

ULTRAVIOLET PHOTOGRAPHY AS AN
ADJUNCT TO TAXONOMY¹CLIFFORD D. FERRIS²

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Several papers have been published on the use of ultraviolet (uv) photography to visualize hidden characters on the wings of Lepidoptera (e.g. Nekrutenko, 1964, 1965; Eisner *et al.*, 1969). These hidden patterns probably relate to differing characteristics of the scales and their arrangement on the wings. Some work has been carried out using a scanning electron microscope to detect differences in scale characteristics (Kolyer & Reimschuessel, 1969). Most of the more recently published papers have treated the Coliadinae, especially the genus *Gonepteryx*. In this subfamily, luminous patches appear on the dorsal surfaces of the wings when they are photographed under ultraviolet light. In other genera, *Papilio* for example, forms which appear quite different when viewed under white light appear nearly identical when photographed under uv light.

Photographic techniques are necessary to visualize the ultraviolet evoked patterns as the human eye does not respond to that portion of the electromagnetic spectrum. From analysis of black light response in Lepidoptera, their visual perception ranges seem to peak in the range 300–400 nanometers (millimicrons).

Since most of the readily available literature on ultraviolet photography of insects does not give details of technique, it is felt that a technique should be described which could be applied by anyone with a basic knowledge of photography. That is the purpose of this paper.

The primary prerequisite is a camera which has a lens that will pass uv. Generally the better quality modern 35 mm single-lens-reflex cameras from Germany and Japan meet this criterion. The author uses two different models of Mirandas with Soligor-Miranda lenses. A simple way to check a lens for uv transmission (other than by taking a photograph) is to use the lens to focus light from a uv source onto a fluorescent object. Suitable objects are the mineral Willemite ($ZnSiO_4$ which fluoresces bright green), if available, or various greases. Vaseline fluoresces a pale green. Fluorescent spray paint also may be used.

Since only ultraviolet reflectance is of interest for distinguishing patterns

¹ Published with the approval of the Director, Wyoming Agricultural Experiment Station, as Journal Paper no. JA 503.

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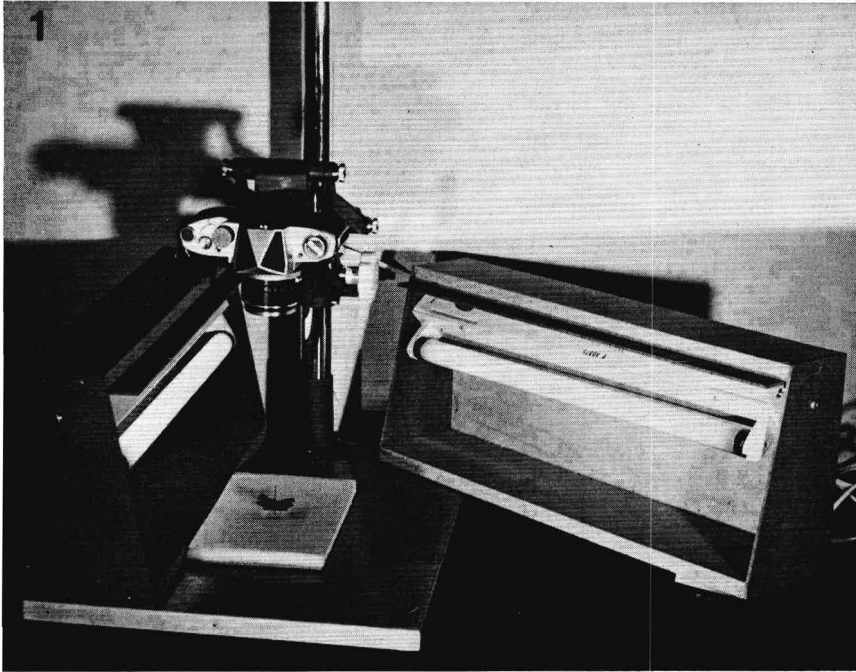


Fig. 1. Camera support and illumination system for ultraviolet photography. Righthand light source swung out to expose mounting technique.

in the Lepidoptera, it is necessary to filter out all light except that in the near uv spectrum (300–400 nm). This may be done with a Wratten 18A filter (Eastman Kodak Co.). This filter is available as a 2" × 2" square and appears opaque. A filter-holder adapter mount is required for the camera. These items can be ordered through any photographic store. The 18A filter transmits ultraviolet light, but blocks visible light.

