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Spiders (Araneae) and araneology in British Columbia

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" . . . spiders are ruthless storm troops in the matriarchal anarchy that is the arthropod world: theirs is the most diverse, female-dominated, entirely predatory order on the face of the earth. As such, spiders are key components of all ecosystems in which they live."

Bennett 1999

THE SPIDERS . . .

In large part because of its cool temperate climate and the significant amount of Pleistocene time much of it spent under a series of transcontinental ice cubes, Canada is sadly lacking in arachnid diversity. Although six of the dozen or so orders of extant arachnids are represented in the national fauna, only two (Acari, mites and ticks; and Araneae, spiders) are significantly diverse in Canada and these contain only a small proportion of the world acarine and spider species.

Canada contains 1,400-1,500 members of the world's described fauna of nearly 40,000 spider species (Bennett 1999). With its tremendous range of biogeographical diversity, British Columbia (BC) provides habitat for nearly half of these – over 650 spider species are known to occur here (Table 1) and many are found nowhere else in Canada.

Canada has representatives of both mygalomorph (tarantulas and their kin) and araneomorph ("true") spiders. Mygalomorphs are most diverse in the subtropics and tropics; few are found in northern hemisphere cool temperate climates and always as northern populations of species more widespread to the south. Three of the four mygalomorph families occurring in Canada are restricted to BC. A tiny funnel-web weaving diplurid is known from a single locality near Creston. One small sheet-web weaving mecicobothriid occurs in disjunct populations in remnant old Vancouver Island wet forests. Two large antrodiaetid trapdoor spiders occur in BC: one is common in a wide range of coastal habitats from old, wet forest to dry Garry oak meadows and suburban lawns and gardens; the other is uncommonly encountered in the dry southern interior valleys.

Similarly, haplogyne ("primitive") araneomorphs are much more diverse and common south of Canada. Of five families with Canadian species, two (telemids and segestriids) and most of a third (pholcids) are found only in BC. The other Canadian haplogynes are cosmopolitan synanthropes. A single, tiny telemid is rarely encountered but likely locally abundant in deep litter in old forests. Extreme south-western BC is home to Canada's single tube-web weaving segestriid. Two swift, small and cryptic pholcids are uncommonly encountered on the undersurface of rocks and other objects (often in apparent association with *Latrodectus* widow spiders) in the hottest, driest parts of southern BC. A third pholcid, the common and familiar "daddy-long-legs" cellar spider is found in older homes throughout much of Canada. One feisty synanthropic dysderid makes meals of isopods in yards and basements across southern Canada.

The world araneofauna (especially in the Holarctic) is dominated by entelegyne ("higher") araneomorphs. Among BC's 643 known entelegynes, the crab-like philodromids and thomisids, orb-web weaving araneids, cob-web weaving theridiids, and active and

highly visually orienting salticid jumping spiders and lycosid wolf spiders are familiar to most people with basic knowledge of natural history.

Table 1
Classification of spider families with Canadian and British Columbia representatives (modified from Bennett 1999).

	Approx. no. of species in Canada	No. of known species in BC
ORDER ARANEAE		
Suborder Opisthothelae		
Infraorder Mygalomorphae		
Fornicephalae		
Atypidae	1	0
Antrodiaetidae	2	2
Tuberculotae		
Mecicobothriidae	1	1
Dipluridae	1	1
Infraorder Araneomorphae		
Neocribellatae		
Araneoclada		
Haplogynae		
"Scytodoidea"		
Scytodidae	1	0
Telemidae	1	1
Pholcidae	3	3
Dysderoidea		
Segestriidae	1	1
Dysderidae	1	1
Entelegynae		
Palpimanoidea		
Mimetidae	6	2
Eresoidea		
Oecobiidae	1	0
"RTA Clade"		
Lycosoidea		
Lycosidae	110	47
Pisauridae	7	1
Oxyopidae	2	1
Dictynoidea		
Dictynidae	75-80	29
Cybaeidae	12	11
Hahniidae	16	15
Dionycha		
Anyphaenidae	7	2
Liocranidae	18	5

