September 5 because of heavy rainfall early in August and the resulting flood waters that covered forty to fifty thousand square miles of interior Alaska for several days at mid-August, forming a shallow "lake" about equal to the area of Alabama or North Carolina. The high water, followed by unseasonably warm weather, may explain the apparent late-emerging population of these species, if, as mentioned by Carpenter and LaCasse (1955) and others, some eggs do not hatch during the spring flooding, but do hatch at subsequent floodings.

In this respect it is interesting to note that the precipitation recorded at Fairbanks International Airport by the Weather Bureau for May, June, and July of 1955 totaled 7.7 inches—almost twice the normal amount. Craig and Pienkowski (1955) first reported *A. canadensis* in Alaska, and also stated it to be the dominant pest species at milepost 337 on the Richardson Highway in late July that same year. Rainfall for the summer of 1954 was also above average, with that of July almost twice the normal amount. These conditions may have contributed to the "large" population in 1955.

A review of the precipitation records as far back as 1947 shows that the only other years when the totals for May, June, and July were about twice normal were 1948, 1949 and 1962. The 1948 Alaska Insect Control Project did not report *A. canadensis* from Alaska (Gjullin *et al.*, 1961). However, last year three pinned specimens were found in some previously unidentified material that had been taken by members of the AICP. Two biting females had been collected at Station 524, one on July 5, and one July 12. The other female had been taken at Station 507 and was labeled "reared, June 14, 1948." Station 524 was located at milepost 355.7, and Station 507 at milepost 353.25, both on the Richardson Highway, in the same area where specimens of *A. canadensis* were collected in June and September of 1967. If repeated flooding does increase the hatch of *A. canadensis* eggs, this may help to explain the vagary of Alaskan *A. canadensis* mentioned by Hopla (1964–65).

L. C. Curtis (1967) has kindly brought to my attention that *Anopheles walkeri* Theobald was erroneously recorded from British Columbia, the material from Esquimalt being instead, *A. freeborni* Aitken. Therefore *A. walkeri* is not known to occur in territory contiguous to Alaska and should not have been included in the key by Sommerman (1966).

References

CARPENTER, S. J., and LACASSE, W. J. 1955. Mosquitoes of North America. University of California Press, Berkeley.

CRAIG, G. B., JR., and PIENKOWSKI, R. L. 1955. The Occurrence of *Aedes canadensis* (Theobald) in Alaska. Proc. Ent. Soc. Wash. 57(6):268.

CURTIS, L. C. 1967. (Correspondence, March 3)

GJULLIN, C. M. *et al.* 1961. The Mosquitoes of Alaska. Agriculture Handbook No. 182, USDA, Washington, D.C.

HOPLA, C. E. 1964–65. The Feeding Habits of Alaskan Mosquitoes. Bull. Brooklyn Ent. Soc. 59 & 60:88–127.

SOMMERMAN, K. M. 1966. True-False Key to Species of Alaskan Biting Mosquitoes, Mosquito News. 26(4):540–543.

U. S. Environmental Science Services Administration. 1947–1967. Climatological Data.

OVERWINTERING HABITS OF *Orthopodomyia californica* BOHART (DIPTERA:CULICIDAE)

DAVID C. BAERG [1]

Entomology Dept., Univ. of Calif., Davis, Calif.

It was first reported by Bohart (1950) that the tree-hole mosquito *Orthopodomyia californica* has several overlapping generations in California, and that the species appeared to overwinter as fourth instar larvae. Chapman (1964) added the information that *californica* hibernates chiefly as second-to-fourth instar larvae. He suggested that the rare occurrence of first instars during the winter months could possibly be explained by the hatching of overwintering eggs or eggs recently deposited by overwintering females. In the present study, conducted in the Sacramento Valley of California (1963), evidence was accumulated which supports the presence of this hibernation potential in the egg and adult stages.

The eggs of *californica* will normally hatch upon completion of embryonic development because no mechanical influence or treatment, such as drying or chilling, is required. Accordingly, Chapman (1964) had found that eggs of the species collected in the fall in the San Joaquin Valley hatched in 4 days at 86° F. and 7 days at 68° F. During the year the author followed the mosquito it was similarly noted that eggs collected as late as September and October all hatched within a few days when exposed to an out-of-doors photo-period and room temperature (74° F.). Incubation periods, however, were extended considerably with very little mortality in lots of eggs from the same collections retained at lower holding temperatures. At 54° F. and 40° F. (without light) the hatching of most eggs, although irregular, required from 10 to 27 and 9 to 28 days respectively. Live, fully developed embryos were additionally seen in unhatched eggs in the above replicates after as long as 40 days. A small portion of these remaining eggs hatched when they were removed from the temperature chambers and were warmed to 74° F. A similar arrested state of development was observed in the few eggs found in tree-holes later in the year (the 3rd and 15th of November). Although all had mature embryos, none responded to room temperature in

[1] Present Address: Gorgas Memorial Laboratory, P. O. Box 2016, Balboa Heights, Canal Zone.

the laboratory when held for 26 days. Higher temperatures (82°–88° F.) and a constant exposure to light also had no effect.

