The Pan-Pacific Entomologist

Vol. 54 JULY 1978 No. 3

Ecology and Habitat Preferences of High Altitude Coleoptera from the Sierra Nevada[1]

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Extensive pitfall trapping in the central Sierra Nevada in 1973-74 was conducted to obtain information on species composition, diversity and associations for terricolous arthropods in five alpine and subalpine plant communities. Over 1200 specimens comprising 37 species in 4 families of Coleoptera were collected. The information presented here provides details of the location, habitat type and time of capture for the 37 species of Coleoptera which were trapped.

Methods and Materials

Pitfall traps consisted of 4.5 x 4 cm glass jars filled to a depth of 1 cm with technical grade ethylene glycol. Traps were collected at 14-day intervals and replaced by new traps. Ten stations of 3 traps each, with traps set 1 m apart in a line, were established in each of the 5 habitats sampled. Some supplemental collecting was done by hand in areas adjacent to the pitfall trap sites. Voucher specimens of insects collected are deposited in the collections of the author, and at the University of Alberta (Edmonton), Biosystematics Research Institute (Ottawa) and the California Academy of Sciences (San Francisco).

Study Sites

All of the trap sites were located in the Harvey Monroe Hall Area of Inyo National Forest along the crest of the Sierra Nevada in Mono County, California. The history, climate and plant affinities of the Hall Area are described in Clausen (1969).

Details of the pitfall trap sites selection, vegetation analysis of the plant communities sampled and arthropod species diversity analyses may be found in Papp (1975). Brief descriptions of the 5 plant communities follow.

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The Pan-Pacific Entomologist 54:161-172. July 1978.

1. Lodgepole Pine Forest

Elevation 3048-3170 m. Located immediately NNW of the Carnegie Institution Timberline Station (CITS) on a SE - facing slope. Contains a considerable variety of understory subhabitats ranging from xeric, almost pure stands of *Pinus contorta* Dougl. to hygric sites with understory vegetation dominated by *Hordeum, Veratrum californicum* Durand and *Senecio triangularis* Hook. Vegetation in the drier sites is diverse, with common species including *Perideridia Parishii* (Coult. and Rose) Nels. and Macbr., *Poa epilis* Scribn. and *Potentilla glandulosa* Lindl. Pitfall trap collections 11 July to 25 September, 1973 and 26 June to 18 September, 1974.

2. Sagebrush Community

Elevation 3078 m. Located on a gently sloping gravel area, facing ESE and sloping to Slate Creek. Surrounded by scrubby lodgepole pine forest. Dominant shrub is *Artemesia cana* Pursh, with other common species including *Carex, Horkelia fusca* Lindl. ssp. *capitata* (Lindl.) Keck and *Sphenosciadium capitellatum* Gray. Pitfall trap collections 17 July to 25 September, 1973 and 26 June to 18 September, 1974.

3. Subalpine Meadow

Elevation 3048 m. Located on the floor of Lee Vining Canyon, about 1500 m WNW of CITS. The meadow vegetation is dominated by *Polygonum bistortoides* Pursh, and is bordered along Slate Creek by thick clumps of *Salix.* Pitfall trap collections 17 July to 25 September, 1973 and 26 June to 18 September, 1974.

4. Alpine Meadow

Elevation 3353 m. Located on the E ridge of Mt. Conness, on site of nival (snow-surface) aeolian ecosystem investigations conducted by Papp (1975, 1978). Dominant herbaceous vegetation includes *Juncus Parryi* Engelm., *Poa Hanseni* Scribn., *Antennaria alpina* (L.) Gaertn. var. *media* (Greene) Jepson and *Lupinus.* Pitfall trap collections 18 July to 26 September, 1973 and 11 July to 5 September, 1974.

5. Elfinwood Whitebark Pine Community

Elevation 3383 m. Located ESE of the alpine meadow on the SW slope of the unnamed peak (3426 m) which forms the W border of Saddlebag Lake. *Pinus albicaulis* Engelm. forms scattered thickets over much of the slope. Various species of alpine grasses and sedges, in addition to *Ribes cereum,* are found around the margins of the pines. Frequent disturbance of pitfall traps by the alpine rabbit *Lepus townsendii* in 1973 forced abandonment of trapping here. Pitfall trap collections 18 July to 26 September, 1973; no traps set in 1974.

