

NOTES ON ORIENTAL DRAGONFLIES OF THE GENUS ACIAGRION.¹

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INTRODUCTION.

In accordance with the hope I entertain of completing, some day, a survey of the Oriental Odonata fauna, I have contributed in this paper an account of the genus *Aciagrion* to be followed, I trust, in due course by similar accounts of other genera of the Coenagrioninae.² As no monographic revision of this subfamily has as yet appeared, it seems advisable to deal with the genera of the subfamily in more detail than is necessary, for example, in the case of the Libellulinae. As the systematic arrangement of the Coenagrioninae is still largely unsettled the method of dealing with it, genus by genus, has considerable advantages, since by a careful examination of the evidence available it should be possible to obtain some data of use to those who will undertake the task of constructing a natural classification of the subfamily which should have some right to be considered final.

Genus ACIAGRION de Selys.

Aciagrion DE SELYS, Ann. Mus. Civico di Genova, vol. 30, p. 159 (pp. 77-79 of separate). *Type of genus*.—*Aciagrion hisopa* de Selys.

The genus includes a number of small, delicate insects, and ranges, so far as known at present, from Ceylon and South India to the East Himalayas, thence through Assam and Burma down the Malay Peninsula to Borneo, whilst an outlying species is recorded by Tillyard from Australia.

¹This is the fourth of a series of papers, the first and second of which, by E. B. Williamson, of Bluffton, Ind., were on The Dragonflies (Odonata) of Burma and Lower Siam, as follows: 1. Subfamily Calopteryginae, Proc. U. S. Nat. Mus., vol. 28, pp. 165-187, published April 22, 1905. 2. Subfamilies Cordulegasterinae, Chlorogomphinae, and Gomphinae, Proc. U. S. Nat. Mus., vol. 33, pp. 267-317, published December 13, 1907.

The third paper in the series, by Frank Fortescue Laidlaw, of Uffculme, England, carrying the same general title of The Dragonflies (Odonata) of Burma and Lower Siam—III, was on the Subfamily Aeschninae and was published in the Proc. U. S. Nat. Mus., vol. 62, pp. 1-29, pl. 1, and was issued on June 21, 1923.

²Coenagrioninae=Legion Agrion of de Selys. See Kennedy, Ohio Journal of Science, vol. 21, pp. 27-28, 1920.

Amongst old world genera it is rivaled only by *Amphicnemis* for extreme delicacy, though structurally it does not seem particularly closely allied to that genus.

The species are probably abundant in suitable localities, and it is likely that several new forms await discovery. The fragility of papered specimens makes it difficult in many cases to determine satisfactorily the more minute details of structure, more especially the anal appendages of the male. Hence it is often difficult to give adequate descriptions or clear figures of these structures. Moreover, in papered specimens the colors are very likely to be faded, so that the discrimination of species is not always an easy matter.

The genus may be defined as follows: A coenagrionine genus, with short tibial spines and a rounded frons. Wings petiolated to level of *ac*, this lying about halfway between the first and second antenodals. Costal margin of quadrangle about one-third the length of the anal margin in the forewing, about one-half in the hind wing. *Rs* arising from vein descending from nodus, *M*₃ from a point immediately proximal to it. Pterostigma of forewing distinctly larger than that of hind wing. Female with spine at apex of eighth sternite of abdomen. Male with apex of terminal segment deeply emarginate and slightly elevated. Upper anal appendages more or less bifid, lower appendages rather flattened, each of these latter carrying on its upper part a thickened process which may be separated by a cleft from the rest of the appendage so as to stand out from it as a strong conical spine.

In the species examined for this structure the penis has the distal part of the shaft armed with fine lateral spines. The third segment (employing Kennedy's nomenclature) has a well-developed internal fold; the terminal fold is present but reduced. The inner surface of the distal lobe of the third segment is armed with a number of fine shagreenlike denticles, and the lateral margin of this lobe carries a strong spine on either side. Its apex may be cornuate (*A. borneense*) or simple and rounded (*A. hisopa*). Lastly, the coloring of the two sexes is similar, no dimorphic females have been known to occur, and postocular spots are present.

The relationship of the genus is evidently with the *Enallagma* series of genera. It resembles them in the shape of the frons, in the presence of a spine on the eighth segment of the abdomen of the female, in the similar coloring of the two sexes, and in the postocular markings. It differs, I think, from all of them in the greater amount of petiolation of the wings, and in the extremely slender build of the body.

