justed according to the nature of the substrate. The basic techniques employed, in order of frequency, are: (1) sieve-washing (0.175 mm mesh size) and sucrose flotation, (2) heat extraction (by Berlese-type funnels), (3) live organisms sorting themselves (through screening or sand), (4) elutriation, (5) hand-picking unwashed samples, and (6) centrifugation-flotation.

A standardized *ad hoc* collecting data form provided entries for (1) pertinent weather data, (2) detailed locality information (including geographic coordinates and elevation), (3) habitat descriptions, (4) vegetative characteristics, such as biotic province, dominant species, and shading, and (5) detailed chemical/physical characteristics.

Success in obtaining viable larvae and pupae increased from ca. 60% to 80% of the sites as the procedures were developed. These procedures have proven to be least effective for the semi-terrestrial representatives of the Forcipomyiinae and Dasyheleinae.

***Culicoides* breeding sites in Panama. Gary Vitale. Yale University School of Medicine, New Haven, Connecticut.**

The purpose of this project was to search for species of *Culicoides* breeding in bromeliads at the Bayano River encampment of the Gorgas Memorial Laboratory in Panama. Other likely breeding sites were also examined. The duration of the field study was from May to August of 1976.

In total, 202 collections were made and processed. Of these, 82 were from bromeliads, 53 from tree holes, 21 from water-containing bamboo internodes, 19 from moist soil and leaf debris, 11 from cut palm trunks, 7 from streams, 3 from *Heliconia* (Musaceae) inflorescences, 3 from palm crowns, 1 from the inflorescence of *Costus* (Costaceae), 1 from *Xanthosoma* (Araceae) and 1 from a water-holding palm frond. The bromeliads and tree holes were distributed from ground to canopy level.

In all, 363 larvae of *Culicoides* were isolated from the collections, 41 live pupae and 256 adults (reared) while 44 larval skins and 68 pupal skins were preserved. The larvae were found in tree holes, bromeliads, streams, leaf humus, cut palm trunks, bamboo internodes and *Heliconia* inflorescences. *Culicoides* adults were successfully reared from tree holes (206), bromeliads (15), cut palm trunks (22) and trapped leaf humus (13). A total of 43 *Culicoides* species was identified (Dr. Willis W. Wirth, personal communication). Those from tree holes included *Culicoides debilipalpis* Lutz, *C. paraensis* (Goeldi), *C. quasiparaensis* Clastrier, and 1 possibly new species. The bromeliads *Viriesia heliconioides* (HBK) and *Aechmea pubescens* Baker each yielded adults of *C. debilipalpis*.

Besides the *Culicoides*, other insects were collected as follows: 359 adults (reared), 29 larvae, 16 pupae, 27 larval skins and 135 pupal cases. All collections were associated with complete data on habitat. Of special interest were 45 adult crane flies (Tipulidae) with 44 pupal cases, which were reared mainly from bromeliads. Preliminary identifications disclosed several genera of mosquitoes as well as predaceous ceratopogonid genera such as *Bezzia* and *Palpomyia*.

Within the study period, rainfall during June and July was below normal. For this reason, the breeding sites of *Culicoides* were restricted and the numbers of *Culicoides* were reduced. It is possible that species found breeding in tree holes make use of new breeding sites which become available as rainfall increases. One potentially excellent breeding site is the palm crown. In the Bayano region species in several genera of palms are among the most abundant understory trees and form a significant component of the canopy. I consistently was able to find moist dirt in the leaf bases of palms and it is likely that with the daily rains of the wet season these would be converted into good breeding sites for *Culicoides* and other insects.

4. ADULT BEHAVIOR.

A latex agglutination test for the identification of blood meals of *Culicoides*. J. P.