Results

Distributional and ecological information for Coleoptera was obtained either from the literature, or from available museum specimen data. Distributions of some Carabidae, Elateridae and Staphylinidae were based on collection data in the Department of Entomology, California Academy of Sciences (CAS), and the California Insect Survey (CIS), University of California, Berkeley. Ecological information from the literature is given for each species, followed by additional (and sometimes contradictory) information obtained in the course of this study. The following species were previously unrecorded from the conterminous United States: *Dyschirius alticola* Lindroth, *D. truncatus* Lindroth (Carabidae); *Limonius pappi* Becker (Elateridae). The following species were recorded for the first time from California: *Amara erratica* Duftschmid, *Bembidion complanulum* Mannerheim, *B. improvidens* Casey, *B. quadrifoveolatum* Mannerheim, *Cymindis unicolor* Kirby, *Dyschirius alticola* Lindroth, *D. truncatus* Lindroth, *Harpalus seclusus* Casey (Carabidae); *Boletobius pygmaeus* Fabricius, *Mycetoporus consors* LeConte (Staphylinidae); *Limonius pappi* Becker (Elateridae).

Carabidae

Agonum fallianum Leng

Distribution: California (Lindroth, 1966)

Ecology: Previously unknown. All of the specimens (42) from the Hall Area were trapped in meadows; 29 specimens (69%) in alpine meadow and 13 specimens (31%) in subalpine meadow. In addition, 14 specimens were collected from the snow surface on Mt. Conness in the alpine zone. This species forages on the snow in both alpine and subalpine areas during the afternoon, but disappears at dusk. Of the specimens from alpine meadow stations, 33 (79%) were not trapped until late September; all but one of the remaining specimens trapped in this habitat were captured immediately following snow melt. It appears that this species either diapauses as an adult during most of the snow-free period of the summer, or spends much of the summer as an immature. A mating pair of this species was observed on June 22, 1974 on wet soil near the sagebrush area.

Amara erratica Duftschmid

Distribution: Circumpolar; in North America transcontinental, south to New England in the east and Mt. Rainier, Washington, and Colorado in the west (Lindroth, 1968); may also occur in Oregon and Idaho (Hatch, 1953); boreoalpine in Europe and Asia, occurring in the Caucasus, and in Siberia east to Kamchatka (Lindroth, 1954). Mani (1968) also records this species from the Alps, the Pyrenees, Lapland and Iceland.

Ecology: Ionescu (1969) trapped this species in five alpine stations in Romania at altitudes of 1800-2035 m, with most specimens taken from May to mid-July; occurs in open country with grass or meadow vegetation, usually on sandy moraine, on both sides of the timber limit (Lindroth, 1968). Conspicuously xerophilic, on sandy moraines in the *Betula*-zone up to 1000 m in Lapland and 1200 m in Iceland (Mani, 1968).

Most of the 26 Hall Area specimens were trapped in meadow situations (alpine or subalpine). One individual was taken in the lodgepole pine forest in late September and four others were trapped in the sagebrush area in early August. Additionally, two specimens were caught foraging on the snow on Mt. Conness on July 12, 1973.

Anisodactylus pitychrous LeConte

Distribution: A species of the dry interior, in Canada occurring only east (sic?) of the Rockies, south to Colorado and California (Lindroth, 1968).

Ecology: Previously unknown. Sixty-eight specimens were taken in the Hall Area, of which 88% occurred in the moist subalpine meadow. Five were recovered from forests, 3 from lodgepole and 2 from elfinwood whitebark pine; 3 specimens were trapped in sagebrush. Within the subalpine meadow, 73% were from marginal, relatively well-drained stations adjacent to young lodgepole pines.

Bembidion commotum Casey

Distribution: In western mountains, from Alberta and British Columbia south to Sierra Nevada of California, east to Wyoming (Lindroth, 1963).

Ecology: Apparently restricted to high mountains; in Sonora Pass, California, recorded from gravelly border of a small creek below timber limit, September 3, 1961 (Lindroth, 1963).

In the Hall Area, specimens were trapped in lodgepole pine forest, sagebrush and alpine meadow, but 76% were taken in alpine traps, with the greatest number (41%) taken immediately after snow-melt.

Bembidion complanulum Mannerheim

Distribution: In western mountains from Alberta, British Columbia and Alaska, south to northern Oregon (Lindroth, 1963).

