

**British Columbia Dragonflies (Odonata), with
Notes on Distribution and Habits**

(With Descriptions of Two New Nymphs by E. M. Walker)

F. C. WHITEHOUSE



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Introduction

Initial publications dealing with the Odonata of British Columbia were as follows:

Osburn R. C.—1905, The Odonata of British Columbia. *Ent. News.* **16**:184-196.

Currie, Rolla P.—1905, Dragonflies from the Kootenay District of British Columbia. *Proc. Ent. Soc. Wash.* **7**:16-20.

By perusal of the reference list, it will be noted that twenty-two years had passed since the appearance of these two papers and that of E. M. Walker in 1927. In this he included not only Osborn's and Currie's records but all additional ones to date; many of which were the result of his own collecting and some the work of the present writer. The author also included, under the latitude permitted by his title, a number of species that had been taken by himself or the present writer in the Alberta Rocky Mountains, and which consequently were deemed likely to occur also in British Columbia.

Since that time (1927) very considerable dragonfly collecting has been done in the Province by E. R. Buckell, in the territory centering upon the Okangan Valley, but wandering wide afield; by W. E. Ricker, in the Cultus Lake section; and by the writer, who, since 1934, has devoted his entire summer seasons to the work and has scoured the country as systematically as possible. This combined effort has resulted in not only a number of Walker's "probabilities" becoming facts, but the taking of some quite unexpected species and one entirely new: *Macromia rickeri*. So, in 1938, Buckell published his paper giving locality records for species taken by him or represented in the Dominion Laboratory at Vernon, and Walker a paper covering the work of Ricker and his associates in the Cultus Lake district.

But these later papers are primarily locality lists (with dates and some notes as to Ricker's species) and, dealing only with sections of the Province, limited in their scope. The present paper aims to cover British Columbian Odonata as a whole; to include notes on the habits of certain species and the association of species in cases of special interest: and thus continue north of the international border the work of Clarence H. Kennedy for the coastal States.

To achieve this, in the first instance, Walker's paper of 1927, with its admirable introduction, is used as a base, and the records of Buckell, Ricker

and the writer are incorporated to give the most comprehensive picture as to the distribution of the species. A map is supplied to further this end. This map, in the complexity of zonal and sub-zonal divisions on the southern border approximately follows that of R. M. Anderson in "Faunas of Canada." Farther north, where boreal forms only occur, conditions are less variable east and west, and the divisions are rather a matter of depicting geographical space than zonal change. And, in the extreme north, it is essential to consider the country as a whole, since collecting is necessarily limited to a few accessible points. The divisions of Vancouver Island in the neighbourhood of Parksville is in accordance with the writer's view that thereabouts a faunal change occurs. His own list demands it.

A peculiarity of the odonate fauna of British Columbia is a tendency in certain species of a number of genera to variability in size: notably *Lestes congener* and *disjunctus*, *Enallagma carunculatum*, *Somatochlora albicincta*, *Sympetrum decisum*, *pallipes* and *semicinctum*, and *Leucorrhinia hudsonica*. This is doubtless attributable to environment: for the mild coastal climate and the extremely varied topography of the country, combine to produce unusual conditions. Owing to these conditions, throughout the Province, and particularly upon the coast and in the Okangan Valley section, some species occur south and some north of their true range. But, where size is concerned, the writer considers altitude rather than latitude is the contributing factor. A good example in support of this argument is *Somatochlora albicincta*. The typical small form is northern or of high altitude. A medium-sized form occurs more southerly at lower altitudes. But the large form flies on the north shore of the Queen Charlotte Islands: northerly enough for its true range, but at sea level, within sight, smell and sound of the mighty rollers breaking upon Graham Island north beach (see plate).

My sincere thanks are due to my old friend E. M. Walker for his assistance these many years, and his special kindness in reading the typescript of this paper; and to E. R. Buckell and W. E. Ricker for specimens, information and willing aid at all times. If, as the writer believes will prove the case, no further general paper respecting the Odonata of British Columbia will be necessary for some decades, this will be due to the individual contributions of these his contemporary workers, now, supplemented by his own endeavours in the field, correlated into a convenient whole.

A concluding expression of thanks is reserved to Keith S. Hay, the companion on my caravan trips of 1936 and 1937, and whose assistance in scouting and in collecting specimens was of real worth.

Two large collections of mounted specimens have been built up in the course of my studies. One of these has been presented to The University of British Columbia, Vancouver, and the other to the Provincial Museum, Victoria. In addition, specimens have been given to The Canadian National Collection, Ottawa; The United States National Museum, Washington; The British Museum (Natural History) London, and individual collectors.

Foreword upon Dragonflies

While the collecting and study of dragonflies is, in the main, both interesting and exciting, it can likewise prove, upon occasion, irritating and disappointing. The irritation is usually due to inability to net some rare or greatly desired specimen that persistently keeps safely out of reach: for they have fine eyesight and the larger species are swift of wing. And the disappointment, consequent to having arrived at the hunting ground all expectant, to find that there is nothing flying.

THE SUN'S INFLUENCE

Those determined upon embracing Odonatology as a study must recognize one basic fact concerning these insects: viz., that they are sun worshipers. There are exceptions to this in a few twilight flyers and species of the genus *Aeschna* which will fly until dark after a sunny day. But, for active flight as to the great majority of dragonflies the sun must be shining in all its blazing glory: unobscured by even a filament of cloud. This does not mean that not a single damselfly or solitary dragonfly will be seen, but that of the many hundreds on the wing in the sun of yesterday but a corporal's guard remains: certainly not enough to make collecting other than a waste of time. Wind can be another annoyance; not that, given bright sunshine, dragonflies will not be on the wing, but that it tends to wild and rapid flight, with added difficulty in netting. However, better, infinitely better, wind with blazing sunshine, than the calmest day deficient as to sun.

Where do dragonflies conceal themselves at night and throughout the long cloudy day when, in spite of their voracious appetites, they prefer a state of starving quiescence? The obvious response would be: immobile upon the bushes, grasses, reeds, adjacent to the water: the same places, in fact, that they use for temporary rests when fly hunting in the sun. Such conclusion would be incorrect. Beat the bushes, grass, reeds upon a cloudy day around a lake teeming with dragonflies in yesterday's sun and the result is negative, save that a few damselflies may be secured. Yet, this we know, that should yesterday's sun blaze forth, those teeming hordes will be again in evidence. They are there: and the only conclusion is that they elect to hide back from the water in the higher bushes and, where available, in the trees.

Why do dragonflies prefer to rest and starve when the sun is not shining? Because the day is not warm enough? No, such midsummer days are frequently free from wind and warm almost to the point of humid heat. Because no small flies are on the wing and it is profitless to hunt? Again, no: the air may be full of flies on a day lacking bright sun, and not a dragonfly in sight. That they are sun worshipers, as already stated, seems the only solution; but I suggest that this is inspired by certain rays of the sun, which stir these insects to life. Once the sun arrives they take the air eagerly and very much awake. Until it comes they sleep. An exasperating fact to the Odontologist is that nectar feeders—insects instinctively associated with sunshine—will be flying, and apparently indifferent, on many a cloudy day when not a dragon-

fly is on the wing. Yes, he could make a fair catch of butterflies and an excellent collection of bees.

Dragonflies are one in that they must have sun, and that they feed upon flies, small and large, including their own kind; but in their individual characteristics the species are consistently different. Some pause in their foraging for flies, to rest high upon trees, some upon bushes, some prefer woodwork: palings, benches, jetties, floating logs or lumber, and some, again, the bare ground of road or path.

OVIPOSITION

Egg laying also affords a diversity of methods: One species will select clear water, wiping an egg from the tip of her abdomen at intervals of say five or six feet; a second will favour spots mid the water plants, but a foot apart, and dip her ovipositor quickly three or four times at each such station; a third will grip the edge of a water-lily leaf and plunge her abdomen many times into the algae beneath; and a fourth will alight upon a reed stem, planting her eggs in it systematically, working lower and lower until she is totally submerged.

I have stated that the different genera and species of dragonflies have widely divergent methods of ovipositing, and I will now instance a specific example to which I gave close attention at Mud Lake, Forbes Landing, B. C. An *Aeschna* female (I think *canadensis*) settled near the end of a floating, bark-clad pole of some four or five inches in diameter. She stood upon the one inch and a half of dry surface, and immediately swung her abdomen overboard, stabbing eggs into the submerged bark. Next, by making a half turn, she dragged her abdomen over the dry surface and placed four or five eggs on the other side. What now? Would she fly away? No, she backed along the pole several inches and repeated the operation on either side. The following move brought her to a water-lily leaf, the edge of which touched the pole at that point, but, quite unconcerned, she dragged her abdomen over its surface until clear and continued her task. In twenty minutes she had worked her way along for possibly five feet, the water-lily leaf incident recurring several times in the process. Even in cases of careful observation it is dangerous to arrive at dogmatic conclusions, but the apparent inference in this instance would be that, once settled upon the pole, there was no coordination between her eyes and ovipositor. She depended solely upon the sense of touch. In spite of her wonderful eyes for looking forward and upward, is she quite blind as to the tip of her abdomen, three inches behind her? In such case, why did she elect to proceed backwards, when by heading in the direction of her course the impeding water-lily leaves would surely have been seen and the futile stabbing of these avoided? As to why there is no answer. It was the method instinct directed. In my opinion the purpose of the female appendages is to provide her with a delicate sense of touch in ovipositing. They tell her what she cannot see. In the *aeschnines* the styli would seem to serve the purpose of organs of touch, but whether in lieu of, or in addition to, the appendages is an open question.

FERTILIZATION

To the female dragonfly a fine sense of touch at the end of her abdomen is imperative quite apart from egg laying. The unique copulatory embrace of the sexes, and the unlike position of the organs of fertilization demand that, once seized by the male, she take the initiative. Her abdomen must be swung upward, the genitalia be brought into juxtaposition and a precise connection made. Unquestionably the female appendages, and, in the case of *Aeschna* and Zygoptera females the styli, are the means to this end.

Judging by the behaviour of dragonflies, nature ordains a much more frequent fertilization of the females than in some of the other orders of insects: indeed, on occasion, copulation of the individual between her various bouts of egg laying may be observed. Such a requirement calls for lustful males, and, to do them justice, they take advantage of privilege to the point of license. I mean by this that not only do they pounce upon any female of their own species offering, but, where other species of the genus are flying—as is apt to be the case with *Aeschna* and *Sympetrum*—no nice discrimination is shown. Doubtless most of these efforts are incomplete and fruitless due to nature's provisions against cross-breeding, but knowledge of this propensity bids the student beware in accepting pairs as proof of identification.

Once the male appendages are snugly in position, he can hold his female firmly and for a long period. In the process of obtaining the requisite grip, however, his appendages may slip, and, should this happen but a short distance over the water, with dire consequences to the female. Unable to right herself in time, she falls on her back and drowns. The male instinct—so all sufficient to carry him through life—is quite unequal to such accidental tragedy. He flies away, apparently in ignorance of it, and unconcerned.

FLIGHT

Dragonflies—I refer to the *Anisoptera*—possess three noticeable speeds, which may best be considered as *low*, *intermediate* and *high*. When hawking or seeking a mate, "low" is employed, and many species will pause entirely and, hovering, scan the horizon. When in "low" even such powerful insects as a *Macromia* on a roadway, *Cordulegaster* on its creek, or an *Aeschna* in a sunny glade, may be easily overtaken by the swing of the net, as they go by, when struck at from the rear.

"Intermediate" is used when the insect is travelling: *Macromia magnifica* crossing the river to take up a reach on the other side; *Cordulegaster dorsalis* crossing a lake to another creek. Momentarily they are not dallying for food, but are about their own business: "going places." At this speed they may still be netted, but it calls for perfect sighting and a rapid follow-through swing. It is something in the nature of an achievement, and, personally, I experience a feeling of jubilation when I net one of the speed artists in "intermediate."

"High" is the velocity of fright—the reserve power used to escape its natural enemies: barn swallows, kingbirds, cedar waxwings, yes, and the

collector's net. Strike at any of the species mentioned and miss, and instantly the insect goes from "low" to "high"—a high so rapid that the eye can scarcely follow. The black and gold *magnifica* becomes a blurred streak through the air! It is unquestionably *magnifica's* assurance of his own speed that nerves him to hawk leisurely along the banks of the Okanagan river, at Penticton—a bird sanctuary. He knows that they cannot catch him in "high."

INSTINCT

Instinct, which in the case of insects must serve for intelligence (and which, as J. Henri Fabre has shown is, in its various manifestations, wonderful beyond belief) is sometimes at fault. In the case of dragonflies, I witnessed recently an error of instinct past question, when I discovered a female *Sympetrum vicinum*, held and guided by the male, as is usual with this species, ovipositing in the dew-bespattered grass of a golf green. The wet moss around the edge of a lake is the correct depository for *vicinum* eggs, but the pair in question, having wandered far from the water, erred *instinctively* in accepting short wet grass as a substitute. I watched her performance for some ten minutes, and left her making a thorough job of it. An example from nature of "love's labour lost." Since this paragraph was first written I have not only seen other couples of *Sympetrum vicinum* ovipositing on golf greens, but, in Tahiti, on two occasions noted females of *Tramea limbata* wiping eggs from the tip of the abdomen into the sandy surface of the highroad.

The same species, *Sympetrum vicinum*, affords a good example of an individualistic trait that the insects positively force upon the collector's attention, though whether "curiosity" or "tameness" would best describe it, I cannot say. Dragonflies, generally speaking, are wary, and avoid the collector and his net. *Vicinum*, single males and females, and pairs flying tandem, will settle, on the sunny side of clothing, net and hands. I have had as many as eight of these beautiful little red dragonflies settled on me at one time. Turn slowly, however, to throw the insects into the shade, and all will depart. Whence comes this unusual tameness, or curiosity, in one particular species of *Sympetrum*?—this individual trait, contrary to the instinct of other members of the genus, and to the dragonfly clan as a whole? The question confronts us. We have not the remotest idea as to an answer.

ENVIRONMENT

Dragonflies are extremely local insects, showing strong preferences for this or that body of water: a large clear lake, or a small muddy one; a mountain stream, or a sluggish brook; a brave river, or a muskeg pot-hole. Two or three examples will best illustrate this trait. At Red Deer, Alberta, on July 1st, for three years in succession, I took the rare *Somatochlora hudsonica* at a small run-way of water near town, a hundred miles out of the insect's proper zone. At a tamarack swamp, a short distance from Red Deer, *Somatochlora franklini* occurred. True, in this instance, the tamarack swamp may be regarded as a Hudsonian zone island in a sea of Canadian zone, but the insects must observe the boundaries of their swamp and, so far as I could ascertain, they

did so. At Vancouver, the small blue and black damselflies *Enallagma boreale* may be taken all through the season at Beaver Lake, Stanley Park. If, on the other hand, I desired a series of *Enallagma carunculatum* I should not go to Beaver Lake, but to Lost Lagoon. Yet it is but ten minutes walk between the two lakes. The explanation is that the larger Lost Lagoon, with its broad reed beds, satisfies *carunculatum*; while the smaller, sheltered, water-lilied Beaver Lake meets the requirements of *boreale*. The same sort of thing occurs right through the dragonfly fauna.

This nice discrimination by dragonflies as to habitat adds greatly to the pleasure to be derived by the student of the order in the field. For, it follows, that if he knows the specific tastes of the individual species, he will, upon arriving at a strange body of water, first visualize its *possibilities*, and, with the netting of several specimens, speculate upon the *expectancy* of the place. Without devoting more space to the subject here, I suggest that, very broadly applied, a natural law—the *association of species under like environment*—lends its aid to the worker.

SEXUAL MATURITY

Regarding the sexual maturity of dragonflies and damselflies, the experience of the collector would point to a distinct difference in this respect in most species as between the two sexes. In one hundred couples noted in copulation (various species) it would be safe to say that in over sixty per cent the males would be of adult coloration and the females not adult—many, indeed, quite teneral. Possibly thirty per cent would be represented by couples both individuals mature. And the remainder—a veritable sprinkling—where the male coloration indicated later emergence than the female. This would appear to lead to but one conclusion: that the males in this order are not physically fit to breed until truly adult, whereas the females are ready for fertilization by the male very shortly after transforming from the aquatic state.

TRANSFORMATION

Dragonflies, upon emerging from the water of their nymphal state, do not (excepting a minor percentage of the stouter types) remain in the immediate vicinity; on the contrary safety lies in any place but there. In point of fact, until the insect is mature and ready to breed and lay its eggs, it has no need to be near water. A mountain top, or a sunny glade in the woods, is better in every way to come to strength, to catch flies and to play with its fellows. Even the stout-bodied dragonflies, as newly emerged teneral, are, for a short time, at the mercy of birds; whereas the damselfly teneral are devoured not only by birds and frogs, but by dragonflies, robber-flies, spiders and wasps. Barn swallows sometimes are particularly destructive to teneral damselflies; as a flock of them will patrol the lake-shore where the flies are emerging and virtually consume the entire flight.

The method of departure of teneral damselflies from the water's edge may be inspired by instinct, but it is certainly aided by kindly nature. Too weak

to fly against the breeze they flail the air frantically with their four narrow wings, (it might be likened to an autogyro) thus attaining elevation. The breeze does the rest.

In the active, aquatic, intermediate stage between egg and adult fly, these insects are unquestionably an important fish food; and, once on the wing, they are equally important (that is, valuable in the maintenance of nature's balance) in holding in check mosquitoes, midges, and other of the pestiferous host.

In Canada considerable study has been devoted to this order by a small number of workers—of whom the outstanding authority is Professor E. M. Walker of the University of Toronto—but the task is still incomplete both as to distribution of species and data respecting habits: while, as to full life histories, these are for the greater part unknown.

Suborder Zygoptera

LESTIDAE

LESTES CONGENER Hagen

The eastern description for this insect "a rather small blackish brown species," while true for Alberta specimens, is not so for the large *congener* of British Columbia.

In this Province it appears to be very local, but the fact that it is the last of the genus to emerge, restricting collection to August into September, may explain the somewhat scanty records. Walker (1927) gives localities in the Okanagan district and Vancouver Island. I can extend the mainland distribution eastward to Crawford Bay, West Kootenay, August 10th 1928; and eastward to Hope and Harrison Bay, dates August 1st-12th, 1936. At Hope I took specimens both at the sloughs on Little Mountain, and at Texas Lake. In Harrison Bay district, it was flying up Elbow Lake creek to the headwaters, where *Octogomphus specularis* and *Cordulegaster dorsalis* also occurred. Specimens from this locality, sent to Walker, drew the comment: "larger than any I have seen."

The single general taken at Sooke, June 13th, (and that I feel sure was premature) was the only locality record for *congener* on my three months Vancouver Island trip, 1937. Walker (1927) records it as emerging in the Nanaimo district August 7th-13th, by which time I was many miles north at Forbes Landing, and, possibly, out of its range.

Further distribution: In 1938 I took *congener* at the following localities: Golden, August 14th, emerging (small size), Kamloops (river reeds and Lac le Jeune) August 19th and 24th; Jesmond, August 29th, pairs and singles. Buckell (1938) gives no less than 33 stations, from Prince George in the north to Osoyoos on the international border, from Similkameen in the west to points near the eastern boundary, which serves to disprove my original impression as to the insect's scarcity.

In 1940, I took a single teneral male, the small northern form, at Tête Jaune, August 10th. I also received a long series from Dawson Creek, Peace River District, without dates.

Flight period: July 10th to November 10th.

Map areas: 1, 4, 5, 6, 7, 8, 10 and 14.*

LESTES UNGUICULATUS Hagen

As in Alberta, this species is on the wing well ahead of *Lestes congener*: Walker (1927) states as early as June 12th. My mainland records, working eastward, are: Chilliwack, July 23rd; Cultus Lake, July 6th; July 26th, and Crawford Bay, West Kootenay, August 17th. At none of these was it plentiful.

My Vancouver Island trip, 1937, provided but two locality records for this species: Sooke, "emerging in numbers," June 13th; Florence Lake, a mature male, July 2nd, and "fairly common, but scarcely adult," July 5th. Walker (1927) also supplies the Nanaimo and Saanich districts, but, while I stayed in the former from July 8th to 16th, I saw nothing of the species: probably I had moved north ahead of its flight there.

Further distribution: In 1938, July 18th-19th, I found this species fairly plentiful, and of large size, at a dry slough at the south end of the Okanagan river, Penticton district. Walker (1927) gives mainland records: Armstrong, and Okanagan Landing; and (1938) Chaperon Lake, August 26th. Buckell (1938) contributes: Canal Flats, Hat Creek, Osoyoos, Premier Lake, Princeton and Wasa. J. Wynne sent me specimens from Enderby, August 4th.

It is by far the most local species of the genus in British Columbia.

Flight period: June 12th to August 24th.

Map areas: 1, 4, 5, 7 and 8.

LESTES DRYAS Kirby (*L. uncatatus* Kirby)

The flight period of this species is two weeks earlier than that of *unguiculatus*. I took it at Crawford Bay, West Kootenay, mid-August 1928: and my more recent mainland records are Cultus Lake, (plentiful) July 2nd-18th, 1936; Chilliwack, July 23rd; Hope (Silver Creek slough, Little Mountain, Hope-Princeton trail) July 26th-August 2nd.

On Vancouver Island (my trip of 1937) I found this species in the south at Sooke, "common, adult and in cop.," as early as June 7th. This was at the reedy pool where *Ischnura erratica*, *cervula* and *perparva* were flying with *Sym. illotum* and *Somatochlora semicircularis*. At the same pool, but not until June 13th, I took newly emerged tenerals of *unguiculatus* and a single teneral of *congener*. The last mentioned was probably a 'freak' emergence, as the insect is usually well subsequent to *disjunctus* in making its appearance.

