Rediscovery of *Anacampsis lupinella* in Ontario

**REDSOvery of ANACAMPsis LUPINELLA BUSck (LEPIDOPTera: GELECHiidaE) IN ONTARIO**


1School of Environmental Sciences, University of Guelph, Guelph, Ontario, Canada N1G 2W1
e-mail, gotis@uoguelph.ca

Abstract

We rediscovered populations of *Anacampsis lupinella* Busck (Lepidoptera: Gelechiidae) in three remnant populations of sundial lupines (*Lupinus perennis* L. (Fabaceae)) in southern Ontario. Here we provide a detailed description of the species and illustrate it with figures of adult moths and both male and female genitalia. Photographs of the moths taken recently in High Park, Toronto, match photos of the type specimen that was collected at High Park in 1901. The male genitalia of contemporary males match those of a male from the original series of specimens collected in Toronto. CO1 DNA barcodes of eight contemporary specimens were very similar to the CO1 barcode recovered from a specimen from the original series. The CO1 sequences demonstrated slight genetic differentiation of the three Ontario populations, but collectively were clearly delimited from the seven congeneric species known from Ontario.

**Introduction**

In early June of 1900, larvae of an unknown moth were discovered feeding on sundial lupines, *Lupinus perennis* L. (Fabaceae), in High Park, Toronto, by amateur

Published March 2020

* Author to whom all correspondence should be addressed.
2 Canadian National Collection of Insects, Arachnids, and Nematodes, Agriculture & Agri-Food Canada, Ottawa Research and Development Centre, 960 Carling Ave, Ottawa, Ontario, Canada K1A 0C6; jean-francois.landry@canada.ca
3 Centre for Biodiversity Genomics, University of Guelph, Guelph, Ontario, Canada N1G 2W1; dewaardj@uoguelph.ca
4 316 Norfolk Co. Rd. 60, RR1, Walsingham, Ontario, Canada N0E 1X0; gartcar@kwic.com
5 4 Yarmouth Gardens, Toronto, Ontario, Canada M6G 1W4; dbeadle@pathcom.com
6 9971 Richmond Lane, Port Franks, Ontario, Canada N0M 2L0; steadken@gmail.com
entomologist Allan Kinghorn. He sent several larvae and lupine cuttings to Dr. James Fletcher, the Dominion Entomologist at the Central Experimental Farm in Ottawa, who reared and mounted them. Fletcher then sent three specimens to August Busck, a noted microlepidopterist of the Bureau of Entomology of the US Department of Agriculture in Washington, D.C., who described them as a new species, *Anacampsis lupinella* Busck. Fletcher retained one specimen, which is now in the Canadian National Collection. Those were the only specimens of *A. lupinella* collected in Canada until recently.

Little is known about *A. lupinella*. In addition to the type locality it has been reported from scattered localities in Illinois, Ohio, eastern Texas, Louisiana, the Florida Panhandle (Moth Photographers Group 2019), and Maryland (BugGuide.net). However, there is no indication of how these records were identified and where vouchers, if they exist, are preserved. Forbes (1923, pp. 277–279) briefly described the adult and larva and summed up what is known of the life history as “[larva] in a slight web between leaves of lupine”. Both *A. lupinella* and its host plant, the sundial lupine (*Lupinus perennis*), are of conservation concern in Canada. The national (and provincial) conservation status ranks are S1S3 (critically imperiled to vulnerable) for the moth and S2S3 (imperiled to vulnerable) for the plant (NatureServe 2019).

After more than 100 years, *A. lupinella* has been rediscovered in remnant populations of sundial lupine in three different locations within Ontario (Fig. 1). In this

FIGURE 1. Map of Southwestern Ontario showing the three known Canadian localities of *Anacampsis lupinella*: 1) High Park, Toronto, York Region, 2) St. Williams Conservation Reserve, Norfolk County, and 3) Lambton Shores, Lambton County.
Rediscovery of *Anacampsis lupinella* in Ontario

In this paper we describe these discoveries, provide a diagnosis of the species, and provide DNA barcode data for all species of *Anacampsis* Curtis (Gelechiidae: Anacampsinae) known from Ontario.

