

REDISCOVERED POPULATIONS OF THE IDAHO POINT-HEADED GRASSHOPPER, *ACROLOPHITUS PULCHELLUS* (BRUNER), 1890 (ORTHOPTERA: ACRIDIDAE)

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ABSTRACT.—The Idaho point-headed grasshopper, *Acrolophitus pulchellus*, is a rare endemic of the Sinks Drainages of east central Idaho. Past collections were infrequent and found few specimens. Searches by entomologists in 2002–2003 failed to find specimens, leading to speculation that *A. pulchellus* was extinct. I report rediscovered populations of *A. pulchellus* based on 55 capture records (10 collected) at 13 localities; describe distribution, habitat, possible host plant relationships, morphology, and life history; and present the first photos of live adult specimens.

RESUMEN.—El saltamontes de Idaho, *Acrolophitus pulchellus*, es una rara especie endémica de los desagües del centro y este de Idaho. Las colecciones pasadas se realizaron con poca frecuencia y encontraron pocos especímenes. En las búsquedas realizadas por entomólogos en 2002–2003 no se encontraron especímenes, llevando a la especulación de que el *A. pulchellus* se había extinguido. Reporto reencuentros de las poblaciones de *A. pulchellus* basándome en 55 registros de captura (10 colectados) en 13 localidades; describo la distribución, el hábitat, las posibles relaciones con plantas huéspedes, morfología, e información de historia de vida; y presento las primeras fotos de especímenes de adultos vivos.

The Idaho point-headed grasshopper, *Acrolophitus pulchellus*, is endemic to the Birch Creek, Big Lost River, and Little Lost River Sinks Drainages of east central Idaho. The sinks originate in the mountains of east central Idaho and percolate southward into the Snake River Plain aquifer. The valleys are dominated by a series of coalescing alluvial fans comprising gravelly loams of carbonate bedrock sediments. Mean annual precipitation is 230–250 mm, with temperatures ranging from –36 to 40 °C. Vegetation consists of sparse, low-growing xerophytic shrubs, grasses, and forbs typical of sagebrush (*Artemisia* spp.) steppe.

Acrolophitus pulchellus was originally described as *Pedioscirtetes pulchella* by Bruner (1890) based on 2 specimens collected in Birch Creek, Clark County, Idaho, in August 1883. Jago (1969) considered this taxon synonymous with the wider-ranging *Pedioscirtes nevadensis*. Otte (1981) placed *P. pulchella* and *P. nevadensis* in the genus *Acrolophitus*, recognizing *A. pulchellus* as taxonomically distinct given “it is separated by more than 400 miles from *A. nevadensis* and *A. pulchellus* is conspicuously spotted on the forewings and more strongly banded along the hind wings.” Specimens of *A. pulchellus* are known from a nar-

row distributional limit below 1829 m elevation in Clark, Butte, and Custer counties (Otte 1981).

Collections of *A. pulchellus* were infrequent from 1950 to 1972 (Scoggan and Brusven 1972, Kell et al. 1993), yielding few specimens per collecting trip. Scoggan and Brusven (1972) required 3 trips to the Blue Dome type locality in Clark County to collect 5 specimens, noting “this species is extremely sparse and apparently of very local distribution.” Kell et al. (1993) produced 2 specimens in 7 days of survey, stating that “*A. pulchellus* is a rare specie [*sic*] of grasshopper” that “still exists in seemingly low numbers in the survey area.” Baker (2003) searched for *A. pulchellus* at type localities in Clark, Custer, and Butte counties in 2002–2003, but found no specimens. Baker (2003) speculated, “It is possible that this species is extinct,” but added, “this very cryptic species occurs at a very low density and only under very favorable conditions will it be seen.” Baker (2003) recommended additional attempts to relocate the species after ≥ 2 successive years of normal precipitation. Kell et al. (1993) and Baker (2003) identified the need for definitive information on host plant preferences of *A. pulchellus*, which would aid

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future search efforts for this taxon. Given speculation on the extant status of *A. pulchellus*, a lack of recent field investigations, and state and federal agency conservation interest in this species, my goal was to survey for *A. pulchellus* to determine its current status in Idaho. Herein, I also comment on the species' distribution, habitat associations, morphology, and previously unreported life history traits.