* See map on page 556.

My additional records were: Florence Lake, July 1st; Nanaimo district: Departure Bay, plentiful, July 8th.

Further distribution: In 1938 I took *dryas* at Kaslo, June 21st; Penticton (large size) July 17th; Revelstoke, 4,500 ft., August 3rd; Kamloops, August 19th. Walker (1927) adds Wellington and Gabriola Is. to the Vancouver Island list, and (1938) Chaperon Lake, to the mainland habitats. Buckell (1938) contributes 28 localities, with northern points, Canim Lake, Chilcotin and Horsefly.

On my trip of 1940, Prince Rupert to the Alberta border, I took but two specimens of this species: at Vanderhoof, July 8th, an adult male, and at Mount Robson, Aug. 6th, a male.

Flight period: June 7th to Sept. 6th.

Map areas: 1, 4, 5, 6, 7, 8, 9 and 10. Mrs. Gloyd's Synopsis (1939) gives one record from Alaska.

LESTES DISJUNCTUS Selys

This is the common *Lestes* of British Columbia: one of those things, like *Libellula quadrimaculata*, ever with the collector. On the Queen Charlotte Islands, Massett district, 1935, I found emerging from lakes, sloughs and muskeg pot-holes July 20th on; and by July 26th adult and in cop. This is roughly three weeks later than the general emergence at Beaver Lake, Stanley Park, Vancouver, which occurred in 1935 on July 27th. Walker (1927) gives dates of flight to August 16th, but remarks: "they doubtless occur later than this." My records indicate that at Vancouver as late as September 2nd they are "common, in cop.," and that the flight continues in reduced numbers to September 24th.

This species emerges on Vancouver Island, so my trip of 1937 would serve to show, at approximately the same time as on the mainland. My notes supply records as follows: Thetis Lake, a teneral male, June 24th; Florence Lake, a teneral male, July 2nd, and several still teneral July 5th. Wellington Lakes (pot-hole), "large specimens, adult and in cop.," July 14th; Courtenay, July 20th; and Forbes Landing, July 26-August 18th. A comparison with the data given respecting *L. congener*, *dryas* and *unguiculatus* makes clear that while *disjunctus* is later in getting on the wing than the two last mentioned, it is the only species of the four *Lestes* that I have taken north of the Nanaimo district. Further collecting may disprove this, but it must stand for the present. In a country of mountains, hills, lakes, rivers and coniferous trees—and such is Vancouver Island—it is difficult to draw an arbitrary line and to state that *there* a zonal change occurs; but I feel that a change does come into effect as to the odonate fauna not far north of Nanaimo, and I now recollect that no *Arbutus* trees were noted by me north of Parksville. Provisionally, then, I draw a dividing line at that point. Shall we find *Pachydiplax longipennis* and *Erythemis s. collocata* north of it, or *Somatochlora walshii* and *minor* to the south?

Further distribution: In 1938 *disjunctus* was flying at the following: Kaslo, June 24th; Vernon (Deep Lake) July 26th; Enderby, July 31st; Revelstoke, August 4th; Field, August 10th; Golden, August 14th; Kamloops (river reeds and Lac le Jeune) August 19th-24th; and Clinton, August 28th; and, in 1936: Hope, Hatzic Lake and Harrison Bay, July 26th-August 9th. The species is common everywhere, but I will show extension of its range by selections from other lists. Walker (1927) Prince Rupert, Okanagan Landing, Nelson, Metlakatla, Peachland; and, (1938) Chaperon Lake, Chilliwack and Cultus Lake. Buckell (1938) gives 46 localities, ranging as far north as Prince George (Summit Lake) and Palling, i.e., north of 54". At Atlin, 60" north, *disjunctus* emerged July 17th and by July 22nd they were plentiful, flying in cop. Two or three survivors seen as late as August 28th. It was the only species of the genus at that latitude.

On my trip of 1940, Prince Rupert to the Alberta border, I found *disjunctus* at Vanderhoof, July 8th, fairly common, adults and teneral; McBride, July 12th; Mount Robson, Aug. 4th, and Tête Jaune, August 8th.

Flight period: June 20th to September 24th.

Map areas: 1-13. Mrs. Gloyd's Synopsis (1939) provides a number of records for Alaska.

COENAGRUIDAE

ARGIA VIVIDA Hagen

There are but two locality records for *vivida* in British Columbia: a single specimen taken by Osburn at Glacier many years ago, and a long series by Buckell at Field.

In 1938 I spent August 6th to 13th at Field, but whether I was too late or the somewhat inclement weather was against me, I certainly failed to find *vivida*.

Walker (1927) inclines to the view that the presence of this species in numbers at Banff, Alberta, would seem to associate it with the hot springs. Buckell's Field captures would fail to support such argument, for their creek—the local people take rather special pride in it, and urged, nay insisted, that I drink some—analyses 100% pure spring water.

Flight period: June 12th to August 27th.

Map areas: 7 and 8.

Note: Field is a railway divisional point, and the thought occurs that Buckell's specimens may have come, not from the creek, but some drainage ditch from the roundhouse, the temperature of which was artificially raised by hot waste or contiguity to hot ash dumps.

ARGIA EMMA Kennedy

At Cultus Lake in 1936 this species—previously taken there by Ricker—was emerging in the afternoon of June 18th, but none reached adult coloration.

tion until June 25th, when numbers were observed in cop. The insect was very plentiful: the breeding water undoubtedly being Sweltzer creek which also produces *Octogomphus specularis* and *Ophiogomphus occidentis*.

On July 31st 1936, camped on the Coquihalla River, Hope, *A. emma* was again located, the breeding place here being the clear water creek draining Kawakawa Lake into the Coquihalla. Hopes ran high; If *emma* associated with rare gomphines on Sweltzer creek, why not on Kawakawa creek? But, on August 7th I moved eastward to Hatzic Lake, leaving *emma* at Kawakawa creek on August 6th "numerous as ever." Ricker, consulted, states the insect flies at Cultus Lake until August 26th.

Distribution: In 1938 I found this species common at Christina Lake, July 3rd-15th; and on the Okanagan river, Penticton, July 16th-22nd. Walker (1927) recorded Penticton and also gave Oliver, with date July 22nd. His (1938) list recorded many specimens taken at Cultus Lake by Ricker, the discoverer of the species there. Buckell (1938) contributes two additional localities: Lillooet and Mabel Lake. These are approximately 75 miles farther north than Penticton.

At the south end of the Okanagan river the insects were ovipositing; and I would see as many as six couples, side by side, within a space of several inches: the males attached in their perpendicular poise so well illustrated by Kennedy (1915, p. 281). A most unusual sight, and not without a touch of the humorous!

Flight period: June 18th to August 26th.

Map areas: 4, 5, and 6.

AMPHIAGRION ABBREVIATUM Selys

This is the species recorded by Walker (1927) as *A. saucium* (Burm.), but he commented upon the fact that it was off-type in size and robustness. In view of Mrs. Gloyd's research respecting *Amphiagrion*, the British Columbian representative must now be classified as above.

Walker gives but two locality records in the Province: Peachland (mainland interior) and Victoria (Vancouver Island) I can add five more: Vancouver, reedy pond adjoining the reservoir, Stanley Park, May 25th-30th 1935; Cultus Lake, slough near Indian village, a good series, July 2nd-6th 1936; and Florence Lake district, Vancouver Island, June 30th and July 2nd 1937, 2 teneral. This one locality record on the Island, as the result of my three months' intensive collecting that year, would indicate but scant distribution. It likes shallow, sun-lit, hard-bottomed, reedy marsh or runway, as favored by *Ischnura erratica*, and this particular type of breeding place is by no means common. In 1938 I took 2 males at Kaslo, June 24th, and several at Penticton, July 15th.

Buckell (1938) adds six localities: Canoe, Hat Creek, Kaleden, Lumby, Salmon Arm and Vernon.

Flight period: May 16th to August 1st.

Map areas: 1, 3, 4, 5, 6, and 7.

NEHALENNIA IRENE Hagen

In this, the most delicate of our *Zygoptera*, the female form (though slightly stouter) closely resembles the male. A timid little insect, it keeps well down in the reeds; and I have found that sweeping with the net is more effective than searching for individuals.

The coastal area, with its lower altitude, appears unsuitable to *irene*, nor has it been taken on Vancouver Island.

Walker (1927) gives records of Nelson and Revelstoke; and, in the latter district, I took a long series at Williamson's Lake, August 2nd, 1938: males being the more plentiful. Buckell (1937) supplies additional localities: Chase, Salmon Arm and Prince George (Summit Lake).

In 1940, between Prince Rupert and the Alberta border, I found this species only at Vanderhoof; Buckell's Summit Lake record stands, therefore, as the most northerly habitat.

Flight period: May 10th to August 2nd.

Map areas: 5, 6, 7, and 10.

COENAGRION RESOLUTUM (Hagen)

The only southern record in the Province is that of Walker at Nelson, July 19th-21st. He also gives the same dates for Revelstoke. Buckell's localities range northward from Bridge Lake, Jesmond, Chilcotin, Stanley to Prince George.

On my trip of 1939, 60'' north, I found this species flying at muskeg pools July 6th with *Enallagma boreale* and *cyathigerum*; *Somatochlora hudsonica*, *albicincta* and *septentrionalis*; *Aeschna eremita* and *coerulea septentrionalis*. The total series of 11 males and but 2 females of *resolutum* would indicate that the insect was by no means plentiful. My latest date was July 22nd. In Alberta, my records show, *C. resolutum* was one of the three first species to appear (end of May), *Leucorrhinia borealis* and *hudsonica* being the others.

In 1940, working the territory between Prince Rupert and the Alberta border, lat. 53'' to 55'' N., I found this species plentiful at Smithers, June 22nd; Burns Lake, June 29th; Vanderhoof, July 8th; and (now getting scarce) McBride, July 12th.

In a long series, specimens will be found with the antehumeral bands divided into an anterior stripe and a posterior spot, as in the case of *C. interrogatum*.

Flight period: June 14th to August 18th.

Map areas: 4, 6, 7, 9, 10 and 13. Alaska, 3 records (Gloyd 1939).

ENALLAGMA CLAUSUM Morse

Up to the date of Walker's 1927 list, the only record of *clausum* in British Columbia was his own, at Penticton, July 28th, 29th, 1926. Since then Buckell (1938) has published captures at Osoyoos; and still more recently (an unpublished list for 1937) he adds Jesmond and Quesnel, in the Cariboo district.

At Penticton, July 15th to 21st 1938, I took a long series of *clausum*, where it was flying with all the other species of the genus in the Province, excepting *hageni*; *Amphiagrion abbreviatum*, *Argia emma*, *Lestes dryas* and *unguiculatus*, *Ischnura cervula* and *perparva*.

As Walker points out, *clausum* in B.C. in general appearance (size and colour pattern) resembles *boreale* and *cyathigerum*. Its female, however, differs from theirs in that segment 8 is wholly blue: this is most helpful in the field.

Flight period: July 2nd to August 22nd.

Map areas: 4, 5 and 10.

ENALLAGMA BOREALE Selys

This insect—*E. calverti* Morse of my Alberta lists—shares with *Ischnura cervula* the distinction of being on the wing longer than any other species, *Zygoptera* or *Anisoptera*, in British Columbia. It emerges as early as April 29th at Stanley Park, Vancouver, and, brood succeeding brood, it may be taken there to mid-October.

In the Massett district, Queen Charlotte Islands, July 18th-30th, *boreale* was flying at pools, pot-holes and lakes of the upland muskeg: being the only species of the genus I took there.

In Alberta, to the best of my recollection, this species and *E. cyathigerum* flew together, but in British Columbia my experience serves to confirm the statement of Walker (1927) that this is unusual: Texas Lake, Hope, August 3rd 1936, provided an exception, and Penticton was another.

Owing to the likeness of this species to *cyathigerum* on the wing, at every piece of water visited many of the little blue damselflies must be netted and examined under a magnifying glass to determine which of them was present, or, though this be improbable, both. My Vancouver Island trip, 1937, gave records for *boreale* as follows: Sooke, (*Ischnura erratica*'s reedy pool) June 7th; Nanaimo district: Departure Bay, July 8th and Newcastle Island, July

16th. Courtenay, July 20th; Forbes Landing district: Upper Campbell Lake (flying on lake shore) August 11th.

A comparison of this list with *cyathigerum*'s localities is interesting, for though the territory covered is the same, the actual breeding place is in every case different. Nor is solution of the riddle simple, such as one preferring large bodies of water, the other small: for in each list are instances of both, and also those of great similarity. The thing is the antithesis of the case of *Ischnura cervula* and *perparva*—the inseparables!

Distribution mainland (selected): Walker (1927) Prince Rupert, Penticton, Revelstoke, Nelson; and (1938) Chaperon Lake. My 1936 records include: Hope and Harrison Bay; and those of 1938, Kaslo, Vernon, Field etc. Buckell (1938) gives 37 localities, and, subsequent to that list, 3 additional. The extent of his range is much as stated under *Lestes congener*.

In 1939, at Atlin (60" north) I took a short series of *boreale* July 12th to August 28th, but it was scarcer than *cyathigerum*, the other truly northern species of the genus.

During my trip of 1940, I took this common species right across the Province: Terrace, June 17th; Smithers, June 22nd; Burns Lake, June 29th; McBride, July 12th; Tête Jaune, Aug. 8th; Mount Robson, Aug. 4th.

Flight period: (continuous emergence) April 29th to October 10th.

Map areas: 1-13. See also Mrs. Gloyd's Synopsis (1939) for records in Alaska.

ENALLAGMA CYATHIGERUM (Charp.)

Walker (1927) gives a number of records, covering a wide range. I will select from mine those that best serve to contribute new territory: mainland, Lower Fraser Valley section: Cultus Lake, July 9th; Chilliwack, July 17th; Hope (Silver Creek) July 26th; Hope (Texas Lake) August 3rd; Harrison Bay (Squawcum Lake) August 15th-19th, flying in hundreds, in cop. Vancouver Island: (northerly) Forbes Landing (Mud Lake) August 9th; Courtenay (Northey's Lake) August 13th.

My Vancouver Island trip, 1937, provided locality records as follows: Sooke, (Young's Lake) mature and in cop., June 12th; Thetis Lake, June 14th; Florence Lake, June 30th-July 4th; Nanaimo district: Wellington Lakes; Forbes Landing: Mud Lake and Lower Campbell Lake, July 26th-August 18th. Courtenay, "Forbidden Plateau," (3200 feet) August 26th.

In 1938 I took this species: Kaslo, Crawford Bay, Christina Lake, Penticton, Vernon, Golden, Kamloops and Clinton, in the Cariboo, where it was very common. Walker (1927) records: Atlin, Chilcotin, Prince Rupert, Okanagan Landing, Nelson, Cranbrook, Bear Lake, Peachland, and, (1938) gives additional stations: Rosedale and Chaperon L. Buckell (1938) contributes 36 locations, north to Prince George.

On my trip of 1939 to Atlin (60'' north) I found this species fairly common July 6th, and it was at the height of its flight July 9th to July 19th. Frost occurred Aug. 3rd and Aug. 11th, but I netted single survivors August 27th and 29th.

In 1940, on my trip between Prince Rupert and the Alberta border, I netted this species at: Terrace, June 18th; Smithers, June 22nd; Burns Lake, June 30th, and, Vanderhoof, July 8th, but none eastward of that point.

Usually in western Canada the colour markings of this species and *E. boreale* are identical, therefore the specimens taken by me of *cyathigerum* at Terrace (Lakelse Lake) are worthy of special mention. The dorsum of the abdomen was heavily marked, reminding one superficially of *E. carunculatum*. Walker confirmed my identification, and stated that he had never seen specimens of *cyathigerum* like those sent to him.

Flight period: May 17th to October 8th.

Map areas: 1-11, -3 and 14. See also Mrs. Gloyd's Synopsis for records in Alaska.

ENALLAGMA HAGENI (Walsh)

There was no good reason why this species should not occur northerly in British Columbia, for I had taken it in the adjoining Province of Alberta in 1918, at Red Deer; but the fact remains that it was unrecorded until 1937, when Buckell took 8 males at Stanley, in the Barkerville district, July 9th. The two points mentioned are of about the same latitude: north of 52''.

Flight period: (based upon Prairie records) Mid-June to end of July.

Map areas: 10.

ENALLAGMA EBRIUM (Hagen)

The two records given by Walker (1927) are in the Okanagan district, Penticton and Oliver, June-July, and I took it at Enderby July 31st 1938. Buckell contributes several more localities in the Sonoran-dry Transition section: Vernon, Falkland and Kamloops. Farther north, he records Bridge Lake and Prince George. Ricker found it at Chaperon Lake, July 27th 1934. *Ebrium* also ranges eastward into the Kootenay Lake section. I netted a long series at Crawford Bay, June 28th 1938, and Buckell supplies Boswell and Wasa in that area.

At Penticton, July 15th-22nd 1938, I took it flying with *carunculatum*, *boreale*, *cyathigerum* and *clausum*, but at Crawford Bay (Fraser's Lake) and Enderby the first mentioned only was present.

My trip of 1940, Prince Rupert to the Alberta border, added one northern habitat to that supplied by Buckell at Prince George, viz, Burns Lake, July 4th. These are both north of Lat. 54''.

Flight period: June 8th to September 3rd.

Map areas: 5, 7, 8 and 10.

ENALLAGMA CARUNCULATUM Morse

In this Province, where the tendency is to oversized insects in a number of genera of *Odonata*, this species provides, in certain localities, the sole exception that I have noted of an undersized form. At Lost Lagoon, Vancouver, the insects are very uniform, length 34-36 mm., and this I regard as normal. Specimens of similar type have been taken by me on the mainland: Lulu Island, August 21st; Chilliwack, July 15th; Hope (Texas Lake) August 3rd; Hatzic Lake, August 8th; Crawford Bay, West Kootenay, August 19th, and Nelson, July 27th-August 28th.

My localities for the smaller form are: Campbell River, Vancouver Island—the most northern record for the species—August 6th-7th; and, on the mainland, Hope (Kawakawa Lake creek) August 4th. The Hope specimens are not only short in length, but slim bodied; in fact, less robust than *Ischnura erratica*.

On Vancouver Island my three months' trip, 1937, only resulted in four additional records: Thetis Lake, emerging, June 22nd; Florence Lake, emerging, July 5th; Nanaimo district: Wellington Lakes, adult—common, July 14th; and Forbes Landing (Mirror Lake) 2 males.

Further distribution: In 1938 I took this species, Kaslo, June 19th; Christina Lake, July 4th; Penticton, July 15th; Vernon, July 27th; Enderby, July 31st and Revelstoke (valley) August 4th. Walker (1927) gives additional locations: Okanagan Landing and Nelson, and (1938) Chaperon Lake. Buckell (1938) contributes: Bridge Lake, Canim Lake, Douglas Lake, Mabel Lake, Nakusp, Oliver, Osoyoos, Salmon Arm and Sugar Lake. The species is clearly of wide distribution in the Province, but less so than *boreale* and *cyathigerum*.

My trip of 1940 provided an interesting record for *carunculatum* at Burns Lake: a teneral male, June 30th, and further tenerals and adults July 4th. The specimens were taken on a road, near a small creek bed, now reduced to a few stagnant pools. Walker (1927) places this species in the General Austral Fauna, so Burns Lake, north of 54°, must be regarded as distinctly boreal for the insect's true range.

Flight period: June 4th to September 29th.

Map areas: 1-7, 10.

ISCHNURA CERVULA Selys

Kennedy (1915), writing of this species and *I. perparva*, states: "wherever I have found one, the other . . . has always been found." This has been my experience almost invariably in British Columbia, say from May 24th to August 24th: *perparva's* approximate flight period. But *cervula* is the rival of *Enallagma boreale* as to the length of its season: my records dating from May 7th to October 25th.

In the field mature *cervula* males are instantly recognized by the spread of the wings when settled and the four blue spots on the dorsum of the thorax. The homoeochromatic female appears the most common, differing from the male in that only segment 8 is light blue, instead of segments 8 and 9.

On my Vancouver Island trip, 1937, the records were: Sooke, June 7th; Thetis Lake, June 14th; Florence Lake, June 30th-July 4th; Nanaimo district: Departure Bay, July 8th; Wellington Lakes, July 14th; Newcastle Island, July 16th; and Forbes Landing, July 26-August 18th. The last mentioned locality is the most northward on the Island, but I do not doubt that it extends into the highwayless northern section.

Distribution mainland: during 1935 and 1936 I took *cervula*: Vancouver district, Cloverdale, Cultus Lake, Chilliwack, Hope district, Hatzic Lake, and 1938, Kaslo, Crawford Bay, Christina Lake, Penticton, Vernon, Enderby, Revelstoke. The records given by Walker (1927 & 1938) relate to much the same territory. Buckell (1938) extends the range northward with the following localities: Bridge Lake, Redstone, and, notably, Quesnel, situated on 53".

Flight period: (continuous emergence) May 7th to October 25th.

Map areas: 1-7, 10.

ISCHNURA PERPARVA Selys

Males of this species, besides being smaller than *cervula*, may also be distinguished in the field by the striped dorsum of the thorax and the light breaks between the abdominal segments. The orange and black females are easy to detect; whole those of the pruinose from mope among the grasses like little ghosts.

Walker (1927) gives southern Vancouver Island records, and but one on the mainland: Penticton. Avoiding his territory, I select, mainland: Vancouver May 24th-August 24th; Lulu Island, August 21st; Cultus Lake, July 1st; Chilliwack, July 17th; Hope, July 28th; Hatzic Lake, August 8th; Harrison Bay, August 15th. Vancouver Island: Campbell River, August 6th; Forbes Landing, August 9th; Courtenay, August 14th.