**Rediscovery of *Anacampsis lupinella***

**High Park, Toronto, York Region**

In 2016, DB and Richard Aaron searched sundial lupines for *A. lupinella* in High Park (43.648N, 79.467W), the type locality for the species. High Park has a small population of sundial lupines (9120 lupine inflorescences when evaluated in 2014; Jarvis 2015), a tiny remnant of the extensive fields of lupines that existed near Toronto in the early 1900s. On 6 July, under hot sunny conditions, their first sweep through lupines yielded moths that matched the description of *A. lupinella* and were recorded in photos (e.g., https://www.inaturalist.org/observations/14227954). In total, they caught four individuals that exhibited the full range in coloration known for the species (as described below). Two years later, on 8 July 2018, R. Aaron, Taylor Leedahl, Ken Sproule, and DB spent several hours sampling all of the lupine patches in the park. Under excellent weather conditions—light winds, moderate humidity, >20°C, and thin high haze—they netted ~50 specimens of *A. lupinella* that they released after capture.

**St. Williams Conservation Reserve, Norfolk County**

During a visit to the Manestar Tract of the St. Williams Conservation Reserve (42.700N, 80.461W) on 8 June 2017, MG, GWO, Peter Carson, and Jessica Linton noticed numerous “leaf nests” on lupines. Sundial lupines are known to have existed in this region for as long as there have been records of the vegetation of Norfolk County (Draper et al. 2002). Constructed by a single moth larva, each “leaf nest” consisted of 2–3 lobes of a lupine leaf webbed together. Being aware of the rediscovery of what were likely *A. lupinella* moths in Toronto, they immediately performed a Google search and found images of *A. lupinella* larvae on sundial lupine from Maryland that visually matched the larvae and leaf nests at the Manestar Tract (BugGuide 2019).

MG returned to the Manestar Tract on 1 July 2017 and observed numerous small adult moths among the lupines. She immediately applied for and received a permit from the Ontario Ministry of Natural Resources and Forestry to collect specimens. On the afternoon of 6 July she made 200 back-and-forth sweeps with an aerial insect net over lupine plants and caught 181 adult moths. Six specimens collected from the Manestar Tract and two from roadside plants ~2 km north along Concession 7/Walshingham Townline were mounted by Jim Troubridge and submitted to the Canadian National Collection in Ottawa for identification. On 7 July of the following year, adult moths were again present but were less abundant. Searches by MG at former agricultural fields 2–3 km away that have been restored with sundial lupines and other native species failed to detect this species.
Lambton Shores, Lambton County

Historically, the northernmost region of Lambton County, from Pinery Provincial Park and Port Franks east to Thedford, harbored extensive oak savanna habitat with large populations of sundial lupines. Agriculture, human settlement, lack of savanna management including suppression of fires, and the unfortunate planting of pine trees within Pinery Provincial Park greatly reduced lupine populations and their savanna habitat. As a consequence, a number of species of Lepidoptera have become rare or, like the lupine-feeding Karner blue (Lycaeides melissa samuelis Nabokov), Frosted Elfin (Callophrys irus (Godart)), and Eastern Persius Duskywing (Erynnis persius persius (Scudder)), extirpated from the region.

In 2017, MG encouraged KS to search for lupine moths by sweeping a net back and forth over lupines in this region. On 9 July 2018, KS caught 8–10 individuals in each sweep of the net within lupines at the Karner Blue Sanctuary (KBS; 43.222N, 8.887W) in Port Franks, a 15 ha property acquired by Lambton Wildlife Inc. to protect its rare habitats. He retained 12 specimens, two of which were barcoded at the Centre for Biodiversity Genomics (CBG), University of Guelph (specimen # CNCLEP00208671 and CNCLEP00208672). On a return visit to KBS on 16 July he observed only 3–4 adult moths. KS also swept lupines and caught a few A. lupinella moths at a site on Goosemarsh Line near the southeastern boundary of Pinery Provincial Park (43.239N, -8.830W) that has small and declining numbers of lupines. No moths were found near the Riverside Campground, near the southwestern corner of Pinery Provincial Park, in a habitat that was burned in 2008 and has a moderate number of lupines.

Results and Discussion

Specimen Identification: Adult morphology

Specimens from both Manestar Tract and Port Franks have been deposited in the CNC in Ottawa (refer to Table 1 for details of specimens). JFL examined morphological characters, including male and female genitalia, and compared them to specimens of various species of Anacampsis in the CNC. The male genitalia of the recently collected moths matched those of the male specimen from the original series of A. lupinella reared by Fletcher.

