

Historical records of the digger wasps, *Astata* Latreille 1796 (Hymenoptera: Crabronidae: Astatinae), from the United States and Canada in the Oregon State Arthropod Collection.

David M. Lowenstein¹
Heather Andrews¹
Erica Rudolph¹
Nik G. Wiman¹
Christopher J. Marshall^{2*}

¹Department of Horticulture, Oregon State University, North Willamette Research and Extension Center, Aurora, OR

²Department of Integrative Biology, Oregon State University, Corvallis, OR

Abstract:

A dataset of 345 observational records is presented for the genus *Astata* (Hymenoptera: Crabronidae: Astatinae) based on 329 museum specimens and 16 photo vouchers. Summary information for the Pacific Northwest records is provided, including the species present, seasonality and county records for Oregon.

Keywords: BMSB, conservation, natural history museum

Cite this work, including the attached dataset, as:

Lowenstein, D. M., H. Andrews, E. Rudolph, N.G. Wiman & C. J. Marshall. 2018. Historical records of the digger wasps, *Astata* Latreille 1796 (Hymenoptera: Crabronidae: Astatinae), from the United States and Canada in the Oregon State Arthropod Collection, OSU, Corvallis, OR. Catalog: Oregon State Arthropod Collection 2(1) p.1-9. DOI: http://dx.doi.org/10.5399/osu/cat_osac.2.1.4321

Introduction:

Astata are small to moderate sized, solitary digger wasps that are reported to prey on hemipterans, especially members of the family Pentatomidae. Members of the genus are found throughout the world with the exception of Australia (Bohart and Menke 1976; Evans 1962). The last revisionary work on new world species was by Parker (1962; 1964), however literature on the new world fauna has been compiled as part of Pulawski's extensive online checklist (2017).

Recent interest in historical records of *Astata* spp in Oregon and Washington by researchers studying biocontrol of *Halyomorpha halys* Stål 1855, the brown marmorated stink bug (Lowenstein et al. 2018), revealed that few authoritatively identified and vouchered specimen records were readily available for the genus. At the time of this paper, only 61 records for 7 species were available through Global Biodiversity Information Facility (Gess and Ranwashe 2017; Gross and Oboyski 2017; Needham 2017). Of these, only a single species, *Astata nubecula* Krombein 1952, is reported from Oregon and Washington based on but 5 specimens (4 from Oregon and 1 from Washington). The majority of the existing PNW records are of specimens taken in Canada's British Columbia, mostly from the southern Interior Mountains on the border with Washington, which likely represent recent surveys by Ratzlaff (2015). Photographically vouchered observations of *Astata* spp. in the Pacific Northwest can also be found online, although none are reliably identifiable to species (see photo vouchers below).

OSAC material

The OSAC has a substantial sphecoid wasp collection due in large part to the research and collecting efforts of Herman A. Scullen and George Ferguson. The Astatinae consist of several drawers-worth of material from throughout the world. This paper presents records for the species known from the United States and Canada, although records from outside of this area (e.g., Mexico) were included if the the species was reported within the US and Canada. Parker included these specimen in his published accounts of the distributional range for each species (Parker 1962), but only describes the distributions generally and does not provide maps, precise label data, collecting date information or any associated information.

Ten species are currently reported from the Pacific Northwest, 8 of which are represented by historical material in the OSAC (Table 1). In total, label data for 316 specimens was transcribed, 187 of which correspond to localities within the Pacific Northwest (Oregon, Washington, western Canada as well as portions of northern California and western Idaho). Label data for *A. bicolor* and *A. mexicana* are included in the attached dataset, but contain no material collected from the Pacific Northwest.

The specimens in the OSAC were identified by F. D. Parker as part of his revisionary work (Parker 1962; 1964) and are thus considered authoritatively determined. These new records will be archived in association with this publication and shared via an IPT server.

Table 1. Specimen records in OSAC and GBIF; (number of observations “PNW : OR : WA”)

	OSAC records	Online PNW records
<i>A. bakeri</i> Parker 1962	43:40:2	8:0:0
<i>A. bicolor</i> Parker 1962	[none]	reported in BC: Ratzlaff 2016(2015))
<i>A. bechteli</i> Parker 1962	12:12:0	[none]
<i>A. leuthstromi</i> Ashmead 1897	21:3:1	6:0:0
<i>A. mexicana</i> Cresson 1881	[none]	4:0:0
<i>A. nevadica</i> Cresson 1881	3:2:1	2:0:0
<i>A. nubecula</i> Cresson 1865	64:48:14	26:4:1
<i>A. occidentalis</i> Cresson 1881	16:12:1	8:0:0
<i>A. unicolor</i> Say 1824	46:45:1	reported in BC: Ratzlaff 2016(2015))
<i>A. williamsi</i> Parker 1962	1:1:0	[none]

Oregon county records (Table 2): Most counties in Oregon are poorly sampled for insects in general, especially those that are east of the Cascade Mountains. These Oregon county records can be used as historical baseline data, but because sampling effort is certainly biased, they should be used with caution in determining the actual ranges of a particular species in the state, especially given the age of the specimens (see below).

