ODONATA

BY: LT.-COL. F. C. FRASER, I.M.S., F.E.S.

(With 5 Text-figures)

In 1866 Brauer published the description of a single species of dragonfly from Samoa, and in the following three years, descriptions of three others. These were the first Samoan dragonflies to be described, nothing further being published on them until a period of fifty-five years had elapsed. In the year 1924 the present author issued a preliminary note on Samoan dragonflies, in which were listed fifteen species, including three new to science. A further note was published at the beginning of last year (1926), in which another new species was described. Since the publication of the latter, much fresh material has been collected by Dr. J. S. Armstrong, Dr. P. A. Buxton, Mr. G. H. E. Hopkins, Mr. E. H. Bryan, and others, bringing the list up to twenty-nine species in all. This new material, consisting of about 300 specimens, includes representatives of four genera, twelve species not hitherto reported from the Samoan Islands, one undetermined species, and one new species from Tonga. In addition, the female of Pacificagrion tokasmusa has been discovered. The complete list of species is as follows.

Order: ODONATA.
Suborder: ZYGOPTERA.
Family: COENAGNONEAE.

1. Pseudagrion samoensis Fras.
2. Agrionemis caudata Selys.
3. Agrionemis vitienisis Tillyard.
4. Agrionemis interrupta, sp. nov.
5. Penticnemis annulata Brauer.
7. Ischnura buxtoni, sp. nov.
8. Ischnura haemastigma, sp. nov.
9. Ischnura albistigma, sp. nov.
10. Ischnura chromostigma, sp. nov.
11. Amorphostigma aristrophi Fens.
12. Amorphostigma curricolor, sp. nov.
13. Pacificagrion lachrymosum Fens.

Suborder: ANISOPTERA = Dragonflies
Family: Aeshnidae.

15. Acaciaeca jasypidea (Burm.).
16. Gynacantha apiensis, sp. nov.
16a. [Gynanthes sternonis, sp. nov., from Tonga.]

Family: Libellulidae.

17. Hemicordulia pacifica Fens.
19. Hemicordulia cupricolor, sp. nov.
19a. Hemicordulia, sp. ?
20. Lithreista asiatica asiatica (Fabr.).
21. Diplacodes bipunctata (Brauer).
22. Rhyothemis regia chalcophrion (Brauer).
23. Rhyothemis regia auris (Ris).
24. Tramea limbat (Desj.).
25. Pontia flavescens (Fabr.).
26. Thobyris allargata (Fabr.).
27. Macrostelax orra (Brauer).
28. Orthetrum sabin (Drury).

It will be noted from a perusal of the above list, that the fauna presents some striking features. In the suborder Zygoptera, which is divided about equally into two large families, the first Family, the Aeshnidae, is entirely unrepresented. In the second, the Coenagrionidae, there is an extraordinary development of the group Ischnura, no fewer than eight out of the twelve species belonging to this genus or its relatives (Amorphostigma, Pacificagrion).

In the suborder Anisoptera, the families Gomphidae and Cordulegasteridae are completely wanting, while only three species of Aeshnidae have been discovered. In the remaining family, the Libellulidae, there is a marked
development of the genus *Hemiodus*, an ancient stock from which the dominant subfamily Libellulinae probably originated. Species belonging to other genera are mostly those with strong migratory tendencies, and are related to Australia and South Asian forms.

1. *Pseudagrion samoensis* Evans. (Text-fig. 1, a and b).


The only representative of the genus in the islands, closely related to the Fijian *P. pacificum* Till. Many specimens collected by J. S. Armstrong, Siuuma, Upolu Isl., 16-24, viii. 22, 18-29, x. 22, 18-xii. 22 and 23-xii. 22.

2. *Agriocnemis cesudana* Selys.


Closely related to *A. pygmaea* and *A. vitians*, and probably of not more than subspecific rank. Found throughout the whole year at Apia, Upolu Isl.: specimens also examined from Savaii Isl., Pago Pago, Tutuila Isl., and Fuaafati, Ellisco Isl. In Upolu the species is common from sea-level to 2060 feet, near Malololalei.


Several males and females collected by J. S. Armstrong, Apia, Upolu Isl., 28-x-30, xi. 23, in company with the foregoing species. I have not been able to satisfy myself as to the differences in the anal appendages pointed out by Tillyard. The main point of differentiation appears to be that the terminal segments of the abdomen remain reddish in this species, even in the very adult stage, whereas they turn blackish-brown in *cesudana*. Age differences, however, are very unreliable, when dealing with genera such as *Agriocnemis*, *Ischnura*
and Enallagma, in all of which reddish colouring predominates in the general condition.

