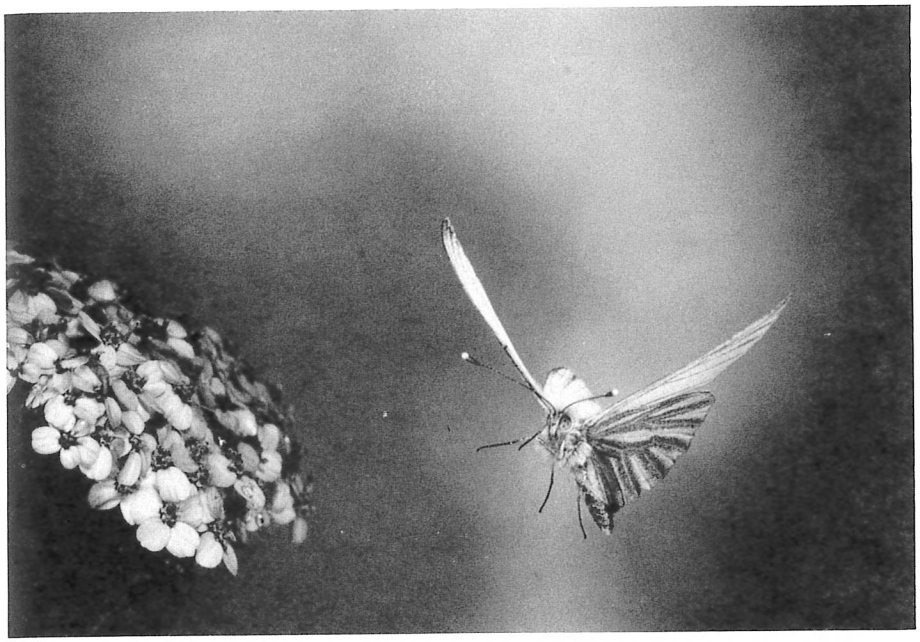


Butterflies, such as this mustard white (Pieris napi), *are easy subjects to photograph because most fly out of the box toward a light source.*

ROBERT H. ARMSTRONG

Photographing Insects in Flight

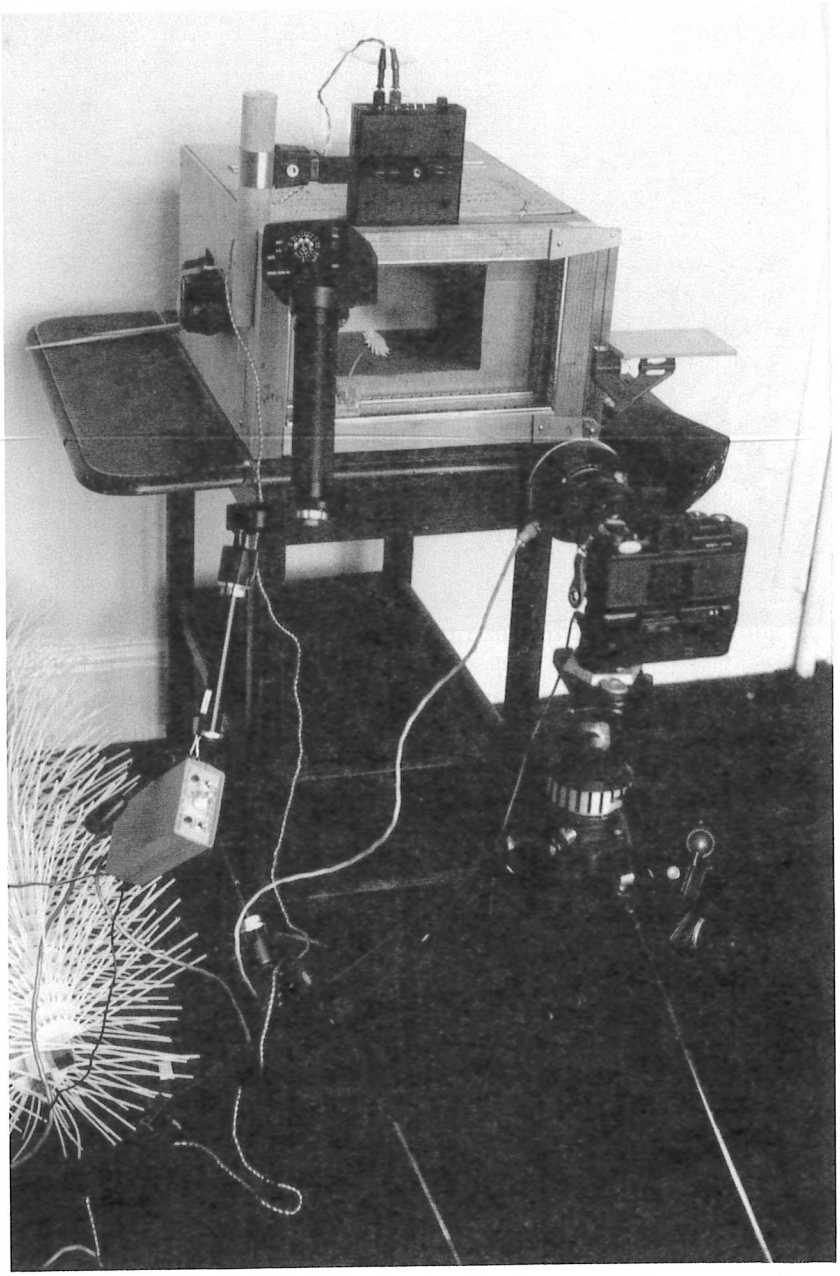
INSECTS ARE FASCINATING CREATURES to photograph. Almost every imaginable shape including the beautiful, ugly, and bizarre can be found among the insects. About three million species of insects are thought to exist in the world, far surpassing the number of most other kinds of living things, so subjects to photograph are abundant. It is challenging to create artistic settings with backgrounds and foregrounds. Add to this the surprise and thrill of capturing flying insects in a pose you cannot see with the unaided eye, and you have a photographic experience that is well worth the effort.