Ecology: Taken at margin of snow patches in Waterton Park, Alberta, Chilkot Pass, British Columbia, and on Unalaska Island; apparently not riparian; normally imaginal hibernation (Lindroth, 1963).

Collected in alpine meadow, subalpine meadow, and lodgepole forest in the Hall Area. Two specimens were taken on snowfields in late June 1972 and 1973. Most of the specimens (77%) were taken in the alpine meadow, with catches quite evenly distributed over the season. This species is a facultative nival predator in alpine areas.

Bemibidion humboldtense (Blaisdell)

Distribution: Northern California, southwestern Oregon (Lindroth, 1963).

Ecology: Previously unknown. A single specimen was taken in the alpine meadow soon after snow melt in late July, 1973.

Bembidion improvidens Casey

Distribution: Mt. Rainier (above 4000 ft. elevation, Washington) (Lindroth, 1963).

Ecology: Previously unknown. Occurs sparsely only in the alpine meadow, where it was trapped at four stations; none of the alpine meadow stations differ substantially from each other with respect to exposure, plant cover or soil type.

Bembidion obscuripenne Blaisdell

Distribution: In western mountains from Washington south to California (Lindroth, 1963).

Ecology: In the alpine and subalpine regions (Lindroth, 1963). In the Hall Area, a single specimen was trapped in the alpine meadow soon after snow melt in late July 1973; at this time this area was noticeably wetter than other trap stations in the alpine meadow.

Bembidion quadrifoveolatum Mannerheim

Distribution: In the western mountains and along the coast south to Oregon (Hatch, 1953).

Ecology: Strictly riparian, occurring among stones and gravel on barren banks of usually small streams. Above timber limit in Chilkot Pass, British Columbia; hibernation apparently in both larval and adult stages (Lindroth, 1963).

This is a widespread species in the Hall Area. Although most common in the alpine meadow, where 70% were taken, it also occurs in elfinwood whitebark pine stands, subalpine meadow and in *Pinus contorta* Dougl. forest. Of those specimens taken above the timberline, 54% were captured within the first two weeks following snow melt. Those specimens trapped in the lodgepole pine forest were taken much later, with 60% captured during the last trapping period in late September. It seems probable that this species is active throughout most of the snow-free period of the year, moving to sheltered locations at lower altitudes during winter.

Specimens of *B. quadrifoveolatum* were taken on snowfields in late June and early July in 1972 and 1973, where it is a facultative nival predator. Another specimen was taken near the Hall Area in Glacier Canyon on the northwest side of Mt. Dana at an altitude of 3200 m on May 18, 1968.

Bembidion timidum LeConte

Distribution: Interior areas of western Ontario, Manitoba, Saskatchewan, Alberta, Northwest Territories and British Columbia south to Oregon, California and Colorado (Lindroth, 1963).

Ecology: Occurs in a diversity of moist habitats often with *Bembidion versicolor*; hibernates as an adult (Lindroth, 1963).

Five specimens were taken in the Hall Area, two in alpine meadow (one immediately after snow melt and the other in late September, 1973), two in sagebrush during late August and early September, 1973, and one in subalpine meadow during late August 1973. This is the only species of *Bembidion* which was trapped in the sagebrush community, which is drier than typical *Bembidion* habitats. *B. timidum* does not seem to occur in forest habitats in the Hall Area, despite its broad habitat occurrence in other areas.

Cymindis unicolor Kirby

Distribution: Transamerican, from Canada and Alaska south along the mountains to Colorado and Utah and isolated on New England mountains (Lindroth, 1969).

Ecology: In treeless country, above timberline and on tundra (Lindroth, 1969). Of the 70 Hall Area specimens 57% were trapped in alpine meadow stations; twenty were also taken in sagebrush, and ten in subalpine meadow. None were trapped in forest habitats.

Dyschirius alticola Lindroth

Distribution: Previously known only from type locality: Canada, British Columbia; the eastern of the two passpoints on Rossland Trail (10 miles west of trail) about 5000 ft. (1524 m), May 21, 1958 (Lindroth, 1961).

Ecology: On open, slightly moist, fine sandy soil, half shaded by *Alnus* bushes, at the margin of mixed forest, with almost no vegetation, except in spots of the moss *(Ceratodon purpureus)*. Associated with *Bembidion dyschirinum* (common) and *Notiophilus simulator* (Lindroth, 1961).