Sampling years: Historical material covered a timespan of 75 years from 1898 (earliest confirmed specimen) to 1973 (latest). Several specimens collected by Orson Bennet Johnson of the University of Washington in Seattle (indicated by ‘OBJ’ labels on specimens), are likely from the 1890’s or earlier, but typically lack explicit dates. The mean year was 1946, with half of the records from 1942 or earlier.

Table 2. Oregon county records of *Astata* with voucher specimens in the OSAC

	<i>bakeri</i>	<i>bechteli</i>	<i>leuthstromi</i>	<i>nevadica</i>	<i>nubecula</i>	<i>occidentalis</i>	<i>unicolor</i>	<i>williamsi</i>
Benton	x				x	x	x	
Coos	x							
Curry					x			
Deschutes				x				
Harney	x		x	x				
Hood River		x						
Klamath	x				x	x	x	
Lake					x			
Lane					x			
Linn					x		x	
Malheur	x		x				x	
Marion	x				x			
Morrow						x		
Multnomah							x	
Polk					x		x	x
Sherman	x	x	x			x		
Union	x					x		
Walla					x			
Washington	x	x	x		x		x	

Seasonality: Seasonality estimates based on label data can be influenced greatly by sampling bias, both in terms of effort as well as geographic, latitudinal and elevational confounding factors. Still, label records can provide a rough estimate of when a species is active in the environment. The earliest and latest season records for PNW records in this dataset are presented in Table 3, along with a average date with standard deviation (in days).

Table 3. Capture dates for PNW records of *Astata* wasps the OSAC

	Earliest/Latest record	Mean (SD; #PNW records)
<i>bakeri</i>	June 5th – Sept 13th	July 13th (29 days) n=43
<i>bechteli</i>	June 10th – July 8th	June 25nd (8 days) n=12
<i>leuthstromi</i>	June 29th – Sept 9th	Jul 21 (19 days; n=21)
<i>nevadica</i>	Aug 8th – Aug 14th	Aug 10th (3 days) n=3
<i>nubecula</i>	June 18th – Sept 27th	July 31st (21 days) n=59
<i>occidentalis</i>	June 12th – Aug 17th	Aug 8th (11 days) n=16
<i>unicolor</i>	June 3rd – Aug 30th	July 20th (16 days) n=25
<i>williamsi</i>	July 27th	N/A (n=1)

Plant associations: Numerous specimen labels indicate that *Astata* have often been captured while on flowers, particularly Queen Anne’s Lace (*Daucus carota*), which was by far the most common association across species and in terms of specimen records.

The plant–wasp associations of US and Canadian *Astata* specimen from OSAC:

Urtica dioica holoserica (Hoary Nettle): *A. bakeri*
Daucus carota (Wild carrot/Queen Anne’s Lace):
A. bakeri, *A. leuthstromi*, *A. occidentalis* & *A. nubecula*
Cicuta douglasii (Water hemlock): *A. leuthstromi*
Chrysothamnus nauseosus (Rabbit brush): *A. occidentalis*, *A. bechteli*
Chrysothamnus sp.: *A. bakeri*
Asclepias sp. (milkweed): *A. nubecula*, *A. occidentalis*
Cleome serrulata (bee spider-flower): *A. occidentalis*, *A. unicolor*
yellow composite: *A. bakeri*

Photographic Vouchers: In addition to specimen-vouchered observations, there exist PNW records of *Astata* available in the form of digital photographs (see: References: Photo Vouchers). These records have been added to the attached dataset, identified as *Astata* sp. While they are perhaps limited in their capacity to be identified to species, they are useful in serving to document the presence of the genus at particular localities. Lacking actual specimens, the photographs themselves serve as the only voucher. Copyright regulations prohibit the inclusion of these photos without permission of the original photographers. The photographs included here (Figures 1–7) are used with permission of the authors.

