LACEWINGS(INSECTA:NEUROPTERA) OFTHECOLUMBIARIVERBASIN

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Taxonomy'

As defined for most of this century, the Order Neuroptera included three suborders: Megaloptera Raphidioptera (= Raphidioidea) and Planipennia. Within the last few years each of the suborders has been given ordinal rank due to a reconsideration of insect classification based on cladistic or phylogenetic analyses. This has given rise to the Orders Megaloptera, Raphidioptera and Neuroptera *sensu stricto* (s.s., = in the narrow sense), as opposed to the Neuroptera *sensu Iato* (s.l., = in the broad sense) as defined above. In this more recent classification Neuroptera s.s. = Planipennia, and the three currently recognized orders are grouped as the Neuropterida (Table 1).

The Neuropterida include approximately 2 1 families and 4500 species in the world (Aspöck, et al. 1980). Of these, 15 families and about 370 species occur in America north of Mexico (Penny et al., in prep.). The fauna of the Columbia River Basin is currently known to include 13 families and approximately 33 genera and 92 species (Table 2). These numbers are likely to change because the regional fauna is not extensively studied. There are approximately 20 species of Neuroptera that occur in adjacent regions that are likely to occur in the Columbia River Basin. Some species almost certainly remain to be discovered, like the recently described *Chrysopiella brevisetosa* (Adams and Garland 198 1) and *the unnamed Lomamyia* sp. These species were recognized on traditional anatomical bases. Newer techniques may reveal additional taxa, e.g. *Chrysoperla adamsi* and *C. johnsoni,* recognized on the basis of courtship behavior differences (Henry, Wells and Pupedis 1993). It is likely that most additions to the regional fauna will be uncommon, some may be rare or highly localized, as both traits increase the probability of the species being overlooked.

Biology

Most Neuropterida are predaceous as larvae (New 1986). The only known exceptions are the Ithonidae, which do not occur in the Columbia River Basin. However, the larvae and biology of *Polystoechotes punctulatus* are unknown, and it is a primitive neuropteran, related to the Ithonidae, thus it too could be a root-feeder.

Among the predaceous Neuropterida there are three general patterns that are specific to the three orders, plus specialized behaviors among the Neuroptera s.s. The Megaloptera larvae are aquatic, chewing predators. They consume mainly arthropods. The adults are relatively short-lived, non-feeding and usually remain near the larval habitat (Davis 1903, Ross 1937, Merritt & Cummins 1978). Raphidioptera larvae are terrestrial, chewing predators that occur under loose bark in litter, under rocks, etc. The feed mostly on other small, slow-moving arthropods. The adults are not strong fliers, thus they remain near their site of eclosion and consume prey similar to that taken by the larvae (Aspöck, et al. 1991, Carpenter 1936).

Among the Neuroptera, the larvae are suctorial feeders, ingesting liquid (or liquefied, by salivary enzymes) food. The mandibles and maxillae fit together to form canals for injection of saliva and ingestion of food. As noted above, most larvae are predaceous, but the type(s) of prey

taken varies. The most widely familiar pattern is seen in the Coniopterygidae, Hemerobiidae and Chrysopidae. In these families the plant dwelling larvae feed primarily upon stemorrhynchous Homoptera, especially aphids and to a lesser degree scale insects (New 1986, and refs. therein). Adult Coniopterygidae are chewing predators. Adult Hemerobiidae require prey for egg production, but also consume pollen and nectar. Some Chrysopidae, *e.g. Chrysopa* spp., also follow this pattern. However, some chrysopids are pollinivorous, e.g. *Meleoma* spp. and *Eremochrysa* (*Chrysopiella*) spp., and some are glycinophagous (consuming honeydew and nectar), e.g. *Chrysoperla* spp. and *Eremochrysa (Eremochrysa)* spp. (Principi and Canard 1984). The latter group harbors symbiotic yeasts in their crop to supply essential amino acids.

The other familiar pattern is seen among the antlions or Myrmeleontidae which have psammophilous (sand-loving) larvae. Antlion larvae live in sandy soil, but only some taxa, e.g. *Myrmeleon exitialis*, construct pits to trap prey. Most larvae simply lurk below the surface and grasp prey items that pass within range of their jaws. Adult antlions are chewing predators or omnivores. Ascalaphid larvae are similar, but some practice their sit-and-wait strategy on vegetation.

The most specialized biologies among the Neuroptera of the Columbia River Basin occur among the Mantispidae, Berothidae and Sisyridae. Mantispinae larvae are predators of spider eggs (Redborg and MacLeod 1985, Rehn 1939). The adults are sit-and-wait predators that use their raptorial forelegs to subdue prey. Berothidae are specialized predators of termites as larvae (Johnson and Hagen 198 1). The adults are apparently glycinophages. Sisyrid larvae feed on freshwater sponges (Parfin and Gurney 1956). Food habits of adult sisyrids are not clear.