In the Hall Area this species was recorded only in the subalpine meadow, where the soil is very finely textured and vegetative cover is almost complete. In 1973 most individuals (58%) were trapped during the last two weeks of August when the meadow was becoming quite dry. In 1974 most (57%) were caught within a few days of snow melt in late June.

Dyschirius truncatus Lindroth

Distribution: Widely distributed but apparently everywhere rare, probably lacking in the Atlantic region. There are records from Manitoba, Saskatchewan, Alberta, Northwest Territories, British Columbia and Alaska (Lindroth, 1961).

Ecology: On barren clay-mixed sand at the margins of standing or slowly running waters; probably constantly in company with *Bledius* (Lindroth, 1961).

A single specimen was taken in the Hall Area on August, 1973 in the lodgepole pine forest. The microhabitat at this station was as follows: traps set in wet soil under shelter of a large clump of *Salix* on a south-east-facing slope; also common at this station were clumps of *Veratrum californicum* Durand, *Allium validum* Watson, *Carex* and mosses. The

station lies at the base of a large granite outcrop and received abundant snow melt runoff throughout the summer.

Harpalus seclusus Casey

Distribution: From Alberta and British Columbia southward in the mountains to Colorado (Lindroth, 1968).

Ecology: On meadows at high latitudes; specimens from Alberta were captured at the margin of a snowfield about timber limit; in Manitoba it is associated with *Harpalus animosus* (Lindroth, 1968).

A very common species in the Hall Area; 51% of the 285 specimens trapped were from meadows, either alpine or subalpine. A few were taken in lodgepole pine forest and one was trapped in the elfinwood whitebark pine community, but the vast majority came from the sagebrush community, where 81% were trapped. This habitat is exceptionally well-drained, with a gravel substrate which provides for warmer surface temperatures than in the other communities sampled (Papp, 1975). Since many harpaline Carabidae are now known to be phytophagous (e.g. Johnson and Cameron, 1969; Zhavoronkova, 1969; Kabcik-Wasylik, 1971; Kirk, 1972) it is probable that this species is a seed-cacher.

Lebia viridis Say

Distribution: Transcontinental, entire United States south to Mexico; the most widespread and abundant member of the genus (Lindroth, 1969).

Ecology: On open, sun-exposed substrates, often in goldenrod flowers or resting on leaves of *Alnus* or *Ulmus* in company with more abundant *Altica* chrysomelids of the same size and color (Lindroth, 1969). Madge (1967) has shown that the larvae of *Lebia viridis* are parasitoids on the Chrysomelidae, and suggests that *Lebia* mimics its host *Altica*.

Four specimens were collected, all in 1973: 3 in subalpine meadow and 1 in the lodgepole pine forest. Interestingly, many specimens of *Altica torquata* LeConte were also trapped in the Hall Area (Papp, 1975).

Nebria ovipennis LeConte

Distribution: Sierra Nevada, from Sequoia National Park north to Yuba Pass (Kavanaugh, pers. comm., 1978).

Ecology: Previously unknown. Four specimens were collected in 1973. A submature male was found foraging on snow at 3353 m on Mt. Conness, on 9 July. A teneral male was trapped in the sagebrush community and a mature male in the subalpine meadow, both in late August. A mature female was also trapped in the subalpine meadow in mid-September.

Nebria spatulata Van Dyke

Distribution: Sierra Nevada, from Sequoia National Park north to Yosemite National Park (Kavanaugh, pers. comm., 1978).

Ecology: Previously unknown. Four males and five females were trapped all in the alpine meadow, in 1973. A teneral male was taken in mid-September, and a submature female in early August. Other specimens, all of which were fully mature, were captured from 15 July until 26 September.

Pterostichus inanis Horn

Distribution: The Cascade Range from British Columbia through Washington and Oregon, into northern Nevada and the Sierra Nevada of California; (Hacker, 1968).

Ecology: Altitudinal range of this species is from 3000 ft. (914 m) in northern Oregon to 9400 ft. (2865 m) in Fresno County, California (Hacker, 1968).