You can photograph insects in flight by using commercially available equipment and a wooden flight box that you can easily make yourself. The specialized equipment cost under $1,000 and included an infrared triggering device, an externally mounted high-speed shutter, and material for the flight box. In addition, you need a 35-mm camera with motor drive, 100-mm macro lens, four electronic flashes, and a tripod. Everything, except the tripod, will fit into one king size Pelican (Pelican Products, Torrance, Calif.) camera case (22 by 17 by 8 in.) and can be set up in the field. The technique allows you to use Kodachrome 25 at *f*/16 and *f*/22 for superb color and maximum depth of field. And you do not need to be an electronic whiz to put it all together and obtain outstanding photographs!

The External Shutter

BECAUSE A CAMERA'S SHUTTER reacts too slowly to capture a sharp image of a fast-moving insect (especially with the shallow depths of field encountered when working with such small subjects), you need an external shutter mounted on the end of a camera lens with the camera's shutter held open in bulb.

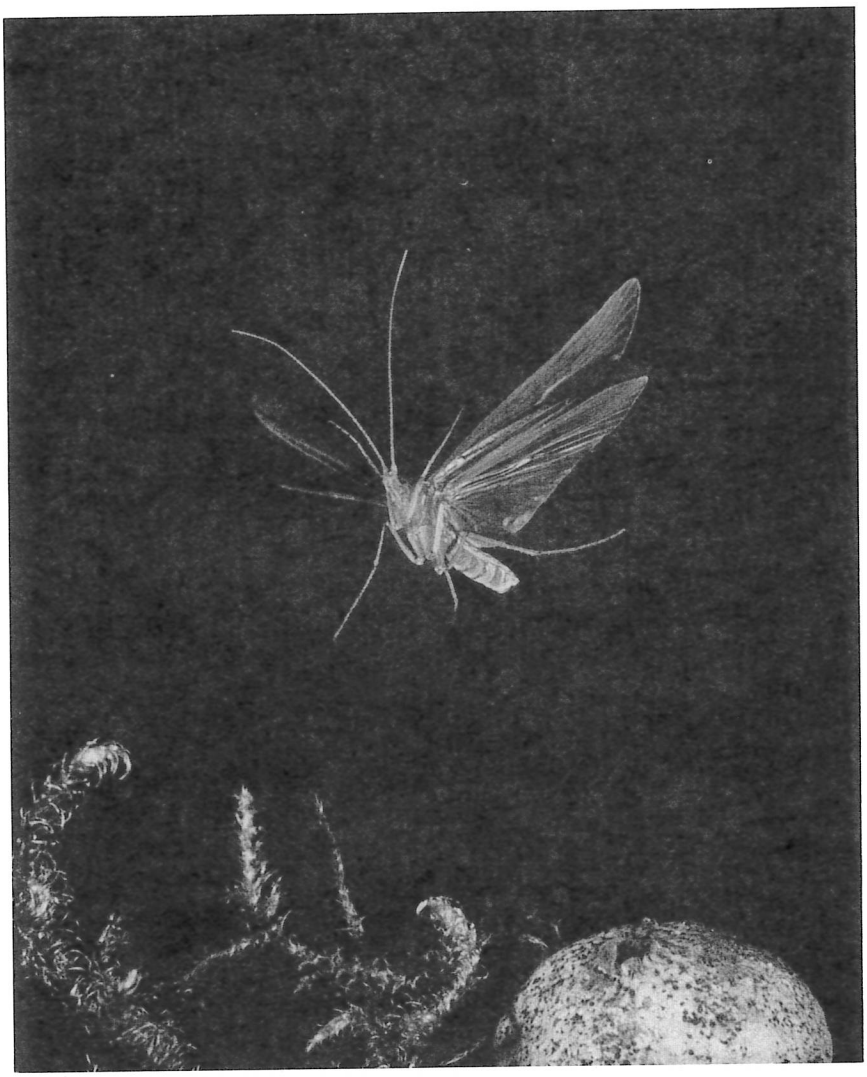
The flight box and related photographic equipment set up for indoor operation.