On Vancouver Island, 1937, my locality records and dates were—as might be expected—precisely the same as those for *I. cervula*, and repetition is unnecessary.

Further distribution, mainland: Enderby, Revelstoke valley (F. C. W.); Buckell (1938) Bridge Lake, Kaleden, Lumby, Oliver, Osoyoos, Peachland, Robson, Similkameen, Vaseaux Lake. Of these Bridge Lake alone ranks as northern. Further, it must be admitted, in spite of what was said under *I. cervula* as to the association in the field of the two species, that a long list of actual records on the mainland fails to substantiate the statement. It would be truer to state: where *perparva* is, there also *cervula* will be found.

Flight period: May 16th to September 9th.

Map areas: 1-6, 10.

ISCHNURA ERRATICA Calvert

This, a somewhat rare species, was located by me near Cultus Lake—precisely, a shallow reedy runway close to the Indian Village—on July 2nd 1936: Ricker had taken a male a day or two previously at what he calls "Lost Slough" and he had a previous record August 4th 1934. On the date given I took a pair in cop.; and single males on July 6th and July 9th.

The runway was quite shallow, possibly thirty feet across and one hundred feet long. It was drying up rapidly. At this insignificant piece of water, on July 2nd were flying, beside *Ischnura erratica*, *cervula* and *perparva*; *Lestes dryas* (common), *disjunctus* and *unguiculatus*; *Amphiagrion abbreviatum* (fairly common); *Libellula quadrimaculata* and *lydia*; two males *Somatochlora semicircularis* (both netted) and *Sympetra pallipes* et al.

On the water the *erratica* male cannot be confused with *cervula* or *perparva*, for while alike as to general appearance (particularly the latter, since it also has the light rings between the segments), it is distinctly larger; and the light blue patch near the end of the abdomen, occupying as it does segments 9, 8 and the apical half of 7, instantly catches the eye. The female taken was the small pruinose form.

My only record for this species on Vancouver Island, 1937, was in the extreme south at Sooke, June 7th-9th. The breeding place was very similar to that in the Cultus Lake district and, excepting for the absence of *A. abbreviatum*, its associates were the same. I took a series of males and one homoeochromatic female. The latter, while slightly shorter and stouter, is otherwise very like the male, even to the light blue patch intruding into segment 7. She is easily identified on the water. I conclude that *erratica's* rarity is due to strict requirements in its breeding place: whereas the commoner *I. cervula* and *perparva* appear satisfied with anything from a pool to a large lake, from a reedy marsh to a brook.

Further distribution: Walker (1927) records four localities, by various collectors, all on Vancouver Island: Ucluelet, July 19th; Sahtlam, May 11th and 15th; Victoria, May 10th and June 2nd; and Langford Lake, July 30th.

Flight period: May 10th to August 4th.

Map areas: 1 and 4.

Suborder Anisoptera

CORDULEGASTERIDAE

CORDULEGASTER DORSALIS Hagen

This is the largest dragonfly in the Province, females having a length up to 87 mm., which exceeds our *Anax junius* of the same sex, though the latter species has a slight advantage in wing spread: 108 mm. as against 110 mm. Needham (1929) states that the wings are hyaline, and Kennedy, though giving the colour pattern, makes no mention of the wings. In females the costa is stained yellow to the wing tip.

I have had quite exceptional opportunity of observing *dorsalis*, since it flies on the small creek which feeds and empties Beaver Lake, Stanley Park, Vancouver. Here it is at sea level, in fact, close to salt water. The flight up and down the creek is as described so admirably by Kennedy (1917). In August 1936 I discovered *dorsalis*, in numbers, on Elbow Lake creek, Harrison Bay district, flying with *Octogomphus specularis*. The creek grade is followed by an abandoned logging railway, which crosses it a number of times and affords the collector close access to the water. Bushes encroach upon the roadbed on either side. Under such conditions the insects, both male and female, leave the creek at obstructions, or for sunshine, and fly up and down between the bushes: I caught a female and a number of males on bridges and flying over the ties, where the same somewhat slow but very direct flight is observed. If frightened, the insect can fly with incredible speed.

Kennedy states that the female he watched ovipositing "usually faced the centre of the stream"; and this always struck me as strange on her part, since to keep in the right depth of water, she must obviously follow the contour of the shore line. Kennedy's female was I think the exception to the general rule: certainly those noted by me faced the bank. The last one observed, August 21st, worked her way along upstream in the shade under a log bridge, and having used her spade every five inches or so, she finished her task by swinging over deeper water (possibly ten inches) and washing off the tip of her abdomen several times.

On August 14th a pair were observed flying in cop. over the water at a small dam near the headwaters of Elbow creek. They turned and went back toward Elbow Lake, some hundred yards distant. Both sexes will rest on bushes along the railroad track, on trees over the water, and (one instance) on the face of rock dropping perpendicularly to the creek.

I have taken *dorsalis* from June 21st at Vancouver to August 21st at Elbow creek. But the former were past the teneral stage, and the latter were by no means over, so, to estimate the flight period as from mid-June to the end of August should be within the facts.

In spite of the scant published records for *dorsalis* in British Columbia, I am convinced that it is one of the most widely distributed coastal species from California to Alaska (see Kennedy 1917, Gloyd 1939). On Vancouver Island, 1937, my records were: Florence Lake, June 30th; Goldstream, July 4th; Departure Bay, July 8th; Wellington Lakes, July 12th; Newcastle Island, July 16th; and Forbes Landing, every creek in the district, July 25th to August 18th.

This species will wander from its creek; and I have taken them hawking in an orchard, flying on lake shores and on sunny roads. Near the largest of the Wellington Lakes—far from any creek—I observed two females hawking over a road. One was seized by a male and I netted the pair in their heavy flight, date July 12th. Their requirements as to a creek are very broad—any-

thing from a mountain torrent to a drainage ditch will suffice; indeed, I have seen them on dry creek beds, waterways only at the Spring freshet.

Dorsalis, in spite of its size, is in character a tolerant, easy-going creature, attending strictly to its own affairs. I have never observed it taking any notice of other species or devouring smaller ones.

On Miller's creek I watched a female for a long while. Having deposited eggs along either shore of the pool by the hovering, perpendicular method peculiar to her kind, she found a place near the centre where a patch of algae was just below the surface. This greatly pleased her, and she remained stationary while she 'spaded-in' 30 or 40 eggs. She then rose to go, and an *Aeschna* male—either *palmata* or *canadensis*—attempted to seize her. The inexcusable and unexpected assault knocked her to the ground, and it required probably nearly a minute to extricate herself from the long grass. When she got on the wing he seized her again. A bush then concealed them from sight, but I hope that she turned upon him (which she was quite large and strong enough to do) and punished him for his importunity.

Walker (1938) records an additional mainland locality: Cultus Lake (Sweltzer creek) August 25th, 1936. In 1940, at Terrace, I am confident that I saw a teneral, but failed to net it. The date, June 18th, would be early for north of 54°.

Flight period: June 10th to August 25th.

Map areas: 1-4. Alaska, type locality, Gloyd 1939.

PETALURIDAE

TANYPTERYX HAGENI (Selys)

To Dr. W. E. Ricker falls the credit of adding this rare insect to the records of odonate fauna in Canada, and, incidentally, the Province of British Columbia. He took a female on Liumchin creek, July 8th, 1934; and he has, I understand, observed one or two others in the same locality. The creek is distant a stiff walk from Cultus Lake, some 65 miles eastward from Vancouver and near the Washington border. The ancient insect, desiring to continue its earthly existence, could scarcely have chosen a better spot: a statement I make with full knowledge of its inaccessibility and some bitterness—for I have tried to get there!

Strangely enough, due to Dr. Ricker's penchant for rare insects, yet another locality for *T. hageni* has been found by him: this time in the State of Washington: and, more precisely, the White River, Mt. Rainier. He saw some 6 or 7 individuals, and netted 2 males and 1 female, July 21st, 1937. By his great kindness one of the former is in my care. This species was discussed and figured most interestingly by Clarence H. Kennedy (1917, pp. 508-511).

A second Canadian locality by Ricker is Yale (Fraser river—vicinity Hell's Gate) a male, August 30th, 1938. This is a most interesting record, for,

though doubtless a stray from the higher reaches of some nearby creek, it gives promise of further distribution in the Cascade range.

Flight period: July 8th to August 30th.

Map areas: 4.

GOMPHIDAE

OPHIOGOMPHUS COLUBRINUS Selys

This species has been taken from Newfoundland and Fort Severn, Ont., to Hudson's Bay Railway in Northern Manitoba, and again northward in Alberta, so it was a strong 'probability' for this Province. The fact remains, however, that there was no record up to July 15th 1938, when Ricker found it on Cluculz Creek, near Prince George.

Flight period: (based upon the main flight of other species of the genus in the Province) July and August.

Map areas: 10 (northward).

OPHIOGOMPHUS SEVERUS MONTANUS (Selys)

During my residence at Nelson, 1920-1934, I took this species both on the hillside road to the Golf Course, and at Crawford Bay: some twenty-five miles distant on the east side of Kootenay Lake. Like the typical form, *severus*, in Alberta, *montanus* flies from the second week in July to the fourth week in August. Both forms delight in disporting themselves along sunny roads, and to rest upon the warm surface. The females are always scarcer than males: Walker also took it at Nelson.

In view of what Kennedy (1917, p. 534) says relative to altitude, in its possible effect upon the above discussed species, it might be well to state that at Red Deer, Alberta, the habitat of *severus*, the altitude is some 2,700 feet, and at Nelson—Crawford Bay, the localities of *montanus* in British Columbia, 1,700 feet.

Distribution: Buckell (1938) records taking this species: Adams Lake, Aspen Grove, Canim Lake, Chilcotin Lake, Mable Lake, Princeton, Salmon Arm and Summerland, (71 specimens). Some of these localities are in the vicinity of 52", just north of which I took *O. severus* at Red Deer, Alberta. I am assuming Buckell's specimens all refer to the dark form figured by Kennedy (1917).

Flight period: June 14th to September 5th.

Map areas: 4 (eastward), 5, 6, 7, and 10 (southward).

OPHIOGOMPHUS OCCIDENTIS Hagen

To the four scattered records given by Walker (1927) for this western species, I can add Nelson, West Kootenay district, August 22nd, 1921, a

male. More recently Dr. Ricker reported *occidentis* at Cultus Lake, and during my stay there June 16th-July 20th, 1936, I kept the species under close observation. The first specimen taken was on June 24th, a male; and by July 7th I had netted six more, all males. On July 16th I took two pairs in cop., in fact, in one of these cases—the cluster flying slowly and clumsily—I found that I had a ♀ and two ♂s, so the males must have found females of their species as scarce as I did. However, by July 20th I had secured one more, and had also increased my series of males.

I watched a female seized as she flew over the water: the pair soared high into a tree.

Ovipositing was observed in Sweltzer creek pool in the fish hatchery grounds, at that time teeming with yearling steelhead trout. She flew low over the water, apparently washing eggs from the tip of her abdomen; the operation being concluded by plunging full length onto the water and rising again three times. Two females were noted throughout such performance on July 19th. Why those terminating plunges were taken is obscure, and how they escaped the voracious, watchful trout was nothing short of miraculous. Flying with *occidentis* throughout the period covered above were *Octogomphus specularis*, *Macromia rickeri*, and *Argia emma*, to mention the more interesting.

On Vancouver Island, 1937, this species was not seen until Forbes Landing was reached July 25th. There it was abundant and continued so until my departure August 22nd. While females were as numerous as males, they appeared to fraternize without thought of sex—in fact I did not see a pair in cop. during my three weeks' stay. The breeding place was the riffles below the hotel, where the Lower Campbell Lake becomes a swift river: there the occasional female was seen ovipositing. The roadways around the hotel were their favorite resting places throughout the day.

Distribution: Walker's (1927) records: Vancouver, Oliver and Peachland, and Sahtlam on Vancouver Island. Buckell contributes: Lillooet and Pritchard. J. Wynne, Enderby, a female, August 14th 1938.

Flight period: June 8th to October 1st.

Map areas: 1-5, and 7.


This is the species figured by Kennedy (1917, p. 541, with mention of *O. phaleratus* Needham, p. 543) as "true *occidentis*."

GOMPHUS GRASLINELLUS Walsh

Fishing at Christina Lake, Boundary district, the first ten days of July, 1921, I noted one day dragonflies flying over my boat. The spot was the bay of water lilies at the extreme end of the lake, remote from Cascade. One moment I would see a "clubbed" abdomen, and the next green eyes as an insect turned into the sun. A new *Somatochlora* surely! And, wildly excited, I used my landing net "as it shouldn't be used." Disillusionment followed.

They were not one species, but two: *Cordulia shurtleffi* contributing the green eyes, and *Gomphus graslinellus* the club tail, though precise identification of the latter did not come till later. I succeeded in netting three or four specimens: the first record for western Canada.

July 1938 I returned to Christina Lake, and found *graslinellus* on both McRae and Texas creeks. At the former, between the 8th and 12th, I took 7 males and 5 females; the specimens being of recent emergence. With one exception netting was achieved as the insects rested on the gravel roads; but they were extremely wary.

The flight of *graslinellus* when hawking is unique in my experience of western Canadian dragonflies: the insect rising and falling in a switchback course from 3 or 4 feet from the ground to 6 or 7 feet: . I captured one male during such flight, timing the sweep of the net for the low point of the U. Walker informs me in a letter that several related species, such as *Gomphus spicatus*, *exilis* and *lividus*, practise this strange flight, and points out (which I confirm) that it is an *optional* leisurely gait. Flushed from the road, or frightened by the net, *graslinellus* can fly both straight and fast. Alternating with my captures of the gomphine were those of *Macromia magnifica*, with *Argia emma* occasionally seen.

Buckell supplies one other record for this species: Salmon Arm, 125 miles farther north.

Flight period: June 29th to July 12th. The first date would probably be about correct for emergence, but the insect would unquestionably continue on the wing until the end of August.

Map areas: 5 and 6.

GOMPHUS OLIVACEUS Selys

Only three individuals of this species have been taken in the Province, and these at three different locations. Walker, a male, at Penticton, July 28th 1926; Wallis, a female, at Peachland, and Buckell, a female, considerably farther north at Pritchard, but still in the dry Transition zone, Oct. 1st. He was fishing in the south Thompson river and it settled on the boat. The landing net was used.

My efforts to secure specimens have been disappointing, though during 1938 I visited Penticton, Peachland and Chase (on the south Thompson) largely with that purpose in view. At the first mentioned only, July 18th-22nd, did I see *olivaceus*. They were very scarce, and those seen pursued a zigzag course in the middle of the Okanagan river—carefully avoiding my boat. A third day I came equipped with a bathing suit and tried standing mid-stream on silt bars. No *olivaceus* would then appear! Once, in the boat, I was within six feet of a fine male. They do not appear to take up any limited reach; but approach, go by, and continue going!

At Chilliwack, July 20th-25th, 1936, I saw a large gomphine settled on a path that was, I think, unquestionably *olivaceus*.

Flight period: July 28th to October 1st.

Map areas: 5.

OCTOGOMPHUS SPECULARIS (Hagen)

This species (specimens had previously been taken by Ricker) was emerging at Cultus Lake at the time of my arrival, June 16th 1936. One teneral was netted June 18th and a number of exuviae were collected at the headwaters of Sweltzer creek, (which empties the lake) where the transformation had taken place on the fish fences and traps pertaining to the hatchery. No new exuviae were noted after June 19th. It should be mentioned that mid-June was wet, and that the emergence, therefore, took place in cool, rainy weather. During the following five weeks 27 ♂s were captured, mostly on the small creek which runs through the hatchery garden. No ♀ were taken, in fact only two were seen.

On August 12th, 1936, *O. specularis* was discovered at the headwaters of Elbow Lake creek, and nine ♀s and two ♂s were netted that day. These were flying with *Cordulegaster dorsalis*, as described by Kennedy, (1917, p. 574) except that the altitude was not more than 1,000 feet, and no great difficulty was experienced in collecting, for, while the country was wild enough, an abandoned logging railroad provided good footing. Nine more ♀s and eleven ♂s were taken August 14th-18th, the latter date yielding but a pair. From emergence to disappearance the flight period in British Columbia can be stated as approximately two months: June 18th-August 18th being actual dates, 1936. *C. dorsalis* was still flying.

Ovipositing was observed, the insect brushing eggs from the tip of her abdomen at intervals of two or more feet, as stated by Kennedy. A pair were seen flying in cop. and these were netted when they settled on a tree over the water.

Where the creek inhabited by *Octogomphus* drains a lake (the case at both Cultus and Elbow Lakes) the insects will venture into the open, the young males to fly a hundred feet and more from their true habitat, and the aged females, at Elbow Lake, to rest on reeds in the sun for lengthy periods. This was the undoing of one female noted, for an *Aeschna eremita* pounced upon her, settled on a bush and ate her.

Since both sexes rest frequently they are easy to net. On the wing, however, the contrary is the case, for not only do the slim, dark bodies present a poor mark for the eye, but at the critical moment they have an annoying propensity of vanishing into the shade.

Flight period: June 10th to August 18th.

Map areas: 4 (southward).

AESCHNIDAE

AESCHNA COERULEA SEPTENTRIONALIS Burmeister

On my Atlin trip (1939) I located a breeding place of this species (previously unrecorded in the Province) on July 8th, and netted 2 males and 2 females on that date; the total series taken to August 28th being 20 males and 10 females. The latitude of Atlin is just south of 60° north; the extreme northern end of Atlin Lake being in the Yukon. The species occurs, I found, throughout the district where the environment was suitable, but they were never really abundant.

In freshly-taken young males the face is a light grey-blue; and the thoracic markings are clearly defined. The abdomen may be as dark as figured in Walker's monograph, but the majority were lighter. In all my specimens the preocular band is much heavier than as shown by Walker (fig. 3, pl. 22). In both sexes the T-spot is subject to extreme variability: one or both ends of the cross-bar may curve downward to merge into the preocular band; and, in one male specimen, T-spot and band form a solid black spatulate patch. In my total series (both sexes) aberrations as to the T-spot were 25 per cent. Most of my short series of females were too general to estimate the ratio of dimorphism in this species. I believe most of them would have developed into the homeochromatic form, but an aged specimen, taken ovipositing on July 14th, was decidedly heterochromatic. The usual overall length of males is 62 to 64 mm., but I have one as small as 55 mm. Females are about 57 mm.

Ovipositing is performed in wet moss patches between tufts of scant grass, or in the creamy-pink muskeg slime bordering small pools, of say 25 to 50 feet in length. They lie flat when so engaged, curving the abdomen to stab in the eggs, and cocking the appendages upward to clear the slime. Walker, in his monograph, comments upon the lack of female appendages in museum specimens; but this I can state is due to the tacky nature of the muskeg slime and not to carelessness on the part of the insects. The net may be placed over them by cautious stalking. If disturbed, they will move on a few feet, or, thoroughly frightened, speed away. The males fly low over the breeding areas searching for mates; and they frequently rest full length on the wet moss or muskeg slime, similarly to ovipositing females.

The habitat is of rather special interest, since the large muskeg pools, with a well-defined solid peaty edge (as favoured by such species as *Somatochlora albicincta* and *hudsonica*) are clearly unsuitable. They require a pool with an edge leveling off into muskeg slime and wet moss, for, as above stated, it is in such the eggs are deposited. These pools are also preferred by *Somatochlora septentrionalis*, and I have seen two males, one of each species, chasing one another in the middle of the pool, and, at the moment, the only occupants thereof. A third species occurring at these pools is *Leucorrhinia hudsonica*.

The flight periods of this species and *A. sitchensis* will doubtless vary north and south of their range; but, judging from my observations at Atlin,

septentrionalis must emerge around June 25th (two or three weeks before it ally) and continue its flight into September: the last specimens taken by me being 2 males August 28th.

Nymph: on July 9th, the day being too cold and cloudy for imagoes, I determined, if possible, to find an exuvia of this unknown nymph; and I searched the species' breeding ground foot by foot. Eventually I got one (a perfect specimen) clinging to a dry grass tuft midst the wet moss, and some ten feet from the water of the pool. In view of Professor E. M. Walker's pre-eminence in this genus, I deemed it only fitting that the description should be his:

Nymph (Figs. 1-4) small and slender, resembling that of *A. sitchensis* but differing in the longer labium and longer lateral spines on the abdominal segments, which are present on segment 6 as well as on 7 to 9.

Head, thorax and wing-sheaths uniform pale brownish, legs of same colour, the femora with the apices and faint traces of an ante-apical annulus, darker. Abdomen light brownish with pale markings as in *sitchensis*, *interrupta* and *eremita*. An ill-defined median dark band, darkest on segments 8-9, and partially divided antero-mesally on 4-7 by a pale streak which extends caudad from base of segment. The dark median band is bordered laterally by pale bands, laterad of which is a series of subcrescentic spots and a broad marginal pale are just enclosing the lateral muscle scars, which are outlined in brown. Puncta moderately dark.