Biogeography

The Neuropterida include to oldest known fossils of holometabolous insects (Hennig 198 1). Their lineage extends back approximately 250 million years. Thus, all of the families that occur in the CRB, except Polystoechotidae, are cosmopolitan. The polystoechotids are currently restricted to the New World. Genera are also widespread, ranging from transcontinental to cosmopolitan. However, at the species level some interesting situations can be seen.

Because of the vast expanse and the complex geological and climatic history of the CRB there are some endemic (or apparently endemic, recall the concerns pertaining to insufficient collecting) species, *e.g. Eremochrysa (Chrysopiella) brevisetosa* and *Lomamyia* sp. nov., and some interesting species complexes, *e.g. Chrysoperla plorabunda*, *C. adamsi*, *C. johnsoni* and *C. downesi* that are known to coexist only within the CRB.

There is also a disjunction pattern between the coastal mountains and mountains in northern Idaho. This is better exemplified by other taxa (Johnson 1987), but can be seen in the case of *Inocellia longicornis* and perhaps *Sialis hamata*.

Table 1. Classification of the Neuropterida, including only families known to occur in the Columbia River Basin.

Neuropterida (= Order Neuroptera s.l.)		
	Order Megaloptera (= Suborder Megaloptera)	
	Family	Corydalidae
		Sialidae
	Order Raphidioptera (= Suborder Raphidioptera)	
	Family	Rapbidiidae
		Inocellidae
	Order Neuroptera (s.s.) (= Suborder Planipennia)	
	Superfamily	Coniopterygoidea
	Family	Coniopterygidea
	Superfamily	Ithonoidea
	Family	Polystoechotidae
	Superfamily	Mantispoidea
	Family	Mantispidae
		Berothidae
		Sisyridae
	Superfamily	Hemerobioidea
	Family	Hemerobiidae
		Chrysopidae
	Superfamily	Myrmeleontoidea
	Family	Myrmeleontidae
		Ascalaphidae

Table 2. Lacewings known to occur in the Columbia River Basin, with distribution and habitat information.

Megaloptera

Corydalidae

Dysmicohermes disjunctus (Walker); OR, WA
occurs along streams in the Cascades.

Dysmicohermes californica Ross; NV
occurs along mountain streams in northern Nevada

Sialidae

Sialis cornuta Ross; ID, NV, E. OR, E. WA

Sialis hamata Ross; ID, E. & C. OR WA

Sialis infumata Newman; S. ID

Sialis rotunda Banks; WA

Raphidioptera

Raphidiidae

Raphidia (= Agulla) adnixa Hagen; ID, OR, WA
widespread, common mostly in forests

Raphidia (= Agulla) assimilis Albarda; ID, OR WA
widespread

Raphidia (= Agulla) bicolor Albarda; S. ID, E. & C. OR, WA
widespread in dry, open areas, often sagebrush

Raphidia (= Agulla) crotchi Banks; C. OR
rarely collected

Raphidia (= Agulla) herbsti Esben-Petersen; ID, OR WA
widespread, common mostly in forests

Raphidia (= Agulla) unicolor Carpenter, ID, OR, WA
widespread, usually in grasslands

Inocellidae

Inocellia inflata Hagen; ID, OR WA
widespread in forests

Inocellia long-icomis Albarda; ID, OR WA
localized in forests, usually in mesic areas

Neuroptera s.s.

Coniopterygidae

Coniopteryx tineiformis Curtis; ID
occurs on Douglas fir and spruce as a predator of scales and gall aphids

Conwentzia californica Meinander; ID, OR, WA
occurs on spruce

Semidalus angusta (Banks); S. ID
occurs on sagebrush

Polystoechotidae

Polystoechotes punctulatus Say; ID, OR; WA

widespread, but localized, usually near streams or rivers, more common in mountainous regions

Mantispidae

Mantispa pulchella Banks; S. ID, NV?

Climaciella brunnea (Say); ID, NV, E. OR, E. WA

in open, dry areas dominated by grasses or sagebrush

Berothidae

Lomamyia occidentalis (Banks); WA

one record from Spokane

Lomamyia sp. nov.; S. ID

occurs in sagebrush-dominated areas, but is apparently rare or localized, associated with termites (prey for larvae)

Sisyridae

Climacia californica Chandler, ID, OR

occurs near lakes or large rivers with freshwater sponges (prey for larvae)

Sisyra vicaria Walker; N. ID, OR

occurs near lakes with freshwater sponges (prey for larvae)