All specimens in the Hall Area were trapped in lodgepole pine forest; most of these were taken early in the season. Fourteen specimens (88%) were trapped from a single station which was located adjacent to Cabin Creek, on a south-southeast facing slope. Most abundant vegetation here was *Phyllodoce breweri* (Gray) Heller, *Solidago* and some grasses, but all of these were present at some other stations where no *P. inanis* were

taken; its presence may therefore be restricted to forested situations near running water, rather than to a specific plant association.

Pterostichus protractus LeConte

Distribution: In the Rocky Mountains of Canada, from Alberta and British Columbia, south to the southern Cascades and into California (Lindroth, 1966).

Ecology: Apparently confined to montane forests; generally imaginal hibernation (Lindroth, 1966). 66% of the 133 specimens were trapped in forested situations (71 in lodgepole pine and 17 in elfinwood whitebark pine). This species also occurred in all of the other habitats sampled: subalpine meadow (18), sagebrush (25) and alpine meadow (2). Two hand collected specimens from the lodgepole pine forest were found near dead trees, one under a rotten log and the other in the soil at the base of a standing dead tree. The species shows a definite preference for dry niches with mature trees and abundant pine needle litter: 4 of the lodgepole forest stations which were of this type accounted for 88% of the specimens taken.

Trachypachus gibbsi LeConte

Distribution: From southernmost British Columbia to the Southern Sierra Nevada of California (Lindroth, 1961).

Ecology: Stenotopic, restricted to a special habitat on banks of big rivers at some distance from the water under *Populus balsamifera*. The soil, consists of finest sand, is dust dry on surface and is covered by an almost continuous layer of dead leaves. *Equisetum arvense* was present in one place, otherwise no vegetation. This habitat is doubtless flooded in the spring (Lindroth, 1961).

This species was trapped exclusively in the *Pinus contorta* forest in both 1973 and 1974. The majority of the specimens were trapped in the first period following snow melt (1973: 65%, 1974: 76%), while the soil was still moist. Litter was present as pine needles and cones, together with leaves of *Salix, Senecio, Veratrum* and *Lupinus*.

Cicindelidae

Cicindela longilabris Say

Distribution: Transamerican, from Alaska to Newfoundland, south into California, New Mexico, Colorado, Wisconsin, Illinois and New York. (Leng, 1920).

Ecology: Of the 41 specimens taken in the Hall Area, 38 (93%) were captured in the sagebrush community. The other specimens were taken in the subalpine meadow and in the lodgepole pine forest. Temporal distribution was bimodal. In both years most specimens were taken either soon after snow melt, or during the last trap period in September.

Cicindela oregona LeConte

Distribution: Alaska, south through British Columbia into California, Nevada, New Mexico and east to Montana, Utah and Idaho (Leng, 1920).

Ecology: Guppy (1948) collected this species on bare gravel below the winter tide lines on Vancouver Island. Twelve specimens were captured in the Hall Area: sagebrush (6), subalpine meadow (5), and lodgepole pine forest (1). As with *C. longilabris*, this species was trapped only in either the first or the last trap period of each year.

Staphylinidae

Aleochara affluens Casey

Distribution: British Columbia, northwestern Washington, northern Idaho and western Oregon (Hatch, 1957).

Ecology: According to Hatch (1957), all members of this genus probably live as ecto-

parasites on pupae of cyclorraphous Diptera.

In the Hall Area, 6 specimens were taken crawling on snow on the east ridge of Mt. Conness, 3353 m elevation, on June 25, 1973; in addition, 2 were taken in the alpine meadow in early September 1973 and 3 were taken in the subalpine meadow in early August and mid-September 1973.

Boletobius pygmaeus Fabricius

Distribution: British Columbia, northwest Washington, southeastern Idaho and northern Oregon (Hatch, 1957).

Ecology: Previously unknown. Four specimens were taken in the Hall Area, all in lodgepole pine forest, from mid-July until late August, 1973.

Mycetoporus consors LeConte

Distribution: British Columbia, Washington and western Oregon (Hatch, 1957). New York, Michigan, Indiana (Moore and Legner, 1975).

Ecology: Previously unknown. Three specimens were taken in the Hall Area: 1 from the elfinwood whitebark pine habitat in late July, 1973; 2 from subalpine meadow, late July and early September, 1973.

Platystethus americanus Erichson

Distribution: Common throughout the United States and in Mexico (Moore and Legner, 1971). Quebec and British Columbia (Moore and Legner, 1975).

