AN APPARATUS AND TECHNIQUE FOR THE CONTINUOUS
ANESTHETIZATION OF HAEMATOPOPHAGOUS
INSECTS WITH DRY ICE

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Carbon dioxide has been used for a long time as an anesthetic in entomologi-
cal research. In their studies on the genetics of Drosophila, l’Heritier and
Teissier (1937) routinely employed carbon dioxide for anesthetizing these flies. Wil-
liams (1946) and Willis and Roth (1949) have described techniques for anesthetiz-
ing small insects with carbon dioxide. Maramorosch (1953) used carbon dioxide in
handling leafhoppers in his transmission studies of plant viruses by these
insects, and, in 1956, described a technique for anesthetizing insects with carbon
dioxide so that he could inject them with viruses and other substances. Caldwell
(1956) employed dry ice for anesthetizing house flies for toxicological studies.
In studying the effects of different anesthetics on the behavior of honey bees, Ribbauds
(1950) concluded that carbon dioxide and nitrogen stop respiration; whereas ether
and chloroform affect the nervous system.

Though the above mentioned works all utilized carbon dioxide in one form or an-
other for the anesthetization of different insects, none of the insect chambers used for
these studies made use of transmitted light, which the author found invaluable in the
work of separating live unfed arthropods from blood-fed arthropods. Therefore, a
new carbon dioxide anesthetizing chamber, or “arthropod stunner,” was designed.
The equipment of Willis and Roth is somewhat similar in design to the arthropod
stunner in that the anesthetizing chamber can be fitted into the grooves of the stage
of a dissecting microscope, but their apparatus does not have a transparent bot-
tom and several other features are somewhat different.

The arthropod stunner is basically a topless, rectangular stainless steel box
with a partial glass bottom (Fig. 1A). A tube, rectangular in cross-section, \( \frac{3}{4} \) inch wide by 1 inch high, through which the carbon dioxide is piped, forms the
four sides of the box. The floor of the box is \( \frac{3}{4} \) inches long by \( \frac{1}{2} \) inches wide. The tube is set in
5\%16-inch from the edge of the floor so that a flange extends out from it; this flange slips into
the grooves of a dissecting microscope normally used to hold the glass stage.
The bottom of the inside of the anesthetizing chamber is of glass. This glass
piece is secured tightly against a soft rubber gasket with two metal strips
screwed to the underside of the metal portion of the bottom (Fig. 1B). In the
side wall of the tube toward the chamber, just above the glass bottom, are 28 holes,
each \( \frac{1}{4} \)-inch in diameter. These holes are screened on the inside of the tube
with 80-mesh stainless steel screen cloth. There is a \( \frac{3}{4} \)-inch needle valve welded
into one of the long outside walls of the tube. Rubber tubing connects this inlet
with the rubber tubing leading from the carbon dioxide supply.

The carbon dioxide used in these studies was obtained by placing crushed dry ice
in a reagent bottle and piping off the gas that formed as the dry ice evaporated at
room temperature, through a second reagent bottle half filled with water, and
then into the anesthetizing chamber (Fig. 2). The water bottle is used only so that
the worker can be sure (by the bubbles produced in the water) that the carbon
dioxide supply is flowing freely from the first bottle. A 1,000 cc. reagent bottle
half filled with crushed dry ice will produce enough carbon dioxide to last for
approximately five hours.

1 Assistance of the following persons is gratefully acknowledged: Mr. Earl Oden, Mr. Joseph
Carroll and Mr. Robert Castle.
Fig. 1A.—(Above) Top view, Arthropod Stunner.
Fig. 1B.—(Below) Bottom view, Arthropod Stunner.
Commercially tanked carbon dioxide may be used with the arthropod stunner; however, the writer found dry ice more suitable since it was always available and there was never the danger of the gas supply being exhausted in the middle of an experiment. More important, the great pressure under which the carbon dioxide gas is tanked commercially makes it difficult to obtain a slow, steady release flow even with a valve system. Sometimes when tanked gas has been used the flow has been so strong as to blow the arthropods out of the anesthetizing chamber.

The glass bottom of the anesthetizing chamber enables one to use the arthropod stunner with a mirror-equipped dissecting microscope. Light transmitted from beneath illuminates the digestive tract so that it can be viewed with ease and even the slightest amount of blood within the tract of a fed insect can be detected. When light is directed on the top or side of a blood-fed insect the digestive tract is darkened to such a degree that it is most difficult to determine whether the insect has taken in blood.

The apparatus and technique have been used successfully with blood-fed fleas (Xenopsylla cheopis) and mosquitoes (Aedes aegypti). Fleas can be anesthetized for several hours and mosquitoes for two hours with carbon dioxide without lethal effects.

SUMMARY. A continuous anesthetizing apparatus ("arthropod stunner") that has been especially designed to utilize transmitted light in separating live unfed from blood fed arthropods has been described. Carbon dioxide obtained from dry ice has

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Fig. 2—Assembled Arthropod Stunner and carbon dioxide supply.
been used as the anesthetic for fleas (Xenopsylla cheopis) and mosquitoes (Aedes aegypti).

Literature Cited


AN ADDITIONAL UNITED STATES RECORD OF HAEMAGOGUS EQUINUS

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Following the report by Trapido and Galindo (1956) of the recovery of Haemagogus equinus from near Brownsville, Texas, we have made extensive efforts to determine its distribution and prevalence. The presence in the United States of this mosquito implicated as a reservoir and transmitting agent of jungle yellow fever in Central America is of considerable interest even though monkeys, the primary vertebrate hosts, are not indigenous. Other animals, notably several species of marsupials, have been shown to be susceptible to experimental infection with the yellow fever virus (Strode, 1951). Numerous species of wild animals abound in the Brownsville area including a marsupial, Didelphis marsupialis.

Brownsville, with an elevation of 16 feet, is located at the extreme southern tip of Texas about 18 miles west of the Gulf of Mexico. The alluvial soil was deposited by the Rio Grande River which separates the contiguous populations of Brownsville and Matamoros, Mexico. The semi-arid area has an average rainfall of only 29.55 inches. The precipitation is poorly distributed with the maxima in May, June and September; frequently a single thunderstorm will account for a month's rainfall.

The estimated 1955 population of Cameron County was 148,952, with a majority of the residents engaged in irrigation agriculture. Principal products are citrus, vegetables and cotton. Normal temperatures during the summer and fall are in the lower nineties in the daytime and middle seventies at night; during February, the coldest month, the normal daily minimum is only 52°F.

It is the purpose of this paper to recount the circumstances concerning our collection of H. equinus together with a list of the other species of mosquitoes recorded from Cameron County. Collections of equinus were made by Trapido and Galindo from 2 locations on September 4 and 6, 1956. Over 8 inches of rain had fallen in Cameron County during the latter part of August and the first few days in September mainly as a result of a minor and 2 major hurricanes that moved into the Mexican coast 150-300 miles south of Brownsville.

Following publication of this informa-