METHODS

Surveys for *A. pulchellus* were conducted at 8 historical localities identified from the Idaho Natural Heritage Program database, published literature, and museum specimens (see Waterbury 2011 for additional detailed information and appendixes on soils, vegetation, and type locality descriptions associated with this survey). Another 26 *ad hoc* sites were surveyed in intervening areas of sagebrush-steppe habitat between historical localities. Surveys were conducted in late summer 2010 to coincide with the adult stage of *A. pulchellus*, which presumably would be more detectable than smaller instar stages (Kell et al. 1993). A team of 2 observers searched 1-km² grids centered on each survey site. All sites were surveyed at least once; historical localities were resurveyed at ≥ 10 -day intervals if *A. pulchellus* was not detected during an initial survey. Surveys combined visual inspection of ground surfaces and vegetation with frequent net sweeping at ground level to flush grasshoppers. Past collectors (Ball et al. 1942, Scoggan and Brusven 1972, Kell et al. 1993) described the locomotion of *A. pulchellus* as "lethargic" and, unless disturbed, *A. pulchellus* is reluctant to leave the low-growing forbs on which it rests and feeds.

Each survey site was photographed and characterized for plant association, soil type, and topography. For each *A. pulchellus* detected, I recorded a location (determined by a handheld GPS unit), substrate (ground, vegetation, host plant), and development stage (nymph, adult). For each captured specimen, I recorded sex and total body length (front of head to tip of wings). Digital photos were taken of most live specimens. Voucher specimens of *A. pulchellus* were collected from sites where ≥ 2 individuals were detected. Sympatric grasshopper species were collected from each survey site. All grasshopper specimens were

deposited in the W.F. Barr Entomology Museum, University of Idaho, Moscow, Idaho.

RESULTS AND DISCUSSION

From 21 July to 20 August 2010, I found 55 specimens of *A. pulchellus* at 6 of 8 historical localities and 7 of 26 *ad hoc* sites in the Birch Creek drainage of Clark County (20 males, 18 females, 3 sex unknown) and the Big Lost River drainage of Custer County (3 males, 9 females, 2 sex unknown; Fig. 1). Surveys were fortuitously timed after 2 consecutive years of above normal precipitation, which Baker (2003) predicted "would allow nymphs to hatch from eggs that may be in protracted diapause" and "would permit some measure of recovery in numbers under improved habitat conditions." Higher-than-average precipitation during the 2010 water year contributed to robust plant growth and extended plant phenology during fieldwork.

Current Status and Distribution

Multiple specimens of *A. pulchellus* were relocated at 4 of 8 historical collection sites: Blue Dome, Birch Creek, and Myers-Grouse Creek in Clark County, and the Cedar Creek locality in Custer County. Specimens of *A. pulchellus* were not found at the Skull Canyon locality in Clark County or the Howe locality in Butte County. In Skull Canyon, exotic plants such as cheatgrass (*Bromus tectorum*) and kochia (*Bassia scoparia*) have supplanted native vegetation along the dirt road corridor. The record for the Howe site (Kell et al. 1993), which is undated and unattributed to a collector, stated the location as "2 miles east of Howe, Idaho, Butte County." However, the location corresponded to a parcel of private agricultural land in the lower Little Lost River Valley, suggesting that this locality record is incorrect. Searches at 5 *ad hoc* sites in the Little Lost River drainage and 8 *ad hoc* sites in the upper Birch Creek drainage of Lemhi County failed to detect *A. pulchellus*. Elevations at occupied sites within the study area ranged from 1572 m to 2082 m, extending the species' known upper elevation range by 253 m (Scoggan and Brusven 1972, Otte 1981). Localities of *A. pulchellus* were contained within latitudinal parallels 43° 58' N and 44° 16' N and longitudinal meridians 112° 32' W and 113° 44' W, forming a rectangular polygon 98 km east-west by