Specimen record metadata

Data standards: All label data is consistent with Darwincore standards for occurrence data (<http://rs.tdwg.org/dwc/terms/Occurrence>). *Taxonomic treatment:* Names used in this dataset correspond to those proposed in the revision by Parker (1962). *Locality and georeference data.* Locality data was transcribed into the DublinCore location fields (<http://purl.org/dc/terms/Location>). Namely: country, stateProvince, county and locality. Missing information (e.g., no county printed on actual specimen label) was added to a record if it could be determined without ambiguity based on gazetteers, maps or in reference to other label data. Elevational data on labels were converted to minimumDistanceAboveSurfaceInMeters. Elevational ranges (e.g, 500-1200m) were recorded as the lower of the two. When available, decimalLatitude and decimalLongitude were included, but not all records were georeferenced at this time.



Figure 1. *Astata* sp. male. USA. Idaho. Latah Co. Moscow. 12.VIII.2016 © 2016 Steve Wells. (Wells, 2016). Used with permission.



Figure 2. *Astata* sp. Canada. BC. Nanaimo. Nanaimo Lakes Rd. 21 VI 2015. © 2015 Jeremy Gatten (Gatten, 2015). Used with permission.



Figure 3. *Astata* sp. USA. Washington. Pend Oreille Co., Hook Nose Mountain viewpoint, Route 31 © 2017 Victor L Berthelsdorf (Berthelsdorf 2017). Used with permission.



Figure 4. *Astata* sp. male. USA. Oregon. Douglas Co. Umpqua Nat. For., Soda Springs Flume. 11.VIII.2017 © 2017 Dale and Elva Paulson (Paulson and Paulson 2017). Used with permission.



Figure 5. *Astata* sp. male. Canada, BC. Vancouver Is. Port Alberni, Somass Estuary. 22.VIII.2009. © 2014 Libby & Rick Avis (Avis & Avis, 2014). Used with permission.

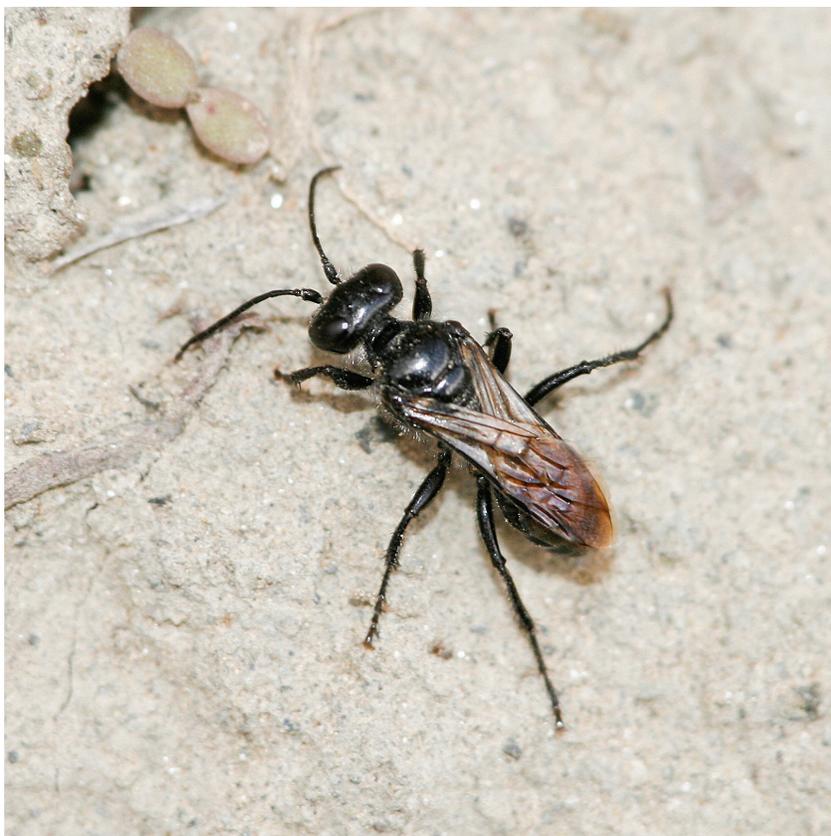


Figure 6. *Astata* sp. female. Canada. BC. Cariboo Region. Horsefly River. 10.X.2010. On mud bank near river. © 2010 Libby & Rick Avis (Avis & Avis, 2010). Used with permission.



Figure 7. *Astata* sp. male. USA. Washington, King Co., Tukwila, 14.VIII.2011. © 2011 Clay Kemper (Kemper, 2008). Used with permission.