4. Agriocnemis interrupta, sp. nov. (Text-fig. 1, c and d).

The largest species of the genus yet discovered, its measurements surpassing all others by about 6 mm. in breadth and length. In this respect it approaches Agriocnemis, a closely related genus.

Male. Abdomen 26 mm. Hindwing 18 mm.

Head.—Labium white; labrum and epistome glossy metallic blue; cheeks and bases of mandibles blue; rest of head matt black, except for a large sub-triangular blue postocular spot on each side behind the eyes.

Prothorax black on dorsum, bluish on sides, the posterior lobe of great length, narrow and grooved above longitudinally.

Thorax broadly black on dorsum, light blue on the sides, with a small black spot on the upper part of the posterior-lateral suture. The dorsum marked with a broadly interrupted blue antehumeral stripe, represented by an upper triangular spot against the alar sinus and a narrow stripe below which tapers to a point and ends about halfway up the dorsum of thorax.

Legs short, robust, yellowish, with a broad black stripe on extensor surfaces of femora.

Wings palely envenomed. 11 postnodal nervures in forewing, 9 in the hind; are distad of outer antenodal nervure in all wings; pterostigma pale brown, smal, its outer edge somewhat rounded, the inner oblique.

Abdomen black on dorsum, bluish laterally, the apical end of segment 7, and the whole of segments 8-10 brick red. Segments 9-7 with short basal blue rings.

Anal appendages brick red, the superiors robust, stoutly built, divaricate, equal in length to segment 10, the apicis notched. The inferiors broad at base, tapering rapidly to a fine point, directed very obliquely upward and almost hidden in the end of abdomen.

Distribution.—A single male from Malololelei, Upolu, W. Samoa, coll., J. E. Armstrong. Distinguished from other species of the genus by its large size (about 6 mm. larger in all directions). It belongs to the pygmaeus group, as is shown by its metallic labrum.
5. Pericemis annulata Brauer.


Not represented in the collections made by J. S. Armstrong and F. A. Buxton. The species is a doubtful one, and was entirely suppressed by Selys in his account of the genus published in 1877. The genus was placed by Selys in the 4th Legion Patronym. in his Synopsis der Agromines, published in 1883, but was subsequently removed to the 5th Legion Agrom. in 1877 as a subgenus of Tachinina. It is quite possible that the species may turn out to be yet another of the Ichneumine group with abnormal pterostigma.

6. Ischura aurora Brauer (Text-fig. 6, iv.).


A common insect at Apia, Upolu Isl., and found from September to April. Also taken at Amauli, Tutuala, and Safuna, Savaii; and at Fanatuti, Ellice Group, during September. Of wide distribution, extending from Western Indis to Samoa, throughout South Asia, Australia and the Pacific Islands. Specimens from Samoa conform to Asiatic examples in having the abdomen yellow (Australian forms are red). In Coorg I have often watched this species taking flight after emerging, and have followed it with my eyes as it rose almost perpendicularly in the air, until finally lost to sight at a great height. Such a frail, tiny insect floats like a piece of gossamer, and is borne by the upper air currents to immense distances. In fact its very weakness becomes a source of strength, enabling it to spread far, and populate a vast area. I have noted swallows snapping up this insect during the natal flight, and Orthocerus abina preys freely upon it in its ready fastnesses.

7. Ischura buxtoni, sp. nov. (Text-figs. 2, a and b; 4, v.).

Male. Abdomen 26-27 mm. Hind-twing 16-17 mm.

Head.—Labium creasy white; labrum pale greeny-white, with its base finely black, this colour produced as a median short point; antennae, the cheeks, and a transverse stripe on front pale olive; above epistome black with a metallic lustre, rest of head most black except for a postocular blue spot on each side behind, and a twin linear spot at middle of back of occiput.
Prothorax black on dorsum, the hinder border very finely and the lower part of sides broadly, as well as coxae and trochanters of anterior pair of legs, yellow.

Thorax with a pair of small yellow horns on its anterior border, projecting towards the posterior lobe of prothorax, the dorsal pair the larger. Dorsum of thorax broadly black, with a narrow antehumeral stripe on each side olive-green (probably blue in life). The stripe narrows gradually above and then expands again at its extreme upper end. Laterally bluish-green with a black stripe, incomplete below, on the postero-lateral suture. The dorsal black area, just posterior to the humeral suture, sends a hooked downward prolongation for a very short distance.

Legs yellow on dorsum surface, broadly black on the extensor.

