posited residues inside the hut continued to emit DDVP.

Table 3 gives results of tests similar to those reported in Table 2 except that a lower temperature prevailed at the end of the test period. During the first 9 days and at mean temperature of 74–78° F., high kills were obtained. However, on days 11, 12, and 13, mean temperatures were 70°, 67°, and 69° F., respectively; and the mortalities on day 13 were far below those obtained in the earlier tests. Although the DDVP vaporizer bag was 13 days old at this time, it is doubtful, in view of the data in Table 2, that age alone caused such a drastic reduction in mortality. Later tests with two new DDVP vaporizer bags also failed to give high mortalities. Therefore, temperature definitely appeared to be a factor influencing the effectiveness of this technique.

TABLE 3.—Influence of declining temperature on mortality of caged female *Anopheles quadrimaculatus* when exposed to DDVP vapor for 4-hour periods in September 1959

	Percent mortality at vaporizer age in days			
No. of vaporizers	1	2	9	13
2	100	100	99	9
3	76	100	91	17
Mean temp. (24-hr. period)	78	76	74	69

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OBSERVATIONS ON THE SNOW-WATER MOSQUITOES OF NEVADA

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During mosquito surveys of agricultural areas in 1959 and 1960, many collections and observations were made in mountainous and foothill areas in Nevada. A group of mosquitoes of the subgenus *Ochlerotatus* Lynch-Arribalzaga inhabit these areas and are often called snow-water mosquitoes because they generally breed in water resulting directly or indirectly from snow melt. All species are univoltine and exhibit a preference for moderate to high elevations, depending on the latitude.

The paucity of information on these species in Nevada is evident when one considers that of the seven species involved, four were shown to be new State records. These four are *Aedes communis* (DeGeer), *A. hexodontus* Dyar, *A. pullatus* (Coq.), and *A. schizopinax* Dyar (Chapman, 1959).

Bohart (1950) reported nine species of snow-water *Aedes* from adjacent California, mentioned the taxonomic difficulties in separating certain of the adults, and discussed the differences of some larval characters that are usually described as being quite precise. *Aedes cinereus* Meigen is considered a snow-water mosquito in

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California by Bohart. However, this species was never noted in Nevada in mountainous areas, only in foothill and valley areas where it was commonly associated with *A. idahoensis* (Theobald), *A. dorsalis* (Meigen), and *A. increpitus* Dyar. Both *A. idahoensis* and *A. dorsalis* are usually found in irrigated areas in the valleys. Thus, the writer does not consider *A. cinereus* to be a snow-water mosquito in the State. In this paper *A. schizopinax* is referred to as a snow-water mosquito for the following reasons: (1) It was observed many times at elevations up to 8,700 feet; (2) it was usually collected in water emanating from snow melt; and (3) it was found only in association with known species of snow-water mosquitoes. Collections by the writer in California indicate that *A. schizopinax* is also a snow-water mosquito there.

Ten species of snow-water mosquitoes are known from adjacent Utah (Nielsen & Rees, 1959).

Nevada snow-water *Aedes* breeding was observed from early March to July at elevations ranging from 4,300 to 10,000 feet. The seasonal occurrence differed with the altitude, breeding site, temperature, amount of snow pack, and the hatching threshold temperature of the egg. The different ecological, biological, and taxonomic data presented herein were obtained by the writer unless otherwise indicated.

Aedes cataphylla DYAR

The writer collected larvae several times in the Sierra Nevada Mountains near Lake Tahoe in open meadow pools at elevations ranging from 6,400 to 7,000 feet. Associated species were *Aedes hexodontus, A increpitus,* and *A. fitchii* (Felt and Young). When in the company of these species, *A. cataphylla* larvae were generally an instar ahead in development. Biting adults were noted in the Sierra Nevada Mountains and in eastern Nevada in the Virgin Mountains and the Toiyabe Range.

A. cataphylla is the only species on which the siphonal tuft of the larvae is located within the pecten. The females are easily separated from other black-legged *Aedes* because they have scattered pale scales on the costa, subcosta, and radial veins of the wing.

Richards *et al.* (1956) reported *A. cataphylla* from Eureka County.

Collection Data:

CLARK COUNTY: Bunkerville, female, IV–15–59 (R. C. Bechtel).

