source and left to run for a certain period of time. It may be checked at intervals over the course of a night, particularly if live trapping is used (See final section).

Specimens of interest are selected for further study and the remainder should be released.

If this is done before the end of a night, it is sufficient to "dump out" the pail at the site of the trap (taking care not to step on released insects…). They should then have adequate time to continue with their business or find suitable refuges for the day.

If daylight, the pail should be emptied in areas of long grass or dense forest to allow trapped insects a chance to escape predation. Various predators (birds, toads, etc.) quickly learn the locations of regularly dumped traps. Often a trap catch will include a large number of aquatic insects (i.e. water-boatmen, family Corixidae, etc.), and these should ideally be dumped into or very near a local water source.

So, that's about it. The trap is used to catch insects when and where the operator wants. Placement (and timing) will determine what is actually caught. The trap is a tool, and like any tool, it will take time, experimentation and practice to develop proficiency in it's use.

The light can be tested for operation by covering the photocell with a finger. If the sensitivity setting is reasonable, the lamp should light up. If it doesn't, check the power supply to make sure all is in order.

If the power supply is in order but the lamp still fails to light up, the sensitivity of the photocell may need adjustment, see section 5.

If adjusting the photocell fails to cause the light to operate, the bulb may need replacement (VERY unlikely if the bulb isn't broken). See section 6.

The electronics for a trap should last more ore less indefinitely (there are no moving parts to wear out) and a bulb should last approximately 4 years in continuous use. This translates to somewhere around 20 years of typical trap use.

4. Power Sources

The trap will operate off of any power source capable of supplying 12 VDC at a current of slightly over 1 amp. The trap uses a 15-watt bulb. This implies a required input current of 1.25 Amps at 100 % efficiency. Unfortunately, nothing in this world is ideal… The strange bit is, in this particular case physics works in our favour.

The following comment is probably irrelevant to most users. It is included simply because the author is a physicist… Note that the 15 Watt rating does NOT mean the bulb produces 15 Watts of light…

The 15 watt rating is for the power input to the bulb is based on a standard AC (60 Hz) ballast. This means the power supplied to the actual bulb given a standard test set-up. It turns out that the actual electronics are somewhat more efficient than this standard design (the conversion from 12 VDC runs at much higher frequencies), as a result the same (or a slightly greater) amount of light is produced for the same or slightly lower input power levels. A typical trap light operates at about 1.15 Amps at 12 VDC but provides the same amount, or more, of light as a standard 60 Hz 15 W AC unit. Finally, most"12 VDC" batteries provide a wee bit more (typically 12.35 to 12.85 volts) than their usual rating. As a result the trap consumes roughly 15 watts of power, and produces at least that amount of light output, as compared to a standard 60Hz test set arrangement.

The power requirements for the trap are a power source that will supply a nominal 12 VDC at least 1 Amp DC.

This means fairly large batteries must be used, at least for extended operation. Batteries are usually rated in terms of voltage and Amp-hours. This means a given battery will supply x amps for y hours at the rated voltage. For example a 12 volt 6 amp hour battery could supply 6 amps for one hour or 1 amp for 6 hours, or whatever combination thereof all at 12 volts.

As a rough guide consider the trap to require 1 amp hour per hour of operation, for nominal 12 volt batteries. Amphour ratings are usually supplied with a battery. Given the battery in the above example, the trap could reliably be run for 5 hours, and possibly 6.

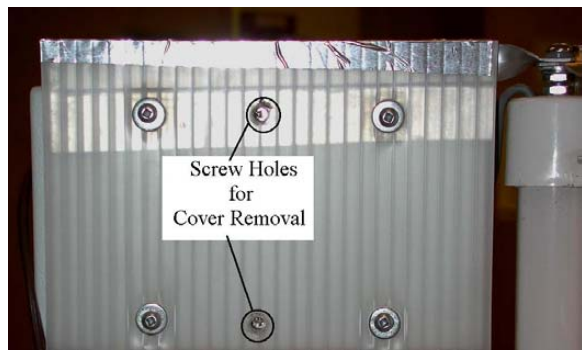
The best choice, for repeated trap use is a rechargeable sealed "gel-cell" battery usually of the 7 amphour rating. (Available from Active/Future Electronics in Edmonton, cost roughly $40.00 each). A suitable recharging mechanism would be required. Such a battery (with appropriate care in recharging) should last for at least 70 nights (6 hours each) of trapping…

Smaller voltage batteries may be used (in series) to reach the required voltage. An alternative to the (initially) relatively expensive gel cells is a pair of 6 volt lantern batteries connected in series. Connect the positive of one to the negative of the other, then connect the trap positive and negative to the remaining terminals. This is cheap initially (somewhere between $10 and $20 depending on where you buy your batteries), but will probably only run the trap for a maximum of 5 nights….