For example, to obtain a reasonable image of a medium-sized butterfly in flight, you need to photograph an area of about 77 by 115 mm (⅓X), whereas for smaller insects, such as bees, you need to photograph an area about 52 by 71 mm (½X), and an area about 24 by 36 mm (1X) for even smaller insects. This means that your depth of field at *f*/16 is quite shallow and will range from about 13 mm at ⅓X down to only 2 mm at 1X.

Depending on the brand of camera, a camera's shutter takes from 30 to 120 ms to open in response to an external signal, so an insect flying through an infrared light beam will be several millimeters beyond the beam before the camera's shutter opens. Therefore, predicting the exact spot to focus would be a difficult, if not impossible, task without the use of an external shutter.

External shutters have their own power source and react much more quickly than a camera's shutter. These shutters open as quickly as 6 ms, which is sufficient to capture most insects in the area of focus around the light beam. The shutter is manufactured by Vincent Associates, Rochester, N.Y., (model 225L with case and mechanical sync contact). To operate the shutter, I use their model PP-1000 portable shutter drive/timer with 10 shutter speeds ranging from 2 to ½00 s. This



This caddisfly (Limnephilidae) was photographed using a black background to simulate darkness.

driver operates on one standard 9-V alkaline battery or AC and has connections for electronic flash sync, external triggering device, and an adjustable delay for operation of a camera's motor drive.

When used with a motor-driven camera, the shutter driver's controls will automatically advance the film and reset and hold the camera's shutter open in bulb. The total cost of the high-speed shutter and driver was $571.

Infrared Triggering Device

HUMAN BEINGS react too slowly to capture a sharp image of a flying insect on film. However, it can be done by a device that detects the presence of the insect and sends a signal immediately to the camera. I use the Dale Beam tripper made by Protech (Alexandria, Va.). This device sends out a pulsed beam of infrared light that is bounced off a small reflector and back to a built-in sensor. A sensitivity dial can be adjusted so that even an insect's antennae entering the beam will trigger the external shutter. The Dale Beam also has audible and visual devices that help to locate the infrared light beam precisely, which is essential for critical focusing of the camera's lens. The tripping device, which costs $325, operates on two rechargeable 9-V batteries or AC.

Lens and Camera

THE 25-MM OPENING on the external shutter I use can cause vignetting when attached to most lenses. A lens of about *f*/3.5 or higher will avoid this problem. I have successfully used Nikon's Micro-Nikkor 105-mm, *f*/4 lens; Minolta's 100-mm, *f*/3.5 macro lens, and a Leica Hektor 135-mm, *f*/4.5 lens.

Attaching the external shutter to the end of the lens may require either modification of adapter rings or having a threaded adapter custom made.

To advance the film after each exposure automatically requires a motor-driven camera. I recommend one in which the batteries in the motor drive are used to hold the camera's shutter open in bulb (such as the Nikon F3 with MD-4 motor drive), otherwise you may be replacing camera batteries every 2–3 h. You can also hold the camera's shutter open in bulb manually with a cable release and advance the film yourself after each exposure. This technique requires close attendance to the equipment to avoid double exposures.

Electronic Flashes

ELECTRONIC FLASHES that will operate in manual mode at 1/20,000 to 1/25,000 s flash duration are sufficient to "freeze" insects in flight. I use two Sunpak (Berkey Marketing Companies, Woodside, N.Y.) 333 flashes set on 1/16 power (1/20,000 s) to illuminate a background. Two sunpak 611 flashes set at 1/64 power (1/25,000 s) illuminate the insect. I mounted the 611 units on Bogen Magic Arms (Bogen Photo Corporation, Fair Lawn, N.J.) attached to the legs of a tripod, enabling quick positioning of the flashes. One flash is attached to the sync terminal of the external shutter driver, and the other three are operated on slaves.