It resembles some of the American species of *Enallagma*, and the African *Proischnura subfurcatum* (de Selys) in having the pteros-

tigma of the forewing larger than that of the hind wing, whilst the anal appendages of the males of some of the species at least (*A. tillyardi*, *A. olympicum*) bear a strong resemblance to the corresponding structure of some of the African species, *Africallagma glaucum* (Burmeister)³ for example.

On the whole we may conclude that the genus is a specialized end-branch of the great *Enallagma* series.

In the following table I have attempted to give the differential characters of all the species (six in number) which I have been able to identify in the material available to me. To make the table as complete as possible I have added a note on species I have not seen, derived from the descriptions given by the author in each case.

In this table the expressions "moderate size," "rather large" must be taken as relative only.

a.¹ With blue coloring on abdomen, the blue being especially vivid on the first three and on the last three segments. Head and synthorax also with blue markings, the latter with blue antehumeral stripes, and with the sides blue.

b.¹ Species of moderate size (abdomen of male 24–26 mm., of female 24 mm.; hind wing of male 15–16 mm., of female 16–17 mm.). In the male, segments 8, 9, 10 of abdomen entirely blue (or in specimens from some localities segment 8 has small, paired, black basal markings on the dorsum). Female similar, but blue less vivid, and segment 8 has a longitudinal, black band on the dorsum not reaching the apex of the segment, whilst 9 has small, paired, basal spots. Postnodal nerves on forewing 10–11.

A. *hisopa* de Selys.

b.² Species of moderate size (abdomen of male 24.5 mm., of female 22.5 mm.; hind wing of male 17.5 mm., of female 17.5 mm.). Rather robust for its size when compared with other species of the genus. In both sexes the last three segments of the abdomen are definitely dilated. In the male, segments 8 and 9 of abdomen bright blue, dorsum of segment 10 black. The female has a dorsal, black band on segments 8 and 9, not quite reaching the apex of 9, whilst 10 is apparently blue, unmarked with black. Postnodal nerves on forewing 12_____ A. *tillyardi* Laidlaw.

b.³ Small species (abdomen of male 22–24 mm., of female 23 mm.; hind wing of male 15 mm., of female 15.5 mm.). Very slender. In the male, segments 8, 9, 10 rich blue, 8 with a black, dorsal triangle, its apex anterior but not usually reaching the base of the segment, 9 entirely blue, 10 has a black X-shaped mark on the dorsum. Female with a broad dorsal band of uniform width on 8, segment 9 with a broad basal triangular mark of black, 10 entirely blue. Postnodal nerves on forewing 9.

A. *occidentale* Laidlaw.

³ I have used Kennedy's generic names here. It seems to me convenient to distinguish African from American forms by according to them subgeneric rank where there is structural modification sufficient to justify such a proceeding.

*a.*¹ With blue coloring on abdomen, etc.—Continued.

*b.*⁴ Very small species (abdomen of male 19 mm., of female 18 mm.; hind wing of male 13 mm., of female 13.5 mm.). In the male, segment 8 has a dorsal band of uniform width of black, and 10 has a dorsal, black mark relatively broader than in the last species; 9 is usually entirely blue, but some specimens have a diamond-shaped, black mark on the dorsum of this segment also. The female has the whole dorsal surface of 8 and 9 covered with a broad black band, narrowing apically on 9, whilst 10 has a basal bilobed black mark. Postnodals 8 or 9_____ *A. borneense* Ris.

*a.*² Without any blue coloring on abdomen.

*b.*¹ Rather large species (abdomen of male 34 mm., of female 32 mm.; hind wing of male 22 mm., of female 22.5 mm.). Ground color generally creamy-white; rather darker on sides of synthorax and of segments 1, 2, 3 of abdomen. In the male, segments 8, 9, 10 are without markings, 2 has an isolated triangular black mark on the distal half of the dorsum surrounded by a pale margin; 3 to 7 with black dorsal bands widened apically on each segment, pointed basally in 3. The female has a longitudinal black band on the dorsum of segments 2 to 7 of the abdomen, and 8 has a black, dorsal mark, narrow basally, widening distally, but not touching either end of the segment. Thirteen postnodals on forewing. Each femur marked with black line in both sexes_____ *A. olympicum* Laidlaw.