Wings hyaline, distinctly suffused; postnodal nervures in forewing 11, in the hind 10; pterostigma slightly larger in the forewing, its inner side somewhat shorter than outer, that of forewing pulverulent white above in adults, that of the hind blackish-brown, all similarly coloured beneath.

Abdomen bluish-green, marked broadly with black on dorsum, and with blue on segments 8–10. Segment 1 with the whole of dorsum broadly black, its apical joint bluish-green, segment 2 similar but the black constricted by the blue ground colour at the apical border, and the apical joint black, segments 3–6 with the whole of dorsum black except for narrow basal blue rings. The black on these segments expanded subapically and then contracted at the apical border where it joins an apical black ring. Segment 7 very broadly black, its lower border yellowish; segment 8 with its apical half azure blue, this colour extending broadly as far as the base of segment on the sides; 9 and 10 entirely blue save for a small lateral black elongate spot on each side, the latter segment with a prominent blunt spine at the apical end of the dorsal carina.

Anal appendages black, the inferiors paler and brownish at base, superiors robust and stoutly built, shaped like the butt end of a revolver, constricted and cylindrical at base, then abruptly bent downward and thickened, bluntly pointed behind and below. The inferiors broad at base, rapidly tapering, thin and cylindrical, curving evenly up and back. Seen from below, these appendages are a little concave towards each other and their apices tend to approximate. The superiors show only as rounded, or thick conical, processes on either sides of them.
FEMALE. Abdomen 13–24 mm. Hindwing 15–18 mm.

Head.—Labium white; labrum creamy yellow, its base black; antennae pale yellow; postclypeus glossy black, an obscure bluish stripe between it and frons above, largely hidden by melanine; rest of head black, especially in adults; but in the younger specimens there are postocular spots similar to those of the male.

Prothorax black on dorsum, yellowish low down on sides, this part more or less pulvulent white.

Thorax broadly black on dorsum with a narrow bluish-green ante-humeral stripe, largely obscured or almost obsolete in very adult specimens. Laterally, bluish-green, with a broad black stripe on the postero-lateral suture. Side and beneath more or less pulvulent white.

Legs reddish-brown, the extensor surface of femora black. The coxae, trochanters and inner surfaces of femora pulvulent white in adults.

Wings hyaline; 12–14 postnodal nervures in forewing, 11 in the hind.

Sterostigma small, light brown framed in black nervures.

Abdomen black, the ventro-lateral borders narrowly ochreous. Segment 7 and the basal half of 8 more or less pulvulent white. Segments 8–10 marked with blue, the extent of this colour varying with the age of specimens, as in two of the present collection quite obsolete. In the younger specimens there is a broad triangular blue patch on segment 8, with its base again the apical border of segment, and its apex extending to within a short distance of the anterior margin; on 9 a similar but more extensive marking its base, at the apical border very broad, its apex narrowed and extends right up to, and broadly contiguous with, the base of segment. Segment 10 with its dorsum wholly blue from base to apex.

Vulvar scale ochreous, robust, extending to end of abdomen.

The 8th abdominal segment without a ventral spine in any of the seven females examined.

8. Ichnura haemastigma, sp. nov. (Text-figs. 2, a and b; 5, vi.).

Male. Abdomen 24 mm. Hindwing 15-5 mm.

Head.—Lips, epistome and frons bright citron yellow; vertex black, marked with small round greenish postocular spots.

Prothorax black, with an anterior collar and the sides broadly citron yellow, Thorax black on dorsum, with the anterior booklets yellow, small. Antehumeral stripes broken up into an upper small linear spot and a lower larger pyriform spot, both citron yellow, the dorsum otherwise broadly black, the sides citron yellow changing to reddish near the ventral surface, and marked with a narrow black stripe on the hind surface, and a small linear black point beneath the root of forewing.

Legs bright crimson, with fine black spines.

Wings hyaline, pterostigma in forewing blood-red, almost quadrate, the costal side shortest, the outer and inner sides oblique, the hinder a little rounded, over about one cell. In the hindwing, this structure is normal and about one-third the size of that of forewing, which is much enlarged. Postnodals in forewings 10–11, in the hind 9; ac lies a little nearer the distal antenodal.

Abdomen bronzed black, this colour forming complete broad apical rings on 3–7.

Segments 1–7 yellow along the ventral borders and beneath. Segment 8 with a blue triangular apical marking on its apical end, the base applied to the apical border of segment, segment 9 entirely blue, 10 with a large dorsal geminate spot of blue.

Anal appendages black, the superiors sickle-shaped in profile, about as long as segment 10, seen from above, rounded and hollowed out. Inferiors slightly longer, broad at base, tapering to a sharp point, which is turned rather sharply inward as seen from below.