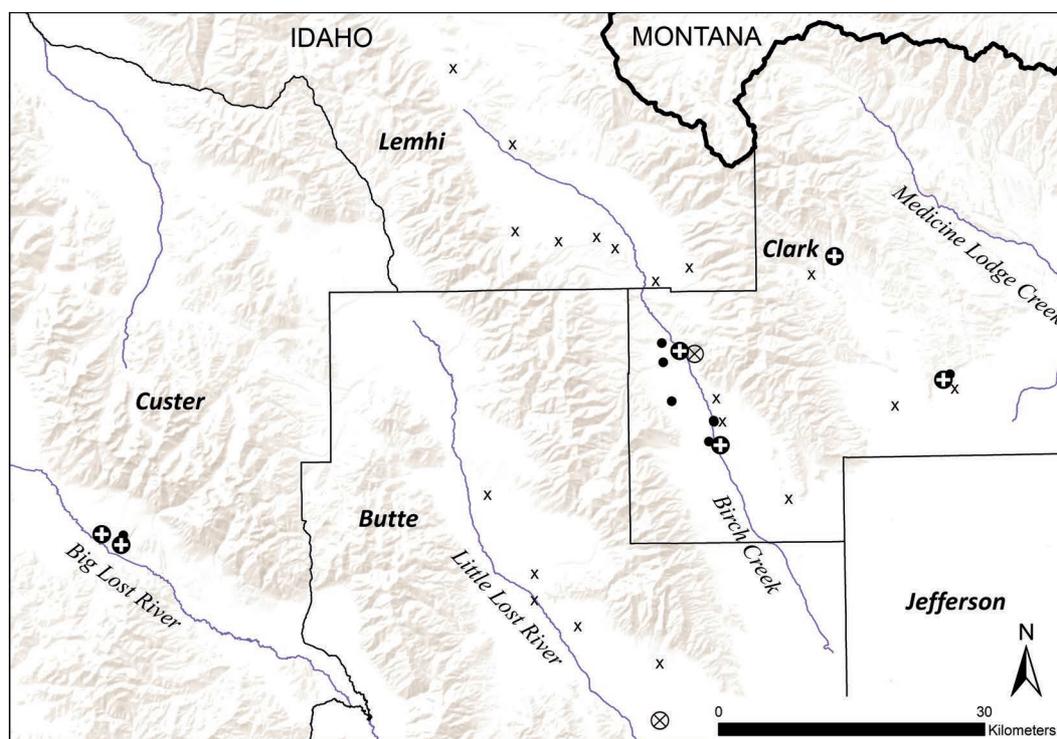


Fig. 1. Localities of occurrence for the Idaho point-headed grasshopper (*Acrolophitus pulchellus*) in the Sinks Drainages of east central Idaho, July–August 2010. Symbols indicate the following findings: ⊕ = historical localities where *A. pulchellus* was detected; ⊗ = historical localities where *A. pulchellus* was not detected; • = localities with detections based on this study; x = localities without detections based on this study.

33 km north–south, an area of approximately 3234 km².

Rediscoveries of *A. pulchellus* at historical and new sites indicate this species is at least tenuously established in the Birch Creek and Big Lost River drainages of east central Idaho. Notably, the species continues to occupy the Blue Dome type locality 127 years after the holotype was collected by Bruner (1890). Lack of detections in the Little Lost River drainage suggests that *A. pulchellus* is either limited in abundance, now extirpated from the vicinity, or possibly never occurred there considering the ambiguity of the Howe record. Further surveys for *A. pulchellus* should be attempted in the Little Lost River drainage, given its intervening location between extant populations in the Birch Creek and Big Lost River drainages. Surveys in the upper Birch Creek drainage of Lemhi County yielded no detections of *A. pulchellus* despite soils and landforms similar to other occupied sites. Notably, the upper Birch Creek sites were the highest

elevation surveys in the study area (≥ 2100 m to 2249 m), suggesting an upper elevation threshold of ≤ 2100 m for *A. pulchellus*.

Habitat

The habitat of *A. pulchellus* consisted of windswept, flat to gently rolling outwash fans and alluvial fan terraces in the Birch Creek and Big Lost River drainages (Fig. 2). Soils comprised alluvium or colluvium derived from limestone parent material and well-drained gravelly to gravelly loam surface profiles with unconsolidated surface gravels and cobbles. Sites were sparsely vegetated with matrices of low-growing xeric shrubs including Wyoming big sagebrush (*A. tridentata wyomingensis*), black sagebrush (*A. nova*), low sagebrush (*A. arbuscula arbuscula*), shadscale (*Atriplex confertifolia*), and yellow rabbitbrush (*Chrysothamnus viscidiflorus*). Dominant perennial grasses were bluebunch wheatgrass (*Pseudoroegneria spicata*), Sandberg's bluegrass (*Poa secunda*),

