# Arthropods potentially associated with spruce (*Picea* spp.) in Interior Alaska

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*by Derek S. Sikes*[1]

## Introduction

While curating an enormous volume of specimens derived from an Alaska Department of Fish and Game (ADF&G) study on the breeding habitat of Olive-sided flycatchers (*Contopus cooperi*) I began to notice a number of insect species that appeared new to the University of Alaska Museum insect collection. This bird species breeds in spruce-rich habitats so I formed the *a priori* hypothesis that these insect species likely preferred habitats with spruce. Perhaps it was my upbringing in the primarily deciduous forests of New England, and my association of tropical diversity with deciduous forests, that caused me to be biased against coniferous forests as a source of invertebrate species richness, and thus led me to under-sample these habitats prior to this ADF&G study. This would explain the prior lack of spruce-associated species in the UAM Insect Collection.

In any case, given the predicted biome shift away from spruce dominated mature forests in interior Alaska (Juday et al., 2015) I thought it would be valuable to see how many and which species in the University of Alaska Museum Insect Collection are known only from habitats with spruce.

I was unsure how successfully I would be able to answer this question, or how difficult it would be, knowing that habitat data can be wildly uncontrolled. Some collectors record no habitat data, others group organisms from a mixture of habitats (e.g. spruce forest, meadow, riverbank), and searches can yield unintended results if data are structured negatively (e.g. a search for the term 'spruce' will find records with this string "collected in a habitat with no spruce.")

## Methods

I created a FileMaker Pro v16 (FMP) database on the index of the Arctos (`https://arctosdb.org/`) habitat field for UAM:Ento (provided by Dusty McDonald, the programmer for Arctos). I worked with this index to first tag all records that had any of these search terms: Spruce, Picea, P. glauca, P. mariana. Some errors in the index and Arctos were corrected, e.g. "sprunce" was changed to "spruce", "Populas, Picca" changed to "Populus, Picea," abbreviations like "bl. spr." were expanded to "black spruce," etc.

I limited searches to interior Alaska which I defined by drawing a rectangle using the Google Map search tool in Arctos with the western edge on and including Kaltag, the southern edge just north of the northern boundary of Denali National Park, the eastern edge on and including Eagle Village, and the northern edge on and including Allakaket. This search only finds records that have been georeferenced with the center of their error radii inside this rectangle. Fortunately, most (90%) of UAM:Ento Arctos records are georeferenced. This rectangle corresponds to the following coordinates (NE lat: 66.59602240341611, NE long: -141.0853271484375, SW lat: 64.07155766950311, SW long: -158.7425537109375).

Searches were also limited to UAM:Ento specimens that had been identified to species with ID formula = A (this unfortunately eliminates ID formula A string records, which includes all new / undescribed species, but was done to eliminate all ID formula A ?, of which there are many)[2].

This search found 28,563 specimen records. I made this Arctos csv file into an Excel file and then into a FMP database. I made a relationship between the specimen data database and the habitat data database, based on the habitat field. I could then easily mark all records with at least one spruce search term (this could have been done by searching Arctos 4 times, one for each term, and then combining the results, but that would have been slower).

Since this list included species that have been found in habitats without spruce, I wanted to filter the list to retain only species in which 100% of the specimens have one or more of the spruce search terms in their habitat field.

I then repeated the above search but asked Arctos to prepare the results as a specimen summary by taxon. This generates a species list rather than a specimen list. I used this file to create a relationship with the prior, specimen record file, based on scientific name, to mark all taxa with 'spruce' which had previously been marked as spruce associates in the specimen file due to their habitat having one of the aforementioned search terms.

To find species that only have been observed in spruce habitats, and no habitats lacking spruce, I did the following: In a copy of the specimen record database I deleted all the spruce records ($n = 4,666$) and all records with no habitat data ($n = 11,266$) leaving behind only records that had habitat data but no mention of spruce. I then made a relationship between these two databases based on scien-

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[2]See Arctos' documentation on ID formulas at `http://handbook.arctosdb.org/documentation/identification.html`.

tific name. Any records that had the same scientific name between these two databases could be easily found and marked. These are species that have been found in habitats with and without spruce in interior Alaska. I searched this marked-up taxon file for species known from spruce habitats but not known from habitats lacking spruce ($n = 81$).

I then eliminated singletons (species in the prior set known from only one specimen) because their species cannot exist in more than one habitat. I did this by use of the Arctos field 'individualcount' which was in the original taxon list summary download. This field holds a count of specimens per record. Because ants and yellowjackets are colonial, this elimination step was applied to their nests rather than individual specimens (these species would only be included if more than one nest was associated with spruce). This latter elimination removed *Vespula consobrina* and *Formica glacialis* from the final list because both were known from single nests in spruce habitat.

Identifications were made by various people as detailed in the original data available at `http://arctos.database.museum/saved/interiorAKUAMEntospeciesnotnulIDformA2` . All specimens are vouchered in the University of Alaska Museum Insect Collection. Taxon concepts and taxonomic classification varied by higher taxon, with details provided in the dataset above.