*b.*³ Species of moderate size (abdomen of male 28 mm., of female 29 mm.; hind wing of male 18 mm., of female 19 mm.). Very fragile and slender. In the adult male the ground color of the dorsum of the head and thorax appears to be a dull blue with a greenish tinge. In immature males, and in females this color is replaced by fawn color. Antehumeral stripes not so sharply defined as in other species. Ground color of abdomen white or buff-white of a warmer tone on the dorsum. Segments 1 to 7 each with a longitudinal dorsal band of metallic green. Segments 8, 9, 10 without markings. In immature males and females the dorsal band is present on the first and second segments and on the base of the third; it is also well developed on segments 6 and 7. In both sexes the femora are without markings, but the joints of the legs, and the spines, are brownish. Postnodals 10 to 12.

A. pallidum de Selys.

*a.*² Species which are not known to me.

*b.*¹ *A. approximans* (de Selys).

This species has never been fully described. It is said by de Selys to be related to *A. hisopa* in venation and by the form of the anal appendages. The last 3 segments of the abdomen of the type are missing. The female is unknown. Said to come from the Kjasi Hills. Abdomen of male 27 mm. (approximately); hind wing 17.5 mm. (Possibly *A. tillyardi* is synonymous, but the anal appendages of that species are strikingly different from those of *A. hisopa* in appearance.)

a.³ Species which are not known to me—Continued.

b.² *A. fragilis* Tillyard.

Postocular markings blue. Narrow antehumeral stripes and sides of synthorax blue, legs gray. Abdomen of male with segments 1 to 8 black, with narrow, transverse, white lines along the sutures. Segment 2 marked with blue at the sides as is 7. Segment 9 bright blue, 10 black above, blue at the sides. Female as in the male, but segment 8 has the sides, base and apex blue, 9 has a bronze basal spot, and 10 is blue. Post-nodal nerves in forewing 9. Length of abdomen of male 22 to 23 mm.; hindwing 14 mm.

b.³ *A. azureum* Fraser.

Rather large species (abdomen of male 30 mm.; hind wing 20 mm.). Markings on head pale yellow, but with large blue postocular spots. Few blue antehumeral stripes on synthorax, sides blue, changing to creamy yellow below. Abdomen with ground color of segments 1 to 2 and 8 to 10 blue; black markings on the dorsum of 1 to 7; the last three segments unmarked. Anal appendages similar to those of *A. olympicum*, the upper pair more conical and not bifid, black in color. Post-nodal nerves on forewing 10 to 11. Said to be very like *A. olympicum*.

ACIAGRION HISOPA de Selys.

Plate 1. fig. 8.

Aciagrion hisopa DE SELYS, ANN. MUS. CIVICO DI GENOVA, vol. 30, p. 159 (pp. 80-81, separate).

Specimens examined.—Four males and three females from Pulau Ubi, a small island near Singapore, and the Botanic Gardens at Singapore. One female from Biserat in Jalor (Siamese Malay State), N. Annandale. Two males and two females from Burma, collection E. B. Williamson, collected by R. A. Earnshaw.

None of these specimens is in good condition, and it is not possible to make a satisfactory figure of the anal appendages of the male.

I have, however, no doubt as to the correctness of my identification. The accompanying plate figure illustrates the structure of the terminal parts of the penis; it is drawn from a specimen from Singapore.

The type specimen is said to have come from Pulo Besoar in Malaya and the species ranges from the Malay Peninsula and Lower Siam through Burma and Assam to peninsular India, as far south as the Nilgiri Hills at any rate. Fraser⁴ has recorded a race *krishna* from Mahableshwar in which the male has occasionally a small black spot on either side of the eighth segment of the abdomen, and sometimes a black dorsal mark on the tenth, and the female has segments 9 and

⁴ Journ. Bombay Nat. Hist. Soc., 1921, p. 542.

10 blue with an occasional black mark on the base of 9. Individuals emerged from the larval state in large numbers on May 23. The specimens that I described as race *occidentalis*⁵ belong to a distinct species subsequently described as *paludense* Fraser (see *occidentale*).

ACIAGRION TILLYARDI Laidlaw.

Plate 1, fig. 15.

Aciagrion tillyardi LAIDLAW, Rec. Indian Museum, vol. 16, no. 2, 1919, p. 187.
Euallagma assanica FRASER, Journ. Bombay Nat. Hist. Soc., vol. 26, 1919, p. 877.

Specimens examined.—One male (paratype) from Tura Garo Hills, Assam, 1,550 feet. One male and one female from Shillong (from Major Fraser).

This is by far the most robust of the species I have seen. The dilatation of segments 8, 9, and 10 of the abdomen is a character not found in other species of the genus.