Further details on power sources are available from the Alberta Lepidopterists' Guild…
Car/Truck/Motorcycle 12 volt vehicle batteries will work…

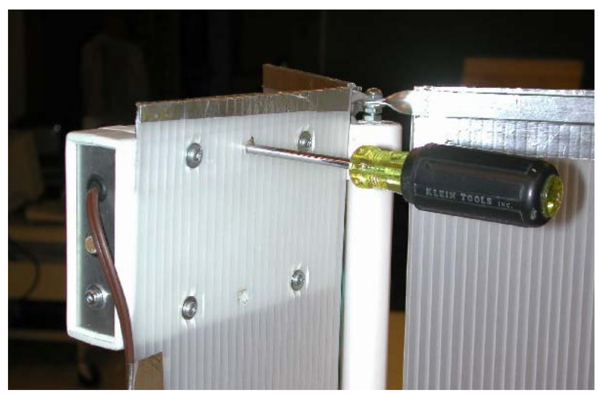
5. Adjusting the Photoswitch Sensitivity

The photoswitch determines if the UV bulb is on or off based on the ambient light level. It becomes more sensitive (and "finicky") as the temperature decreases. As such, it may be necessary to adjust the sensitivity for various climatic conditions. Note that the photoswitch is most useful in places/times where traps are left unattended for long periods (close to one day) of time. For many cases it is probably most useful to reduce the sensitivity to minimum (meaning the light is "on", regardless of ambient light conditions). This is particularly true where the trap is used only for a few hours in close proximity to the operator(s). Turning on or off the light in this case simply means connecting/disconnecting it from the power supply.



Adjustment is straightforward.
On the back side of the vane that carries the photoswitch and electronics, there are two screw holes for the removal of the cover of the electronics box, as shown at right.

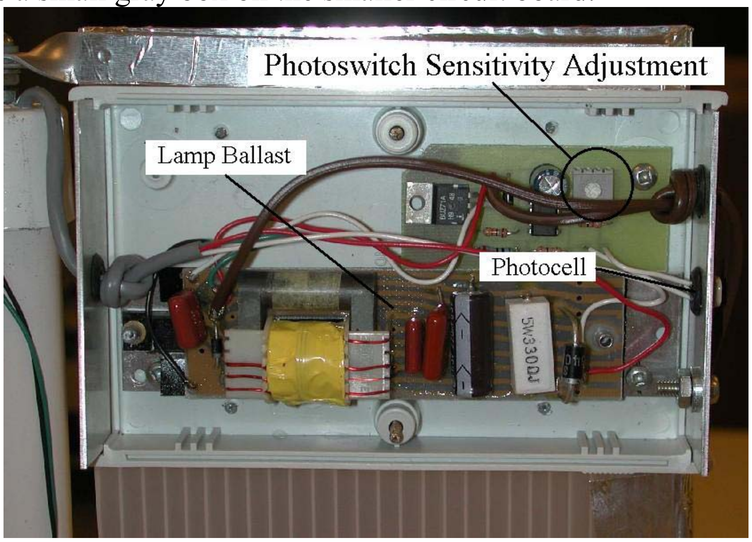
A Phillips # 2 ("star"-small/medium) screwdriver is required to undo the screws to release the cover. The screwdriver fits through the holes, and the holes are sized to make it virtually impossible to loose the screws….