	Clubionidae	35	15
	Corinnidae	11	5
	Gnaphosidae	100	49
	Zoridae	1	1
	Philodromidae	47	33
	Thomisidae	68	32
	Salticidae	110	43
	Amaurobioidea		
	Amaurobiidae	30	10
	Titanoecidae	4	2
	Agelenidae	11	9
Orbiculariae			
	Deinopoidea		
	Uloboridae	3	1
	Araneoidea		
	Nesticidae	2	1
	Theridiidae	100	51
	Theridiosomatidae	1	0
	Mysmenidae	1	1
	Pimoidae	2	2
	Linyphiidae	>500	230
	Tetragnathidae	23	12
	Araneidae	74	33
TOTAL		~ 1,400	653

Uncommon in Canada, palpimanoids are represented in BC by two species of araneophagic mimetids found in the south. All other BC entelegynes are either orbicularians (orb-weavers and their kin) or members of the "RTA clade" (spiders with a distinctive process on the male pedipalpal tibia).

RTA clade diversity in Canada is dominated by dionychan (two-tarsal-clawed spiders) and lycosoid (true wolf spiders and their relatives) hunters. The other RTA groups (dictynoids and amaurobioids) are reasonably diverse web weavers but tend to be overlooked because members are mostly cryptic, litter inhabitants and many are tiny (except for a small number of amaurobiids and some synanthropic, introduced agelenids).

Lycosid wolf spiders often are the most abundant (but not necessarily most diverse) ground dwelling predators in any open habitat from forest openings and coastal shorelines to bogs and alpine meadows. Pitfall traps may be inundated, often by a single species. A good sign of spring is the first appearance of myriad small, dark *Pardosa* spiders in meadows as soon as the snow disappears. Nearly half of Canada's lycosid species have been found in BC. Of Canada's seven known pisaurids (nursery-web or fishing spiders), only one is found west of the Rockies. This is BC's loss – two eastern pisaurids are Canada's largest spiders and contribute greatly to the excitement of shoreline life east of the Rockies. One of Canada's two oxyopid lynx spiders is common in some agroecosystems and similar open habitat in southern BC.

Nearly half of Canada's approximately 400 species of dionychans occur in BC. Gnaphosid ground spiders, philodromid and thomisid crab spiders, and salticid jumping spiders predominate with a combined total of well over 150 species in the province. Gnaphosids are common ground dwelling hunters. Generally nocturnal and cryptic, gnaphosids are infrequently encountered by general collectors but may be as abundant as

lycosids in many habitats. A few are well-known synanthropes. In contrast, salticids are often conspicuously coloured and diurnal. Although difficult and confusing taxonomically, they are well known by the general public and regularly serve as photogenic subjects of natural history essays. Thomisid and philodromid crab spiders are sit-and-wait, generally cryptic, diurnal hunters. Thomisids are rather bristly, slow moving, ground dwelling and very crab-like; philodromids are faster, hairier, less crab-like and mostly encountered above the ground layer.

The remaining dionychans form a diverse assemblage of primarily nocturnal hunters occupying a variety of habitats. Clubionids and anyphaenids are active on foliage while corinnids and liocranids are ground dwellers. Some corinnids and liocranids are ant mimics. Restricted to BC in Canada, Zoridae is a recent addition to our fauna. One species of these relatively small, ground dwelling, lycosid-like spiders has expanded its range northward into southern Vancouver Island and the south Okanagan Valley.

Most of Canada's dictynoids (dictynids, cybaeids, and hahniids) and amaurobioids (amaurobiids, titanoecids, and agelenids) weave more or less reduced sheet webs. Nearly all cybaeids are restricted to BC in Canada. All cybaeids are forest floor litter inhabitants and some are dominant but infrequently collected species where they occur. (It is interesting to note that few cybaeids are found in eastern Nearctic forests. Coelotine amaurobiids dominate cybaeid-type habitats there but are absent from western Nearctic forests.) Half of Canada's hahniids are restricted to BC. Like cybaeids, hahniids are generally small, cryptic litter inhabitants and often abundant but infrequently collected. Dictynidae is a large group of small to tiny, often exceedingly difficult to identify spiders. Many are arboreal and produce distinctive cribellate silk; their small, "hackled" webs may be abundant among conifer branch tips. Ecribellate dictynids are primarily litter inhabitants and, not surprisingly, often abundant but overlooked.