The species appears to be confined to Assam.

I have not been able to examine the structure of the penis.

ACIAGRION OCCIDENTALE Laidlaw.

Plate 1, figs. 11 and 16.

Aciagrion hisopa (?) race *occidentalis* LAIDLAW, Rec. Indian Museum, vol. 16, no. 2, 1919, p. 187.

Aciagrion paludense FRASER, Journ. Bombay Nat. Hist. Soc., 1922, pp. 698-699.

Specimens examined.—Two males and two females from Ceylon (collection E. E. Green). One male from Cochin Strait (collection Indian Museum).

It is very unfortunate that my brief account of this form is quite incorrect. Nevertheless in accordance with the laws of nomenclature I imagine my name must take precedence over that proposed by Major Fraser.

My description states that the black mark on segment 8 of the abdomen has its apex directed toward the hinder end of the segment. This should read "directed toward the base of the segment."

The penis, like that of the next species, has the apex of the third segment cornuate and not truncate as in *hisopa*. It differs from that of *borneense* chiefly in not having the most basally situated denticles of the inner surface of this segment enlarged. Like it, it has a bilobed boss on this surface of this segment lying just basally to the denticles, whilst the lateral marginal projections are relatively larger and more apically placed.

The species is quite distinct from *hisopa* and apparently near *borneense*. It has been recorded from the Nilgiri Hills southward to Ceylon.

⁵ Laidlaw, Rec. Indian Museum, vol. 16, no. 2, 1919.

“Very conspicuous though small, by reason of the bright blue color, and can easily be picked out from the more somber *hisopa* with which they mix.” (Fraser.)

ACIAGRION BORNEENSE Ris.

Plate 1, figs. 10, 12, 13.

Aciagrion borneense Ris. Ann. Soc. Entomol. Belgique, vol. 55, 1911, pp. 234-235, figs. 2 and 3.

Specimens examined.—Eight males and seven females, collected by W. L. Abbott, Trong, Lower Siam (collection of the United States National Museum). I have also seen specimens from the Malay State.

This is the smallest species of the genus. The female has not been described; it is similar in coloring to the male save that segments 8 and 9 of the abdomen have a longitudinal band covering the whole of the dorsum of these segments, whilst the tenth has a basal, bilobed black mark.

The type specimen (from Borneo) is said to have the ninth segment of the abdomen entirely sky-blue. Two of the males from Trong have a small, diamond-shaped, black mark on the dorsum of this segment. I have figured one of these specimens. The anal appendages have been figured by Ris; they are very similar to those of *A. occidentale*.

The apex of the third segment of the penis is cornuate; the spur-like projections of the lateral margins are small and lie far back from the apex; the most basally situated of the denticles of the inner surface are enlarged and lie considerably more distad than the lateral projections, and between them and the projections there is a small bilobed swelling. The internal fold is small.

The species ranges from Borneo through the Malay Peninsula as far north approximately as the Isthmus of Kra.

ACIAGRION PALLIDUM de Selys.

Plate 1, figs. 1-7, 9.

Aciagrion pallidum DE SELYS, Ann. Mus. Civico di Genova, vol. 30, 1891, pp. 80-81 (separate).—LAIDLAW, Rec. Indian Museum, vol. 16, no. 2, 1919.

Specimens examined.—Very numerous females and males from Lower Burma, collected by R. A. Earnshaw, in Mr. Williamson's collection. I have seen also specimens from Assam and from peninsular India from the north Kanara District and Nagpur.

As the species is structurally a typical member of the genus I have figured certain details of venation, etc., in some detail. In color-

ing *pallidum* is possibly more specialized than other *Aciagrion* (except perhaps *olympicum*). At any rate it departs more widely in this respect than do most of its congeners from the usual *Enallagma* pattern. Young specimens are curiously suggestive of *Amphicnemis*, though there is, I believe, no close relationship.

As in *hisopa* the penis has the apex of the third segment truncate and without cornua. It differs from *hisopa* in that the most basally situated denticles are much enlarged and project backward like barbs between the two large, lateral marginal spurs.

ACIAGRION OLYMPICUM Laidlaw.

Plate 1, fig. 14.

Aciagrion olympicum LAIDLAW, Rec. Indian Museum, vol. 16, no. 2, 1919, pp. 184-186.

Specimens examined.—One male (paratype) from Darjiling District.

