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DOWN-VALLEY FLIGHT OF ADULT THECLINI (LYCAENIDAE)
IN SEARCH OF NOURISHMENT

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Down-valley movement of adult Theclini was reported by MacNeill (1967) for *Satyrium saepium* Boisduval. In this paper I will report down-valley flight of four additional species and will show the presumed flight pattern (Fig. 1) and the purpose of the down-valley flight.

There are two types of mate-locating behavior among males of butterflies (Scott, in press). In *perching* species, males sit at characteristic sites and dart out at passing objects in search of females, often returning to or near the previous spot after an investigative flight. Virgin females fly to these mating sites after emergence. In *patrolling* species, males fly almost constantly in search of females.

Down-valley flight is defined as continuous rapid flight predominantly in a down-valley direction. Such flights can occur for several reasons, including migration. In patrolling species, male patrolling may appear similar to down-valley flight, but differs in that males investigate females, flight upstream occurs about as frequently as downstream, and males usually patrol on hillsides in addition to valleys. Females may have different flight behavior in the two situations. In this paper I show that down-valley flight is part of a feeding response (Fig. 1).

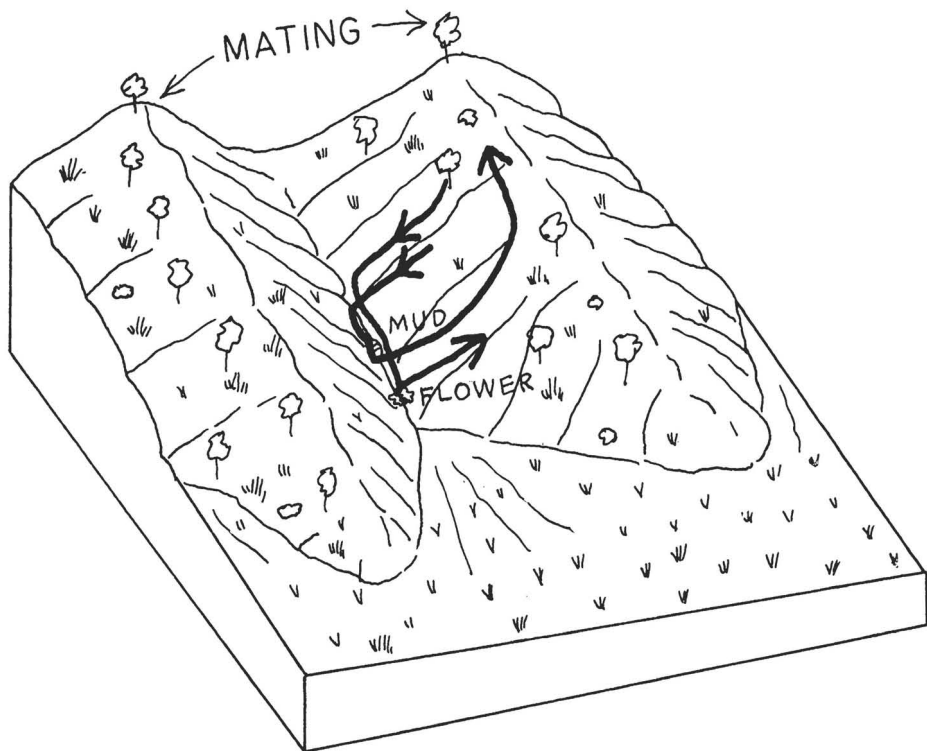


Fig. 1. Postulated flight pattern of two adult *Theclini* in search of nourishment.

METHODS AND RESULTS

Down-valley flight of *Callophrys johnsoni* Skinner, *Callophrys augustinus* Westwood, and *Atlides halesus* Cramer was observed 18, 19, 20, and 21 March 1972 at Thompson Canyon, Yolo County, California. Behavior of the three species was identical. *C. augustinus* was only about two-thirds as abundant as *C. johnsoni*, and *A. halesus* was uncommon. The interval between the appearance of individuals passing the stationary observer averaged about 10 minutes for *C. johnsoni* on 18 March, and increased to about 25 minutes on 21 March, as abundance declined. These intervals for *C. augustinus* were about 15 minutes, increasing to about 30 minutes. Because observations were made near the end of the brood, both species declined in numbers with time. Weather was similar on all four days, and so did not affect the observed numbers. Only about five *A. halesus* were seen per day. Individuals flew down-valley about a meter about the ground at a rapid rate of perhaps 3 meters per second for both *Callophrys* species; *Atlides* flew slightly faster. Very few in-

dividuals of these species flew up-valley. Individuals were observed flying far enough apart so that they could seldom see one another in flight. They flew down-valley from about 0930 to 1600 on all days, but most individuals were observed between 1200 and 1400, the warmest part of the day. Where the road along the stream bottom ran onto the hillside, individuals flew along the stream bottom rather than the road.

Down-valley flight of *Erora laeta quaderna* Hewitson was observed on 6 April 1966 near Stewart Campground, Cochise County, Arizona. Down-valley flight of both sexes was the same as that of the *Callophrys* species except that individuals flew down-valley mainly along a road in the canyon bottom. Down-valley flight also occurred mainly in warm midday hours.