Head small, postocular margins straight for a short distance then passing in a broad regular curve into the hind margin, which is slightly excavate in the middle. Eyes as in *sitchensis*, moderately prominent, occupying about two-thirds of the lateral margin of the head. Mentum of labium (Fig. 2) reaching a little beyond mesocoxae, like that of *umbrosa* in form, basal breadth about half the apical and less than one-third of the length; greatest breadth three-fifths of length, sides nearly straight and slightly divergent in proximal half, strongly arcuate in distal half; median lobe forming an angle of about 120°, with straight sides; labial palpi broad, the terminal parts parallel-sided, squarely truncate, outer angle not rounded, inner angles without a tooth. Supra-coxal processes (Fig. 3) low and obtuse, the posterior branch much the broader at base, the intervening angle obtuse. Abdomen narrower than thorax, its greatest breadth from segment 5 to 7, lateral spines present on segments 6 to 9, those of 6 minute, those of 7 extending half-way to the base of segment 8, those of 8 three-fourths of the distance to the base of 9, those of 9 to the proximal third of 10. Caudal pyramid two and one-half times as long as the tenth segment. The inferior appendages longer and more gradually incurved at apices than in *sitchensis*; median appendage one-third shorter, lateral appendages two-fifths as long as the inferior pair. Lateral valves of ovipositor just reaching the end of segment 9, the terebra barely longer (Fig. 4).

Length of body 34 mm., mentum of labium 6 mm., hind wing 7.75, hind femur 5.75; inf. apps. 4; ovipositor 2.5; width of head 7; width of abdomen 5.

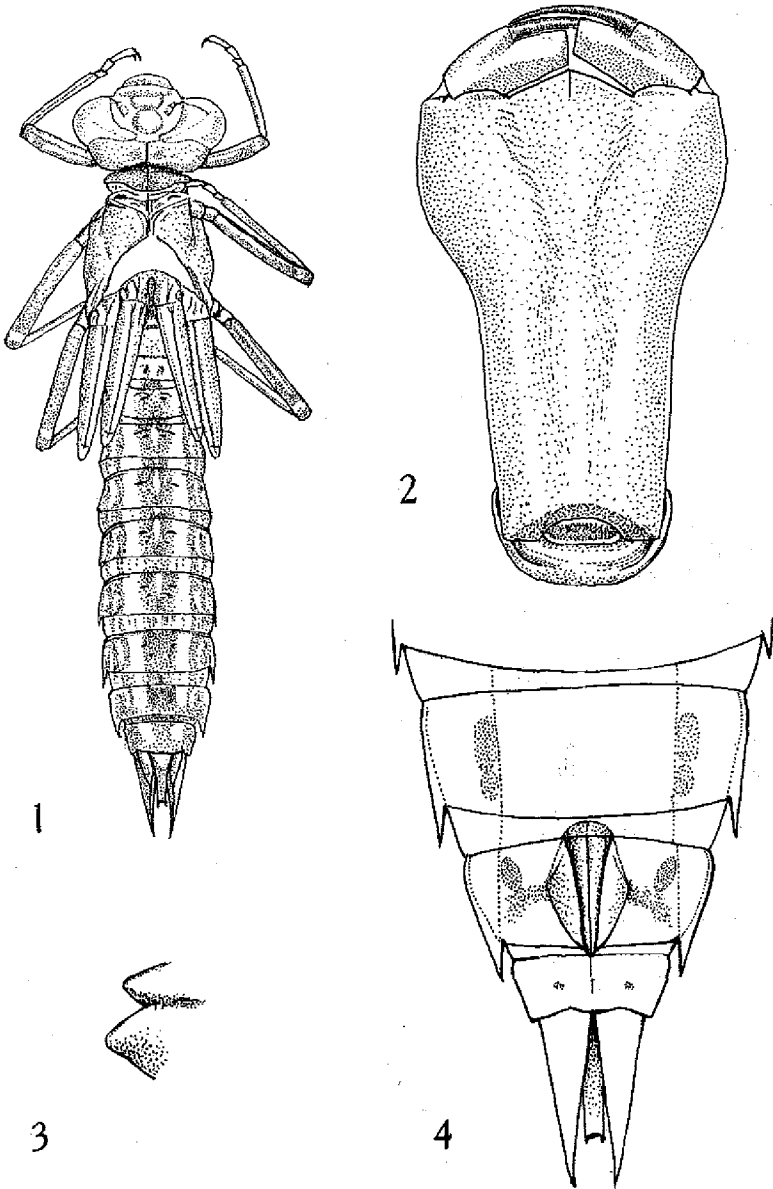


PLATE 1. *Aeschna coerulea septentrionalis* Burm. Fig. 1. Final exuvia, ♀. Fig. 2. Labium. Fig. 3. Left supra-coxal process. Fig. 4 Terminal abdominal segments, ventral view, showing ovipositor.

The nymph of the typical race of this species (*A. c. coerulea* Ström) has already been described by Ris (Mitt. Schweiz. Ent. Ges. XII, 7: 348-354). Comparison of the exuvia of *septentrionalis* with two exuviae (♂ and ♀) of the typical form from the Spiesshorn, Bavaria, confirm the view held by the writer that these two forms are best regarded as races of one species. The Bavarian exuviae are larger with a relatively more robust abdomen, slightly broader labium and somewhat darker coloration, lacking the pale median streak. None of these features, however, appear to be reliable characters, certainly not in the case of the colour-pattern. (E. M. Walker).

Flight period (actual captures) July 8th to August 28th.

Map areas: 13.

Note: Mrs. Gloyd's Synopsis (1939) gives no record in Alaska, but, (p. 15) mention is made to a record from Sitka (Hagen, 1856, p. 381) as possibly this species. The proximity of Atlin to the "panhandle" of Alaska would certainly indicate its presence there at habitats as described in this paper.

AESCHNA SITCHENSIS Hagen

When I arrived at Massett, Graham Island, Queen Charlotte Islands, July 17th, 1935, *A. sitchensis*, newly emerged, was the common dragonfly and the only species of that genus then on the wing. For a period of two weeks, both on the roadways at sea level and on the upland muskegs, I had opportunity of observing these insects and their choice of resting places. These were invariably tree trunks, living or fallen, planks in the roadway or the sand in between, and, on the muskeg, twigs of dead bushes: never green vegetation on either tree or bush. My Q.C.I. notes respecting *sitchensis* include the statement that they were "very tame"; and I now recollect that I amused myself upon occasion by plucking them from their resting places with my fingers.

On Vancouver Island, 1937, a short series of this species was taken in the Forbes Landing district between July 26th and August 11th. It occurred in two localities, each the roadway above a cedar swamp. One is situated a mile or so from Lower Campbell Lake on the Upper Campbell Lake road, and the other the pack trail past Upper Campbell Lake camp. To the first mentioned (being readily accessible) some time was devoted, for the possibility of *Somatochlora franklini* or *Coenagrion interrogatum* as flying mates with *sitchensis* was not overlooked. Neither was seen, but individuals of *Cordulegaster dorsalis* would cross the road to follow their creek down into the cedar swamp. There was a strong temptation to do likewise, for I much desired to find *sitchensis*' breeding pot-holes—that must have been there—but consideration of that Devil's Club underbrush always served to check the impulse.

Distribution mainland, south of 52", Prince Rupert (E. M. W.) Field (E.M.W., E.R.B., F.C.W.) August 10th, Jesmond (E.R.B., F.C.W.) August 29th.

On my visit to Atlin, B.C., 1939 (60" north) nothing was seen of *A. sitchensis* until July 14th, when a female was taken emerging with her exuvia.

At the same habitat on that day *Somatochlora franklini* was flying, and an aged *Aeschna coerulea septentrionalis* was netted ovipositing. My further captures of *sitchensis* were as follows: July 18th, a young male; August 8th, a homoeochromatic female; August 9th, 2 males; August 21st, 1 of each sex.

The above paragraph suggests three points worthy of comment: (1) a further confirmation of *A. sitchensis* as a flying companion at the habitat of *Somatochlora franklini*; (2) the relative dates of emergence of *sitchensis* and its ally, *A. c. septentrionalis* at the same habitat: the latter appearing, as I estimate it, two or three weeks earlier; and (3) the comparative rarity of *sitchensis* to its ally at that latitude. This, I take it, would be the true range of *A. c. septentrionalis*, but well northward in the range of *sitchensis*. Walker (1927) records finding one or two *septentrionalis* at Banff, Alta., June 29th 1913, "in company with *A. sitchensis*, which was common." There (51" north) *sitchensis* would be the species in its true territory, and *septentrionalis* at the extreme south of its range. Relative to these views, Walker warns me that we have no positive knowledge that *sitchensis* does not range as far north as its ally. I, therefore, qualify the argument as my personal opinion in the matter.

My trip of 1940 provided a record for *sitchensis* in the area, Rocky Mountain Range, north, viz, at Mount Robson, August 4th. This, of course, was to be expected, but the territory had, previously, not been worked. It was flying with *Aeschna juncea*, *eremita*, *palmata*, *umbrosa* and *interrupta lineata*, with *Somatochlora semicircularis* in abundance.

Flight period: (Actual captures) July 14th to August 29th. It would undoubtedly emerge earlier, and fly later, than these dates would indicate.

Map areas: 2, 4 (northward) 8, 9, 12 and 13. Also Alaska, Gloyd 1939).

AESCHNA JUNCEA L. (race AMERICANA Bartenef)

To the three widely separated records for British Columbia given by Walker (1927), viz., Inverness, Prince Rupert, and Grouse Mountain, Vancouver, I can add Port Clement, Queen Charlotte Islands, two ♀s, July 31, 1935; and the same year, on Vancouver Island, Forbes Landing, August 9th, a ♀, and Courtenay, August 13th a ♂.

My 1937 trip on Vancouver Island produced but two records for this species: southward, at the junction of Waugh and Goldstream creeks, July 4th, 2 females; and on the "Forbidden Plateau," Courtenay (3,200 ft.) August 26th, 5 males. The first of these was quite unexpected, being a low elevation for *juncea*, so far south. The second is a typical habitat, and the Courtenay record of 1935 was doubtless a stray from the Plateau.

Distribution mainland: I have records Field, August 8th-11th 1938, common; Kamloops (Lac le Jeune) August 24th, a male. Buckell adds: Leancoil, Lumby, Penticton, Quesnel and Sinclair; and Ricker contributes, Cultus Lake (Liumchin Mt.) August 26th.

On my visit to Atlin, 1939, (60" north) young males, just come to adult coloration, were first taken July 15th, and the flight continued until the end of August, when I left for the south.

Females, of both colour forms, were observed ovipositing around the edge of muskeg pools on many occasions: reed stems being grasped and the abdomen being lowered some two inches below the surface to the muskeg slime.

On my trip of 1940, I took this species in the Yellowhead Pass, at Mount Robson, August 4th, 2 males.

Flight period: June 16th to August 28th.

Map areas: 1-6, 8-13. Mrs. Gloyd's Synopsis (1939) provides a number of records in Alaska.

AESCHNA SUBARCTICA E. M. Walker

At the time of publication of his monograph (1912) Walker believed this species confined to the Canadian zone—Atlantic Coast to Manitoba; and to the date of his "The Odonata of the Canadian Cordillera" (1927), there was still no record to upset such belief. Then, August 26th 1934, Buckell took *subarctica* at Field, a single male.

To establish the species further as a native of British Columbia, a male fell to my net on Vancouver Island, Courtenay (Northey's Lake and Black creek) August 13th, 1935. But if Walker overlooked British Columbia as a possible region for *subarctica*, it was not for lack of knowledge of the species. I quote his monograph, page 100: "*Ae. subarctica* is closely related to *Ae. juncea*. . . . these two species fly together at Nipigon, Ont." To which I may add, so they do at Courtenay—see my record for *juncea* there, of the same date. The natural law implied here, *the association of species under like environment*, while often at fault can, upon occasion, give the field worker a great thrill.

On my trip of 1940, I located *subarctica* at Tête Jaune, (the entrance to the Yellowhead Pass) August 12th, netting 4 males: the habitat being the muskeg pools bordering a large reedy slough. The day was unfavourable, being both cloudy and windy. Two days previously I had netted several *aeschnas* on the slough proper: *palmata*, *eremita* and *umbrosa*, but not *subarctica*. Now, on the muskeg pools, my four captures were all that species. Probably to avoid the wind, the insects were flying low, just over the tips of the moss rising to the surface of the water. My specimens were all netted at one pool, at the only spot it could be approached. Assuming that the species was also flying at the other unapproachable pools, then it is obvious that the insect is not rare at this habitat: Lat. 53 N., altitude, 2,600 ft. I did not take *Aeschna juncea* (*subarctica*'s usual flying mate) at Tête Jaune, but I had taken both *Aeschna juncea* and *sitchensis* at Mount Robson, 18 miles to the east, and they doubtless occur at Tête Jaune.

Flight period: (actual dates of capture) August 12th, 13th and 26th. A safe assumption would be early July into September.

Map areas: 2, 8 and 9.

AESCHNA INTERRUPTA Walker

The four *races* of this species, as described by Walker, present an interesting but somewhat difficult example of geographical forms, and the intermediate varieties resultant where the respective territories of two of these forms converge. In this paper it would be out of place to discuss the *Ae. interrupta* problem at length, but since in British Columbia it reaches the acute stage, a brief outline as to the distribution of the *races* appears necessary.

(a) *AESCHNA INTERRUPTA INTERRUPTA* Walker—This is the eastern race, occurring—north of the international boundary—from Newfoundland to Ontario.

(b) *AESCHNA INTERRUPTA LINEATA* Walker—The Prairie-country race, occurring from the Rocky mountains in Alberta, through Saskatchewan and Manitoba to western Ontario.

My trip 1940, I took specimens of race *lineata* (passed upon by Walker) in the Yellowhead Pass, at McBride, Tête Jaune and Mt. Robson, July 15th-August 11th.

Map areas: 9.

Note: As must be expected, between the two great areas of distribution for the above mentioned races of *interrupta*, a "no-mans-land" occurs, which Walker has found to be the Patricia section of the Kenora District in western Ontario. Here variable forms will be taken leaning towards one or other of the *races* to east and west.

(c) *AESCHNA INTERRUPTA INTERNA* Walker—This race is the most southern of the group, occurring in the high mountains of New Mexico and continuing northward through the eastern American cordillera to appear in British Columbia in the territory between the Rocky and Gold ranges, that is, centering upon the Selkirks.

Structural characters of the superior appendages serve to keep this race distinct: "A slight ventral prominence at the base, seen best when viewed obliquely from above. The lateral thoracic bands are typically wider in *interna* than in *lineata*." (Walker, in a letter.)

At Nelson, in the Kootenay District, Walker and myself took specimens of *interna*; and at Golden, August 14th 1938, I netted a good series which were referred by Walker to this race: "about as pronounced as it ever is in British Columbia." I have also specimens from Field.

Map areas: race *interna*, 6, 7 and 8.

(d) *AESCHNA INTERRUPTA NEVADENSIS* Walker—This race, also belonging to mountainous country, has been taken (Kennedy 1917) at high altitudes

in California. Its range is westward of *interna* territory in both the American and Canadian cordillera, occurring in British Columbia between the Gold and Cascade ranges, and westward to the coast. Many of the records throughout the Okanagan District and northward to Kamloops, etc., are referable to *nevadensis*.

Note: Sandwiched in, as in *interna* between the territories of *lineata* and *nevadensis*, off-type specimens abound throughout the entire interior area; and it is for this reason that I am not attempting to define the range of each race except in a general manner.

Map areas: race *nevadensis*, 5 and 4, blending into the coastal form in areas 3, 1 and 2.

Coastal area: On reaching the coast, including Vancouver Island, *nevadensis* grades into a form resembling the eastern race *interrupta* in that the thoracic markings are frequently reduced to spots, but differing from that race in various slight details such as those of proportion of parts. This form probably deserves a racial name but as it has not yet been critically studied, it must remain provisionally in the race *nevadensis*. Walker records this form from Prince Rupert and the Nanaimo district, Vancouver Island. I have taken it from Vancouver (mainland) to Forbes Landing, Vanc. Is.

Map areas: 1, 2, 3 and 11.

Flight period: (all races) 3rd week July to mid-September. Extreme dates: June 25th to October 8th.

Note: Mrs. Gloyd (1939) gives records of races *interrupta* and *lineata* in Alaska. The former is possibly the form discussed above under "Coastal area."

AESCHNA EREMITA Scudder

In the Massett district, Queen Charlotte Islands, the second half of July 1935, this species was associated with *Aeschna sitchensis*: first emergence of both having occurred prior to July 15th. I took several specimens of *eremita*, both sexes, July 19th-30, but it was less common than the typical muskeg species in a terrain largely of that character. My Vancouver Island records are: Forbes Landing (Mud Lake) August 9th-11th; Courtenay (Northey's Lake) August 13th-14th. In 1937, on the Island, this species was flying at Forbes Landing, July 25th to August 18th, when I left.

On the mainland, Harrison Bay (Elbow Lake) August 14th 1936; Field (Ottertail creek) August 10th; Kamloops (Lac le Jeune) August 24th 1938, very common. Buckell records 18 additional localities from the southern interior of the Province north to Prince George. Walker (1927) records the taking of *eremita* at Vancouver and Peachland; and Wellington, Vancouver Island, and gives Atlin (E. M. Anderson) and Daisy Lake, Garibaldi district (G. A. Hardy).

On my Atlin trip, 1939 (60" north) this species was already upon the wing July 6th, but the insects were young and their exuviae were in evidence, indicating recent emergence. By July 15th *A. juncea americana* had appeared as a flying companion at the larger muskeg pools. In spite of adverse weather conditions, including frost on the nights of August 3rd and 11th, the flight of *eremita* continued until August 31st, when I left for the south.

In 1940 I took this species northwards, in the previously unworked territory: McBride, July 15th; and, more eastward, Tête Jaune, August 8th and Mount Robson, August 4th.

Flight period: June 19th to September 2nd.

Map areas: 1-10, 12, 13. Alaska, see Gloyd (1939).

AESCHNA CANADENSIS E. M. Walker

Walker (1927) gives but three localities for this species: two southerly on Vancouver Island, and at Vancouver. I found it common on the Island at Forbes Landing (Mud Lake) August 9th-11th, 1935, and again in 1937, July 25th to August 18th, when I headed south.

On the mainland, my records, besides Beaver Lake, Vancouver, where it flies until the end of September, are: Chilliwack, July 22nd-24th; Hope (Kawakawa Lake) July 28th, Harrison Bay (Echo Lake) August 9th. Buckell records: Malakwa, Salmon Arm and Prince George (Summit Lake).

Hunting for flies, it will follow the contour of the lake shore, entering and searching the low bushes in a most systematic manner. It is consequently very easy to net. At Forbes Landing, it was one of the *Aeschnas* flying on the Lower Campbell Lake shore at dusk. In point of fact *canadensis* in that district was a nuisance, for with nine species of the genus on the wing, I was searching for two more. This meant that every passing *Aeschna* must be netted for positive identification.

Flight period: July 25th to September 29th.

Map areas: 1-6, 10.

AESCHNA TUBERCULIFERA E. M. Walker

This was another species believed to be eastern in its habitat, until Walker himself took it in the Nanaimo district and, in larger numbers than he had ever taken it in the east. Considerably farther north on Vancouver Island, Forbes Landing, I netted a fine male, August 9th 1935, and the probability is that others were there. But with the swarms of dragonflies on the wing—including six species of the genus *Aeschna* and three of *Somatochlora*—one net had its limitations in a short visit.

In 1937, the three weeks spent at Forbes Landing served to prove that of the nine species of the genus there flying *tuberculifera* had good representation. It was possibly most abundant over the roads and grass plots around

the hotel, but specimens were netted at Miller's creek and Upper Campbell Lake, respectively ten and sixteen miles distant. An ample series was obtained. I found that care was necessary in netting females, the appendages being delicate and prone to break off.

The females taken were homoeochromatic without exception; indeed, the likeness to the male was not only in the blue coloration, but in the long graceful body.

Ovipositing was observed on several occasions at Mud Lake, near Forbes Landing. The insects—sometimes side by side—would alight on the slim stemmed sedges rising from shallow water. With a hold, possibly four inches from the surface, they would curve their abdomens and punch eggs into the sheafed stem. This was mid-August.

Flight period: (Actual dates) July 26th to August 19th. It is safe to assume that the full flight would be from early July well into September.

Map areas: 1 and 2.

AESCHNA PALMATA Hagen

I have records for this species from July 7th to November 1st; but, in the same district, it does not precede *Aeschna umbrosa* by more than a few days.

Walker (1927) gave scattered records for *palmata* over a wide territory, commencing with Atlin in the north, and I will select localities from my list best serving to present new ground. Queen Charlotte Islands, Massett tide flats, two ♀s netted and others, both sexes, seen July 27th-30th 1935. Vancouver Island, northerly, Forbes Landing, August 10th; Courtenay (Northey's Lake and Black creek) August 13th; and, 1937, "Forbidden Plateau," (3,200 feet) flying with *Aeschna juncea americana*, August 26th.

Mainland: Vancouver, August-November 1st, and Grouse Mountain, 4,000 feet, August 20th; Lulu Island, August 21st; Cultus Lake, July 7th; Chilliwack, July 24th; Hope district, (Silver creek and lake) July 25th-27th, (Kawakawa Lake) July 31st, (Little Mountain) August 1st, (Hope-Princeton trail) August 2nd, (Texas Lake) August 3rd; Harrison Bay, August 9th, Penticton, Vernon, Revelstoke, Field, Golden, Kamloops, Clinton, July 15th-August 28th. Buckell gives 42 localities, and Ricker 6.

The males of this species vary, even in the same district, in that some have the triangular medio-dorsal spots blue, and some yellow. In insects of apparently the same age, and probably bred in the same water, the factor affecting the pigmentation of these spots is an interesting question.

On my Atlin trip, 1939, (60" north) I found *palmata* less common than I had expected, those netted being: 2 teneral males July 17th, a pair in cop. July 20th and a single male August 22nd. Its usual flying companion farther south, *A. umbrosa*, was not in evidence, though Walker (1927) records latitude 62" north within the range of this species.