Canada is home to a range of cribellate and ecribellate amaurobiids; a third of these (all cribellate) occur in BC. Four are found nowhere else in Canada. Most amaurobiids are forest floor spiders. A couple of beefy *Callobius* species are common under bark or in bark crevices of coastal BC conifers; the exceedingly small and rare members of the genus *Zanomys* may be ground dwelling rodent associates. Agelenids construct large, distinctive, sheet-like funnel webs in a variety of habitats. In Canada, most species are widespread and often abundant. Three closely related introduced agelenids are well known BC synanthropes: one (*Tegenaria domestica*) is cosmopolitan, another (*T. duellica*) rivals the eastern pisaurids as Canada's largest spider and is very abundant around buildings, disturbed areas, and beaches in south western BC; the third (*T. agrestis*, the undeservedly infamous "hobo spider") is rare but locally abundant at various sites in southern BC. Canadian titanoecids are a small group of wide ranging, nondescript, small forest floor species. Half occur in BC.

The remaining BC spiders (fully half the known fauna) are orbicularians. Uloborids spin cribellate, radial sector webs and are uncommon in southern Canada. One species has been found in BC. Nesticids are cryptic, rare, often troglobitic "comb-footed" cobweb weavers. One of Canada's two species is restricted to southern Vancouver Island, the other is a European introduction in eastern provinces. Mysmenids are minute, rarely encountered deep litter inhabitants and troglobites. Canada's single mysmenid appears restricted to southern Vancouver Island. In Canada, the long spiny-legged pimoids also are restricted to BC. Two species hang underneath tangled sheet webs in relatively dark, humid places in southern BC: one is common on the south coast, the other is rare in the southern interior. The remaining orbicularians are widespread and much more diverse.

About half of Canada's nearly 100 species of orb-web weaving araneids (garden spiders) and tetragnathids (long-jawed orb weavers) are found in BC. Spinners of the

radially symmetrical sticky webs familiar to most people around the world, individuals of certain species may be very abundant in fields or around homes. Theridiids are the quintessential cobweb-weavers. Over half of Canada's 100 theridiid species are found in BC in a wide variety of habitats. Black widow (*Latrodectus* sp.), false black widow (*Steatoda* spp.), and brown house (*Achaearanea* spp.) spiders are familiar to most British Columbians. Individuals of the latter two genera are common in and on homes throughout the province. Black widows are locally abundant in some areas of southern BC. The most interesting theridiids often are small, inconspicuous soil and deep litter inhabitants. Linyphiid species and individuals dominate the northern hemisphere, especially the Holarctic region. Over a third of Canada's araneofauna are linyphiids. At least 230 species are known to occur in BC. Linyphiids may be exceedingly abundant in certain habitats, especially meadows and old fields. Most are tiny to minute and famously difficult to identify.

For more detailed information on Canadian and Nearctic spiders, see Roth (1993) and Bennett (1999) and references therein.

. . . AND THE STUDY OF THEM . . .

Figure 1. Bert Turnbull, a pioneer of spider ecology in Canada, was a long-time faculty member of Simon Fraser University and is now in retirement in the Vancouver area.

Given that nearly half the total number of spider species known to occur in Canada are found in (and often only in) British Columbia (Table 1) and the obvious importance of spiders to all terrestrial and many aquatic ecosystems, one wonders why such fascinating creatures have received little scientific attention in the province. No professional arachnologist is employed anywhere in Canada currently and, in BC, few researchers have

ever seriously considered spiders or other arachnids. In BC, araneology has largely been the realm of a few dedicated amateur natural historians.

