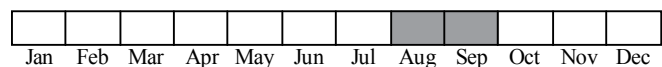


Best Survey Period



Status: State special concern

Global and state rank: G2G3/S2S3

Other common names: Michigan bog grasshopper

Family: Acrididae (short-horned grasshopper)

Range: *Appalachia arcana* is endemic to the northern half of Michigan's lower peninsula (Vickery & Kevan 1985).

State distribution: This species has been collected from 9 Michigan counties; records for 2 of these (Iosco, Missaukee) are known only from the late 1930s or early 1940s.

Recognition: The secretive locust is a relatively small, short-winged grasshopper which does not have the ability to sing or fly. Two field characteristics will confirm a specimen as *Appalachia arcana*. In both sexes, the **undersides of the hind femora are bright red** and the **tegmina (forewings) are reduced to small pads held almost laterally along the body**.

Booneacris glacialis canadensis (northern wingless locust) can occur in the same habitats at the same time of year, but has yellowish-green on the underside of the hind femora and lacks wings entirely. Female *Booneacris* have a deep olive cast to their bodies with white or bright pink spots on the pronotum (neck) and elsewhere, while the males are significantly smaller, less olive, and more deeply lime green in color. It is critical to check for these characteristics, because these two

species are quite similar in appearance (Higman et al. 1994). *Appalachia arcana* **males range in length from 17-19 mm (0.7-0.8 inches) and females from 24-30 mm (1.0-1.2 inches)**. Males are brownish gray in color and have a **conspicuous broad pale stripe dorsally**, with contrasting lateral black stripes extending from the head almost to the end of the abdomen. Females are more subtle shades of brown and lack the prominent striping of the males. The **hind femora** of both sexes are **prominently striped laterally with alternating light and dark brown bands**. Though the male's coloration is more noticeable, both sexes can be quite cryptic and difficult to see against the bark of trees and shrubs.

Best survey time: Adults have been observed from early July until November, though typically they are found between August and September. They are most easily seen in the mid-mornings and early evenings when activity peaks.

Habitat: The habitat of this insect may not be fully known. Hubbell and Cantrall (1938) suggest that it may occur in almost any habitat that is shrubby yet open enough for full sunlight exposure through large parts of the day. However, the species is best known from bogs where leatherleaf (*Chamaedaphne calyculata*) and Labrador tea (*Ledum groenlandicum*) typically occur in dense stands underlain by deep, hummocky sphagnum. These bogs often are surrounded by stands of jack pine (*Pinus banksiana*) and some tamarack (*Larix laricina*) which may encroach along the margins of the bog. The species also has been documented on bracken fern



(*Pteridium aquilinum* var. *latiusculum*) and sweetfern (*Comptonia peregrina*) in open groves of aspen and pines (Vickery and Kevan 1985), in early shrub thicket stages of second-growth hardwood forests, in shrubby undergrowth in jack pine barrens (Hubbell and Cantrall 1938), and in northern wet prairies and intermittent wetlands (Higman et al. 1994).

Biology: The best source for life history and ecological data remains Hubbell and Cantrall's species description (1938). As the common name implies, the species is secretive and may only be detected where it is abundant. Hubbell and Cantrall (1938) observed that this insect spends most of the day sunning itself, shifting its position to follow the path of the sun and moving to the undersides of twigs and branches or on the trunks of trees for the night. Males are most commonly observed sunning themselves on the branches of leatherleaf or on the trunks and branches of jack pine and tamarack (Vickery & Kevan 1985). They tend to remain motionless, largely hidden by their cryptic coloration. When they do move, they appear jerky and nervous, leaping two to three times in a rapid zigzag fashion down the tree. If they reach the ground, they may burrow into moss or plant debris. Females typically remain hidden closer to the soil surface.

Mating has been observed in the field in mid to late September, usually on trunks of trees over 5-6' tall (H. Ballard 1989 pers. comm.). Hubbell and Cantrall (1938) noted that pairs have been observed to remain in copula for up to twelve hours. During oviposition, which has only been observed in captivity, eggs were laid on twigs rather than in the soil, and were suspended in a frothy material which hardened into brown globose masses from 8-12 mm in diameter. In the wild, it is thought that the eggs are laid in the soil of surrounding uplands rather than in sphagnum, and that the early instars (immature stages) later migrate to bogs from their margins (Hubbell & Cantrall 1938). Ballard (1995 pers. comm.) suggested that this orthopteran may be more of an arboreal species than a ground-dweller, since most of the individuals he observed were found in the shrubs and trees. He pointed out that oviposition may in fact take place on the branches of shrubs rather than in the soil of adjacent uplands. The secretive locust is univoltine (one generation each year), overwintering in the egg stage. The eggs presumably hatch in early summer.

Conservation/management: The secretive locust may occur in locations affected by gypsy moth defoliation, but the species (like all grasshoppers) is immune to the type of *Bacillus thuringiensis* (Bt) used to control the gypsy moth. They are, however, adversely impacted by Dimilin, a regulated pesticide for restricted use, that is sometimes used by private landowners and which affects growth in orthopterans. The locust also could be affected by development, road construction, and logging

at occupied sites. Uncut buffer areas around bogs/wetlands may be necessary to protect oviposition sites. Because habitat needs are unclear, the maintenance of a mosaic of suitable upland and wetland habitats in their natural state is prudent until further research more clearly defines specific habitat requirements.

Research needs: Life history studies are needed to determine oviposition sites, dispersal mechanisms, and other special habitat needs. Field surveys would help determine distribution and abundance. The effects of timber harvest at different intensities, as well as conversion of upland forest to red pine, should be examined. The effects of prescribed burning in nearby habitats on potential oviposition sites, food plants, and recolonization efforts should be assessed. Intensive monitoring from June through October at a number of known sites could provide invaluable information about this species. Mark-recapture studies should be conducted to better estimate population size at several known sites. Studies should be designed to evaluate the degree of habitat fragmentation and isolation tolerated by the secretive locust.

Related abstracts: pine barrens, bog, intermittent wetland, pale agoseris, rough fescue, Kirtland's warbler

Selected references:

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- Hubbell, T.H. and I.J. Cantrall. 1938. A new species of *Appalachia* from Michigan (Orthoptera, Acrididae, Cyrtacanthracridinae). Occ. Pap. of the Mus. of Zoo. U. of Mich. No. 389. 23 pp.
- Vickery, V.R. and D.K.M. Kevan. 1985. The grasshoppers, crickets, and related insects of Canada and adjacent regions. Biosystematics Research Inst., Ottawa, Ontario, Canada. Pub. No. 1777. 918 pp.

Abstract citation:

- Rabe, M.L., J.T. Legge, and D.A. Hyde. 1996. Special animal abstract for *Appalachia arcana* (secretive locust). Michigan Natural Features Inventory, Lansing, MI. 2 pp.

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