This is the largest species of the genus so far as I know. Its markings are on the whole similar to those of the most of the species of the genus, save perhaps that in the male the marking on the dorsum of the second segment of the abdomen is reduced to a pentagonal or triangular spot. The coloring is however remarkable in that blue is altogether absent, and that the ground color is a fawn or buff. I have not been able to examine the penis. The anal appendages of the male as already noted are similar in plan to those of some of the African species of *Africallagma* figured by Doctor Ris.

A. olympicum has been recorded only from the foothills of the Himalaya, near Darjiling.

The following are the references to the three species I have not had an opportunity of examining.

ACIAGRION APPROXIMANS (de Selys).

Pseudagrion microcephalum (?) race *approximans* DE SELYS, Bull. Acad. Belgique, ser. 2, vol. 42, 1876, pp. 507-508.

Aciagrion approximans DE SELYS, Ann. Mus. Civico di Genova, vol. 30, 1891, p. 80.

ACIAGRION FRAGILIS (Tillyard).

Ischnura (?) *fragilis* TILLYARD, Proc. Linn. Soc. New South Wales, 1906, pt. 2, pp. 186-187, pl. 17, fig. 6.

Aciagrion fragilis TILLYARD, Proc. Linn. Soc. New South Wales, vol. 37, pt. 3, 1912, p. 472, pl. 46, figs. 21, 22; pl. 49, fig. 22.

ACIAGRION AZUREUM Fraser.

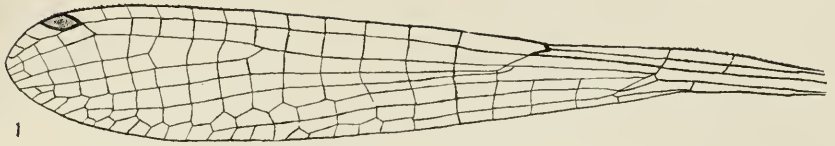
Aciagrion azureum FRASER, Mem. Dept. Agr. in India, vol. 7, no. 7, 1922, p. 51.

EXPLANATION OF PLATE.

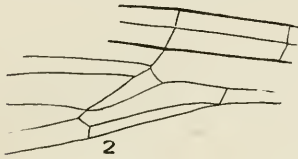
(All figures drawn by the author.)

- FIG. 1. Forewing of male *Aciagrion pallidum* from collection of E. B. Williamson.
2. Detail of base of forewing of *Aciagrion pallidum*.
 3. Detail of base of hind wing of *Aciagrion pallidum*.
 4. Apex of abdomen of male *Aciagrion pallidum*, from the side.
 5. Apex of abdomen of female *Aciagrion pallidum*, from the side.
 6. Pterostigma of hind wing of *Aciagrion pallidum*.
 7. Pterostigma of forewing of *Aciagrion pallidum*.
 8. Terminal parts of penis of *Aciagrion hisopa*.
 9. Terminal parts of penis of *Aciagrion pallidum*, seen obliquely from the side.
 10. Apex of abdomen of male *Aciagrion borneense*, seen from above.
 11. End-on view of tenth segment of abdomen of *Aciagrion occidentale*.
 12. Terminal parts of penis (slightly diagrammatic) of *Aciagrion borneense*.
 13. Apex of abdomen of female *Aciagrion borneense*, from above.
 14. Anal appendages of male *Aciagrion olympicum*, from the side and a little ventrally.
 15. Apex of abdomen of *Aciagrion tillyardi*, seen from side.
 16. Apex of abdomen of male *Aciagrion occidentale*, seen from above.

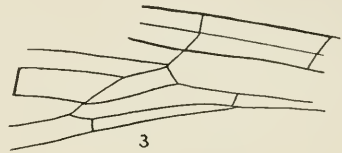




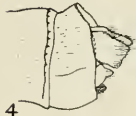
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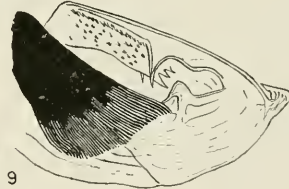


7

pallidum



8 hisopa



9

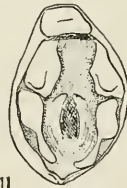


10



13

borneense



11

occidentale



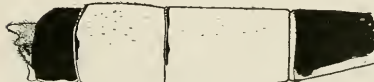
12

borneense



14

olympicum



15

tillyardi



16

occidentale

DETAILS OF DRAGONFLIES OF THE GENUS ACIAGRION

FOR EXPLANATION OF PLATE SEE PAGE 9