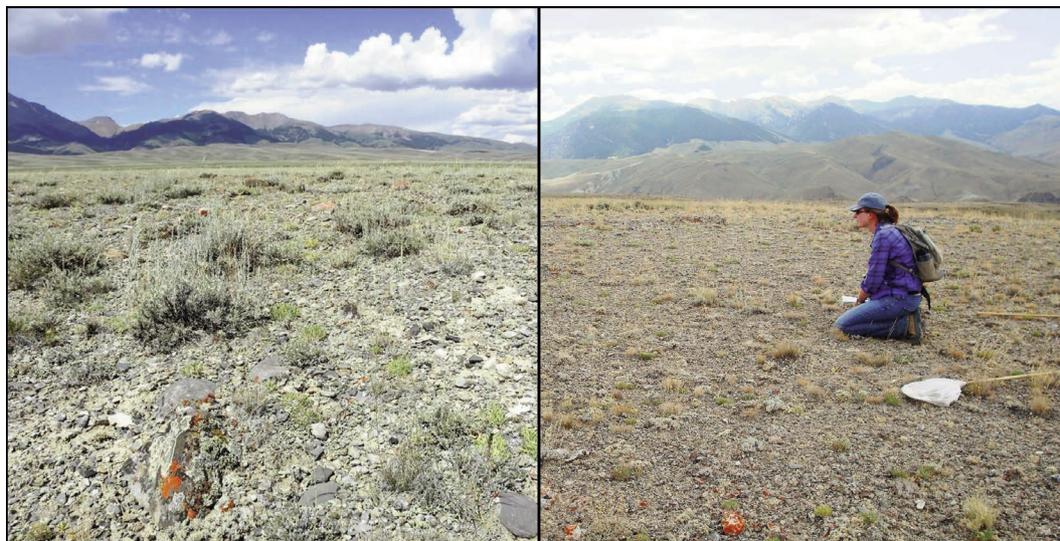


Fig. 2. Type localities of *Acrolophitus pulchellus*: left photo, Blue Dome vicinity, Birch Creek Drainage, Clark County, Idaho; right photo, Cedar Creek vicinity, Big Lost River Drainage, Custer County, Idaho.

and Idaho fescue (*Festuca idahoensis*). Common forbs were stemless mock goldenweed (*Stenotus acaulis*), Hood's phlox (*Phlox hoodii*), aster (*Symphotrichum* spp.), prickly pear (*Opuntia* spp.), and buckwheat (*Eriogonum* spp.). Vagrant lichens (*Rhizoplaca* spp., *Xanthoparmelia* spp.) were common across the study area. Land use is primarily public lands livestock grazing and dispersed recreation, with scattered private ranches along floodplains.

Morphology

Prior to my fieldwork, morphometric data were available for few of the 32 paratypes of *A. pulchellus*, and no photographs of live specimens existed. Scoggan and Brusven (1972) considered this taxon "the most distinctive of Idaho Gomphocerinae," distinguished "by its long dense pubescence in all instars and the green mottled with white color pattern." This description, other species identifiers (e.g., acutely slanted face, filiform antennae, lethargic mode of locomotion), and reference to key literature (Bruner 1890, Otte 1981, Kell et al. 1993) enabled me to identify the species in the field.

During the July–August survey period, 53 of 55 *A. pulchellus* specimens were found in the adult stage. Of 50 specimens for which sex was determined, 22 were male and 28 were female. Total body length measurements and

sex were recorded for 40 adult specimens. Mean length of adult males was 22 mm (range 20–26, SD 1.6, $n = 17$). Mean length of adult females was 31.6 mm (range 27–37, SD 2.1, $n = 23$). In addition to body length, sexual dimorphism in *A. pulchellus* was expressed in color pattern (Fig. 3). Whereas adult females were bright green mottled with white, adult males were tinged with reddish brown on the antennae, femora, tegmina, and distal edge of the pronotum.

I deposited 10 voucher specimens of *A. pulchellus* and 147 voucher specimens of associated grasshoppers with corresponding field notes and digital photographs in the W.F. Barr Entomology Museum, University of Idaho, Moscow, Idaho.

Life History Traits

Previous collectors have speculated widely on possible feeding strategies and host plant preferences of *A. pulchellus*. Bruner (1890) collected the holotype "upon the thorny plant known as *Grayia polygaloides*" (synonym of *Grayia spinosa* [Hook.] Moq.) at the Blue Dome locality. However, Baker (2003) noted that *Grayia* was conspicuously absent from this site and suggested Bruner may have misidentified shadscale as *Grayia*. Ball et al. (1942) and Jago (1969) reported *A. pulchellus* as a general feeder on a variety of shrubs, forbs,



Fig. 3. *Acrolophitus pulchellus* detections on *Stenotus acaulis* (Nutt.) Nutt., stemless mock goldenweed, a common forb and possible host plant in the study area: left photo, adult female (left) and adult male (right) in copulating position; right photo, crypsis in the *A. pulchellus* adult female showing disruptive coloration and background matching to stemless mock goldenweed.

and grasses. Scoggan and Brusven (1972) suggested that nymphs of *A. pulchellus* are forb feeders. Other collectors noted that rabbit-brush (Kell et al. 1993), black sagebrush, and vagrant lichens might be preferred host plants that also offer camouflaging concealment to *A. pulchellus* (Baker 2003).