Ecology: Common in manure and in isolated field droppings; occasionally in other decaying organic matter and at lights (Moore and Legner, 1971).

In the Hall Area, 1 specimen was taken in the subalpine meadow in late July, 1973; 6 others were found foraging on the snow on Mt. Conness, at 3353 m elevation.

Quedius breviceps (Casey)

Distribution: In western mountains from Alaska through British Columbia, Washington, Oregon to southern Sierra Nevada (Mineral King) in California (Smetana, 1971).

Ecology: Specimens from Valdez, Alaska, were taken beneath an *Alnus* bush at a creek. In the southern part of its range it occurs in wet biotopes in moss, under fallen leaves and often near water; in high mountain elevations (alpine and subalpine zones) it occurs in moss, lichens, grass patches, under stones, etc., and often in rather dry biotopes (Smetana, 1971).

Of the 85 specimens collected in the Hall Area, all but one were taken in lodgepole pine forest traps. Most of the specimens (58%) were taken soon after snow melt in late July. No subhabitat preferences within the lodgepole forest were evident.

Quedius validus Smetana

Distribution: From type material only: holotype male, California: Stanford University, May 13, 1950, PSB; allotype female, California: Grassy Lake, September 27, 1914, Lassen National Forest, Lassen County, ex R. Hopping collection, California Academy of Sciences (Smetana, 1971).

Ecology: No details of habitats known; a related species, *Q. explanatus* LeConte, occurs under stones; development may be in mammal burrows (Smetana, 1971).

Eight specimens of this distinctive species were collected in the subalpine meadow and in the lodgepole pine forest, in August and September of both years. As this is evidently a boreal species, the data for the male holotype is probably erroneous, and the designation of that specimen as the holotype is unfortunate.

Tachyporus californicus Horn

Distribution: From southern British Columbia, south into Wyoming, Idaho and Oregon (Blackwelder, 1936); also in California (Fall, 1901).

Ecology: Members of this genus are commonly taken sweeping herbage (Blackwelder,

1936).

A single specimen was taken crawling on snow on the east ridge of Mt. Conness, 3353 m elevation, on July 5, 1973.

Elateridae

Ampedus phelpsi (Horn)

Distribution: From Alaska, across most of Canada, and south into New York (Mt. Marcy), New Hampshire (Mt. Washington), Michigan, Wisconsin and Minnesota; in the west it occurs in the Rockies south to the Parowan Mountains in Utah, and in the Sierra Nevada south to Bubbs Creek Canyon on the Kings River.

Ecology: Previously unknown. A single specimen was collected beneath the bark of a dead whitebark pine *(Pinus albicaulis)* near the Carnegie Institution Timberline Station on June 17, 1973.

Ctenicera aeripennis (Kirby)

Distribution: From Alaska, south and east through the Yukon, Northwest Territories, Alberta and British Columbia, along the mountains into Washington, Oregon and California; also in the Rocky Mountains through Montana, South Dakota, Wyoming, Colorado, Utah and New Mexico.

Ecology: Previously unknown. A single specimen was taken in the sagebrush community in early August, 1973.

Ctenicera candezei (Leng)

Distribution: In the Sierra Nevada of California, from the Lake Tahoe area south into Madera County (Lake Ediza).

Ecology: Previously unknown. Three specimens were collected, all crawling on the snow on the east ridge of Mt. Conness, elevation 3353 m; one was taken on June 21 and the others on July 12, 1973.

Ctenicera edwardsi (Horn)

Distribution: From localities around Vernon, British Columbia south through Washington and Oregon, and into California as far south as Marin County along the coast and Fresno County (Lower Hot Springs) in the Sierra Nevada; there are additional records from what appears to be an isolated distribution on Mt. Timpanogos in north central Utah.

Ecology: One specimen was taken in the Hall Area in the subalpine meadow during late July, 1973. Also recorded from 1981 m in Nevada Co., California, on *Juniperus*.

Ctenicera tahoensis Van Dyke

Distribution: In the high Sierra Nevada of California from Placer County south to Lake Alpine in Alpine County.

Ecology: Previously unknown. In the Hall Area, 2 specimens were captured while crawling on snow, one on the east ridge of Mt. Conness at 3353 m elevation on June 28, 1972, and the other near Spuler Lake, elevation 3024-3194 m, 0815-0845 hours. Five others were taken in pitfall traps, as follows: *Pinus contorta* Dougl. forest, late July, 1973 (2 specimens) and late July-early August, 1974; subalpine meadow, late July, 1973; alpine meadow, late July, 1973.