DOUGLAS COUNTY: Spooner Summit, larvae, III–27–59; larvae, IV–7–60, 7,000 feet; Glenbrook, larvae, IV–18–60, 6,400 feet; Lake Tahoe, larvae, IV–20–60, 6,700 feet.

LANDER COUNTY: Kingston Canyon, females, IV–21–59, 6,300 feet (R. C. Bechtel).

WASHOE COUNTY: Mt. Rose, females, VIII–24–58, 8,200 feet.

Aedes communis (DEGEER)

Abundant larval populations were observed in the Sierra Nevada Mountains from 5,800 to 7,800 feet and in the Ruby Mountains in eastern Nevada from May to June at elevations from 7,200 to 8,700 feet. Habitats were open and shaded areas, especially overflow meadow pools adjacent to streams, meadow pools, and old stream beds. Associated species were *A. hexodontus, A. increpitus,* and *A. pullatus,* and when in the same pools with these species, *A. communis* larvae quite often pupated about 2 to 3 weeks sooner. In the Sierras, biting adults were common in June in shaded pine and aspen woods at elevations of 6,300 to 8,200 feet, whereas in the Ruby Mountains they were extremely abundant later in June at elevations of 8,800 to 9,500 feet and constituted a problem in that recreational area.

The larvae are easily confused with those of *A. increpitus,* but *A. communis* larvae possess speckled anal gills, have a shorter siphon, and lack large spicules on the apex of the saddle. Double upper or lower frontal head hairs are not uncommon; thus this character should not be used in separating *A. communis* from *A. increpitus.* Adults of *A. communis* possess black supraalar bristles and mixed black yellow forked hairs on the vertex

which differentiate it from *A. hexodontus*.

Collection Data:

DOUGLAS COUNTY: Spooner Summit, larvae, III–19–59; larvae, IV–7–60, 7,100 feet; Glenbrook, larvae, IV–24–59; larvae, III–22–60; females, VI–8–60, 6,300 feet.

ORMSBY COUNTY: Lake Tahoe, larvae, IV–18–60, 6,500 feet; Marlette Lake, larvae, VI–8–60, 7,600 feet.

WASHOE COUNTY: Lake Tahoe, larvae, IV–9–59; larvae, IV–18–60, 6,300 feet; Mt. Rose, larvae, IV–21–59, 7,800 feet, female, VI–18–60, 8,100 feet; Sundown, larvae, IV–18–60, 5,800 feet.

ELKO COUNTY: Lamoille Canyon, larvae, VI–2–59, 7,200 to 8,700 feet; larvae, V–26–60, 7,200 to 8,500 feet; females, VI–22–60, 8,000 to 9,500 feet

Aedes fitchii (FELT AND YOUNG)

Large larval populations were noted from April to June in the Sierra Nevada Mountains in open meadow pools and ponds and open marshy lake margins at elevations ranging from 6,800 to 8,700 feet. Collections were also made in shaded meadow pools and roadside ditches in the foothills of the Ruby Mountains (5,500 to 6,000 feet). *Aedes hexodontus, A. increpitus,* and *A. schizopinax* were associated species. In any given pool with one or more of these species, *A. fitchii* larvae were usually the last to mature. Biting adults were noted in partially shaded woods in June and July.

The long slender siphon is distinctive only to *A. fitchii* larvae, whereas the abundantly scattered, pale scales on the wings can be used to separate adults from *A. increpitus*. *A. fitchii* adults also usually possess a T-shaped patch of pale scales on the dorsal aspect of the first abdominal segment.

Richards *et al.* (1956) reported *A. fitchii* from Eureka and Humboldt Counties.

Collection data:

ELKO COUNTY: Lamoille, larvae, V–26–60; Jiggs, larvae, V–26–60; Deeth, larvae, V–27–60; Wilkins, females, VI–23–60.

DOUGLAS COUNTY: Spooner Summit, larvae, III 19–59; larvae, IV–7–60, 7,100 feet; Lake Tahoe, larvae, III–29–59; larvae, IV–20–60, 6,700 feet; Glenbrook, larvae, IV–24–59; larvae, IV–18060, 6,400 feet.

WASHOE COUNTY: Hunter Lake, larvae, VI–12–59, 8,700 feet; females, VII–23–59, 8,500 feet.