In 1940, I took *A. palmata* at two habitats in the Yellowhead Pass: Tête Jaune, August 8th and Mount Robson, August 1st to 7th.

Flight period: July 1st to November 1st.

Map areas: 1-13. For Alaskan records see Gloyd (1939).

AESCHNA UMBROSA, and race OCCIDENTALIS E. M. Walker

This is the last of the genus to emerge, my earliest date being Cultus Lake, July 20th 1936. It is usually associated with *Aeschna palmata*, and both species last out the season to the end of October, or prior freeze up: indeed, I have taken it subsequent to several degrees of frost. At Hope and Harrison Bay *umbrosa* and *palmata*, very numerous, flew until dark, and I caught and released dozens to arrive at which had the advantage in numbers. It worked out about a tie.

Umbrosa varies from ultra-dark specimens, with the P.D. spots in the male much reduced and green in tint, to individuals having such spots considerably larger and blue in tint: that is, the race *occidentalis*. Intermediates between these extremes may also be taken. At Beaver Lake, Vancouver (easily accessible to me) I take all shades.

My records, Vancouver Island: Campbell River, August 8th; Forbes Landing, young specimens, July 26th. By August 18th, when I left, they were fairly common, but some were still teneral.

Mainland: Vancouver, August-October, inclusive; Cultus Lake, July 20th; Hope (Silver creek and Kawakawa Lake creek) July 26th-31st; Harrison Bay (Echo Lake creek) August 9th, Golden, August 14th; Jesmond, August 29th. The last two records were race *occidentalis*.

I give a selection of localities by both Walker and Buckell.

Race UMBROSA: Walker (1927) Yukon Territory, Departure Bay, Vancouver Island; Nelson, Kootenay Lake; (1938) Cultus Lake, Sumas Game Preserve, Fraser River. Buckell (1938) Smithers, Quesnel.

Race OCCIDENTALIS: Walker (1927) Prospect Lake, Shawnigan Lake, Wellington, Greenwood. Buckell (1938) Creston, Falkland, Golden, Mabel Lake, Okanagan Landing, Quesnel, Vernon and Wasa.

Apart from these two races (the status of which remains undetermined) I took at Forbes Landing, Vancouver Island, several specimens of a third interesting form. This is ultra-dark, small in size, and having an extremely thin abdomen. Walker (1927) mentions taking a specimen at Departure Bay, Vancouver Island, "an abdomen almost black with no traces of the postero-dorsal spots." These records are given here for the benefit of future collectors on Vancouver Island.

In 1940 I took typical *umbrosa* in the Yellowhead Pass at Tête Jaune,

August 8th, and, more eastwardly, Mount Robson, August 4th, and Red Pass Jct., July 25th.

Flight period: July 19th to October 30th.

Map areas: 1-10. The fact that *umbrosa* is usually late in emerging quite probably explains the absence of records from areas 11, 12 and 13, and also Alaska, for Walker (1927) gives records from Yukon Territory: Lat. 62"-63".

AESCHNA CONSTRICTA Say

Up to the date of Walker's paper (1927) the only record for *constricta* was a single female taken by himself, August 16th, 1913, at Okanagan Landing. Buckell, however, proved it to be well established in the Province when he took a series of 20 at Creston, August 22nd, 1934; and this was additionally confirmed in 1939, when J. Wynne took specimens at Enderby, August 6th.

Flight period: collected specimens are for the month of August, but based upon the flight periods of its allies, (*palmata* and *umbrosa*) the warm southern territory where it occurs, and its season in Ontario, it is safe to assume an emergence about the third week in July and a continued flight certainly into October.

Map areas: 5 and 7.

AESCHNA CALIFORNICA Calvert

Unlike most of the species of the genus in British Columbia, the flight period of *californica* becomes definitely over before August. In size no larger than *Aeschna sitchensis*, it emerges with the earliest spring dragonflies: *Enallagma boreale*, *Libellula quadrimaculata*, I found a male transforming at Beaver Lake, May 7th 1935, in the sunshine of the forenoon, but I have no other evidence of daytime emergence for this species as an exception to the general custom of the genus. When mating the pair fly around seeking a place to alight, when they rest for some time.

My records serving to add new territory to the locations given by Walker (1927) are: mainland, Vancouver, May 7th to the end of July; Cultus Lake, June 18th-24th; Chilliwack, July 25th.

My 1937 records on Vancouver Island were: Sooke, June 7th; Thetis Lake, June 14th; Florence Lake, June 29th-July 4th. Nanaimo district: Wellington Lakes, July 14th and Newcastle Island, July 16th. Forbes Landing, a male flying with *Aeschna eremita*, *multicolor* and *canadensis*, July 25th. This was the last seen and the date, it will be noted, tallies exactly with my final record on the mainland of the previous year!

Further records: Kaslo, June 19th, and Crawford Bay, June 28th 1938 (F.C.W.); Sumas canal and Liumchin creek (Ricker) May 5th-June 23rd;

Aspen Grove, Adams Lake, Salmon Arm, Squilax, Tatla Lake, Osoyoos, Vernon, Westbank, (Buckell) May 16th-July 4th.

Flight period: April 24th to July 25th.

May areas: 1-5, 7 and 10 (southward).

AESCHNA MULTICOLOR Hagen

This species may be readily identified on the wing, even at some distance, by its light blue face. At Vancouver it is the second *Aeschna* to appear, being usually three or four weeks later than *californica*.

Walker (1927) gives two mainland records for the species, Vancouver; and Ainsworth, West Kootenay district. My south Fraser Valley captures serve to fill this gap partially: Cultus Lake, June 25th; Chilliwack, July 17th; Hatzic Lake, August 8th; Cloverdale, (Nicomkle River) September 5th.

Walker's records for this species (1927) do not extend north of the Nanaimo district on Vancouver Island. I took it all along the route of my trip, 1937, viz: Thetis Lake, June 22nd; Florence Lake, very common, June 29th-July 4th; Nanaimo district: Departure Bay, July 8th; Wellington Lakes, July 14th; and Newcastle Island, July 16th. Courtenay (Northey's Lake and Black creek) July 20th. Forbes Landing, less common than some of the species of the genus, but sharing honours with *Aeschna palmata* at Mirror Lake, July 25th-August 18th.

Distribution: further records: Crawford Bay (Kootenay Lake) (F.C.W.) June 28th and Christina Lake, July 3rd-14th, 1938; and Buckell contributes: Adams Lake, Salmon Arm and Squilax. Enderby, June 18th 1939, J. Wynne.

On my trip of 1940, Prince Rupert to the Alberta border, I found this species flying at McBride, July 12th to 19th, at a large horseshoe-shaped slough, believed to have been a former channel of the Fraser River. Walker (1927) places *multicolor* in the Western Austral or Sonoran Fauna, and since McBride is north of Lat. 53", the insect would appear to be well out of its range as understood at that time. However, it was quite common, flying with *Aeschna eremita* and *interrupta lineata* and nine other species of Odonata, all typical of the Canadian Zone.

Flight period: May 18th to October 3rd. The height of its season is mid-June to mid-August.

Map areas: 1-7, and 9, at McBride.

ANAX JUNIUS (Drury)

This species is far from common in western Canada, in fact I collected dragonflies in Alberta and British Columbia for twenty years before seeing one. When I was at Chilliwack golf course sloughs, 1936, an adult was on the wing July 15th-17th, but it would not come within netting distance, and another was seen August 8th at Hatzic Lake. Then, at Squawcum Lake,

Harrison Bay, August 15th-19th, a true habitat for *junius* was discovered: and the first actual breeding record for the Province. These were recently emerged males and females, (the latter predominating) and as yet uninterested in sex: at least none were observed in cop. As many as ten were seen in the air at one time; and ten ♀s and four ♂s were netted.

My 1937 trip on Vancouver Island, over the length of the highway, provided records as follows: Thetis Lake, June 24th and 27th; Florence Lake, June 30th, and at a nearby small lake, an aged female ovipositing, July 5th. Wellington Lakes, July 12th; Forbes Landing an individual seen July 25th, and a male netted, flying with the aeschnas on the lake shore, August 15th. My experience at Squawcum Lake, 1936, set the time of emergence to mid-August (also the time in Ontario) and I questioned whether any of the records given above were local bred insects, except the last at Forbes Landing—which was probably a stray from one of the lakes farther south.

Distribution: Buckell records Salmon Arm and, southwardly, Oliver and Osoyoos. The last mentioned was July 2nd 1937 (subsequent to his published list) and he gives me a notation "ovipositing in tandem among water weeds." He netted 2 males and 1 female. Osoyoos is close to the Washington boundary and these insects may have come from much farther south.

Flight period: May 18th to September 6th, with the probability of those recorded earlier than August being migrants from the south. The insects of British Columbia, of August emergence, would, of course, fly much later than the last date given, September 6th.

Map areas: 1-5. For Alaska see Gloyd (1939).

CORDULIIDAE

MACROMIA MAGNIFICA McLachlan

There are two positively established habitats of *magnifica* in British Columbia: the Okanagan river, between Penticton and Dog Lake; and Christina Lake, in the vicinity of McRae creek. At the former locality Walker observed the species July 22nd and 23rd 1926, and I netted 10 males there July 18th to 22nd 1938. At the latter I took 6 males and 5 females July 3rd to 12th 1938.

Walker (1927) records 2 males by Wallis at Peachland, July 24th and 31st 1909. These may have been locally bred insects from either Trepanier or Deep creek, or again, they might have been strays from the Okanagan river to the south. During my visit to Peachland July 22nd and 23rd 1938 I saw no *Macromia*. Buckell also publishes a record: Vernon. This single specimen was taken by Bird at Deep Lake, which failed to impress me as a breeding place for *magnifica*. It was in all probability a stray from a river or creek in that district.

At Christina Lake my captures were all on roads, and, in spite of the insect's powerful flight, a comparatively simple matter. The technique is the

same as with *M. rickeri*: watch it coming, wait until it is alongside, and swing with the net as it goes past. Its boldness is its downfall. On the Okanagan river I used a boat and rowed centre stream. Observing a *magnifica* hawking along the bank, I would give two hasty strokes and clutch a bush to steady my craft against the stream. On his return trip he would probably be within netting distance, or, if not, on the following one, for his reach is of no great length. If bushes or other obstacles prevented the boat from reaching the bank, I would get as close as possible to crowd the insect inshore. I found that these males were generally in pairs, and that one safely netted, it paid to remain stationary for the companion to come along.

At Christina Lake, associated species were *Argia emma* and *Gomphus graslinellus*, and on the Okanagan river, *Argia emma* and *Gomphus olivaceus*.

Ovipositing was observed at the latter habitat, but this has been described by Kennedy (1915), and is the same as stated by me for *Macromia rickeri*.

Flight period: (specimens collected) July 3rd to July 31st, but the true flight would be undoubtedly as long as that of *rickeri*, mid-June to the second week of September.

Map areas: 5 and 6.

MACROMIA RICKERI E. M. Walker

This new species, discovered by Dr. Ricker at Cultus Lake, and described by Walker (1937), yielded a good series during my stay at the lake June 16th-July 20th 1936: viz., 21 ♂s and 3 ♀s.

By July 28th I had moved to Hope district, and on this date at Kawakawa Lake an aged ♂ was netted. Keenly interested to learn whether this might be a stray from Cultus Lake, forty to fifty miles distant, or an additional habitat, I worked the lake assiduously. On August 4th two ♂s were seen flying together; August 5th netted a mature ♂ and ♀; August 6th I watched a ♀ ovipositing. The question was answered.

At Cultus Lake the mature nymphs live under stones, and, when I was staying there, eleven were collected and 'pailed' June 17-23rd. Of this total five emerged safely, four being ♀s. These were kept alive two to three days to mature as far as possible, but unfortunately all in the end had to be thrown away, having been spoiled by parasites. However, besides their exuviae, the captive nymphs yielded points of interest. The first emerged about 8 a. m. June 23rd, and by 11 a. m. had spread her wings. The other four (and three more that died in the process) climbed up the sticks provided in the early evening, remaining with head and shoulders out of the water until dark. Transformation took place between 10 and 11 p. m. Assuming that the captives behaved as under natural conditions, it would appear that (1) the insect accustoms itself to atmospheric conditions for about five hours before daring the great adventure, and (2) that, like the *aeschnas*, it is ready for flight and safety before dawn.

June 25th a pair were taken in cop., my earliest date of sexual maturity.

At Kawakawa Lake, where the shore line is not stony, the ovipositing ♀ flew quickly some eight or ten inches above the water, swooping down every five or six feet to touch the tip of her abdomen. The water was five to ten feet deep, with a muddy bottom and reeds well below the surface.

While a very fine flyer, *rickeri* is not particularly difficult to capture on the wing, for, like the aeshnas they will take a fairly definite reach for a few minutes; and they are bold enough to fly within netting distance. True, I used a British "kite" net, 24 by 17 inches, the efficacy of which they may have underestimated. Occasionally specimens may be taken at rest.

Distribution: Besides the two localities given above as occurring in the southwest corner of the Province, Buckell records 2 specimens at Salmon Arm, approximately 125 miles due northeast, and not very far north of a *M. magnifica* record.

Flight period: June 16th to September 10th—the latter date by kindness of Ricker.

Map areas: 4 and 5.

Note: The destruction of my specimens was wrought by the grubs of a minute fly, of which I found the white larvae, brown pupae, and black imagoes all present in the box of papered Odonata two or three weeks later; when the *M. rickeri* had to be discarded, other specimens salvaged, and the box thoroughly cleaned. My view was that the eggs were deposited in the *rickeri* during their captivity under an insect net, out of doors in the sun. I regret that I no longer remember whether the flies were two-winged or four, though I satisfied myself at the time. This is the only occasion in my experience of parasite trouble with newly killed specimens, i.e. where the live dragonflies must have been attacked.

TETRAGONEURIA SPINIGERA Selys

The mainland record of Cultus Lake can now be added to the several Vancouver Island localities given by Walker (1927). Six ♂s were obtained by me in the vicinity of the lake, June 21st-30th, and one damaged ♀ was taken from the radiator of a car.

I had not previously taken insects of this genus; and I was impressed by the unusual colour of the eyes: a peacock blue, comparable in its translucent depth to the green eyes of the *Somatochlora* group. This colour in freshly caught specimens has doubtless been commented upon by other authors, but I have failed to note it. With drying the eyes become a dull brown.

On Vancouver Island, 1937, I took this species from Sooke, in the extreme south, June 12th, to a northern record at Forbes Landing. At the latter camp my last capture was a female, July 30th. She had been resting on a cedar bough overhead, and, attacked by a robber fly, dropped, still in its grasp, to

the table. Early in the insect's flight period I found females difficult to obtain, but later, at Thetis Lakes and Florence Lakes they might be seen flying along the shore and, in some cases, with an inch of the egg-ribbon hanging. The lateral view of females in flight gives the illusion of miniature sea-planes, due, apparently, to the tip of the abdomen being canted upward and a glimpse obtained of the forked vulvar lamina; but, once netted, the peculiarity is gone.

Needham (1901) wrote of *Tetragoneuria* egg masses to be found in lakes, and, to give a conception of bulk, mentioned a barrel. At Florence Lake, June 28th to July 7th, I examined clusters of egg-ribbons (one on either side) too large to be contained in cupped hands, and to which scores of females must have contributed once the initial 'nest eggs' were placed. At the top of the mass would be several braids of recent placement: these of a blue-grey coloration. Beneath these the mass, bleached by the sun and dirtied by the water, would gradually grade to an uninteresting brown. The eggs in newly placed braid are yellow in colour, the shape oblong.

At Thetis Lake this species was emerging in numbers June 16th, the nymphs crawling over the grassy slope and gravel pathway and transforming on the seats and fencing. The distance traversed was 20 feet.

Distribution mainland: Cultus Lake (Ricker and F.C.W.) Kaslo, June 6th-19th; Crawford Bay (Kootenay Lake) June 28th; Christina Lake, July 1st-9th 1938, and egg masses (all F.C.W.). Buckell contributes Squilax and Vernon. Walker's (1927) records, confined to Vancouver Island, were Alberni (Carter) Nanaimo district (Huntsman), Victoria, Langford Lake and Goldstream (Osburn).

Flight period: June 6th to July 30th. At Kaslo, June 6th, they were fairly common and the emergence must have been some days previous.

Map areas: 1, 2, 4, 5, 6, and 7.

TETRAGONEURIA CANIS McLachlan

It seems strange that in a Province where *Tetragoneuria spinigera* can accommodate itself over so wide an area, the range of *canis* is confined to the Sumas canal sloughs. Here Ricker discovered it May 11th 1933, and he has subsequently found it abundant there in May and June.

On June 9th, 1940, I visited the Sumas area and I found the species flying at sloughs along the highway for several miles. The 2 males netted were young, and no females were in evidence.

On my trip of 1940, Prince Rupert to the Alberta border, a northern station was discovered for this species at Burns Lake, just north of Lat. 54". The first specimen netted was at a slough on June 29th, but I later found that the insects were fairly numerous on Burns Lake itself, flying over the water lilies along the shore, July 5th.

Needham, writing of *Tetragoneuria spinigera* (1929), states: "it is the most northern of the genus," but the above Burns Lake record for *canis* is more northerly than any for *spinigera* in British Columbia to date: indeed, by a margin of 200 miles.

Flight period: May 11th to July 5th; but at the latter date, at Burns Lake, they were still plentiful.

Map areas: southerly in 4, and, north of Lat. 54", in 10.

CORDULIA SHURTFLEFFI Scudd.

This is an early summer species, emerging with *Enallagma boreale*, *Aeschna californica*, *Libellula quadrimaculata*, etc. I have records at Beaver Lake, Vancouver, from May 2nd to August 21st; but the fourth week in May to the fourth week in June is the peak of the flight.

Walker (1927) gives a long list of records, covering wide territory, and I contribute the following additional localities: Queen Charlotte Islands, Masett, July 20th 1935, a ♂; Vancouver Island, northerly, Forbes Landing, August 9th-11th 1935; mainland, Boundary district, Christina Lake, 1st week July 1921; Lower Fraser Valley, Hope, August 2nd 1936, a ♀.

On my 1937 trip up Vancouver Island I found this species consistently present, south to north: Sooke (Young's Lake and pool on highway) June 12th; Thetis Lake, June 21st; Florence Lake, June 29-July 4th; Nanaimo district. Wellington Lakes, July 14th, and Newcastle Island, July 16th; Courtenay (Northey's Lake and Black creek) July 20th; Forbes Landing district: Lower to Upper Campbell lake, July 25th to August 18th: by the latter date the flight appeared to be about over. The "green-eyed" *shurtleffi* can be somewhat of a pest in districts where the collector is intent upon the similarly "green-eyed" *Somatochlora*.

Distribution: localities selected from lists to indicate extent of range: Walker (1927) Atlin, Prince Rupert, Cranbrook district, Revelstoke, Nelson & Kaslo. Ricker (1938) Sumas Canal slough. Buckell (1938) Barkerville, Prince George, Kamloops, Salmon Arm, Princeton etc.

On my trip of 1940, Prince Rupert to the Alberta border, I took this species at Terrace, June 17th; Smithers, June 22nd, Burns Lake, July 5th and McBride, July 15th.

Flight period: May 2nd to August 21st.

Map areas: 1-7, 9-13. For Alaskan records see Gloyd (1939).

SOMATOCHLORA WALSHII (Scudd.)

This species—of which I took a female at Nordegg, western Alberta, July 15th 1917—had escaped the attention of collectors in British Columbia until August 9th 1935, when I netted a male at Forbes Landing, Vancouver

Island. The precise locality was Mud Lake. Then on the mainland, at Harrison Bay, on the abandoned logging railway to Echo and Elbow Lakes, another lone male fell to my lot: the date being August 10th 1936.

In 1937 I devoted three weeks of my Vancouver Island trip to Forbes Landing district, viz., the last week in July and the second and third in August. Throughout this period *walshii* was on the wing, and might be taken on four separate creeks. The most prolific of these was the drainage waterway between Mirror and Echo Lakes, some two miles on the road to Upper Campbell Lake. In all, I took over 40 males and 9 females, without making any serious inroad into the available supply.

Males, when not visiting the water, would fly together in nearby sunny glades at the edge of the conifers. A number of females were observed in process of ovipositing and were watched most carefully at the stagnant pot-holes of the drainage creek above referred to. The insect would fly down to the surface of the water amid the broad-leaved reeds, going from one small open space to the next, the dip, dip, dip, of her abdomen never ceasing except when she manoeuvred around the reed stems. Some scores of eggs must have been released at one laying and within an area of three or four feet. Intent upon her task, she would be oblivious of the net held in readiness two feet above her. The eggs disposed of, she would rise to just above the reeds, poise for an instant to look around her, and dart away. That instant is the collector's only chance. On only one occasion was there a male present when a female was ovipositing; and this, I feel sure, was purely a coincidence.

To the two widely separated records given above, a third was added, August 4th 1938, when Buckell and myself found the species flying at a runway on the Eagle river, some ten miles out of Revelstoke.

On my trip of 1940, I took a single male of *walshii* at Tête Jaune, August 8th. It was flying in the sun, among the trees overlooking a large (quite unworkable) muskeg swamp. This specimen is very small—39 mm. The creeks in the Yellow Pass area are too cold for either *Somatochlora walshii* or *minor*, being of icy cold mountain spring origin, or glacial streams.

Flight period: July 25th to August 18th. Based upon my captures in British Columbia and Alberta, I estimate *walshii* in the west emerges about July 10th, to fly into September.

Map areas: 2, 4, 6, and 9.