Hypolithus bicolor Esch.

Distribution: A common species transcontinental in Canada below treeline and extending into the northern United States along mountain chains (Becker, 1978, pers. comm.).

Ecology: Previously unknown. Of the 176 specimens captured in the Hall Area, 97% were taken in meadow situations: subalpine meadow, 99 specimens (56%), alpine meadow, 71 specimens (40%). Becker (1978, pers. comm.) reported that all specimens

examined from the Hall area were wingless females, and that parthenogenesis is known in this species.

Limonius nitidulus Horn

Distribution: From southern British Columbia and southwestern Alberta south to the high mountains of California (Becker, 1978, pers. comm.).

Ecology: Apparently unknown. Three specimens were captured crawling on the snow on the east ridge of Mt. Conness, elevation 3353 m, on June 21, June 25, and July 2, 1973. One specimen was taken in the *Artemesia* community in late July, 1973, and two others were trapped in the *Pinus albicaulis* habitat in late July, 1973.

Limonius pappi Becker

Distribution: Recently described from material collected in the Harvey Monroe Hall Natural Area, Inyo National Forest, Mono County, California (Becker, 1976).

Ecology: The most commonly collected elaterid in the Hall Area, where 226 specimens were trapped. All but 4 of these were taken in meadow habitats: 196 specimens (87%) from the alpine meadow, and 26 specimens (12%) from the subalpine meadow. A few additional specimens were collected in pitfall traps under elfinwood whitebark pine *(Pinus albicaulis)*, on foliage of *P. albicaulis*, and on snowfields on the E ridge of Mt. Conness, 3353 m elevation.

Discussion

Most of the 37 species treated herein represent extensions of widespread boreoalpine species into southern latitudes. For example, in the Carabidae 13 species including *Amara erratica, Anisodactylus pitychorus, Bembidion commotum, B. complanulum, B. obscurripenne, B. quadrifoveolatum, B. timidum, Cymindis unicolor, Dyschirius truncatus, Harpalus seclusus, Pterosticus inanis, P. protractus* and *Trachypachus gibbsi* are reported from other boreoalpine localities. Of these only *Amara erratica* occurs outside of North America. The cicindellid species *Cicindela longilabris* is also boreoalpine. Of the Staphylinidae, 6 of the 7 species collected are broadly boreoalpine, as are 7 of the 8 elaterid species collected.

Five boreoalpine species, including the carabids *Agonum fallianum, Bembidion humboltense, B. improvidens* and *Dyschirius alticola* and the elaterid *Limonius pappi* have rather limited distributions, in some cases restricted to type localities, and probably reflect the formation of disjunct islands during Pleistocene glaciations.

Acknowledgements

I wish to thank the following systematists for identifying material from the Harvey Monroe Hall Natural Area: G.E. Ball, University of Alberta, Edmonton (Carabidae); E.C. Becker, Biosystematics Research Institute, Ottawa (Elateridae); J.M. Campbell, Biosystematics Research Institute, Ottawa (Staphylinidae); K.S. Hagen, University of California Berkeley (Cicindelidae); J.T. Howell, California Academy of Sciences, San Francisco (vascular plants); D. Kavanaugh, California Academy of Sciences, San Francisco

(Carabidae: *Nebria*); A. Smetana, Biosystematics Research Institute, Ottawa (Staphylinidae: *Quedius*); J. Strother, Jepson Herbarium, University of California, Berkeley (vascular plants).

I also wish to thank: K.S. Hagen, F.A. Pitelka and E.I. Schlinger for critical reading of my dissertation manuscript, of which this paper formed a part; the Carnegie Institution of Washington, for use of the Timberline facilities; the Mono Ranger District, Inyo National Forest, for permission to conduct research in the Hall Area; and the Departments of Entomology, California Academy of Sciences and University of California Berkeley, for permission to examine Coleoptera collections.

Literature Cited

Becker, E.C. 1976. A new species of *Limonius* (Coleoptera: Elateridae) from California. Can. Entomol. 108:689-692.