Although the sampled specimens were only compared to a photograph of the actual type specimen (type # 5351, deposited in the National Museum of Natural History, Washington, D.C., and photographed during a visit by JFL in 2004), we consider that the morphological match with a specimen from the original reared series from which the type was selected positively confirms the identity of the moths reared on lupines in Norfolk County as Anacampsis lupinella. Other species of Anacampsis recorded from Ontario, namely A. agrimoniella (Clemens), A. conclusella (Walker), A. consonella (Zeller), A. niveopulvella (Chambers), A. populella (Clerck), A. rhoifructella (Clemens), and A. tristrigella (Walsingham) are easily distinguished from A. lupinella by their external aspect (photos of the various species can be seen in the BOLD taxonomy browser: http://v4.boldsystems.org/index.php/TaxBrowser_Home).

In phenotypic appearance, adults of A. lupinella have the upper surface greyish
TABLE 1: Data for specimens of *Anacampsis lupinella* examined in this study and deposited in the CNC. BOLD Process ID = sequence identifier in the Barcode of Life Data System. This material represents the entire CNC holdings for this species.

<table>
<thead>
<tr>
<th>Specimen ID</th>
<th>BOLD Process ID</th>
<th>Sequence Length</th>
<th>Dissection</th>
<th>Sex</th>
<th>Locality</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Collecting Date</th>
<th>Collector</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNCLEP00100647</td>
<td>NGSFT2078-16</td>
<td>439</td>
<td>–</td>
<td>M</td>
<td>Toronto</td>
<td>–</td>
<td>–</td>
<td>18 Jul 1900</td>
<td>Allan Kinghorn</td>
</tr>
<tr>
<td>CNCLEP00175634</td>
<td>MNAR0907-17</td>
<td>658</td>
<td>MIC 8074</td>
<td>M</td>
<td>Manestar Tract</td>
<td>42.7076</td>
<td>-80.3575</td>
<td>6 Jul 2017</td>
<td>Mary Gartshore</td>
</tr>
<tr>
<td>CNCLEP00175635</td>
<td>MNAR908-17</td>
<td>658</td>
<td>MIC 8075</td>
<td>F</td>
<td>Manestar Tract</td>
<td>42.7076</td>
<td>-80.3575</td>
<td>6 Jul 2017</td>
<td>Mary Gartshore</td>
</tr>
<tr>
<td>CNCLEP00175636</td>
<td>MNAR909-17</td>
<td>658</td>
<td>–</td>
<td>F</td>
<td>Manestar Tract</td>
<td>42.7076</td>
<td>-80.3575</td>
<td>6 Jul 2017</td>
<td>Mary Gartshore</td>
</tr>
<tr>
<td>CNCLEP00175637</td>
<td>MNAR910-17</td>
<td>658</td>
<td>–</td>
<td>F</td>
<td>Manestar Tract</td>
<td>42.7076</td>
<td>-80.3575</td>
<td>6 Jul 2017</td>
<td>Mary Gartshore</td>
</tr>
<tr>
<td>CNCLEP00175638</td>
<td>MNAR911-17</td>
<td>658</td>
<td>–</td>
<td>M</td>
<td>Manestar Tract</td>
<td>42.7076</td>
<td>-80.3575</td>
<td>6 Jul 2017</td>
<td>Mary Gartshore</td>
</tr>
<tr>
<td>CNCLEP00175639</td>
<td>MNAR912-17</td>
<td>658</td>
<td>–</td>
<td>F</td>
<td>Manestar Tract</td>
<td>42.7076</td>
<td>-80.3575</td>
<td>6 Jul 2017</td>
<td>Mary Gartshore</td>
</tr>
<tr>
<td>CNCLEP00175885</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>F</td>
<td>Port Franks</td>
<td>43.2314</td>
<td>-81.8903</td>
<td>9 Jul 2018</td>
<td>Ken H. Stead</td>
</tr>
<tr>
<td>CNCLEP00175886</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>F</td>
<td>Port Franks</td>
<td>43.2314</td>