A notable exception to this is A.L. Turnbull (Fig. 1). A pioneer of ecology in Canada, Turnbull's scientific career spanned most of the latter half of the 20th Century. His professional interest in spiders was sparked by mid-century encounters with "vast numbers of spiders" during spruce budworm (*Choristoneura* sp., Tortricidae) work in the vicinity of Lillooet, BC. He subsequently studied spider ecology as an Oxford graduate student and learned the arcane art of spider taxonomy at the American Museum of Natural History under Willis Gertsch, one of the granddaddies of modern arachnology. Turnbull's interests in spider ecology and taxonomy were honed during a stint at the federal lab in Belleville, Ontario. There C.D. Dondale, who went on to become Canada's premier professional arachnologist, eventually joined him. Turnbull returned to BC in the late 1960s to join the faculty of the nascent Simon Fraser University. During his tenure there he published his landmark summary review of spider ecology (Turnbull 1973). Following his retirement in 1982, failing eyesight has kept him from contributing further to araneology.

The difficulties and drawbacks of spider ecological studies noted by Turnbull (1973) are still relevant today: ecologists necessarily are reliant upon sound taxonomy; the work of taxonomists and systematists is often excellent but much taxonomy is deplorably produced and presented (where are the taxonomy police when we need them?); taxonomic studies should be undertaken at inclusive supraspecific levels; assessing species distributions is relatively simple but quantifying populations and communities and drawing meaningful ecological conclusions are exceedingly difficult to do well; spider ecology papers often are of questionable merit and; authors tend (understandably) to overlook relevant papers not published in their native language. Ecologists and taxonomists will do well to keep Turnbull's observations in mind.

In recent years at least one student at each of the Universities of Victoria, British Columbia, and Northern British Columbia and Simon Fraser University have worked on some aspect of local spider diversity or the ecology of single species. However, most of this work is unpublished and all the students have gone on to other things.

Most published knowledge on BC spiders, other than species descriptions, is in the form of faunal lists (Thorn 1967; West *et al.* 1984, 1988; Blades and Maier 1996). Much of the raw data for these came from the undirected efforts of a small number of amateur collectors working in only a few areas of BC. Thus, the spider fauna of large areas of BC remains unknown.

Two early spider collectors in BC were English expatriates Reverend John H. Keen and Marianne Hippesley-Clark. Better known as beetle collectors, both made important spider collections. Around the end of the 19th Century, as an Anglican missionary Keen collected in the vicinity of Massett and Metlakatla on the north coast of BC. His spiders apparently went to Nathan Banks. Subsequently, J.H. Emerton described several new species from these specimens including at least one, *Diplostyla keeni*, named in Keen's honour. Hippesley spent much of her life near Terrace. A challenge for spider collectors is to come up with new specimens of some of the tiny linyphiids unseen since collected by her.

George and Elizabeth Peckham collected BC jumping spiders late in the 19th Century. Emerton made at least one foray into the colonial wilds of BC, apparently making it as far west as the Yoho area. The famous duo of Ralph Chamberlin and Wilton Ivie collected in various areas of BC in the 1930s and described a number of new species from BC material. In later years, other well known arachnologists such as Takasuma Kurata, Boris Malkin and, most recently, C.D. Dondale made important collections of BC spiders.

A relatively small, good collection of about 4,400 vials of identified BC spiders is maintained at the Royal BC Museum. A large proportion of these specimens were amassed by S.L. Neave from the Kyuquot region of Vancouver Island and donated to the Museum in the late 1950s. The Museum collection has been considerably augmented by specimens collected from various BC localities by Rick West (primarily in the 1980s) or during studies conducted or directed by Dave Blades or Neville Winchester (1990s). The Universities of Victoria and British Columbia possess smaller collections. Geoff Scudder and some of his students have collected substantial numbers of spiders from the south Okanagan and south coastal BC. Robb Bennett, Don Buckle, Walter Charles, Robert Holmberg, Lee Humble, Douglas Knight, Robin Leech, Jeff Lemieux, Malcolm Martin, and others also have produced significant collections of BC spiders.