SOMATOCHLORA MINOR Calvert

The long stay allotted to Forbes Landing in my 1937 trip up Vancouver Island was intended to determine what further species of the genus *Somatochlora* occurred in that district, for I had taken *albicincta*, *semicircularis* and a single of *walshii* there in my brief visit in 1935 and the argument was all in favour of *minor* also being present could I but find its habitat.

On July 27th, on *walshii*'s drainage creek, I caught a male of *minor*, and

on July 29th I saw a female—the conspicuous vulvar lamina obviating the possibility of error. Then, on July 31st, at the same place, I caught both a male and female. But, while I had taken the insect, I had not located its true breeding place: a swifter creek, with clearer water must be found. On August 18th I got out to Miller's creek, which, draining the swamp end of Gooseneck Lake, empties into Snake Lake, some six miles from Upper Campbell Lake. A wonderful dragonfly country! Here I took 7 males and 1 female of *S. minor*. And, just as I had netted the odd *minor* at *walshii's* sluggish ditch, so now I got the odd *walshii* on *minor's* rapid creek. All of which bears out what Walker said as to the breeding habits of these two species in his admirable monograph. In that work, however, he had to show the Province of British Columbia a blank as to these two species, which the requisite amount of collecting has corrected. However, my belief that the above captures constituted the initial record for *minor* in the Province proved to be incorrect, for upon communicating with the Canadian National Collection, Ottawa, I was informed that they had one male specimen, taken by J. McDunnough at Shuswap Lake, (mainland, Kamloops-Revelstoke) July 22nd 1926. I have more recently learned that Buckell also located a habitat of this species in 1937, at Jesmond in the Cariboo, taking 2 males and 1 female. His dates were June 23rd and August 5th. Thus there are three widely separated records, on Vancouver Island, and the mainland south of 52".

Flight period: June 23rd to August 19th. In spite of the single June record, I estimate the season about the same as that of *S. walshii*: July 10th into September in western Canada.

Map areas: 2, and, northerly, in 4 and 5.

SOMATOCHLORA FRANKLINI (Selys)

Two collectors, Walker and Buckell, have taken this species in British Columbia south of 52", the locality being the same: Field. Here it flies with the muskeg *Aeschna, sitchensis*, which I found to be the case in Alberta both at Nordegg and in tamarack swamps west of Red Deer. This, however, appears to be a rule that does not work both ways, for there are innumerable locality records for *sitchensis* in this Province, with no evidence of *franklini*. Southwardly, in western Canada, it favours the Rocky Mountain range.

On my Atlin trip, 1939, (60" north) I located *franklini* July 14th on a tiny streamlet that drained a large muskeg pool. It ran through a bog, some 50 feet wide, between trees and terminated after a course of 150 yards in a mud pool devoid of life. On that day I netted a male, and a female ovipositing. The insects were mature but still young; that is to say the play period following emerging—when they fly wide of the water—was over, and they were back at their habitat to breed. On that occasion an aged *Aeschna coerulea septentrionalis* female was taken ovipositing, and an *Aeschna sitchensis* female emerging. On July 17th I visited the place again, taking a male *franklini*, and seeing a female; but subsequent visits on July 26th and August 9th were most disappointing, no more being seen.

Flight period: actual captures: July 14th to August 27th. Western records would indicate emergence early July, the flight continuing into early September.

Map areas: 8 and 13 (Atlin).

SOMATOCHLORA SEMICIRCULARIS (Selys)

Walker (1927) gives a number of localities and states this "is by far the commonest and most generally distributed of the genus in British Columbia," and in this I concur. In 1935 I took a ♀ of *semicircularis* at Mud Lake, Forbes Landing, Vancouver Island, August 11th; and a single ♂ on Grouse Mountain, Vancouver, 4,000 feet, August 20th. In 1936, on the mainland, two ♂s were netted at Cultus Lake (runway near Indian Village) July 2nd; and Hope district produced the following locations: Silver Creek Lake, July 27th, three ♂s, 1200 feet; Little Mountain, two ♂s and a pair seen in cop., August 2nd; Texas Lake, three ♂s, August 3rd.

My long collecting trip on Vancouver Island, 1937, served not only further to confirm the general distribution of this species, but to give a better idea as to its period of flight. At Sooke, in the south, the insects were fully adult, in cop. and ovipositing, on June 7th; and on the "Forbidden Plateau," Courtenay district, they were taken in first-class condition August 26th. It would be safe, therefore, to state that on the Island they fly from the end of May to the beginning of September. This is longer than is usually credited to species of the genus, but, to my mind, where the 'flight period' of a given dragonfly is stated to be short (and this applies to most of the rarer species) the belief is based upon insufficient collecting rather than fact.

My records on Vancouver Island, besides the localities already given, were Florence Lake district, junction of Waugh and Goldstream creeks, July 4th; and Forbes Landing district, all suitable water between the Lower and Upper Campbell Lakes July 25th-August 18th. *Semicircularis* seems to prefer reedy swamps, small pools and muskeg pot-holes; but I have taken it on quite large lakes, where these have shallow, reedy shores.

Distribution: localities selected from lists to indicate extent of range: Walker (1927) Prince Rupert, Garibaldi district, Peachland, Glacier, Ainsworth, Bear Creek. Ricker took it at Lost Slough near Cultus Lake. Buckell adds: Chilcotin, Fernie, Field, Moyie, Prince George, Quesnel, Revelstoke, Slocan Park, Stanley, and, in 1937, Jesmond. From my own long list I contribute: Christina Lake.

In 1940 I found this species common at the muskeg end of a long slough at Mount Robson (Yellowhead Pass) August 4th. There was no trace of yellow lateral abdominal spots in these specimens, but segment 8 had whitest apical annulus. It was also quite plentiful at Tête Jaune, August 11th, at the marshy sloughs along the railway tracks.

Flight period: June 7th to August 26th.

Map areas: 1-11. I failed to locate this species at Atlin, but there are two records in Alaska (Gloyd 1939).

SOMATOCHLORA WHITEHOUSEI E. M. Walker

Walker (1927) gives one record for this species in British Columbia: a single specimen taken by P. N. Vroom on Revelstoke Mountain, 6,000 ft., August 12th, 1923. Accompanied by Buckell, I visited the muskeg pools in question August 3rd, 1938, but *Somatochlora semicircularis* only was to be seen. Buckell, however, had taken a single male of *whitehousei*, July 7th of the previous year at Jesmond, in the Cariboo; the location being the series of muskeg pools above the dam. At the dam itself he captured a number of *Somatochlora hudsonica* and three *S. minor*. It is a wonderful location for this genus, combining the requirements of all: lake, muskeg, flowing creek and stagnant brook, but it was too late (4th week of August) when I visited in 1938. The midsummer fliers were over—the fall brood on the wing!

Flight period: actual captures July 7th and August 12th. Walker (1927) gives: June 12th to August 15th.

May areas: 4 and 6.

SOMATOCHLORA SEPTENTRIONALIS (Hagen)

On my Atlin trip (1939) the first specimen taken was a male of this species, July 6th. The insect was flying at a small muskeg pool, of some 25 feet diameter. The total series from that date to July 22nd consisted of 14 males and 6 females; with a further belated female on August 21st. I had tried to catch her on August 6th and again on August 8th, as she flew with the apical third of her abdomen drooped at a right angle, but without success. From July 22nd to August 5th the weather had been cold, windy and sunless, with frost on the night of August 3rd. Previously, the only record for British Columbia was a single male in the Provincial Museum, Victoria: "Atlin, July 20th, 1914": Walker (1927).

In fresh male specimens segments 6, 7, 8 and 9, have faint whitish apical annuli: the last two plainly discernable, that of 7 less so, and that of 6 scarcely perceptible. Seg. 10, dorsal view, is polished black, in striking contrast to the metallic blackish green of segments 3-9. In the female, segments 6 to 10 have similar whitish apical annuli, grading off as in the male. Seg. 10 is metallic blackish green, and not black as in the male. In the final female taken, I noted particularly that she had small basal lateral dull yellow spots on segments 5, 6 and 7.

Ovipositing is performed in the centre of the pool, with a deliberate dip, dip, dip, of the tip of the abdomen, whilst the insect moves around in alert flight. She is indifferent as to whether the eggs go into clear water, or into the creamy-pink slime of decayed vegetation arising in places to the surface. For her task, she appears (apparently from nowhere) well in the middle of the pool, and, once this is completed, she leaves it, unobtrusively as she came, and usually on the side remote from the collector. I have witnessed this over and over again, and my scanty captures indicate the dif-

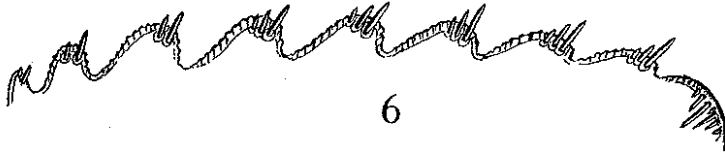
faculty of netting this sex. I followed one female 100 feet back from the water, as she flew low selecting a place to alight with nice discrimination: her choice being a small pot-hole, surrounded with tall grass. Unable to see her, but positive that she was there, I placed my large kite-net on top, and she flew up into it. On another occasion I followed a male, and netted him in precisely the same way. I feel sure that such small grass-ringed pot-holes are the natural resting place of this species; for to fly back to the trees in a large muskeg flat would be too far from their water, and the scrub willow of the muskeg would offer no protection from the ever prevailing wind of northern latitudes. Indeed, at the extreme northern limit of its range (and higher altitude habitats) there would be no trees.

Ovipositing: the males hawk over the pools awaiting mates, and they are slightly less cautious in approaching the edge. They will hover momentarily on occasion, but restless flight is more usual. More than one on a pool at the same time is rare. The female is seized over the water, and they fly back over the muskeg and scrub willow: presumably to come to rest in a pot-hole as described in the case of individuals. In about fifteen minutes she is back ovipositing; and her male (should he return) while taking no interest in the proceedings, will not interfere with her.

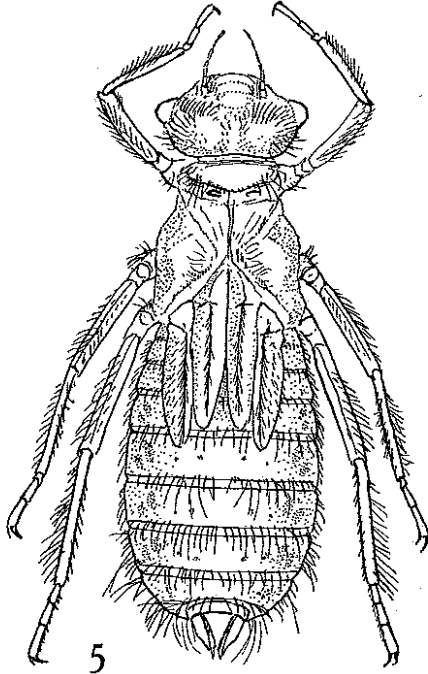
The habitat of this species is small muskeg pools of 25 to 50 feet in length, with level wet edges, as favored by *Aeschna c. septentrionalis*, not large muskeg pools, with firm peaty banks, where *Somatochlora albicincta* and *hudsonica* fly. In the case of *A. c. septentrionalis* I have given the reason for this, viz, ovipositing requirements, but another must be found for *S. septentrionalis*, since it oviposits in the middle of the pool. Two solutions are available: (a) that nymphal life demands the rather shallower water of the smaller pools, and the creamy-pink slime of decayed vegetation peculiar to them; or (b) that at the smaller pools the females can oviposit in peace, undisturbed by the annoying attentions of the larger white-ringed species. In support of the latter argument, I may say that only once did I see an individual of this species on the large pool—a female striving to oviposit. She was driven off by males of *S. albicincta* and *S. hudsonica*, and, returning, was driven off again. She did not return.

The nymph of *S. septentrionalis* being unknown, I spent the cloudy days of July 10th and 11th hunting for exuviae, gathering all that I could find around the four pools where the species had been flying on the previous sunny day, and rejoicing in those found of measurement around 21 mm.—the length of the nymph of *S. whitehousei*—the nearest ally. In view of Dr. E. M. Walker's outstanding knowledge of the genus, I sent my total find to him. He classified 9 exuviae as of this species; his description being as follows:

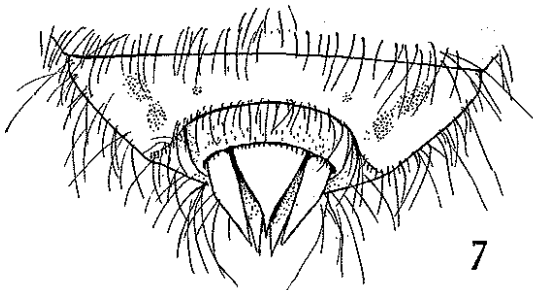
Nymph (final exuvia, Figs. 5-7); pale brownish or almost colourless, the only distinct markings being those of the abdominal segments, most of which are marked on each side with a pair of darker brown lateral spots



6



5



7

PLATE 2. *Somatochlora septentrionalis* Hagen. Fig. 5. Nymph, from final exuvia, ♂. Fig. 6. Crenulations of labial palpus. Fig. 7. Terminal segments and caudal pyramid, dorsal view.

(muscle scars) and two pairs of dark dorsal puncta, those nearer the median line being larger.

Eyes as in *whitehousei*, less prominent than in the *arctica* group; postocular margins of head passing in a broad curve into the hind margin, which is but little concave; a patch of rather long hairs on dorsal surface of head next to the eyes and along lateral margin; antennae nearly bare. Labium large, the mentum broader than long, reaching laterad as far as inner margin of eyes (as viewed from below); mental setae 11-13, usually 12, the 3rd to 8th from outside being longest, the 4 or 5 innermost much smaller than the others; a few marginal mental spinules, including 3 or 4 at the articulation; labial palpi with about 8 deeply-cut crenulations (Fig. 6) each typically with 3 setae in a graded series, the longest about equal to the height of one of the crenulations; lateral setae usually 8, the first smaller than the others, more rarely 7.

Pronotum with antero-lateral angles somewhat acute and elevated, with a tuft of hairs. Legs very hairy, hind femora reaching to about the middle of segment 6; wing-pads reaching just over the base of 6, the costal margin of each pad with a row of hairs, those of the hind wing much the longer; hind wings also with some additional hairs along some of the longitudinal veins.

Abdomen elliptical, nearly twice as long as broad, its greatest breadth at segments 5-6, abruptly narrowing on 9, without trace of lateral spines or dorsal hooks. Hairs of dorsal surface small and scattered except along hind margins of segments, those on segments 5 to 9 being increasingly longer, some of them being as long as the segments which follow them; lateral margins of most of the segments also with a fringe of hairs, which is very long on the last 3 segments.

Caudal pyramid somewhat longer than segments 9 and 10; median appendage about as long as broad, slightly acuminate, lateral appendages of about same length as median, outer margin in male slightly bent, in female straighter; inner margin in male straight, in female somewhat convex, apices acute; inferior appendages slightly longer than the other appendages, straight, regularly tapering to acute apices.

Length (mm.) 19-20, abdomen 11-12, hind wing 6-6.5, hind femur 5.7-6, width of head 6, width of abdomen 6.5-7.

Described from nine exuviae, all more or less damaged. They were heavily coated with a greyish deposit and had to be soaked in water and cleaned before they could be studied. The cleaning was facilitated by placing them in dilute hydrochloric acid, which produced a vigorous bubbling but still left a heavy residue. (A similar deposit coated the exuviae of *S. whitehousei* which the writer found in a springy bog at Banff, Alberta.)

The nymph of *S. septentrionalis* is extremely like that of *S. whitehousei*, differing chiefly in the presence of abdominal markings, which are absent in

the latter species, and in the larger number of mental and lateral setae of the labium, which in *whitehousei* are 9 or 10 and 6 or 7 (rarely 8) respectively. These two closely related species are the only ones in North America in which there are no traces of lateral spines on segment 9. The same character is found in the Eurasian species of this group, *S. alpestris*. (E. M. Walker)

Flight period: Actual captures July 6th to August 21st. Emergence must have commenced two or three weeks earlier, so its full season would be (as might be expected) similar to *S. whitehousei*, say June 15th to the 4th week in August.

Map areas: 13, Atlin, at extreme north.

SOMATOCHLORA ALBICINCTA (Burm.)

In western Canada—British Columbia and Albertan Rocky Mountains—three forms of *albicincta* occur, and these should be considered separately where the distribution of the species is concerned.

(a) The typical small northern form, a Hudsonian zone species. I took a number at Nordegg, Alberta, in July 1917, and Walker (1927) records it from Banff. It will doubtless be taken on the western slope of the Rocky Mountains in British Columbia, and in its true habitat northerly in the Province. Specimens taken by me, 1937, on the "Forbidden Plateau" (3,200 ft.) Courtenay V.I. are quite small: date August 26th.

(b) A larger form than (a), and, as Walker states in his paper, "darker, with somewhat less conspicuous white annuli." This is the common form in British Columbia, generally speaking, south of and at lower altitude than the true habitat.

My records for this form are, mainland: Grouse Mountain, Vancouver, August 20th; Hope district, Kawakawa Lake, July 28th-August 5th; Little Mountain, August 1st; Harrison Bay district, Echo Lake, August 10th, Elbow Lake, August 12th, Squawcum Lake, August 19th, a ♂ netted and a ♀ ovipositing. Vancouver Island: Forbes Landing, (Mud Lake) August 9th, but, as to this last record, see what is said under (c).

(c) This form, for which I suggest the name *massettensis*, is of very large size: on the wing, both as to length and width across the abdomen at segment 5, having the appearance of *Somatochlora cingulata*. Length, overall, 58 mm. Wing-spread 79 mm.

I found young females flying at a runway some miles east of Massett, Graham Island, Queen Charlotte Islands, July 20th-23rd, 1935. The exact locality was James Pearson's pasture, separated from the great north beach only by sand dunes, surmounted by a fringe of conifers. The insects were hawking for flies, then resting high on the trees in the sun. From below I was struck by the way the appendages were carried in flight at a wide angle. I secured two females, but unfortunately missed two other chances, and no

male was taken. This is evidently a northern, sea level form; and I do not doubt that in August a good series might be obtained.

The three weeks spent at Forbes Landing, Vancouver Island, July 25 to August 18th 1937, permitted further study of *albicincta* as flying there. On the first date mentioned I took a male and female of recent emergence; and between August 8th and 18th I netted males and ovipositing females both at Mud Lake and at the mouth of the drainage creek between Lower Campbell Lake and McIroy's Lake. This flows either way according to the levels of the respective lakes at different seasons. This series is of considerable interest, for whereas the males are approximately form (b) the females are oversized and qualify for form (c) *massettensis*. Further, it should be noted, that at Massett, Q.C. Is., I failed to secure males, so I do not know if they are oversize like the females, or relatively smaller as in the Forbes Landing insects.

Distribution: On my 1938 trip, I took a female at Peachland (Trepanier creek) July 23rd, and a female, ovipositing, at Field (Narao Lake—5,610 feet) August 11th. Also, with Buckell, a long series—very small size—at the top of Revelstoke Mountain, 6,300 feet, August 3rd. Walker (1927) records Nanaimo district, Black Tusk mountains, Garibaldi district and Bear Lake. Ricker took it at sloughs and lakes, Liumchin Mountain. And Buckell adds: Falkland, (Arthur Lake) and Salmon Arm (Fish Lake).

On my trip of 1939 to Atlin, B.C., (60" north) I located typical *albicincta* on July 6th flying with *Somatochlora hudsonica* in about equal numbers, though I feel sure that those of the latter species were of earlier emergence. Subsequently I found *albicincta* on a number of pools throughout July and August: my last record being August 29th, a female ovipositing and 3 males. Nothing had been seen of *S. hudsonica* since July 22nd.

Flight period: June 30th to August 29th. But my Atlin captures, of July 6th, had most certainly emerged at least ten days earlier: so the season in this Province might be stated as June 25th to the end of August.

Map areas: 1-6, 12 (form c) and 13. Alaska, Gloyd 1939.

SOMATOCHLORA HUDSONICA (Hagen)

At the date of Walker's paper (1927) he could publish no record for this species in British Columbia. Since then Buckell has taken it at no less than six localities south of 54", viz., Falkland (Arthur Lake), Kamloops (Lac le Jeune) Salmon Arm, Bridge Lake, Jesmond and Prince George (Summit Lake).

At Atlin, July 6th 1939 (60" north) I found *hudsonica* at its true habitat: a muskeg pool with a firm peaty edge. It was flying with its ally and usual companion, *Somatochlora albicincta*, in about equal numbers. On that date I took 5 males, and 2 females ovipositing; and subsequent visits to the pool increased my series to 13 males and 6 females. The last netted was a male on

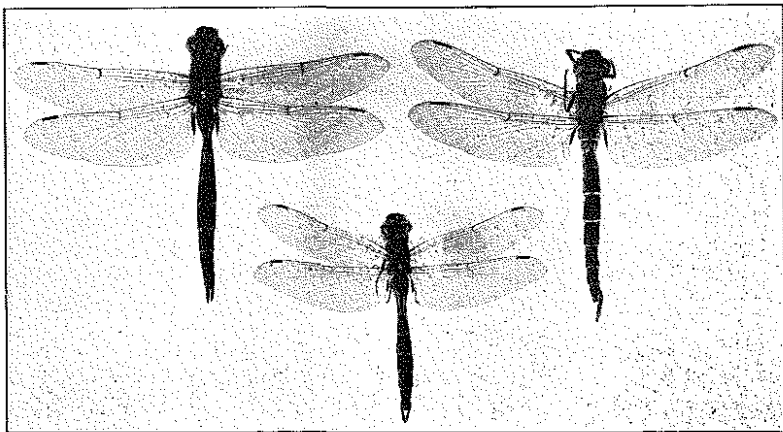
July 22nd. These were the first *hudsonica* I had taken since I first found the species in Alberta back in 1916.