<td>-81.8903</td>
<td>9 Jul 2018</td>
<td>Ken H. Stead</td>
</tr>
<tr>
<td>CNCLEP00175887</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>F</td>
<td>Port Franks</td>
<td>43.2314</td>
<td>-81.8903</td>
<td>9 Jul 2018</td>
<td>Ken H. Stead</td>
</tr>
<tr>
<td>CNCLEP00175888</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>F</td>
<td>Port Franks</td>
<td>43.2314</td>
<td>-81.8903</td>
<td>9 Jul 2018</td>
<td>Ken H. Stead</td>
</tr>
<tr>
<td>CNCLEP00175889</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>F</td>
<td>Port Franks</td>
<td>43.2314</td>
<td>-81.8903</td>
<td>13 Jul 2018</td>
<td>Ken H. Stead</td>
</tr>
<tr>
<td>CNCLEP00175890</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>M</td>
<td>Port Franks</td>
<td>43.2314</td>
<td>-81.8903</td>
<td>13 Jul 2018</td>
<td>Ken H. Stead</td>
</tr>
<tr>
<td>CNCLEP00175891</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>M</td>
<td>Port Franks</td>
<td>43.2314</td>
<td>-81.8903</td>
<td>13 Jul 2018</td>
<td>Ken H. Stead</td>
</tr>
<tr>
<td>CNCLEP00175892</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>F</td>
<td>Port Franks</td>
<td>43.2314</td>
<td>-81.8903</td>
<td>13 Jul 2018</td>
<td>Ken H. Stead</td>
</tr>
<tr>
<td>CNCLEP00208671</td>
<td>KSLEP1177-18</td>
<td>658</td>
<td>–</td>
<td>F</td>
<td>Port Franks</td>
<td>43.2314</td>
<td>-81.8903</td>
<td>13 Jul 2018</td>
<td>Ken H. Stead</td>
</tr>
<tr>
<td>CNCLEP00208672</td>
<td>KSLEP1178-18</td>
<td>658</td>
<td>–</td>
<td>F</td>
<td>Port Franks</td>
<td>43.2314</td>
<td>-81.8903</td>
<td>13 Jul 2018</td>
<td>Ken H. Stead</td>
</tr>
</tbody>
</table>
black and the ventral surface grey. The forewing length is 5.4–6.2 mm (mean = 5.7, N = 18). The forewing surface has a dark, blackish brown ground color with a slightly iridescent sheen in bright light (Fig. 2). In most specimens, the forewing has a pair of elongate yellowish-white spots in the distal third, one before the apex, the other opposite near the termen (10/17 examined) (Fig. 3A); in some specimens, the spots are variously connected with a narrow transverse fascia of the same color (3/17 examined); some specimens have uniformly dark brown forewings without pale marks (4/17 examined) (Fig. 3B). Under magnification, three or four smaller black spots can be discerned in the middle (discal) area of the forewing (more distinct in old, faded specimens). In the original description, Busck (1901) described the variation in the forewing pattern. This variation is not sex-related, as evidenced by variants being represented among both males and females. The hindwing is dark blackish brown. The eyes are dark red (Fig. 3C), a characteristic shared by several other *Anacampsis* species. The labial palpi are tan-colored, sickle-shaped, with the third segment acicular, longer than the second segment, and extended well above the level of vertex with an infuscated tip. Old specimens in collections can be somewhat faded and appear grey brown, especially the basal two-thirds of the forewing preceding the white fascia. In such specimens the dark discal spots are more evident against the surrounding background (Fig. 3D).