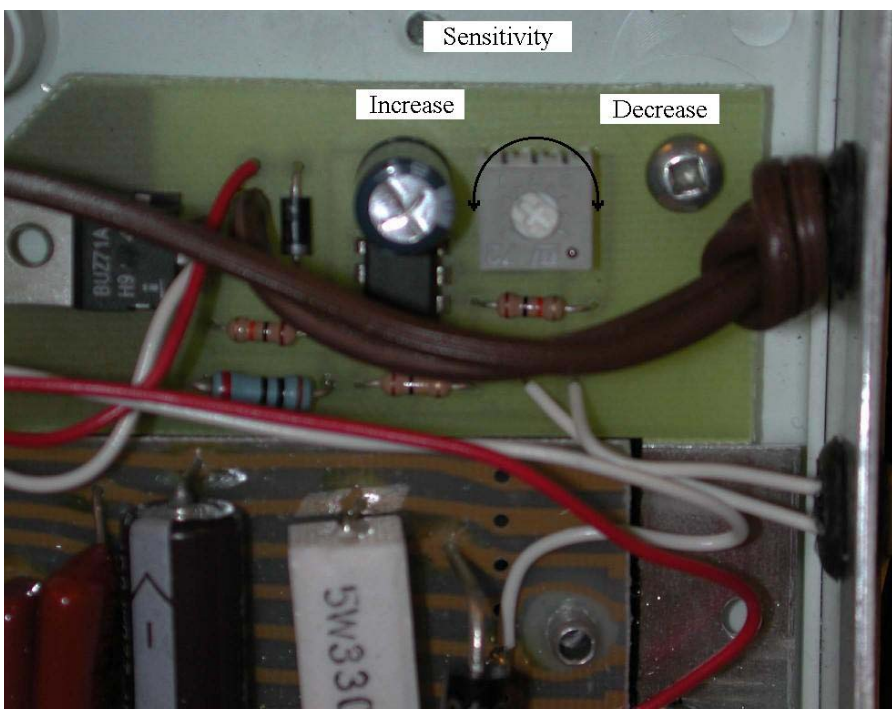
Any suitable type of screw diver may be used, including those found on jack-knives.

Carefully loosen the screws until the cover is free. Remove the cover.

The interior of the electronics box will look like the following figure. The Photoswitch sensitivity is adjusted by changing the setting of the potentiometer shown. The potentiometer is a small gray box on the smaller circuit board.



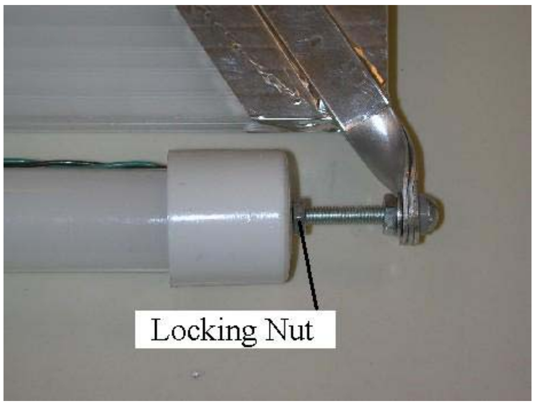
The switch becomes more sensitive (Turns on/off) at lower light levels by turning the potentiometer counter clockwise. Clockwise is less sensitive. If the potentiometer is turned fully clockwise, the photoswitch stops working (trap is on at all ambient light levels). Any setting is possible and no damage will result form setting it to minimum (always on) or maximum (always off) sensitivity. It is possible (and acceptable) to adjust the potentiometer with power applied. This makes adjustments much easier.



6. Changing the Bulb

It is unlikely that a bulb will need to be changed for any reason other than breakage. The procedure is straightforward, but can be complicated in the field due to a number of small parts. If you choose to change the bulb in the field, make sure you have a clear area to work and a place for setting small parts.

First, unscrew the locking nut on the lower bulb support as shown below:



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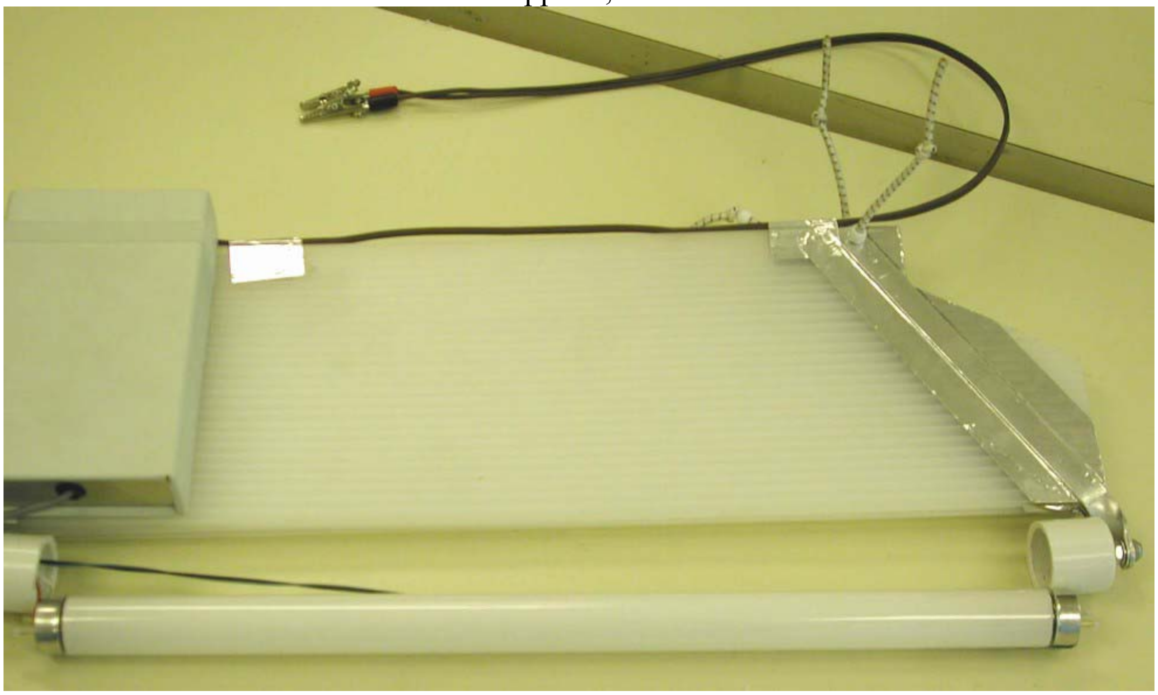
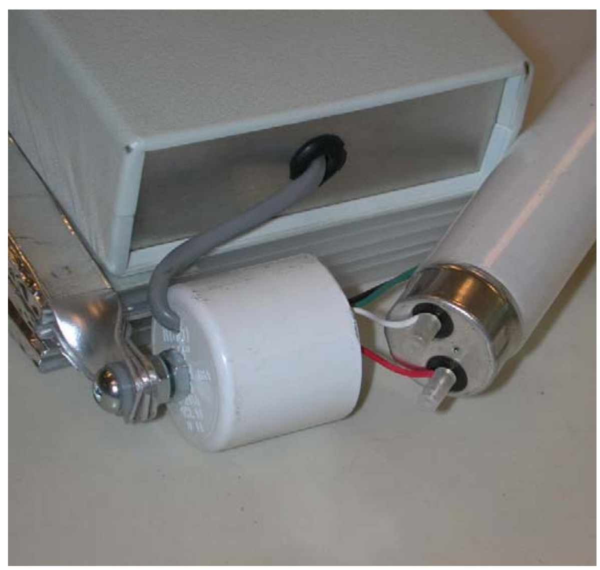
Next, unscrew the bulb support:

This will mostly free the bulb. Tolerances are tight and it is necessary to flex the bulb support in order to free the bulb. The pins on the lamp will just clear the support if manipulated carefully.

The bulb should now be free from the supports, but still connected to the electronics:



There are 4 wires connected to the bulb. The wires are inserted into plastic genitalia vials and slipped over the pins on the end of the bulb, as shown:



Carefully remove the plastic vials (these are notoriously easy to loose in the field). The old bulb should now be free from the vanes. Connect the new bulb to the wires using the vials. There is no particular order to the wires so long as the black and green are on one end and the red and white on the other. All 4 wires are required for proper operation.

Reverse the above process to install the bulb in the vanes. Note that due to the electrical connections, the top bulb support cannot be rotated by more than about ½ turn.

6. Bulb Specifications:

The trap will run ANY 15 Watt fluorescent light bulb. Various types may provide different effectiveness in attracting insects.

The bulb supplied with the trap is:

15 Watt Blacklight Type: FL15BL

It is a fairly standard "bugzapper" bulb.

An alternate type is:

15 Watt Black light black Type: F15T8-BLB

This is a dark "purple" bulb that produces much greater emission in the UV region of the light spectrum.

Other types ("growlights") are possible, but the one supplied with the trap has proved to be most effective.

7. Comment on Live/Dead Trapping

It is possible, and sometimes desirable, to include killing agents (usually ethyl acetate) in the pail. This usually gives better quality specimens and prevents escape, but often results in a very large unwanted "by-catch". For most purposes, live trapping and the release of unwanted insects is to be preferred. Good quality specimens can be obtained particularly if newspaper/paper towel is used in the pail.

Final Note:

Questions or Problems not covered above?

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