References:

- Bohart RM, Menke AS (1976) *Specid Wasps of the World: A Generic Revision*. University of California Press, Berkeley, California.
- Evans HE (1962) Further notes on the ethology of *Astata* (Hymenoptera: Sphecidae). *Journal of the New York Entomological Society* 70: 30-32
- Gess DS, Ranwashe F (2017) AM: Terrestrial Insect Collections (1896-2000). Version 1.5. South African National Biodiversity Institute. Occurrence Dataset accessed via GBIF.org on 2017-12-05.
doi: <https://doi.org/10.15468/nlkj0p>
- Gross J, Oboyski P (2017) Essig Museum of Entomology. In: Museums. BNH (Ed). 121.18 ed. Occurrence Dataset accessed via GBIF.org on 2017-12-01, pp. doi: <https://doi.org/10.15468/0saucj>
- Lowenstein DM, Andrews H, Rudolph E, Sullivan E, Marshall CJ, Winman NG (2018) *Astata unicolor* (Hymenoptera: Crabronidae) population in Oregon with observation of predatory behavior on Pentatomidae. *Annals of the Entomological Society of America*. *Annals of the Entomological Society of America*. 111: 122-126.
<https://doi.org/10.1093/aesa/say010>
- Needham K (2017) University of British Columbia - Spencer Entomological Collection (UBCZ). In: Columbia UoB (Ed). 13.4 ed. Occurrence Dataset accessed via GBIF.org on 2017-12-01.
doi: <https://doi.org/10.5886/r5d29ft9>
- Parker FD (1962) On the subfamily Astatinae, with a systematic study of the genus *Astata* of America North of Mexico (Hymenoptera: Sphecidae). *Annals of the Entomological Society of America* 55: 643-659
- Parker FD (1964) On the subfamily Astatinae, part II. A review of the genus *Astata* from Mexico and Central America. *Annals of the Entomological Society of America* 57: 552-559
- Pulawski WJ (2017) Catalog of Sphecidae: Family Group Names and Classification. [accessed 30 November 2017]
<https://www.calacademy.org/scientists/projects/catalog-of-sphecidae>
- Ratzlaff CG (2015) Checklist of the sphecoform wasps (Hymenoptera: Crabronidae & Sphecidae) of British Columbia. *Journal of the Entomological Society of British Columbia* 112: 19-46

Photo Vouchers:

- “edmonds” (2014) *Astata* sp. Photo # 962286. <https://bugguide.net/node/view/962286> [accessed 12.II.2018].
- “ImaPaqRat” (2012) *Astata* sp. Photo #684148. <https://bugguide.net/node/view/684148> [accessed 12.II.2018].
- Asche M (2014) *Astata* sp. Photo #982869. <https://bugguide.net/node/view/982869> [accessed 12.II.2018].
- Avis L, Avis R (2010) *Astata* sp. Photo #480147. <https://bugguide.net/node/view/480147> [accessed 12.II.2018].
- Avis L, Avis R (2014) *Astata* sp. Photo #1025459. <https://bugguide.net/node/view/1025459> [accessed 12.II.2018].
- Bearup M (2012) *Astata* sp. Photo #564921. <https://bugguide.net/node/view/564921> [accessed 12.II.2018].
- Berthelsdorf VL (2017) *Astata* sp. Photo # 1414771. <https://bugguide.net/node/view/1414771> [accessed 12.II.2018].
- Gatten J (2015) *Astata* sp. Photo # 1088487. <https://bugguide.net/node/view/1088487> [accessed 12.II.2018].
- Huntley-Franck P (2016) *Astata* sp. Photo #222929. <https://bugguide.net/node/view/222929> [accessed 12.II.2018].
- Iris (2017) *Astata* sp. Photo #1411507. <https://bugguide.net/node/view/1411507> [accessed 12.II.2018].
- Kemper C (2008) *Astata* sp. Photo #564600. <https://bugguide.net/node/view/564600> [accessed 12.II.2018].
- Paulson E, Paulson D (2017) *Astata* sp. Photo # 1431275. <https://bugguide.net/node/view/1431275> [accessed 12.II.2018].
- Sullivan E (2015a) *Astata* sp. Photo #1108677. <https://bugguide.net/node/view/1108677> [accessed 12.II.2018].
- Sullivan E (2015b) *Astata* sp. Photo # 1108681. <https://bugguide.net/node/view/1108681> [accessed 12.II.2018].
- Volkman K (2008) *Astata* sp. Photo # 207977. <https://bugguide.net/node/view/207977> [accessed 12.II.2018].
- Wells S (2016) *Astata* sp. Photo # 128816. <https://bugguide.net/node/view/128816> [accessed 12.II.2018].