A suitable light source is necessary. Photographs can be taken in direct sunlight utilizing the uv content of natural light. Generally speaking, light which has passed through window glass should not be used, as most glass filters out ultraviolet rays. For an artificial source, the author uses two 15 watt blacklight fluorescent tubes that have a built-in filter glass which filters out most of the visible portion of the light spectrum. These are model 50058 available from Ultra-Violet Products, Inc., 5114 Walnut Grove Ave., San Gabriel, California 91778. Similar tubes are manufactured by various lamp firms and can be obtained from lamp jobbers.

Fig. 1 shows a simple setup for doing ultraviolet photography. The



Fig. 2. Dark ♀ form of *Papilio g. glaucus* photographed under uv illumination.

light sources are mounted in two homemade wooden reflector housings. Standard 15 watt fluorescent light brackets are used (available from most mail-order catalog stores or from electrical suppliers). A 35 mm photographic enlarger easel is used to support the camera. If available, a Polaroid Camera Corp. copy stand makes an ideal setup as only the 15 watt blacklight tubes are required as additional items. A conventional camera tripod can be used as a camera support, but is less convenient than an enlarger easel. In Fig. 1, one of the lamp housings has been swung out to illustrate the lamp mounting. The lamp appears white in color as the light was on when the photograph was taken. To insure photographing the full extent of the uv reflectance pattern with this setup, specimens must be mounted with the wings flat.

Either Tri-X or Panatomic X film (Eastman Kodak Co.) is suitable for uv photography. The former requires much shorter exposure time than the latter, but tends to develop slightly more granularity. Exposure time can be determined by placing the 18A filter over the light entry port of a CdS exposure meter and measuring the reflected light from the specimen. The background to which the specimen is pinned should not be fluorescent. The high-density polyethylene foam usually used in pinning trays is satisfactory. A typical exposure setting for Tri-X film (ASA 400)

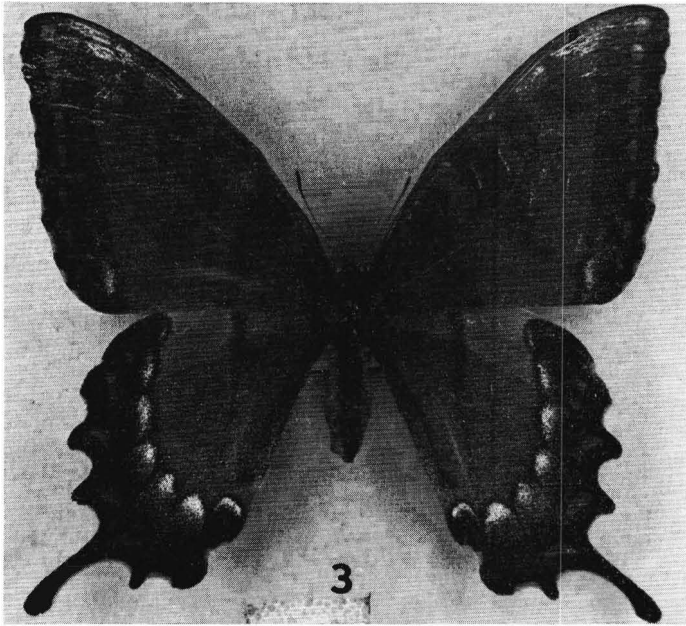
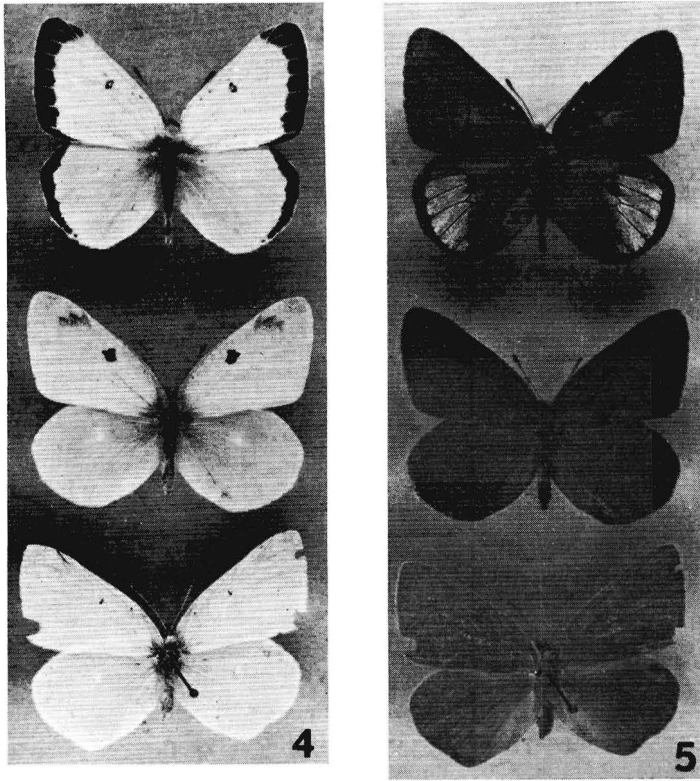