Aedes hexodontus DYAR

Larval collections of *A. hexodontus* were made in both the Sierra Nevada and Ruby Mountains at elevations ranging from 6,300 to 10,000 feet. Although the larvae were often found alone at higher elevations, they were also collected in association with all of the other snow-water *Aedes*. Breeding was mostly noted in open and partially shaded meadow pools, ponds, and marshy lake margins from March to June. Biting adults were observed in June and July. *A. hexodontus* is undoubtedly the most important pest species in many mountain areas.

The complete encircling of the anal segment by the saddle is diagnostic in separating larvae of this species from the other snow-water *Aedes*. The upper and lower frontal head hairs are usually double and the average number of comb scales is 5–6, although the writer observed some larvae with 11 to 13. These specimens would bypass *A. hexodontus* in most keys since the number of comb scales is usually given as 9 or less. The mesonotal hair 1 is generally single and of medium length instead of short and multiple as depicted in Carpenter and LaCasse (1955) and Yamaguti and LaCasse (1951). Adults have supra-alar bristles and upright forked vertex scales that are straw-colored.

Collection Data:

DOUGLAS COUNTY: Spooner Summit, larvae, III–19–59; larvae, IV–7–60, 6,700 feet; Glenbrook, larvae, IV–24–59; larvae, IV–18–60, 6,300 feet; Stateline, larvae, III–29–60, 6,400 feet.

ELKO COUNTY: Lamoille Canyon, larvae, VI–2–59; larvae, V–26–60, 8,000 to 8,700 feet; larvae, VI–22–60, 8,500 to 10,000 feet.

ORMSBY COUNTY: Lake Tahoe, larvae, III–16–59, 6,300 feet; larvae, IV–7–60, 6,700 feet; Marlette Lake, larvae, VI–8–60, 7,600 feet.

WASHOE COUNTY: Mt. Rose, larvae, IV–21–59, 7,800 to 8,000 feet; larvae, V–25–59, 7,500 to 8,700 feet; larvae, VI–30–59, 9,500 feet; larvae, V–20–60, 7,500 to 8,700 feet; females VI–13–60, 7,800 feet; Hunter Lake, larvae, females, VI–11–59, 8,200 to 8,700 feet; females, VII–23–59, 8,200 feet; Marlette Lake, larvae, VI–8–60, 8,000 feet.

Aedes increpitus DYAR

Larval populations of this species were observed from March to June in the Sierra Nevada and the Ruby Mountains at elevations ranging from 4,300 to 8,200 feet. Habitats were open and shaded meadow pools and ponds in the mountains and open and shaded pond and pool margins and open roadside ditches in the lower foothills. *A. increpitus* was the most common snow-water mosquito noted at lower elevations in the foothills and valleys. Although *A. increpitus* was observed associating with all of the other snow-water *Aedes* species except *A. cataphylla,* it was most often found with *A. communis* and *A. hexodontus.* In the same pool development was usually an instar or two behind these species. Biting adults were collected from June to August. *A. increpitus* is one of the principal biting pests in the foothills and resort areas at higher elevations.

The large spicules on the apex of the anal saddle and the creamy white, almost transparent anal gills of the larvae separate *A. increpitus* from *A. communis.* The second character appears to be specific to *A. increpitus* larvae since the anal gills of other snow-water *Aedes* are speckled or spotted. Females resemble *A. fitchii* but have a few or no pale scales on the inner surface of the torus, whereas the inner surface of the torus of *A. fitchii* has a conspicuous patch of pale scales. *A. increpitus* females are much neater and less shaggy looking than *A. fitchii* since they have the pale scales concentrated toward the costal margin of the wings.

Richards *et al.* (1956) reported the species from Eureka County.

Collection Data:

DOUGLAS COUNTY: Lake Tahoe, larvae, III–4–59, 6,300 feet; Glenbrook, larvae, IV–9–59; larvae, III–22–60; larvae, females, males, VI–6–60, 6,300 feet; Gardnerville, larvae, IV–26–59, 5,900 feet; Stateline, larvae, III–29–60, 6,600 feet.

ELKO COUNTY: Lamoille Canyon, larvae, VI–2–59, 7,500 feet; larvae, V–26–60, 7,200 feet; Lamoille, V–5–60; Ruby Lake, larvae, V–4–60; Deeth, larvae, V–27–60; Jiggs, larvae, V–26–60.