## Results

The results are in Table 1.

Table 1: Forty-eight potential spruce-associated arthropod species known from more than one specimen (or nest, in the case of social Hymenoptera), from interior Alaska, represented by specimens in the UAM insect collection, identified to species, known from habitats with spruce, and not known from any habitats lacking spruce (within the same dataset).

| Order | Family | Subfamily | Scientific Name | Specimen Count |
|---|---|---|---|---|
| Araneae | Linyphiidae | | *Agyneta allosubtilis* | 3 |
| | | | *Diplocentria perplexa* | 2 |
| | | | *Pityohyphantes limitaneus* | 3 |
| | | | *Sisicottus orites* | 2 |
| | | | *Tapinocyba simplex* | 10 |
| | Lycosidae | | *Piratula canadensis* | 2 |
| Mesostigmata | Macronyssidae | | *Ornithonyssus sylviarum* | 102 |
| Coleoptera | Buprestidae | Buprestinae | *Phaenops drummondi* | 6 |
| | | Chrysochroinae | *Dicerca tenebrosa* | 2 |
| | Cerambycidae | Cerambycinae | *Callidium cicatricosum* | 4 |
| | | | *Phymatodes maculicollis* | 2 |
| | | | *Semanotus litigiosus* | 3 |
| | | Lamiinae | *Pogonocherus parvulus* | 4 |
| | | Lepturinae | *Pachyta lamed* | 15 |
| | | | *Pygoleptura nigrella* | 2 |
| | Curculionidae | Curculioninae | *Dorytomus parvicollis* | 2 |
| | | Scolytinae | *Cryphalus ruficollis* | 13 |
| | | | *Crypturgus borealis* | 8 |
| | | | *Dryocoetes autographus* | 7 |
| | | | *Ips borealis* | 3 |
| | | | *Orthotomicus caelatus* | 10 |
| | | | *Phloeosinus pini* | 7 |
| | | | *Scierus annectans* | 9 |
| | | | *Scolytus piceae* | 8 |
| | Elateridae | Agrypninae | *Danosoma brevicorne* | 7 |
| | | Dendrometrinae | *Corymbitodes lobatus* | 11 |
| | Laemophloeidae | | *Laemophloeus shastanus* | 2 |
| | Latridiidae | Corticariinae | *Melanophthalma helvola* | 4 |
| | Melandryidae | Melandryinae | *Orchesia cultriformis* | 4 |
| | | | *Serropalpus substriatus* | 3 |

*Continued on next page...*

| Order | Family | Subfamily | Scientific Name | Specimen Count |
|---|---|---|---|---|
| | | | *Xylita laevigata* | 3 |
| | Melyridae | Dasytinae | *Hoppingiana hudsonica* | 12 |
| | Monotomidae | Rhizophaginae | *Rhizophagus pseudobrunneus* | 5 |
| | Mordellidae | Mordellinae | *Mordellaria borealis* | 2 |
| | Staphylinidae | Aleocharinae | *Atheta campbelli* | 8 |
| | | | *Placusa tacomae* | 7 |
| | | Staphylininae | *Quedionuchus plagiatus* | 3 |
| | Trogossitidae | Peltinae | *Peltis septentrionalis* | 2 |
| Diplura | Campodeidae | | *Metriocampa allocerca* | 6 |
| Diptera | Tabanidae | Chrysopsinae | *Chrysops frigidus* | 2 |
| Hemiptera | Psyllidae | Psyllinae | *Cacopsylla fibulata* | 6 |
| Hymenoptera | Vespidae | Eumeninae | *Symmorphus cristatus* | 6 |
| Lepidoptera | Hesperiidae | Pyrginae | *Erynnis persius* | 11 |
| | Lycaenidae | Polyommatinae | *Glaucopsyche lygdamus* | 35 |
| | | Theclinae | *Callophrys augustinus* | 8 |
| | Noctuidae | Noctuinae | *Eurois occulta* | 14 |
| | | Plusiinae | *Plusia putnami* | 2 |
| | Tortricidae | Tortricinae | *Clepsis persicana* | 45 |

## Discussion

This is a fairly coarse-grained approach to identifying spruce associated species. Its advantage is speed. A more thoroughly vetted list could be prepared by cross-referencing all 1,421 species in the original interior Alaska download with published natural history information about each species scattered through the scientific literature. Such a process would likely identify spruce associated species absent from Table 1, and might provide enough information to remove some false positives from Table 1. For example, one of the butterflies in Table 1, *Glaucopsyche lygdamus*, is described to prefer habitats that are generally open, meadows, forest clearings, and tundra with legumes (Philip and Ferris 2016). It is in Table 1 because specimens of this species have been collected at two interior Alaska sites, one with a habitat description of boggy black spruce, and the other of airstrip, spruce, birch, aspen. Had the search been expanded to include records of the Kenelm W. Philip (KWP) Lepidoptera collection many more specimens of this species would have been found in interior Alaska, but unfortunately none of them have habitat data (as is true for most of the specimens in the KWP collection). Their geocoordinates could potentially be used to infer the habitat in which they were collected, using a niche-modeling approach, but the majority of their coordinates predate GPS technology and have fairly large errors which limits their value for exploration of such questions. Another false positive is the one psyllid, *Cacopsylla fibulata*, a known *Salix* associate (Hodkinson, 1978). It is in Table 1 because specimens of this species in interior Alaska were collected on the edge of a mixed boreal forest that included spruce (but also *Salix*). I chose to leave these species in Table 1 as examples and warnings of how this approach can generate false positives.