The Flight Box

I BUILT A BOX of 1/4 in. plywood with an opening in front so that when an insect flies out it passes through the infrared beam and triggers the external shutter and electronic flashes. The box is 18 in. long, 16 in. wide, and 10.5 in. high. It is designed to be dismantled and will fit into a standard Pelican camera case.

The flight box includes corkboard at the back for pinning on colored backgrounds. I use colored heavyweight construction paper that comes in 12- by 9-in. sheets. I spray paint the paper to simulate out-of-focus colors that might be encountered in nature—woods or sky. The background is illuminated with the two Sunpak 333 electronic flashes that are strapped to the sides of the box about 4–6 in. from the colored background. The flash heads are set in the 35-mm mode and angled inward for the broadest coverage. For nightflying insects, such as moths or caddisflies, a black background without illumination will simulate darkness.

At the open front of the box, I installed slots so that cardboards with different-sized exit holes can be inserted, depending on the size of insect to be photographed. An exit hole of 4 by 5 in. works well with most of the larger insects, such as butterflies and dragonflies.

I place the infrared beam just beyond the exit hole and designed the box so that the beam could be used in either a vertical or a horizontal mode. In the vertical mode, you can place a flower or foliage to one side or the other of the flight path of the insect. In the horizontal mode, you can have an insect flying over or under a flower or foliage.

Insects are introduced to the flight box through a hole cut in the top cover near the back. This hole fits the opening of a 1.8-liter plastic jar. The insects are captured in the jar, and then the jar is inverted over the hole so the insects fall into the box.

The flight box has uses other than photographing insects in flight. The consistent illumination of a background facilitates taking portraits of insects and photographing aquatic insects placed in a small narrow aquarium.

Operation

THE FLIGHT BOX can be used indoors or in the field. When I use it indoors, I position the exit hole toward a window, and the insects usually fly to the window where they can be collected and reused. In the field, I usually set up the equipment in the trunk of my car, but it can be used anywhere. A small table would simplify the operation. Field operation is usually best because the insects

are fresh and it can be a little unnerving to have hornets and bumble bees flying about your home. You can also capture insects in the field, put them into a live cage, and bring them home for photography.

Flowers or foliage from the area frequented by the insect is the best and most natural to use. I arrange the flower or foliage around the exit hole to achieve the most pleasing composition. The plants can be kept fresh by placing them in a small container, such as a film can filled with water.

I determine exposure by use of a flash meter. I have used the Minolta III flash meter with good success. Beware of the cheaper meters because some do not measure extremely short flash durations accurately. I first determine the exposure on the background and then adjust the distance of the two Sunpak 611 units until I get the same exposure reading in the area in which I want to photograph the insect. Because light through the lens is diminished in closeup work, I open up the lens by as much as one *f*-stop, depending on the extension. Most final exposures are *f*/16 or *f*/22 with Kodachrome 25.

Be prepared to use a lot of film to obtain good results. Most insects fly erratically and are difficult to steer where you want them. Trial and error and lots of repetition and patience are needed for success. Some insects will stay in the flight box and may require gentle nudging before they will fly out. Others will crawl out of the box or fly out at such a steep angle that the wings or some other part of the insect is out of the picture. Because everything is automated, it is possible to put 10 bumble bees in the box at one time and take the picture of each bee as it flies out without having to reset or readjust the camera. This technique is not without problems, however; sometimes the foliage slips into the infrared beam, and I get 36 pictures of a flower before I can shut off the equipment. ❑

Suggested Reading

Cooke, J. & T. Tilford. 1987. High-speed photography. Photomethods 30(11): 53–57.

This article describes the use of Rollei SLX and 6000 series cameras with the Presto 180/25R high-speed flash unit. I have not tried this equipment but, judging from the article, it should work for photographing insects in flight. The shutters of these Rollei apparently have such a fast reaction time that an external shutter is not needed.

Dalton, S. 1982. Caught in motion. Van Nostrand Reinhold, New York.

This is the best source of information I have found on photographing insects in flight. Dalton's beautiful images of flying insects were the main stimulus for my endeavors.

Bob Armstrong has pursued a career in Alaska as a biologist, naturalist, and nature photographer since 1960. He is the author of A Guide to the Birds of Alaska. *He has been a fishery biologist and research supervisor for the Alaska Department of Fish and Game, an assistant leader for the Alaska Cooperative Fishery Research Unit, and an associate professor of fisheries, University of Alaska, Fairbanks. He retired from the State of Alaska in 1984 to pursue an interest in Alaska and nature photography.*