Fig. 3. Normal yellow ♀ form of *Papilio g. glaucus* photographed under uv illumination.

is $f/16$ at $\frac{1}{2}$ second with 10 inches between the filter plane and the specimen, and with the light sources approximately 6 inches from the specimen. The camera lens should be stopped down to at least $f/8$ to produce sufficient depth of field to counteract the difference between focusing white light and near ultraviolet light. Focusing is achieved by removing the 18A filter. If required, a supplementary closeup lens such as a 3+ Portra lens (Eastman Kodak Co.) can be added. This lens does transmit uv light.

Excluding the camera body, lenses, light meter, and stand or tripod, the present cost of setting up to do ultraviolet photography is as follows: 18A filter and holder \$25.00, two 15 watt uv tubes \$14.00, fluorescent lamp fixtures \$15.00, miscellaneous (reflector housings, etc.) \$5.00. These are approximate prices. Special ultraviolet-transmitting lenses are available, but these are designed for very short wavelengths and range in cost from \$750.00 to \$1,600.00. Such lenses are not required for this type of insect photography.

Figs. 2 and 3 illustrate one aspect of uv photography. The two female forms of *Papilio glaucus glaucus* Linnaeus are shown as they appear under uv light. Similar patterns appear when they are photographed



Figs. 4 & 5. Specimens of *Colias a. alexandra* from Albany Co., Wyoming: 4, photographed under normal illumination—male at top, yellow female in middle, white female form at bottom; 5, same specimens as they appear under uv illumination.

under uv illumination, although they are quite different when viewed by visible light. Only a suggestion of the black bars appears in the yellow female form in the ultraviolet photograph.

As a comparison, the wings of both sexes of *Colias alexandra alexandra* Edwards are shown as they appear when photographed with visible light (Fig. 4) and with ultraviolet light (Fig. 5). Under uv light, luminous patches appear on the hindwings of the male, while the female appear drab (a characteristic of the female sex in most North American *Colias*). A forthcoming paper by the author on the *Colias alexandra* complex will demonstrate the utility of ultraviolet photography in taxonomic research.

More sophisticated techniques do exist for ultraviolet photography, but these involve the use of special light sources and filtering techniques. Such matters are beyond the scope of this presentation. The intent here

has been to describe a simple method which can be applied using a limited amount of equipment.

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A NEW SUBSPECIES OF *EUMEDONIA EUMEDON* (LYCAENIDAE) FROM CAUCASUS

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During the past few seasons I have had the opportunity to collect in the Western part of the Main Caucasus Ridge and to review Caucasian material deposited in the Lepidoptera Collection of the Zoology Museum, Kiev State University and in the private collection of Dr. Eugene S. Miljanowski (Sukhumi, Georgia) who spent more than 30 years collecting in different parts of Abkhasia. From these sources I found some interesting, heretofore undescribed forms of lycaenid butterflies, one of which is described here with some brief remarks.

***Eumedonia eumedon modestus* Nekrutenko, new subspecies** (Figs. 1-6)

Lycaena eumedon Esp.: Romanoff, 1884, p. 52.

Lycaena eumedon Esp.: Wojtusiak & Niesiolowski, 1947, p. 58-59.

Lycaena teberdina Tschetv.: Miljanowski, 1964, p. 114.

Male. Length of the forewing (base to tip) of the holotype 14.0 mm (variation in type series 13.0 to 14.5 mm). Upperside of both wings of dark black-brown ground color, discal spots hardly recognizable. Underside ground color steel-grey,