In 49 of 55 detections (89%), I found *A. pulchellus* on the ground, suggesting the species is geophilous, at least in the adult stage. In the 6 detections on vegetation, individuals were found resting, feeding, stridulating, and copulating on stemless mock goldenweed, a cushion-form forb prevalent in the study area. Stemless mock goldenweed senesces later than most other herbaceous plants in the study area, retaining green, turgid leaves through early August 2010. *A. pulchellus* is remarkably cryptic to the plant's color pattern of green and senesced leaves (Fig. 3). Crypsis is also suggested in the shape, color, and compartment of the grasshopper's antennae, which strongly resemble the senesced peduncles of stemless mock goldenweed. Furthermore, the plant's ciliate leaves are texturally similar to the dense pubescence of *A. pulchellus*. Such plant-associated crypsis is considered an effective mechanism of predator avoidance for sedentary grasshopper species (Joern et al. 1986, Chambers et al. 1996).

Quite plausibly, *A. pulchellus* is a specialist feeder on stemless mock goldenweed. This would corroborate previous work reporting nymphs of this species resting and feeding in the crowns of low-growing forbs (Ball et al. 1942, Scoggan and Brusven 1972). Baker (2003) also surmised that *A. pulchellus* "is primarily a ground dwelling form that only incidentally has been collected on shrubs in the area where it lives." Among members of the Gomphocerinae, a grasshopper subfamily that feeds almost exclusively on grasses, *Acrolophitus* spp. are uniquely specialist feeders (Otte and Joern 1977, Otte 1981). *Acrolophitus hirtipes*, found in the North American Great Plains, is a forb-feeder strongly associated with *Mentzelia* and *Phaecelia* species. In the southwestern United States, *A. maculipennis* is host specific to *Tiquilia canescens*, a forb restricted to dry, rocky, calcareous soils. *Boottettix argentatus*, grouped with *A. pulchellus* in the Acrolophitini tribe, is a specialist feeder on creosote bush (*Larrea tridentata*), to which it is cryptically matched. Diet selectivity reported in these species is likely congruent to *A. pulchellus*. The relative abundance and extended phenology of stemless mock goldenweed at sites inhabited by *A. pulchellus* suggest spatial and temporal predictability of this host plant, at

least in years of favorable precipitation. Grasshopper species that feed on predictable host plants typically have low diet breadths and tend toward oligophagy (restriction to a plant family) or monophagy (restriction to a plant genus) (Bernays and Chapman 1978, Joern 1983, Chapman and Joern 1990).

Late-summer surveys provided the opportunity to observe reproductive behaviors previously unreported by collectors. On 28 July 2010, I encountered a colony of *A. pulchellus* at the Pass Creek survey site comprising several stridulating males. Songs consisted of 2–9 brief, faint pulses heard from ≤ 8 m away. I was able to audibly track calling songs to locate, photograph, and record video of stridulating males and a copulating pair (Fig. 3). Stridulation was produced by rubbing the inner hind femora against the tegmina. On 10 August 2010, I visually and audibly observed a female stridulate in response to male stridulation, establishing that both sexes communicate in this manner. Notably, I observed short crepitation flights by one male and 2 females at the Pass Creek colony. Crepitation flights of both sexes elicited a soft “ticking” sound. This finding is apparently uncommon among Gomphocerine grasshoppers, of which only a few are known to crepitate (Otte 1981, Richman et al. 1993, Capinera et al. 2004). I was unsuccessful in documenting egg deposition by females, but suspect that egg-laying occurred within or adjacent to reproductive colonies. Colony sites had flat relief and loamy soils, suggesting attributes that factor in oviposition site selection.

Conservation Considerations

Because of its endemism and scarce records, *A. pulchellus* is designated by the state of Idaho as a “critically imperiled” species of greatest conservation need (IDFG 2005). The species is also listed as Type 2 sensitive (rangewide/globally imperiled) by the Idaho State Office of the Bureau of Land Management (BLM). *Acrolophitus pulchellus* is assessed as vulnerable (facing a high risk of extinction in the wild in the medium-term future) by the International Union for Conservation of Nature Red List of Threatened Species.

Sites occupied by *A. pulchellus* are within the Upper Snake and Challis Field Offices of the BLM and the Dubois Ranger District of Caribou–Targhee National Forest, where public lands are primarily managed for livestock

grazing and recreation. Anthropogenic impacts observed at survey sites included roads, off-road vehicle use, noxious weeds, cattle grazing, range seedings, and infrastructure associated with ranching and mineral extraction. Further study is needed to better define the ecological niche of *A. pulchellus*, including identification of potential threats and development of conservation actions for this rare and range-restricted taxon.

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