It is apparent that low temperature is an important factor in bringing about dormancy in *californica* eggs. However, the stimulation to bring about a resumption of their activity is more involved. It is yet to be determined whether such eggs will respond to changes in day length.

As concluded by Grant (1953), the species completes development of the immature forms and emerges, only after high outdoor temperatures have been reached. The yearly range of reported pupal incidence for *californica*, a criterion of emergence, is from May to early November in the San Joaquin Valley (Chapman, 1964). In the Sacramento Valley in 1963, these stages appeared in April and were last seen by the end of October. Adults have been recorded over a similar period. According to Freeborn and Bohart (1951), and Loomis, *et al.* (1956), males have occurred from April 3 to August 14, and females from April 3 to October 13. For the present study light traps were not used, but there was no difficulty in locating both males and females (they were never numerous) in tree-holes where the aquatic stages were present. In these collections males disappeared with the approach of fall; however, females were captured as late as December. One specimen was taken December 8, and another on the 15th from the same rot-hole (in a cottonwood tree in northern Yolo County). At the time of the collections (mid-day) the air temperatures in the tree hole were 64° F. and 55° F. respectively. Such a late occurrence of females is presumptive evidence that *californica* adults do hibernate. Experiments with laboratory-reared adults attest to their long life span. In small replicates retained at room temperature, individuals of both sexes lived well over three months. Field studies were not continued beyond December, but quite possibly additional adult hibernation records of the mosquito could be obtained if more tree-holes are searched throughout the winter.

The above findings of an overwintering potential in the adult and egg stages, when coupled with even greater such capabilities of the larvae, demonstrate that the species is well adapted for the passage of winter. It is also indicated that a low reproductive potential in *californica* is perhaps largely compensated by a strong and varied ability to survive.

Thanks are extended to Dr. S. F. Bailey, Entomology Department, U.C.D., for confirmation of the identifications of the adult specimens.

Literature Cited

BOHART, R. M. 1950. A new species of *Orthopodomyia* from California. Ann. Entomol. Soc. Amer. 43:399–404

CHAPMAN, H. C. 1964. Observations on the biology and ecology of *Orthopodomyia californica* Bohart. Mosq. News 24:432–439.

FREEBORN, S. B., and BOHART, R. M. 1951. The mosquitoes of California. Bull. Calif. Insect Survey 1:25–78.

GRANT, C. D. 1953. Notes on the occurrence of *Orthopodomyia californica* Bohart. Proc. and Papers Calif. Mosq. Cont. Assoc. 22:73.

LOOMIS, E. C., BOHART, R. M., and BELKIN, J. N. 1956. Additions to the taxonomy and distribution of California mosquitoes. Calif. Vector Views 3:38–45.

NOTES ON THE OCCURRENCE OF ABNORMAL SCALE PATTERNS IN ADULT FEMALE *Aedes vexans* (MEIGEN) [1]

WAYNE J. CRANS AND LINDA J. GANDEK

Department of Entomology and Economic Zoology
Rutgers–The State University,
New Brunswick, N. J.

Aedes vexans (Meigen) is a common mosquito found throughout the United States and Canada. During the late spring and summer the species frequently occurs in sufficient numbers to create substantial nuisance. In upland light trap collections, *Aedes vexans* is generally the foremost floodwater species in New Jersey.

Adult female *Aedes vexans* normally display dark scaled abdominal tergites with conspicuously indented basal white bands (Fig. 1). The indented white bands are most often used as the conclusive key character. Occasionally, the apical tergites exhibit a few scattered pale scales.

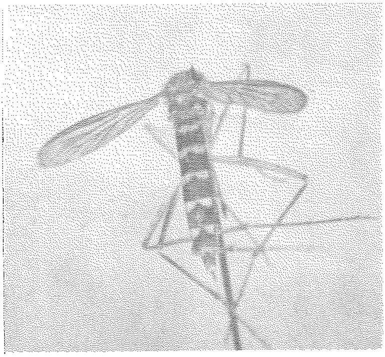

FIG. 1.—Normal Adult Female *Aedes vexans*.

Routine light trap investigations have for several years revealed occasional females with abnormal

[1] Paper of the Journal Series, New Jersey Agricultural Experiment Station Rutgers–The State University, Department of Entomology and Economic Zoology.