S. hudsonica is an easy species to net since the females oviposit around the edge of the pool, and the males patrol the shore line close in looking for them. A pair in copula flies back into the trees. On July 12th I netted a pair over the water struggling to make connection of which the female was *S. hudsonica* and the male *S. albicincta*; and I imagine such abortive attempts between these species must be of fairly common occurrence. The fact remains, however, that one never takes a specimen even remotely suggestive of hybridism. On the wing the slightly larger size of the *hudsonica* male serves to separate it from *albicincta*; and with the females identification is still easier: that of the former being distinctly more robust.

On my trip of 1940, I found *hudsonica* at only one place between Prince Rupert and the Alberta border, viz., Burns Lake. Here, at two large sloughs it was very common, June 29th to July 7th. They varied considerably in size and I caught and released many individuals in expectation of finding *Somatochlora albicincta*, its usual flying mate, but without success. Next to *semicircularis* the species last mentioned is the commonest insect of the genus in the Province, yet, in over two months I found no single habitat.

Flight period: June 29th to August 27th. Where this species and *S. albicincta* occur at the same habitat (as at Atlin, July 6th) the state of maturity of the insects and oviposition lead to the view that *hudsonica* is of rather earlier emergence. I should estimate the date about June 12th to 15th.

Map areas: 4 (northerly) 5, 10 and 13. Alaska, Fort Yukon, Walker (1925), Gloyd (1939).



Left to right: reduced one-third, *S. albicincta*, form *massetensis*, sea shore, Massett, Queen Charlotte Islands. *S. albicincta*, typical, Revelstoke Mt., 6,300 ft., 200 miles south of Massett. *S. cingulata*, typical, to show comparative sizes.

SOMATOCHLORA CINGULATA (Selys)

Credit for the first record for *cingulata* in British Columbia falls to Buckell, he having found it, August 10th, 1932, at Arthur Lake, Falkland, in the Okanagan Valley. This location gave the required conditions: a fairly large lake at a fairly high altitude, 4,000 ft. A series of ten was taken. The two allied, white-belted, species: *Somatochlora hudsonica* and *albicincta*, were also present.

Flight period: only collecting date, August 10th. In the Alberta Rockies I took teneralis of this species July 14th and 17th; and, based upon these and other records, both western and eastern, I judge its season to be rather later than that of *S. albicincta*: say the 4th week of June to early in September.

Map areas: 5 (mountain lake, 4,000 ft.).

LIBELLULIDAE

LIBELLULA JULIA Uhler

This is the most subdued species of the genus flying in the Province. The males rest on water lilies and reeds, with occasional short flights, and the females oviposit quietly among the reeds without their fertilizing males being in evidence.

Walker's records are restricted to south Vancouver Island, which I can extend northwardly to Northey's Lake, Courtenay, August 13th; and Mud Lake, Forbes Landing, August 10th. My 1936 trip also established *julia* as a mainland species, the records being one ♂ Chilliwack, July 21st; four ♂s and five ♀s Kawakawa Lake, Hope, July 28th-August 5th; and several ♂s Echo Lake, Harrison Bay, August 10th-23rd. By the last date given the insects were aged.

My three months' trip on Vancouver Island in 1937 supplied records for this species at every body of water visited from Sooke, in the extreme south, June 12th—they were then mature and plentiful—to Upper Campbell Lake, in the north. My last date is Courtenay, August 26th, and I have a notation: "still in good condition." The species, away from the water, rests on roadways, rocks and shrubs indiscriminately.

Distribution, mainland: I found *julia* abundant at Christina Lake, July 1st-15th 1938; and Buckell records it from Osoyoos and Oliver in the south, to Salmon Arm (Loon Lake) and Horsefly in the north. The last locality is north of 52".

Flight period: June 12th to August 26th.

Map areas: 1, 2, 4, 5, 6 and 10.

LIBELLULA QUADRIMACULATA Linné

This species is so generally distributed in the Province (including the Queen Charlotte Islands) that I feel justified in omitting my lengthy records

for both the mainland and Vancouver Island, and to state instead, most bodies of water inhabited by dragonflies. It should also be remarked that it is on the wing from early May to the end of September. In point of fact, *quadrimaculata* is frequently a great nuisance to the collector, in preventing the capture of a rarer insect by rushing at it at the critical moment.

In my paper (1917) I mentioned the habit of males of this species standing by while their females were ovipositing. The summer of 1936 at Texas Lake, Hope, I watched two pairs so disporting themselves at a pot-hole sheltered by reeds from the wind on the main lake. Three times females of *Somatochlora semicircularis*, (with no male in attendance, of course) sought to oviposit in the same sanctuary, but were driven off by the guards.

A savage feeder: teneral symptetrums are not infrequently the victim.

All Walker's (1927) records for Vancouver Island for this species relate to the Nanaimo district with three exceptions. In 1937 I found it generally distributed, and I will add: Sooke, June 7th; Thetis Lakes, June 14th; Florence Lake, June 29th to July 4th; and, in the north, Upper Campbell Lake, August 11th, and Courtenay, August 26th. While seen on most bodies of water visited, it must, as to numbers, take second place to *Libellula julia*.

Mainland: (selected) I have records: Vancouver district, Cultus Lake, Chilliwack, Harrison Bay, Hope, Christina Lake, Kaslo, and Crawford Bay—Kootenay Lake district. Ricker contributes: Sumas Canal, Liumchin creek. And of Buckell's list: Chilcotin, Clinton, Edgewater, Horsefly, Osoyoos, Princeton, Revelstoke, Salmon Arm, Westbank. Walker (1927) Prince Rupert, Cranbrook. J. Wynne, Enderby, May 24th.

On my trip of 1940, Prince Rupert to the Alberta border, I took this species at Terrace, June 17th; Smithers, June 22nd; Burns Lake, June 29th and McBride, July 12th. It was the only species of the genus seen throughout the Summer.

Flight period: May 7th to September 29th.

Map areas: 1-12. At Atlin (north in area 13) I failed to find this species, but Mrs. Gloyd's Alaskan list (1939) supplies two records.

LIBELLULA PULCHELLA Drury

At the time of Walker's (1927) paper the only record for *pulchella* was his own at Penticton. Since then Buckell's work in the Okanagan Valley section has extended its range from Osoyoos (on the international border) northward through Oliver, Peachland, Vernon to Salmon Arm. He has also a somewhat unexpected record of Revelstoke, since this is out of the Sonoran—dry Transition zonal area to which the species obviously belongs in this Province.

I took a nice series of *pulchella* around a large marsh at Penticton, July 15th to 18th, 1938, where *Libellula forensis* was also abundant. If I found it difficult sorting out on the wing those I desired, the insects themselves

appeared to be in no better state, for they chased individuals of the allied species into the air as often as their own. Confusion reigned. These two striking dragonflies were surely never intended to fly together!

Flight period: (actual records) June 9th to August 20th. The full season for this species is doubtless very similar to that of its close ally (and flying mate at Penticton) *L. forensis*: the first week of June, well into September.

Map areas: 5 and 6.

Note: for association of these species in Oregon, Nevada and California, see Kennedy (1915, 1917).

LIBELLULA FORENSIS Hagen

Needham states that this species is "the western equivalent of *L. pulchella*" which while broadly speaking is correct, is not precisely so, for Walker (1927) found them flying together at Penticton. Over how wide an area they overlap has not been determined. (See Note, *pulchella*).

Forensis, a species of long flight period and wide distribution, must give place to *Libellula quadrimaculata* in both respects, nor is it, to my experience, as common: though, owing to its size and beauty, it is conspicuous wherever it occurs. It is true of many of the *Anisoptera* (or appears to be) that the males are more numerous than the females, and this is particularly the case with this insect: of which I netted and released scores of males before obtaining a short series of females for my own requirements.

The sturdy nymph is willing on occasion to travel well back from the water to transform. I took one at Beaver Lake, Vancouver, on June 27th 1935, at 10 a. m., scrambling across the path in full sunshine, and making good time of it.

On Vancouver Island *forensis* occurs quite widely and my 1937 records extend from Sooke, in the south, June 12th, to the Upper and Lower Campbell Lakes, in the north, July 25th-August 18th. In the Nanaimo district: Wellington Lakes, Newcastle Island, etc. it is very plentiful, but I cannot concur with Walker's statement (1927) "the commonest *Libellula* of south-western British Columbia." On the Island, over a wide area, *julia*, I feel sure, exceeds it. On the mainland, I have records: Cultus Lake, June 19th; Chilliwack golf course slough, July 17th, Hope district, July 28th-August 2nd, Hatzic Lake, August 7th, Harrison Bay, August 10th, all 1936; Kaslo, June 21st, Christina Lake, July 4th-5th, Penticton, July 15th-23rd 1938. Buckell contributes: Salmon Arm, Oliver and Osoyoos.

Flight period: June 3rd to September 16th.

Map areas: 1-7.

LIBELLULA LYDIA Drury

This attractive species, in which the sexes differ, (Howard's fig. 1, plate XL, is of course a young ♂) is of wide distribution in the Province, my

records extending as far north as Forbes Landing, Vancouver Island; and, on the mainland, from Vancouver to the Hope-Princeton trail, one hundred and twelve miles east.

The male poises on the wing over his ovipositing female and drives away all intruders, but whereas *L. quadrimaculata* distributes her eggs within a limited area, *lydia* will remain hovering, or settled, at one spot, driving her abdomen dozens of times into the algae beneath.

On Vancouver Island *lydia* is the least common *Libellula*, though as widely distributed according to the available data. My 1937 locality records were: Sooke, 2 or 3 seen, June 7th; Thetis Lake, 1 seen, June 20th; Long Lake, fairly common, June 25th; Florence Lake, not common, June 29th-July 4th; Nanaimo district: Wellington Lakes, a few seen, July 14th, and Newcastle Island, a male and female seen July 16th. Courtenay, 2 seen, July 20th; Forbes Landing district, a few seen, July 25th-August 18th. At Vancouver, Beaver Lake, Stanley Park, *lydia* swarms the last week in June—the heights of its season. On June 27th, 1935, I counted ten males resting on the path within an area of a few feet, and I have seen as many on one long garden seat.

Distribution: omitting Walker's (1927) Vancouver Island records, as my own given above suffice, his mainland locations are: Cloverdale and Rosedale (Blackmore) and Boundary (Bruce). Ricker has taken it at Cultus Lake and Vedder Crossing; and Buckell at Oliver and Osoyoos. My record at Forbes Landing, Vancouver Island, is on 52", but the mainland ones are spread along the international border.

Flight period: May 14th to September 24th.

Map areas: 1-6. (The last by virtue of the record "Boundary," [Walker 1927] a name applied to the district, Grand Forks-Cascade, on the international border).

ERYTHEMIS SIMPLICICOLLIS (race COLLOCATA) Hagen

Walker has satisfied himself that the British Columbian insect differs slightly as to segment 3 from the eastern *simplicicollis* (thus supporting the view of the late E. B. Williamson) but not to an extent justifying specific rank: I, therefore, list it as race *collocata*.

With seven weeks of my Vancouver Island trip of 1937 allotted to the southern area, I had anticipated taking a good series of this insect, but in this I was disappointed. My captures were: roadway between Pike and Long Lakes (of the Thetis group) 2 females, June 25th and another June 27th. Shore of Long Lake, pair in cop., June 27th. Goldstream, reservoir road, a young male, July 4th; pot-hole, near Florence Lake, a female ovipositing, July 5th; and Newcastle Island pond, one seen, July 16th, flying with *Pachydiplax longipennis* and *Sympetrum illotum*. The insect is given to resting on

gravelly roads, after the manner of species of the genus *Ophiogomphus*, *Leucorrhinia* etc.

This species has cross-veins below the stigma, but no brown stain at the base of the wings; whereas *P. longipennis* has the base of the wings stained, but no cross-veins below the stigma. These points are worth remembering in the field, as pruinose males are otherwise much alike.

Early July 1941, a teneral ♀ was taken on a lawn in Vancouver; and, collecting at Chilliwack, July 24th and 25th 1941, I found the insect flying, in association with *Leucorrhinia intacta*, at the large slough near the old golf course: 3 ♂'s and 1 ♀ being netted. Chilliwack is some 70 miles east of Vancouver, and the belief of Walker and myself that the species was confined in British Columbia to the south end of Vancouver Island is clearly incorrect.

At Chilliwack a female was observed ovipositing, and not only was this similar to the egg-laying of *Leucorrhinia intacta*, but her tactics, to avoid further attention from the hovering male, were precisely as described by me under that species.

Flight period, records June 1st to July 25th.

Map areas: 1, 3 and 4.

PACHYDIPLAX LONGIPENNIS (Burm.)

As in the case of the preceding insect, this species proved somewhat disappointing in my Vancouver Island trip of 1937, when, though in its recorded territory from June 4th to July 16th, I took it at but two localities: the junction of Waugh and Goldstream creeks, a young male, July 4th; and the pond on Newcastle Island (off Nanaimo) July 16th, 12 males.

Except as to colour; this species and *Sympetrum illotum* are much alike in form, and in behaviour they appear identical. They both delight in perching, with wings drooped, at the extreme tip of a dry twig; from which point of vantage they make short sallies to catch a fly or to rush at any other species invading their chosen territory. They are both given to hovering, and are thus easy to net.

Flight period: records, June 30th to July 23rd. These dates represent too short a span for its full season.

Map areas: 1. Walker (1927) gives a record for Vancouver, which he credits to Osburn. This I think was in error, for I failed to find the record in Osburn's paper (1905); and I most certainly have never found the species in the Vancouver district during six years of residence.

SYMPETRUM ILLOTUM (Hagen)

On June 21st 1935, at Beaver Lake, Stanley Park, Vancouver, I saw a fly of this species, and on the following day at the same spot I netted a male:

possibly the same insect. This to date is the only record on the mainland of Canada. The breeding place, since discovered, is the pond adjoining the reservoir, Stanley Park.

For Vancouver Island, my trip of 1937 provided additional locality records as follows: Sooke, flying with *Ischnura erratica*, *Somatochlora semicircularis*, etc., 3 males, June 7th; Thetis Lake group: Long Lake, 4 pairs in cop netted and singles, June 25th and 27th; Florence Lake, a few seen, June 29th-July 4th; and, at a large slough nearby (another breeding place) a good series taken. Nanaimo district: Rock City pond, July 8th, and Newcastle Island, fairly common and flying in cop., July 16th. My next moves were north to Courtenay and Forbes Landing, and no more of the species were seen. Walker (1927) records dates as late as August 14th; and the argument is that I had moved out of *illotum's* range. It was the same with *Sym. madidum*, and it tends to strengthen my convictions as to a change in zone, as discussed under *Lestes disjunctus*.

The resting habits of this species are referred to under *Pachydiplax longipennis*. Ovipositing was observed upon a number of occasions: the pair usually arrive at the water flying tandem, and the eggs are dipped in, an inch or so apart, where open spaces occur between the reeds. The male not infrequently tires of his share in the proceedings (purely ornamental!) and relinquishes his grasp, when the female (better informed as to the supply of eggs demanding release than he) continues her duties alone. What more striking contrast in nature than a number of bright scarlet *illotum* flying over green reeds!

Flight period: records, May 20th to August 14th.

Map areas: 1 (common) and 3 (Stanley Park, Vancouver, rare).

SYMPETRUM CORRUPTUM (Hagen)

Previous records in the Province have been interior districts: Okanagan and West Kootenay, and, north of these, on the main line of the Canadian Pacific Railway. June 14th 1936, I took a young male at Stanley Park reservoir, Vancouver; and the same season netted single specimens at Hope, July 29th, and Harrison Bay, August 10th. At Hatzic Lake, August 8th, I captured and saw enough teneral to cause the notation: "apparently common here," and this I should the more readily make since it was the first time that I had personally ever found it common anywhere.

This is one of the species that for some unaccountable reason is usually noted when teneral. Of course the "motley" of the young insects instantly catches the eye, whereas adults might be overlooked in the galaxy of red forms on the wing together in this Province. Such explanation, however, is unsatisfying, and it is more likely the case that whereas one may come across ranging young insects anywhere, to take adults needs locating their breeding place when they re-assemble for that purpose.

Above I referred to a general emergence of *corruptum* at Hatzic Lake the first week in August 1936. At Kaslo, 1938, I found a general emergence taking place the first week in June. If, as would appear from this, the insect is double-brooded, with an interval of two months, it is understandable why occasional specimens are taken throughout the season, from early June to well into September. In my Alberta paper (1917) I expressed perplexity over this. It would seem that I have now answered my own riddle.

Distribution: Walker (1927) records: Penticton, Peachland, Nelson, and gives dates June 7th to September 13th; and (1938) Cultus Lake, August 26th, Chilliwack Golf Course, August 11th. Buckell contributes: Cranbrook, Creston, Hope, Kamloops, Oliver, Osoyoos and Wasa. J. Wynne, Enderby, teneral female, June 4th.

Flight period: First brood 1st week in June; second brood last week in July and 1st week in August: flying until September 13th.

Map areas: records, 3, 4, 5, 7 and 8.

SYMPETRUM MADIDUM (Hagen)

All Walker's records of this species in British Columbia relate to Vancouver Island. In 1936, however, I took three ♂s at a small pond on the Chilliwack golf course, the dates being July 22nd-23rd; and on August 2nd a ♂ in a dry stony runway on the Hope-Princeton trail, some twelve miles east of Hope.

The even-textured red wings make the insect conspicuous to the collector.

On Vancouver Island, as early as June 7th, I took a young male of *madidum* at Sooke. This was on *Ischnura erratica's* reedy pool, and where teneral of the *Sympetrum* were emerging. Florence Lake (at a nearby pot-hole) a number of adults were flying and a pair in cop., July 5th. Nanaimo district: Departure Bay, 1 netted and another seen, July 8th, and Wellington Lakes, 4 pairs in cop., July 14th-15th. North of here none were taken or seen. Whether it is due to this species favouring particularly foul water breeding places or other cause I do not know, but my specimens were usually heavily laden with red mites.

Distribution: Walker (1927) records Nicola Lake, July 26th. Buckell (1938) gives Aspen Grove, Bridge Lake, Canim Lake, Hat Creek, 70-Mile House, Osoyoos, Princeton, Salmon Arm, Tatla Lake; and since then at Jesmond, Kamloops and 100-Mile House.

Flight period: June 7th to September 7th.

Map areas: 1, 2, 4, 5, and 10 (southerly).

SYMPETRUM COSTIFERUM (Hagen)

Most authors in describing this species feature the flavescence of the costal margin, irrespective of sex. Admittedly this should be so or Hagen's

name for the insect is misleading, but the fact remains that it is only true of teneral. According to my experience, in fully mature red males the tinge of colour along the costa is scarcely discernible. Mature females, on the contrary, may have wings flooded with colour, intense as to the upper half and fading away to the lower margins.

In western Canada, with the exception of *vicinum*, *costiferum* is the last of the genus to appear. My 1935 notes record teneral ♂ and ♀ August 10th and 11th, at Forbes Landing, Vancouver Island; and, 1936, teneral emerging August 8th at Hatzic Lake. The first records in my Alberta list (1918) are August 5th and 6th. But it is not until September that the fully mature specimens, discussed in the preceding paragraph, have been noted by me, and I have taken specimens to November 1st. Should this belated maturity be more or less the case elsewhere, it would serve to explain the teneral coloration being stressed in published descriptions: indeed, in view of the name selected, it raises doubts as to the full maturity of Hagen's types. Should this be so, then that author's *S. atripes* might well be fully mature *costiferum*.

The male usually accompanies the female when ovipositing. They delight in resting on earth paths, where these are available near their habitat.

My trip of 1937 on Vancouver Island did not add materially to my data respecting *costiferum*, for I was north of its appearance in Nanaimo district and southwardly. At Forbes Landing it was "emerging in numbers" August 15th, 16th, or five days later than in 1935. This might be attributable to cold, wet weather. Taking Walker's (1927) locality records in conjunction with my own, it is clearly distributed from Victoria to Forbes Landing—and, doubtless, still farther north.

On the mainland, paralleling the international border, locality records for *costiferum* (other collectors' and my own) are virtually continuous from Vancouver to Creston (East Kootenay), which includes areas of both Canadian and Transition zones. Farther north (again using all available records) the species has been taken at Golden, Kamloops, and Crawford Bay (F.C.W.) Brisco, Invermere, Salmon Arm, etc., west to Clinton (Buckell). It would seem of general distribution south of 51°.

In 1940, at Tête Jaune, Lat. 53 N., teneral were quite numerous August 8th to 12th. This habitat, at the entrance to the Yellowhead Pass, is the most northerly of which I have record in the Province.

Flight period: records, July 8th to October 19th. In Stanley Park, Vancouver, I took a ♀ in good condition November 1st 1936.

Map areas: 1-9. In view of my Tête Jaune captures, I feel sure the species must occur in area 10, at least southerly.

SYMPETRUM VICINUM (Hagen)

The male of this well-named, friendly species is easily recognized among the number of red forms flying together by its lighter tint: scarlet.

At Beaver Lake, Vancouver, from mid-September to the end of October (in spite of nights of several degrees of frost) hundreds of pairs may be seen ovipositing in the wet moss round the shore line, the continual tap, tap, tap of the female organ being admirable in steadfastness of purpose.

I have an early record, teneral ♂, of July 31st, 1936, Hope, and the emergence takes place from then on, with the peak of the flight not until six weeks later, as stated above. In all probability the species is of wide distribution in the Province, but the activity of the collector in the field is pretty well over and he is homeward bent before the general flight is on: hence the somewhat scanty locality records.