However, all the scolytine weevils in Table 1 are unsurprising and well-known spruce associates, as are most of the beetles. The skipper in Table 1, *Erynnis persius*, seems to actually be at least forest associated, if not strictly spruce, being known from roads, power line cuts, and other open sites in taiga (Philip and Ferris, 2016). This investigation provides an example, and some of the challenges and pitfalls, of how data from both structured, and unstructured sampling, which are typically mixed in natural history museum data, can be queried to answer general, landscape-ecology questions with relevance to climate change.

This list is only a starting point towards an understanding of what appears to be a very distinct community of spruce-associated organisms in interior Alaska. Juday et al. (2015), who were studying white spruce in interior Alaska, stated, "with modest additional warming widespread tree death will be unavoidable on warmer lowland interior sites, where persistence of white spruce is unlikely." As spruce disappear from interior Alaska it is likely that some of the species in Table 1 will as well.

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Alaska Department of Fish and Game's Threatened Endangered and Diversity Program for funding from the State Wildlife Grant and conducting the Olive-sided flycatcher project, which appears to have significantly increased the spruce-associated species represented in the UAM Insect Collection.

## References

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# A second Alaska record for *Polix coloradella* (Walsingham, 1888) (Lepidoptera: Gelechioidea: Oecophoridae), the "Skunk Moth"

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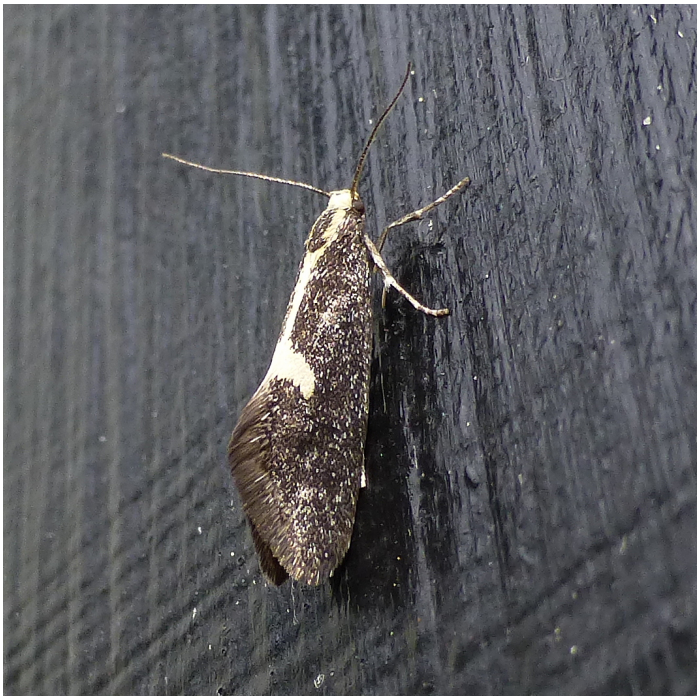

Figure 1: *Polix coloradella* photographed on 3 July, 2013.

On 3 July 2013 I photographed a single individual of the "Skunk Moth," *Polix coloradella* (Walsingham, 1888) on a wall below a backyard incandescent porchlight in Anchorage, Alaska (61° 11′ 10″N, 149° 46′ 07″W, Figure 1). The location is a single-family home in a largely residential area adjacent to a wooded area surrounded by homes (Figure 2). The photograph was submitted to Kenelm Philip for confirmation and distributional information about the species in Alaska. His reply on 23 July, 2013 follows.

> The ALS collection has one specimen of *P. coloradella*, and it's from Camp Denali in Denali National Park. That's over 100 miles from Anchorage just to get to where you can see the mountain, but I have no idea as to its distance as the crow flies. I doubt this is a rare species—so few people collect micros that they are usually far more widespread and common than one would guess from just the few known specimens.

The distance from Camp Denali to the Anchorage *P. coloradella* record is approximately 162 miles and roughly due south (Figure 3). This record appears to be only the second report for Alaska based on the information provided by Ken Philip from the Alaska Lepidoptera Survey and the two moth checklists, which reported the same single Camp Denali record (Ferris et al., 2012; Pohl et al., 2018). There are also no Alaska records of *P. coloradella* in iNaturalist, BugGuide, or Butterflies and Moths of North America. A single Alaska record of *P. coloradella* is listed in GBIF and reflects a moth collected in 1970 described below. Based on these databases, information provided by G. Pohl (p. comm. 15 Feb, 2019) and Scholtens and Wagner (2007), *P. coloradella* is widespread across northern North America

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