Blackwelder, R.E. 1936. Revision of the North American beetles of the subfamily Tachyporinae. Part I. Genus Tachyporus Grav. Proc. USNM 84:39-54.

Clausen, J. 1969. The Harvey Monroe Hall Natural Area. Carnegie Inst. Wash. Dept. Plant Biol. Publ. no. 459, 48 pp.

Fall, H.C. 1901. List of the Coleoptera of southern California. Occ. Papers Calif. Acad. Sci. 8:282 pp.

Guppy, R. 1948. A list of Coleoptera collected near Lagoon Head, Wellington, V.I Coleopt. Bull. 2(3):21-23.

Hacker, H.F. 1968. The species of the subgenus *Leptoferonia* Casey (Coleoptera: Carabidae: *Pterostichus*). Proc. USNM 124(3649):1-16.

Hatch, M.H. 1953. The beetles of the Pacific Northwest. Part I. Introduction and Adephaga. Univ. Wash. Publ. Biol. 16:1-340.

Hatch, M.H. 1957. The beetles of the Pacific Northwest. Part 2. Staphyliniformia. Univ. Wash. Publ. Biol. 16:1-384.

Ionescu, M. 1969. Observatii cu privire la entomofauna din zona alpina a Muntilor Cibin. Stud. Ceret. Biol., Ser. Zool. 24:347-384.

Jeannel, R. 1940. Carabidae: Trechinae. British Museum (Nat. Hist.) Ruwenzori Expedition 1934-1935, 3:123-127.

Johnson, N.E. and R. Cameron. 1969. Phytophagous ground beetles. Ann. Entomol. Soc. Amer. 62(4):909-914.

Kabacik-Wasylik, D. 1971. Studies on the diet of three field species of Carabidae. Ekol. Polska 19(33):501-508.

Kirk, V.M. 1972. Seed-cacheing by larvae of two ground beetles, *Harpalus pennsylvanicus* and *H. erraticus*. Ann. Entomol. Soc. Amer. 65(6):1426-1428.

Leng, C.W. 1920. Catalogue of the Coleoptera of America, North of Mexico, John D. Sherman, Jr. Mount Vernon, New York, 444 pp.

Lindroth, C.H. 1954. Carabidae common to Europe and North America. Coleopt. Bull. 8(2):35-52.

Lindroth, C.H. 1961-1969. The ground beetles of Canada and Alaska. Parts 1-6. Opuscula Entomologica Supplementa XX, XXIV, XXIX, XXXIII, XXXIV, XXXV.

Madge, R.B. 1967. A revision of the genus *Lebia* Latreille in America north of Mexico (Coleoptera: Carabidae). Quaest. Entomol. 3:139-242.

Mani, M.S. 1968. Ecology and Biogeography of High Altitude Insects. W. Junk N.V. Publishers, The Hague, 527 pp.

Moore, I. and E.F. Legner, 1971. A review of the nearctic species of *Platystethus* (Coleoptera: Staphylinidae). Pan-Pacific Entomol. 47(4):260-264.

Moore, I. and E.F. Legner, 1975. A Catalogue of the Staphylinidae of America North of Mexico (Coleoptera). Special Publ. 3015, Univ. Calif. Div. Agr. Sciences, 514 pp.

Papp, R.P. 1975. Ecological interrelations among arthropods in some high altitude communities in the central Sierra Nevada of California. Ph.D. Dissertation, Univ. of California, Berkeley, 158 pp.

Papp, R.P. 1978. A nival aeolian ecosystem in California. Arctic and Alpine Res., 10(1): 117-131.

Smetana, A. 1971. Revision of the tribe Quediini of America north of Mexico (Coleoptera: Staphylinidae). Mem. Entomol. Soc. Canada 79, 303 pp.

Yablakov-Khnzoryan, S.M. 1961. Opit vosstanovlieniya genezisa faunii zhestkokriilikh Aremnii. Akad. Nauk Armyanskoi SSR. Zool. Inst., Erivan, 264 pp.

Zhavoronkova, T.N. 1969. Certain structural peculiarities of the Carabidae (Coleoptera) in relation to their feeding habits. Entomol. Obozr. 48(4):729-739.

RECENT LITERATURE

The Atlas of Insect and Plant Viruses including Mycoplasmaviruses and Viroids. Karl Maramorosch Ed. 1977. Academic Press, N.Y. 512 pp. $49.50.

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