LYON COUNTY: Dayton, females, VII–15–58, larvae, III–20–59; larvae, IV–7–59; larvae, III–7–60, 4,500 feet.

ORMSBY COUNTY: Marlette Lake, larvae, VI–8–60, 7,600 feet; Lake Tahoe, larvae, III–4–59, 6,300 feet; larvae, IV–18–60, 6,500 feet;

STOREY COUNTY: Virginia City (Six-Mile Canyon), larvae, III–18–60, 4,700 feet.

WASHOE COUNTY: Washoe Valley, larvae, III–19–59, 4,300 feet; Lake Tahoe, larvae, IV–9–59; larvae, IV–18–60, 6,300 feet; Mt. Rose, larvae, IV–21–59, 7,500 feet; females, VIII–26–58, 7,500 feet; females VI–18–60, 8,100 feet; Hunter Lake, larvae, VI–21–59, 8,200 feet.

Aedes pullatus (COQ.)

Abundant larval populations of *A. pullatus* were observed only in the Ruby Mountains from May to June at elevations ranging from 7,200 to 10,000 feet. Habitats were both open and shaded meadow pools, usually adjacent to streams, which they shared with *A. hexodontus, A. increpitus,* and *A. communis.* When in the company of the first two species, *A. pullatus* was usually the first to emerge. It is one of the principal pest species in this outdoor mecca. Biting females were observed in June.

The dark head, multiple upper and lower frontal head hairs, and comb scales with subequal spinules separate *A. pullatus* from larvae of other snow-water *Aedes.* The thoracic pattern and possession of a hypostigial spot of scales delimits the females from other black-legged snow-water *Aedes.*

Collection Data:

ELKO COUNTY: Lamoille Canyon, larvae, VI–2–59, 7,200 to 8,700 feet; larvae, V–5–60; larvae, V–26–60, 7,200 to 8,300

feet; females, larvae, VI–22–60, 8,000 to 8,800 feet; larvae, VI–22–60, 10,000 feet.

Aedes schizopinax DYAR

Larvae of *A. schizopinax* were collected from the Sierra Nevada Mountains and in eastern Nevada from the Schell Creek and Toiyabe Ranges and the foothills of the Ruby Mountains. Habitats were usually open meadow pools and marshy lake margins at elevations ranging from 5,000 to 8,700 feet. Since the species occurs at these elevations, generally in water resulting from snow melt and in the company of such other snow-water *Aedes* as *A. hexodontus, A. increpitus,* and *A. fitchii,* it should be referred to as a snow-water mosquito. Nothing is known of the habits of the adults. *A. schizopinax* may not be an important pest since no adult activity was observed during several visits to areas where considerable numbers of larvae had been produced.

The large many-branched mesothoracic hair 1 and the long lateral hair of the anal segment separate *A. schizopinax* from its larval congeners. In larvae in the western parts of the State (Sierra Nevada Mountains) the upper and lower frontal head hairs are usually four- and three-branched, respectively, whereas in larvae from the eastern areas these two head hairs are usually three- and two-branched. The yellow or grey scaling of the ventral aspect of the proboscis and the usual dorsal pale scaling of the entire last abdominal segment separate it from other black-legged snow-water *Aedes*.

Collection Data:

DOUGLAS COUNTY: Genoa, larvae, II–25–60, 5,000 feet.

ELKO COUNTY: Ruby Lake, larvae, V–4–60; larvae, V–26–60, 5,100 feet.

LANDER COUNTY: Kingston Canyon, larvae, V–3–60, 7,000 feet.

WASHOE COUNTY: Mt. Rose (Thomas Creek Canyon), larvae, IV–21–59; larvae, IV–11–60, 6,000 feet; Hunter Lake, larvae, VI–11–59, 8,200 to 8,700 feet.

WHITE PINE COUNTY: Ely, larvae, V–3–60, 6,000 feet.

SUMMARY. Snow-water mosquito breeding was observed from early March to July at elevations ranging from 4,300 to 10,000 feet. Seven species, *Aedes cataphylla, A. communis, A. fitchii, A. hexodontus, A. increpitus, A. pullatus,* and *A. schizopinax* are reported as snow-water mosquitoes in the State. The latter species is designated as a snow-water mosquito in Nevada and California for the first time owing to its breeding habitat and association only with other known snow-water mosquito species.

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