FIGURE 2. Photograph of a live *Anacampsis lupinella* taken at the Manestar Tract, Norfolk County, by Mary Gartshore.
Forbes (1923, p. 279) briefly diagnosed the larva as dull green with a testaceous head and a black spot on each side near the eyes, and indicated that it lives in “a slight web between leaves of lupine”. No other descriptions of the immature stages have been published.

*Anacampsis lupinella* externally resembles some species of *Aproaerema* Durrant (Gelechiidae: Anacampsinae) in the dark brown forewing with a distal, transverse pale fascia. However, *Aproaerema* species with a similar forewing pattern in the CNC examined by JFL are distinctly smaller on average than *A. lupinella*. Additionally, members of *Anacampsis* have the termen of the hindwing rounded and indistinctly sinuate. In contrast, members of *Aproaerema* have the termen of the hindwing markedly sinuate ending in a sharp point.

One unidentified (and possibly undescribed) *Aproaerema* species from southern Alberta in the CNC and similar in coloration to *A. lupinella* was reared from larvae tying together leaves of a lupine (*Lupinus argenteus* Pursch). Species of *Aproaerema* with known
host plants all feed upon species within the family Fabaceae. Species of *Anacampsis*, at least those related to the type species (i.e. *A. populella* (Clerck)), are predominantly known to be oligophagous or monophagous on trees, shrubs, and herbaceous plants of various families, including Adoxaceae, Betulaceae, Cistaceae, Fabaceae, Fagaceae, Rosaceae, and Salicaceae (Bland et al. 2002; Robinson et al. 2002). To date, *A. lupinella* larvae and adults have only been reported in association with sundial lupine.

Examination of genitalia by JFL of all the above-mentioned species as well as several others not recorded from ON (*A. psoraliella* Barnes & Busck, *A. lacteusochorella* (Chambers), *A. fragariella* Busck, *A. pasadenae* Keifer) showed both sexes of *A. lupinella* to be distinct in the shape and relative size of several structures. Diagnostic combinations of genitalic characters for each sex are as follows.

In the male (Fig. 4): uncus with the dorsal surface evenly rounded, the distal half roundly conical, the ventral surface covered with 15–20 peg-like sensilla on each side and divided by a narrow mesial gap; gnathos without ventrally protruded mesial process; tegumen elongate, almost 2 × as long as wide, with sides nearly straight and barely concave anteriorly (ventral aspect); cucullus of valva distally spatulate, barely extended beyond apex of uncus; vinculum with anterior margin not extended beyond apex of pedunculi of tegumen and broadly rounded, without saccus (lateral aspect); juxta with apex mesially U-emarginate, making it to appear bilobate (ventral aspect), sides anteriorly concave and narrowed, in lateral aspect distally slightly downcurved and tapered, extended to ¾ of cucullus; phallus sigmoid in lateral aspect, ventral margin medially angulate, apically tapered, in ventral aspect nearly straight with slight constriction at phallobase which is about 0.4 length of phallus; cornuti absent.

In the female (Fig. 5): projection of posterior margin of tergum 8 narrowly digitiform in dorsal aspect, flat and wedge-like in lateral aspect; sternum 8 divided into two subtriangular plates separated by a membranous, longitudinally wrinkled sinus vaginalis which is about 0.5 × width of sternum; ostium bursae ventrally bordered by thin, weakly scleritized transverse band; distal third of ductus bursae membranous, gradually widened to ostium bursae, anteriorly extended to anterior apex of anterior apophyses; corpus bursae elongate-ovoid, 1.8 × as long as wide, with a constriction anterior to signum, surface sparsely spiculate, except for area surrounding the signum with a smooth membrane; signum a thin, transverse, finely spinulate, zipper-like band; accessory sac subspherical, about a third the size of corpus bursae.

The other *Anacampsis* species differ variously in shape and size of several or all of these characters. They are not shown here as it is beyond the scope of this paper. Illustrations are found in Harrison and Berenbaum (2013, 2014) for *A. consonella*, *A. psoraliella*, *A. rhoifructella*, and *A. wikeri* Harrison.

The genus *Anacampsis* is quite large, comprising over 150 described species, with the greatest diversity in the Neotropics (Karsholt & Riedl 1996; Ponomarenko 2008; Lee 2009). Twenty-four species are known from North America (Lee et al. 2009; Harrison and Berenbaum 2013, 2014), 12 are recorded from Canada and 8 from Ontario (Pohl et al. 2018). There are no taxonomic revisions of *Anacampsis* or of other genera of Anacampsinidae, and the delineation of included genera is unclear. There are no good and unique external characters that allow unequivocal recognition of members of *Anacampsis*, and consequently microdissections and examination of genitalia are required to achieve positive identification. Even
FIGURE 4. Male genitalia of *Anacampsis lupinella*: (A) intact genitalia, lateral aspect, (B) tegumen, uncus, gnathos, ventral aspect, (C) vinculum, juxta, cucullus, ventral aspect, (D) phallus, lateral aspect, (E) phallus, ventral aspect. Abbreviations: cu = cucullus (of valva); gn = gnathos; jx = juxta; pb = phallobase; pd = pedunculus of tegumen; ph = phallus; tg = tegumen; un = uncus; vn = vinculum.
FIGURE 5. Female genitalia of *Anacampsis lupinella*: (A) corpus bursae, accessory sac, abdominal segment 8 and ducti, ventral aspect, transmitted light with dark background, (B) detail of corpus bursae and signum, (C) sternum 8, ventral aspect, (D) tergum 8, dorsal aspect, (E) tergum 8, lateral aspect. Abbreviations: aa = apophysis anterior; ap = apophysis posterior; as = accessory sac; cb = corpus bursae; db = ductus bursae; ds = ductus seminallis; ob = ostium bursae; pap = papillae anales; pT8 = posterior projection of tergum 8; sig = signum; sm = smooth area of ductus bursae; sv = sinus vaginalis; S8 = sternum 8; T8 = tergum 8; wT8 = wall of tergum 8.
Rediscovery of *Anacampsis lupinella* in Ontario