Hemerobiidae

Wesmaelius (= Kimminsia) brunneus (Banks); WA

Wesmaelius (= Kimminsia) coloradensis (Banks); S. ID

occurs in sagebrush habitat

Wesmaelius (= Kimminsia) constrictus (Parfin); W. WA

in the Cascades, mostly in forests

Wesmaelius (= Kimminsia) involutus Carpenter; LD

Wesmaelius (= Kimminsia) longifrons (Walker); ID, NV, OR, WA

rarely collected

Wesmaelius (= Kimminsia) nervosus F.; ID

Wesmaelius (= Kimminsia) pretiosus (Banks); OR

Micromus montanus (Walker); ID, WA

Micromus reniformis *Oswald; ID,* OR

Micromus variolosus Hagen; ID, NV, OR WA

widespread, common, occurring in forest and sagebrush habitats

Hemerobius *bistrigatus* Currie; *ID,*. OR

Hemerobius *conjunctus* Fitch; WA

Hemerobius humulinus L.; N. ID, WA

Hemerobius kokaneeanus Curry; WA

Hemerobius neadelphus Gurney, ID, S.E. OR

Hemerobius *ovaiis* Carpenter, ID, OR, WA

common, widespread in forests

Hemerobius stigma Stephens; ID, NV, OR, WA

widespread in forests

Psectra diptera (Burmeister); N. ID
one record near Bonners Ferry
Sympherobius angustus (Banks); ID, OR
Sympherobius barberi (Banks); OR
Sjmpherobius beameri Gurney; NV
S'pherobius killingtoni Carpenter, S. ID
Sjmpherobius occidentalis (Fitch); ID
Sympherobius perparvus (McLachlan); S.E. ID, NV, OR, WA

Chxysopidae
Nothochrysa californica Banks; N. ID, OR, WA
occurs in forests in the Cascades and around Priest Lake
Nineta gravida (Banks); *N. ID*
rare, 2 specimens recorded from Moscow
Mallada perfectus (Banks); WA
uncommon, in forests
Mallada sierra (Banks); OR, WA
rare
Eremochtysa altilis Banks; N. ID
one record from Moscow
Eremochrysa fraterna Banks; S. ID
occurs in sagebrush habitats
Eremochrysa hageni Banks; S. ID
occurs in sagebrush habitats
Eremochrysa pumilis Banks; S. ID
occurs in sagebrush habitats
Eremochrysa punctinervis MacLachlan; S. ID, E. OR, E. WA
most common and widespread species in the region occurs in sagebrush habitats
Eremochrysa (= Chrysopiella) brevisetosa Adams & Garland; S. ID
rare, in sagebrush habitats
Eremochrysa (= Chrysopiella) minora Banks; C. WA
rare, in grassland habitats
Eremochrysa (= Chrysopiella) pallida Banks, OR
Chrysoperla adamsi Henry, Wells & Pupedis; ID, OR, WA
endemic to western montane conifer forests
Chrysoperla downesi Smith
occurs in conifer forests, overwinters in splits in dead conifers
Chrysoperla johnsoni Henry, Wells & Pupedis; ID, OR WA
endemic to western montane conifer forests
Chrysoperla plorabunda (Fitch); ID, NV, OR, WA
widespread, common in all habitats
Chrysopa coloradensis Banks; ID, NV, OR, WA
widespread, common, except in dense forests
Chrysopa excepta Banks; S. ID, NV
rare, occurs in sagebrush habitats

Chrysopa intima McLachlan (= *chi Fitch); ID, OR,* WA
occurs in openings in mesic forests
Chrysopa nanina Banks; S. ID
rarely collected
Chrysopa nigricomis Burmeister; ID, NV, OR, WA
occurs on broadleaf (deciduous) trees
Chrysopa oculata Say; ID, NV, OR, WA
widespread, common, except in dense forests
Chrysopa pleuralis Banks; ID, OR, WA
uncommon, restricted to higher elevations, usually above 6000'
Meleoma beardi Tauber; S. ID, NV
Meleoma dolichartha (Navas); ID, OR, WA
widespread, but not common
Meleoma emuncta Fitch; ID, OR, WA
widespread, moderately common, associated with deciduous trees
Meleoma kennethi Tauber; N. ID
rare, one collection at Lewiston
Meleoma schwartzi (Banks); E. OR
uncommon in xeric habitats

Myrmeleontidae
Paranthaclis congener (Hagen); E. OR, E. WA
uncommon in xeric sites with sandy soils, usually with scattered grass and shrubs
Psammoleon sinuatus Currie; NV
uncommon in xeric sites with sandy soils
Dendroleon speciosus Banks; S. ID, E. WA
uncommon in xeric sites with sandy soils
Brachynemurus abdominalis (Say); S. ID, E. OR, E. WA
locally common in xeric areas with sandy or light loam soils
Brachynemurus blandus (Hagen); S.E. ID, E. WA
Brachynemurus elongatus Banks; S.W. ID
Brachynemurus ferox (Walker); S. ID, E. OR
Brachynemurus henshawi (Hagen); OR
Brachynemurus papago (Currie); S.W. ID, E. OR
i3rachynemuru.s sackeni (Hagen); S. ID, OR
Clathroneuria coquilleti (Currie); S.E. ID, E. WA
Clathroneuria schwartzi (Currie); *S. ID,* E. OR
Scotoleon nigrilabris (Hagen); S.E. ID
Scotoleon nivatensis (Navas); S. ID, E. OR
Myrmeleon exitialis Walker; ID, NV, OR, WA
widespread, but localized, larvae dig conical pits in sandy soil, usually at the base of a cliff

Ascalaphidae
Ululodes arizonensis Banks; NV, S.E. OR

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