These collection efforts resulted in the publication of a series of BC provincial spider checklists. Thorn (1967) compiled the first comprehensive list of 212 species from Royal BC Museum holdings. These represented a relatively small number of collection localities, dominated by Kyuquot (Neave) and Masset/Metlakatla (Keen) records. Subsequently, efforts led by Rick West boosted the number of known BC spiders to 433 (West *et al.* 1984) and then 570 (West *et al.* 1988). Recent large collections by Winchester and others increased the list to 653 (Bennett *et al.* unpublished data) by the time of this writing. Apparently only one BC regional list has been produced: Blades and Maier (1996) listed spiders and other arachnids collected in their general survey of south Okanagan arthropods.

Large areas and many specific habitats of BC remain uncollected and no doubt many list additions are still to come, especially from northern areas and the deep south of BC. No effort has been made to produce a comprehensive, habitat-specific spider inventory for any area in BC. That new records can be made with relative ease is suggested by the following examples: hundreds of specimens of a gnaphosid previously only known from a couple of Washington specimens turned up in a simple pitfall study in Burnaby (see cover of Journal of the Entomological Society of BC, Vol. 96, 1999), the first specimen of a new family record for Canada came from the carpet of a provincial government office (Bennett and Brumwell 1996), and a new species record for BC came from the bathtub of an Osoyoos motel (Bennett unpublished data) in 2001.

Araneology in Canada at the start of the 21st Century is in a dismal state. Advancement of our knowledge of spiders depends upon the uncoordinated work of amateurs and occasional students provincially and, since the retirement of C.D. Dondale, nationally. Ecologists seeking expert identification of their data points depend upon the volunteer services of a small number of qualified amateurs – the majority of people with arachnid expertise in North America receive little or no payment for application of their knowledge (Coddington *et al.* 1990). This may change with growing interest in biodiversity, non-vertebrate endangered species, and habitat protection and restoration in Canada. But I'm not holding my breath.

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REFERENCES

Bennett, R.G. 1999. Canadian spider diversity and systematics. Newsletter of the Biological Survey of Canada (Terrestrial Arthropods) 18 (1): 16-27.

Bennett, R.G. and L. Brumwell. 1996. *Zora hespera* in British Columbia: a new spider family record for Canada (Araneae, Zoridae). Journal of the Entomological Society of British Columbia 93: 105-109.

Blades, D. C. A. and C. W. Maier. 1996. A survey of grassland and montane arthropods collected in the southern Okanagan region of British Columbia. Journal of the Entomological Society of British Columbia 93: 49-74.

Coddington, J.A., S.F. Larcher and J.C. Cokendolpher. 1990. The systematic status of Arachnida, exclusive of Acari, in North America north of Mexico (Arachnida: Amblypygi, Araneae, Opiliones, Palpigradi, Pseudoscorpiones, Ricinulei, Schizomida, Scorpiones, Solifugae, Uropygi). Pp. 5-20 In: M. Kosztarab and C.W. Schaefer (Eds.), Systematics of the North American Insects and Arachnids: Status and Needs. Virginia Agricultural Experiment Station Information Series 90-1. Blacksburg.

Roth, V.D. 1993. Spider Genera of North America, with Keys to Families and Genera, and a Guide to Literature, 3rd ed. American Arachnological Society, Gainesville, 203 pp.

Thorn, E. 1967. Preliminary distributional list of the spiders of British Columbia. Report of the Provincial Museum of Natural History and Anthropology of British Columbia. 17 pp.

Turnbull, A.L. 1973. Ecology of the true spiders (Araneomorphae). Annual Review of Entomology 18: 305-348.

West, R., C.D. Dondale and R.A. Ring. 1984. A revised checklist of the spiders (Araneae) of British Columbia. Journal of the Entomological Society of British Columbia 81: 80-98.

West, R., C.D. Dondale and R.A. Ring. 1988. Additions to the revised checklist of the spiders (Araneae) of British Columbia. Journal of the Entomological Society of British Columbia 85: 77-86.