C. johnsoni males and females fed in the valley bottom on mud and on flowers of *Rhus trilobata* Nutt., and (rarely) on *Cercis occidentalis* Torr. *C. augustinus* fed there on mud and on *Rhus*. *A. halesus* and *E. laeta* Edwards fed on mud.

Females outnumbered males in the two *Callophrys* species. Observed sex ratios based on collections by several persons during the 4 days were: *C. johnsoni*, 33♂, 59♀; *C. augustinus*, 15♂, 45♀; *A. halesus*, 2♂, 2♀. The sex-ratio of *E. laeta* was 32♂, 31♀.

DISCUSSION AND CONCLUSIONS

Down-valley flight among Theclini has been recorded previously only at high population density. MacNeill (1967) observed down-valley flight of *Satyrium saepium* in a small dry ravine. About 5–15 individuals per minute flew down-valley about a meter above the ground, from 1130 to 1200; very few individuals flew up-valley. The present observations indicate that the phenomenon may be widespread at fairly low density in Theclini, but is seldom noticed except at high density.

The continuous down-valley flight contrasts markedly with the short flights characteristic of mate-locating behavior. All five species are perching species. Details of mate-locating behavior of these species follow:

- 1) Oakley Shields (pers. comm.) observed mate-locating behavior of *C. johnsoni* on a hilltop next to Thompson Canyon, where many males perched on the tops of tall trees, from which they often chased each other. I observed the same behavior in the closely related species *C. spinetorum* Hewitson occurring on small pines near hilltops in Grand Canyon, Arizona, in the afternoon.

- 2) Powell (1968a) described mate-locating behavior of *C. augustinus*. Males perched on a small tree in a clearing from 1030 to dusk. Mating

was observed only in the late afternoon. However, I observed copulation at 1110 on a tree on a hillside at Alpine Lake, Marin County, California, 4 April 1970.

3) I have observed many *A. halesus* males perching on the tops of small trees on hilltops at midday and in the afternoon at four localities in New Mexico and Arizona.

4) Many *E. laeta* males were observed perching on the tops of juniper trees on hilltops in the afternoon near Emory Pass, Sierra County, New Mexico, 5 April 1966, and near Onion Saddle, Cochise County, Arizona, 6 April 1966 and 24 April 1973.

5) I observed mate-locating behavior of *S. saepium* at numerous localities in Jefferson County, Colorado, where males perched about one meter above the ground on the sides of small pine and juniper trees on ridgetops and hilltops. Males perched mostly on the eastern side of trees in the morning, and on the western side in late afternoon. The preferred side was less predictable at midday, but males often chose the south side. The perching males darted after passing objects (mainly other males) and usually returned to the same tree after an investigative flight. Such behavior occurred from 0715 to 1600. A copulating pair was found at 1155 on one of the trees where males were perching.

The presumed flight pattern is shown in Fig. 1. Individuals fly from hillsides to the valley bottom, then downstream to a feeding site. Having fed, they depart to the hillsides again. The following points support these contentions: 1) individuals were most abundant in a small area in the middle of Thompson Canyon; only one individual was seen at the mouth of the canyon, and only one (a female showing preoviposition behavior toward the larval hostplant) was seen near the head of the canyon; (MacNeill (1967) also noted that down-valley flight was confined to a small area); 2) study on four consecutive days showed that individuals do not move down-valley one day and up-valley the next. More than 20 individuals of each of the two *Callophrys* species were seen to fly down-valley each day, whereas less than 4 per day flew up-valley.

Down-valley flight may be advantageous to these species because flowers and water are often more abundant in the central portions of small canyons in arid areas of the western United States. Down-valley flight may prove to be limited to arid areas, since it involves movement toward regions of high moisture. Individuals need to seek nourishment in the valley bottom because flowers are much less common on hillsides. Also, larval hostplants grow on hillsides, and do not serve as nectar sources for the adult butterflies. The known larval hostplants are as follows: *Arceuthobium campylopodium* Engelm. for *C. johnsoni*, a plant

parasitic on *Pinus sabiniana* Dougl. in Thompson Canyon (Shields, 1965); many plants for California *C. augustinus* (Powell, 1968b); *Phoradendron* for *A. halesus*, a plant parasitic on live oak; and *Ceanothus* sp. for *S. saepium* (Clench, 1961).

Net down-valley movement was not observed for either sex in any of the species. The flight pattern postulated in Fig. 1 does not result in net down-valley movement, because individuals of at least *C. johnsoni*, *A. halesus*, *E. laeta*, and *S. saepium* apparently move upslope to seek mates on hilltops. Scott (1973) and Shields (1967) have shown that hilltops serve as mating sites for some butterflies.

Finally, down-valley flight also probably occurs in other butterfly taxa. I have observed what appears to be down-valley flight in *Oeneis chryxus* Doubleday and *O. uhleri* Reakirt (both Nymphalidae, Satyrinae) in southern Colorado. However, about 20–30 percent of the individuals of these species seen were flying upstream; individuals of these two species also were observed feeding on mud in the gully bottom.

SUMMARY

Down-valley flight (continuous rapid flight predominantly in a down-valley direction) was observed in four species of Theclini and appears to be part of a behavior pattern in which individuals seeking nourishment fly to the valley bottom, fly downstream until mud or flowers are found, feed, then fly to hillsides. Mate-locating behavior, which occurs elsewhere (usually on hilltops), is very different.

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