For the reason stated above *vicinum* was hardly to be expected southwardly on Vancouver Island, during my 1937 trip up the country. Northerly, at Forbes Landing, it appeared just before I left, August 17th. Walker (1927) gives records Nanaimo district and farther south.

On the mainland: Walker (1938) records, Cultus Lake (Sweltzer Creek) and Chilliwack Golf Course, August 15th, a pair, very teneral.

Flight period: records, July 20th to November 1st.

Map areas: 1-4.

SYMPETRUM SEMICINCTUM (Say)

While the Harrison Bay district (its smaller lakes and streams) yielded a fine variety of dragonflies, the great body of water itself seemed in mid-August to be favoured only by *semicinctum*, which positively swarmed in mated pairs, busy ovipositing. The species is subject to considerable latitude as to size and also as to the density of the wing coloration. Length up to 37 mm., and wingspread to 59 mm.

I have taken tenerals from July 24th, and belated adults to October 10th, but the peak of the flight is, as indicated above, mid-August.

Distribution: my records, mainland, Vancouver to Chilliwack and Harrison Bay, and again Crawford Bay, Kootenay Lake. By filling in with Walker's records, we have a fairly continuous known territory of from the coast to the Selkirk range. On Vancouver Island, Walker (1927) records Nanaimo district and Langford Lake.

Further mainland records: Walker (1927) Armstrong, Peachland, Penticton and Okanagan Landing, and (1938) Cultus Lake and Rosedale. Golden, abundant, August 14th (F.C.W.) Buckell (1938) gives 19 localities, from Field and other points on the eastern boundary, to Clinton in the Cariboo, and south to Osoyoos.

Flight period: July 18th to October 8th.

Map areas. 1, 3-8.

SYMPETRUM DANAE (Sulzer)

This species—*S. scoticum* Donovan of my Alberta lists—was emerging at sea level in the Massett district, Queen Charlotte Islands, July 24th-26th, 1935. At Beaver Lake, Stanley Park, Vancouver, I have taken it, occasionally, from September 3rd to October 10th. My other mainland records include Hope (Little Mountain) August 1st, 1936; and Crawford Bay, West Kootenay, mid-August, 1928, where it was plentiful. Also Field, Golden, Revelstoke, Kamloops, and north to Jesmond.

Walker (1927) gives no record for *danae* on Vancouver Island, but on my 1937 trip I anticipated taking it northwardly in view of its numbers on the Queen Charlottes. In this I was not disappointed—but by a very narrow margin. At Forbes Landing the species did not appear until August 17th, and these quite teneral. An adult female was netted at Miller's creek, August 18th. On August 22nd I turned south.

Further mainland distribution: Walker (1927) gives Metlakatla, Quesnel Forks, Okanagan Landing, Cranbrook; and, (1938) Hope Slough and Rosedale. Buckell contributes 28 localities, from Osoyoos, on the international border, to Prince George (Summit Lake) and from points near the eastern boundary to Burns Lake.

During my stay at Atlin (60" north), from July 1st to August 31st, 1939, *danae*, a species of late emergence in the north, did not put in an appearance until August 16th, which was subsequent to frost on the nights of August 3rd and 11th. The insects were scarce.

On my trip of 1940, I found *danae* common in the Rocky Mountains, western trench, north: McBride, July 12th, teneral; Mount Robson, August 4th, both teneral and mating pairs, and Tête Jaune, August 8th, with flying companions: *Sympetrum obtrusum* and *costiferum*.

Flight period: June 20th to October 10th.

Map areas, 2-14. There are two records for Alaska (Gloyd 1939).

SYMPETRUM DECISUM (Hagen)

Certainly, as to the mainland of British Columbia, this is a common species: somewhat variable as to the appearance, and very much so as to size. The face may be a creamy-brown, (in specimens not quite adult) to what the late E. B. Williamson aptly called a "cherry red." Again, as that author points out, the wings of western *decisum* may have a reddish venation, giving a distinctly tinted appearance.

My records, mainland, are: Beaver Lake, Vancouver, September 3rd-16th; Chilliwack, July 23rd, Hope district, Silver creek, July 25th-30th, Hope-Princeton trail, August 2nd, Kawakawa Lake, August 5th, Hatzic Lake, August 8th, Harrison Bay, August 9th-24th, common. These lower Fraser Valley specimens were mostly the cherry-faced form; and those of Harrison Bay district unusually large. Examples were sent to Walker, whose comment

was: "the largest specimens I have ever seen." I have also taken it: Penticton, Golden (small specimens) Kamloops (river and Lac de Jeune) and Jeumont, in the Cariboo, dates July 16th to August 29th. Walker (1927) records: Okanagan Landing, Peachland, Armstrong, Kootenay Landing, Vernon, and (1938) Cultus Lake district, Rosedale, Chaperon Lake, Liumchin Mt. Of Buckell's 26 localities, I give those best serving to extend the range: Burns Lake, 150-Mile House, Canim Lake, Prince George, Canal Flats and Osoyoos.

There is no record to date of this species on Vancouver Island. During my 1937 trip, the length of the highway, I watched for it most carefully, but with negative results.

At Atlin, B.C., 1939, (60' north) I took my first specimen July 18th: a young male just coming into red coloration. The occasional insect was netted from that date until August 29th, but it was never plentiful. This is the most northerly record of which I have knowledge in western Canada.

On my trip of 1940, Prince Rupert to the Alberta border, I found this species emerging in numbers at Vanderhoof, July 8th, and again common at McBride, July 12th. Still more eastwardly, in the Yellowhead Pass, it was not in evidence, *Sympetrum obtrusum*, *costiferum* and *danae* being the species of the genus netted.

Flight period: June 15th to October 8th.

Map areas: 3-10, 13 and 14. It will be noted that it is in the seaboard areas, 1, 2, 11 and 12, for which records are lacking. It is, however, recorded from Alaska (Gloyd 1939).

Note: Harrison Bay specimens: length up to 37 mm. and wing-spread to 61 mm.

SYMPETRUM PALLIPES (Hagen)

This species, easy to identify in the field by the light stripes on the sides of the thorax, is recorded only by Walker (1927) from southern localities on Vancouver Island.

On the mainland I have records: Crawford Bay and Nelson, West Kootenay, August 17th-24th, 1928; Cultus Lake (runway near Indian Village) emerging July 8th on; Hope (Silver creek) July 26th-29th, (Kawakawa Lake) July 31st, (Texas Lake) August 3rd, flying in cop.; Harrison Bay, August 9th. At Beaver Lake, Vancouver, I have taken it to September 24th. It would appear to have a flight period of about fifteen weeks.

My records on Vancouver Island were: Sooke, emerging as early as June 6th; and at Florence Lake, still emerging, June 29th-July 4th. In the Nanaimo district: Wellington Lakes, there were adults but also teneral, July 14th. Again, upon reaching Forbes Landing, July 25th, my notes read: "mostly teneral seen," and, under date August 12th: "now some adults." The progressive emergence, over virtually a two months' period, would appear to be

governed by climatic conditions in the short distance northward of 200 miles. Or, of course, the species may be one of sporadic emergence, in which case the teneral on the water might be observed rather than the adults away from it. On the "Forbidden Plateau" (3,200 feet), Courtenay district, I took a final specimen August 26th.

Further distribution: In 1938 *pallipes* was emerging at Kaslo, June 24th, and I also took it at Penticton, July 17th. Walker (1938) records: Cultus Lake district, also Rosedale and Chaperon Lake. Buckell (1938) contributes Christina Lake, Douglas Lake, Mable Lake, Moyie, Nelson, Okanagan Landing, Oliver, Osoyoos, Quilchena, Stump Lake, Vaseaux Lake and Wasa.

Flight period: June 6th to September 24th.

Map areas: 1-8.

SYMPETRUM OBTRUSUM (Hagen)

In the field the white face of the *obtrusum* male serves for instant recognition from *Sympetrum decisum*, but with regard to females much more care is necessary, and, bearing upon this, the late E. B. Williamson's paper (1933) leaves nothing to be said. The morality of dragonflies is notoriously lax, a lustful male unhesitatingly seizing the female of his or another species. In a genus such as *Sympetrum*, where six or more species may be flying together, it is unwise for the collector to accept mated pairs as identification of the female. I mention the point here since (an extreme instance) I have taken an adult red *obtrusum* male holding a black *Sympetrum danae* female: a case where mistaken identity must fail as an excuse. However, fertilization apparently does not result, for the species in this genus produce nothing leading to suspicion of hybridism.

Distribution is general. I have records on the mainland from Vancouver to Harrison Bay and Hope, and again at Crawford Bay and Nelson, West Kootenay. By filling in with Walker's Okanagan records the gap is covered. On Vancouver Island my records are from Forbes Landing district only, but I had left the southerly section before this species might be expected. My notes read: "Flying: just coming into red colour," July 25th; "now almost adult," July 29th; and "full coloration," August 12th. On *Somatochlora walshii*'s favoured drainage creek I recollect there was usually a well-behaved little white-faced *obtrusum*, which I permitted to stay there as a "decoy."

Walker (1927) in quoting records for *obtrusum* from Kaslo (mainland, West Kootenay) by Currie and Langford Lake and Victoria (Vancouver Island) by Osburn, appears to question correct identity. I have two specimens in my collection taken at Crawford Bay (West Kootenay), and my Forbes Landing (Vancouver Island) specimens are likewise above suspicion. The insect's range is apparently wider than believed.

Further distribution: In 1938 I took *obtrusum*, Kaslo, June 24th, emerging: Penticton, July 17th, Vernon, July 26th, Revelstoke, August 4th and Jesmond,

in the Cariboo, August 29th. Walker (1938) records: Cultus Lake district, Chilliwack and Nicola river, dates July 1st-August 30th. Buckell (1938) contributes 25 localities, from Osoyoos, on the international border, to Quesnel, July 10th, on 53".

In 1940 I found *obtrusum* plentiful in the Yellowhead Pass area, both at Tête Jaune, August 8th, and at Mount Robson, August 4th.

Flight period: July 1st to October 19th.

Map areas: 1-10.

LEUCORRHINIA BOREALIS Hagen

Walker (1927) published W. A. Newcombe's record of 1 male at Chilcotin. Since then Buckell has also taken it at Chilcotin (Big Creek), 8 specimens; and has added two new localities: Squilax, June 6th, and 100-Mile House, July 8th, both 1937. Somewhat to my surprise—for *borealis* is recorded from Alaska (Gloyd 1939)—I failed to find the species at Atlin, B.C., when collecting there in 1939.

In general appearance *Leucorrhinia borealis* is extremely like its ally, *L. hudsonica*, only larger. Length, male, 40 mm.; wing-spread 64 mm. Dorsum of abdomen with spots to segment 8, yellow in young specimens, but blood-red in aged adults. Lateral view, superior appendage, similar to its ally. *Borealis* is less widespread than *hudsonica*, but where both occur as at Red Deer, Alberta, they emerge at the same early date (about 4th week of May) and fly together until towards the end of July.

On my trip of 1940, Prince Rupert to the Alberta border, I located this species at Burns Lake, taking a male July 2nd and another July 4th. Walker (1927) refers to *borealis* as a "prairie species," and it will be noted that the above records relate to the central—more prairie-like—country. Burns Lake is the same altitude as Red Deer, Alberta, 2,700 ft.; and the trees: spruce, white poplar, willow, birch, etc. (no cedar) are identical. Waiving all question of provincial boundaries and geographical mileage, I was justified in expecting the association of a like list of species under like environment—and found them: *Leucorrhinia borealis* and *hudsonica*, *Cordulia shurtleffi*, *Libellula quadrimaculata*, *Somatoclora hudsonica*, *Enallagma boreale* and *cyathigerum*, and *Coenagrion resolutum*. But when comparing the odonate fauna of two fairly distant places, separated by high mountain ranges, as in this instance, certain species must be expected peculiar to each. So, to the Burns Lake, B.C., list I must include *Enallagma carunculatum* and *Tetragoneuria canis*, neither of which has been recorded from the Canadian Zone in Alberta; and to the Red Deer, Alberta, list, *Coenagrion angulatum*, that has never been found west of the Rocky Mountains. In spite of precise environmental similarity leading to a dragonfly fauna common to both, the distribution of such extraneous species still confronts us. It will be noted, of course, that these are the non-boreal species, and, south in their own range, denied migration east or west (as the case would be) by the formidable mountain ranges;

whereas the truly boreal species could work south upon either side of the mountains from an area of distribution in the northern plateau.

Flight period: records, June 6th to July 8th. This is too short for its full season which is probably, as in Alberta, from the 4th week in May to the 4th week in July.

Map areas: 5 northwardly, and 10.

LEUCORRHINIA HUDSONICA (Selys)

While this boreal species appears as early as May 14th at Vancouver (ten days earlier than the emergence at Red Deer, Alberta) and there are records showing wide distribution in British Columbia, it does not appear 'at home' southwardly in the Province: one notes the occasional specimens, but misses the swarming hordes of the insect in its truer habitat.

As Walker (1927) points out, *hudsonica* in British Columbia attains a large size, but I have taken specimens the exception to this, such as those on the "Forbidden Plateau" (3,200 feet) Courtenay district, August 26th 1937. This was my only record for the species on Vancouver Island during the months June, July, August, and including the territory Sooke to Forbes Landing: 200 miles. However, Walker gives two other localities on the Island, so it clearly occurs where conditions are suitable.

On the mainland beside Vancouver, mentioned above, I have records: Cultus Lake, June 19th, Hope district, August 2nd and Kaslo, June 14th-21st. Ricker, Lost Slough, July 1st-August 7th. Buckell contributes: lakes in the Falkland district, Aspen Grove, Bridge Lake, Chilcotin, Chase, Jesmond, Quesney, Salmon Arm and Prince George (Summit Lake).

On my trip of 1939 to Atlin (60" north) I found this species adult upon my arrival July 6th. It occurred at the smaller muskeg pools as favoured by *Aeschna coerulea septentrionalis* and *Somatochlora septentrionalis* and not at the larger, with firm peaty edges, were *Somatochlora albicincta* and *hudsonica* were flying. *Leucorrhinia hudsonica* is an early species—quite possibly the first dragonfly to emerge at that latitude—and by July 31st the flight was about over. My last record was August 2nd, a female.

Between Prince Rupert and the Alberta border, 1940, I found this species at Smithers, June 22nd; Burns Lake, June 29th; Vanderhoof, July 8th, and Mount Robson, in the Yellowhead Pass, August 5th. At Burns Lake it was flying with its Alberta flying mate, *Leucorrhinia borealis*.

Flight period: May 7th to August 26th.

Map areas: records, 1-5, 7, 9, 10, 11 and 13. Quite obviously this species is of wide distribution in the Province, and I see no good reason why it should not also occur in areas 6, 8 and 12. Mrs. Gloyd's Synopsis for Alaska (1939)—as might be expected—gives a number of records.

Note: I have females with a length up to 34 mm., and a wingspread to 55 mm.

LEUCORRHINIA GLACIALIS Hagen

On my Vancouver Island trip, 1937, I found this species at two localities only, and these at the far extremities of the highway south and north: Sooke, common and in cop., June 7th-9th; and Forbes Landing, breeding, July 25th to August 22nd. In the latter area it was flying with *Leucorrhinia proxima*, and, Anisoptera and Zygoptera, no less than 33 other species.

Distribution: Walker took *glacialis* at Loon Lake, Nanaimo district, Vancouver Island, July 19th 1913, and on the mainland, Prince Rupert, June 10th-July 1st. Buckell contributes: Chase, Horsefly, lakes in the Salmon Arm district, Meadow Lake, Quesnel and Prince George (Summit Lake).

On my trip of 1940, Prince Rupert to Alberta border, the only habitat I found for this species was at Terrace, June 17th, where it was common. Terrace is only a few miles east of Prince Rupert, where Walker (1927) found it to be the most numerous species of the genus: "outnumbering *L. hudsonica* at least ten times."

Flight period: June 7th to August 22nd.

Map areas: 1, 2, 5, 10 and 11.

LEUCORRHINIA PROXIMA Calvert

Walker (1927) gives a number of localities for *proxima*, both on Vancouver Island and the mainland. On my Vancouver Island trip, 1937, I took specimens in the Nanaimo district on Newcastle, flying with *Sym. illotum* and *Pachydiplax longipennis*, July 16th; and at Forbes Landing, flying at several bodies of water, July 25th to August 22nd. By the latter date they were becoming scarce. *Glacialis* was also present in Forbes Landing area; a fact I mention since Walker records that he found the two species associated in the Nanaimo district, at Loon Lake, July 19th 1913.

Distribution: Atlin (E. M. Anderson), Victoria, Vancouver Island (Hagen) Vancouver, Stanley Park (E.M.W. and F.C.W.) Revelstoke (E.M.W.), Kaslo (Currie and F.C.W.) June 24th, Crawford Bay (F.C.W.) June 28th. Buckell contributes 15 localities, from Prince George (Summit Lake) in the north to Osoyoos on the international border; and Princeton and Tatla Lake in the west to Revelstoke, May 15th-August 14th.

In 1940, between Prince Rupert and the Alberta border, I took but two specimens of *proxima*: a male at Smithers, June 22nd, and an aged male at Red Pass (in the Yellowhead Pass) July 24th.

Flight period: records, May 15th to August 22nd.

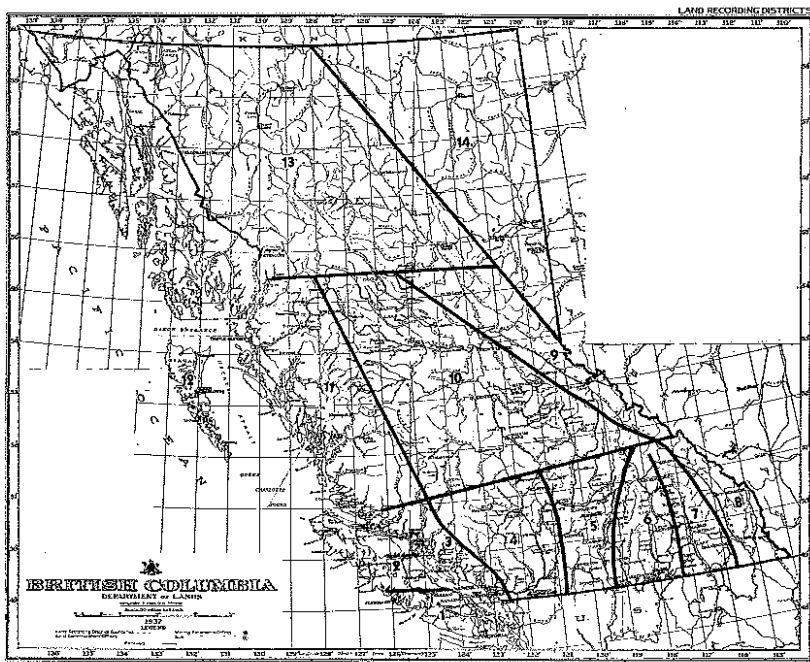
Map areas: 1-7, 9, 10 and 13. Also Alaska (see Gloyd 1939).

LEUCORRHINIA INTACTA Hagen

Intacta was the commonest dragonfly at the Golf Club slough, Chilliwack, July 15th-25th 1936. Like the other species of the genus they will settle on

bushes, but seem to prefer a warm road in the blazing sun. The male, after the manner of *Libellula quadrimaculata* and *lydia*, will follow the ovipositing female, hovering some twelve inches above the water and slightly behind his mate, while she busies herself distributing eggs where the water plants touch the surface. That duty finished for the time being, (and presumably to avoid being seized again) she will shoot perpendicularly twenty or thirty feet into the air. In the number of pairs I observed, the male seemed to miss this manoeuvre, for he remained on the water, apparently searching for her. The insects in this Province are inclined to be large. Length up to 37 mm.; wing-spread up to 60 mm.

Walker (1927) gives three Vancouver Island records: Alberni, Saanich district and Elk Lake, and, on the mainland, Vernon, Okanagan district. Beside the occurrence in numbers at Chilliwack, discussed above, the insect is on the wing at Beaver Lake, Stanley Park, Vancouver, from June 13th, but



Areas of Distribution of British Columbia dragonflies.—1. Vancouver Island, south. 2. Vancouver Island, north. 3. Pacific Coast, southern. 4. West and East Cascades. 5. Okanagan Valley. 6. Monashee Range and Columbia Valley. 7. Selkirk Range and Kootenay Valley. 8. Rocky Mountain Range and its Western Trench, south. 9. Rocky Mountain Range and its Western Trench, north. 10. Central Hinterland. 11. Pacific Coast, northern. 12. Queen Charlotte Islands. 13. Northern Hinterland. 14. Eastern Foothills, Rocky Mountains. Published with the permission of the Minister of Lands, Province of British Columbia.

it is not common there. My Vancouver Island records are different from those given by Walker, I therefore state them, with their dates: Thetis Lake district: Long Lake, a female netted, others seen, June 25th; Upper Thetis Lake, common, June 26th; Florence Lake, a few seen, June 29th-July 4th; on Goldstream creek, a female, July 4th; Wellington Lakes, 2 females, July 14th. One of the last mentioned was of the sooty winged form: the first I have taken in this Province.

Further mainland records: Kaslo, emerging, June 24th, Crawford Bay, June 28th, both 1938. Buckell's localities: Chase, Salmon Arm, Westbank, Creston, Oliver and Osoyoos. J. Wynne, Enderby, June 4th.

Flight period: records, May 1st to August 16th.

Map areas: 1, 3, 4, 5 and 7.

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