the current (traditional) inclusion of several species in *Anacampsis* (e.g., Hodges 1983; Lee et al. 2009) appears questionable; an assessment of genitalia and DNA barcodes among 18 of the North American species, conducted by JFL in preparation of this paper, revealed that several of these (*A. conclusella* (Walker), *A. covardalella* (Kearfott), *A. fullonella* (Zeller), *A. levipedella* (Clemens), *A. paltodoriella* (Busck)) have genitalic configurations that differ markedly from the type species *A. populella* and related species like *A. lupinella*, and thus probably belong to other genera, either described or undescribed.

Species identification from external features can be challenging as several species of *Anacampsis* display variation in coloration and wing pattern. Moreover, species boundaries have never been re-examined nor have the genitalia of most species been characterized; their original descriptions were based solely on external features such as coloration and shape of the wings and labial palps. Conversely, different species may have confusingly similar adults but different, very distinct larvae. As a case in point, recently the status and distinction of two common species were shown to have been historically conflated and erroneously synonymized and their host plant mistakenly attributed (Harrison and Berenbaum 2014). It is notable that no new species of *Anacampsis* were described from North America between 1933 and 2013 (see Harrison and Berenbaum 2013), possibly because the cryptic nature of recently described species necessitates careful study of internal morphology and life histories, now supplemented by DNA evidence.

**DNA barcode analysis**

Tissue samples were sent to the CBG for further confirmation through DNA barcoding. Firstly, the single remaining specimen in the CNC (CNCLEP0000647) reared by Fletcher in 1900 was DNA-barcoded using protocols designed for recovering the barcode region of the cytochrome oxidase I (COI) gene from the degraded DNA of legacy specimens (Prosser et al. 2016). The eight contemporary specimens were DNA barcoded with standard protocols that target the entire COI barcode fragment (deWaard et al. 2019). The sequences generated were compared with DNA barcodes for the seven other *Anacampsis* species recorded from Ontario (Pohl et al. 2018).

The COI barcodes of the eight recently collected specimens were a close match (0.93–1.40% Kimura-2-parameter distance) to the Fletcher specimen, further confirming their identity. They revealed a geographic pattern consistent with three isolated populations that differ slightly from each other (Fig. 6). Additionally, *A. lupinella* sequences were clearly delimited from the seven congeneric species known from Ontario (Fig. 6). All records are available on the Barcode of Life Data System (http://www.boldsystems.org) in the public dataset ‘DS-ANACAM19’ (http://dx.doi.org/10.5883/DS-ANACAM19) and have been submitted to GenBank (see BOLD dataset for GenBank accessions).

We find it interesting that *A. lupinella* has persisted in Ontario in relatively small, isolated populations of lupines. In contrast, other lupine-specialist species such as the Karner Blue, Frosted Elfin, and Eastern Persius Duskywing butterflies have become extirpated in Canada (Environment and Climate Change Canada 2017). It is unclear why *A. lupinella* has not yet been observed in sites with restored lupine habitat in relatively close proximity to extant populations.
Jason Webb of OMNRF-Aylmer expedited a research permit in time for adult moths that had been observed at the St. Williams Conservation Reserve to be collected. Jim Troubridge prepared several specimens of adult *A. lupinella* and delivered them to the CNC. Lambton Wildlife, Inc. allowed KS to collect specimens at their Karner Blue Sanctuary in Port Franks. Support for DNA barcoding at the Centre for Biodiversity Genomics was provided through the University of Guelph’s ‘Food From Thought’ project, funded by the Canada First Research Excellence Fund, and through a generous donation by KS. Lisa Bartels (AAFC–CNC) assisted JFL with the preparation of Figures 3–5. The manuscript was improved through the critical comments of three anonymous reviewers.

**References**


Rediscovery of *Anacampsis lupinella* in Ontario

**JESO Volume 151, 2020**