Distribution.—A single male from Malololele, Upolu Isl., 2,000 ft., P. A. Bartik, 5.xii.25. The colour of the pterostigma is unique in the genus, with
the exception of a new species, of which I have seen specimens from the Society Islands. In this latter the shape of the pterostigma is normal, though enlarged. The shape of the structure in the present species recalls that of Protosticta, and is very similar to that of Ischnura perpavone, of N. America.

9. Ischnura albistigma, sp. nov. (Text-fig. 5, i.). Male. Abdomen 25 mm. Hindwing 18 mm.

Head.—Labium creamy white; labrum greemish-yellow, with a small medial basal punctate spot black; apistome glossy black; postclypeus and frons greenish-yellow, including basal segments of antennae; vertex black, marked by small round azure-blue postocular spots.

Prothorax black. Thorax black on dorsum, the anterior loeklets, narrow antehumeral stripes, and the sides broadly greenish-yellow. The latter with a narrow black stripe on the hinder suture, and a small linear spot beneath the root of forewing.

Legs yellow, hind femora with a black outer stripe.

Wings hyaline. Pterostigma of forewing about three times the area of that of hind, pale creamy white, with its inner angle broadly black, giving an eye-like effect to the structure. Its outer side very oblique and elongate, its costal border longer still and, like the outer, framed in pale creamy white, so that the costa appears to be absent here. Inner and hinder borders very short and black, the latter slightly rounded. Pterostigma of hindwing normal, sepia framed in black, with a paler ring within. Postnodal index, 13-14 in the forewings, 10-11 in the hind; so situated nearly midway between the two antennomasts.

Abdomen citron yellow, marked broadly on the dorsum with enfumed ochreous and black, as follows: Segment 1 with a sub-quadrate black dorsal spot on a blue background, 2 with a broad thistle-head shaped spot on dorsum connected to an apical ring, segments 3-6 with broad dorsal stripes black at either end, warm reddish ochreous in between, the basal ends of the stripes not quite extending to the base of segments, where they leave narrow yellow rings. Segment 7 entirely black on the dorsum, 8 with a broad triangular blue spot on dorsum, the base of triangle applied to the apex of segment, 9 all blue save for a small sub-dorsal apical black spot on either side, 10 similar but the hestral black spot larger.

Anal appendages black. Superior seen in profile shaped like the butt of
28 INSECTS OF SAMOA.

a revolver, seen from above rounded and with a robust outer spine. The inferior
of about the same length, and equal to the length of segment 16, broad at base.
tapering to a fine point, widely divericate.
Female unknown.

Distribution.—Only two specimens, both males, are known: the first, the
type, came from the same locality as that of the foregoing species, and was
taken on the same date, in the same deep ravine. The second is a temral
male, taken between sea-level and 300 ft. at Pago Pago, Tutuila Isl., 18.8/123
(H. C. Kellers). The species is closely related by its appendages to others
of the group as represented in Samoa, and especially to A. armstron.g, but dis-
tinguished easily from all others by the shape of its pterostigmas. I have seen
a Tahitian species, in which the pterostigma shows almost identical shape and
colouring, but in which the anal appendages are almost identical with those of
I. hawaiastigma.

10. Ischnura chromostigma, sp. nov.

4 5 and 5 5, all from Pago Pago, Aotze Trail, Tutuila Island, 10.ii.29
to 12.iv.29, col., E. H. Bryan, Swooty and Wilder. All specimens except a
single female are imperfect, the terminal segments with anal appendages
being absent.

Male. Abdomen 24 mm. (7 segments only). Hindwing 18–20 mm.

Head.—Labium yellow; labrum azure blue, its anterior border narrowly
yellow, its base narrowly black, as also the epistome. A broad transverse
greenish-blue stripe across front extending from cheek to cheek and changing
to yellowish-green low down on the cheeks and bases of mandibles. Rest of
head matt black, marked with two rounded postocular blue spots.

Forehead black, the sides yellow, as also coxae and trochanters.

Thorax black on dorsum, marked with two pale blue antehumeral stripes.
Laterally blue, with a broad black stripe over the second lateral suture and
anterior border of metepimeron. Anteriorly the blue area slightly overlaps
the first lateral suture in its lower third-fourths.

Legs yellow, with black spines; the hinder and outer parts of all femora
and the hinder surfaces of tibiae black.

Wings hyaline, 14 postnodals in forewings, 11 in the hind. Pterostigma
differing in fore- and hind-wings, normal in the latter, where it covers less than.
one cell, sepia in colour, its outer angle very acute. In some the costal border pale yellow. Pterostigma of forewing extremely narrow, nearly twice the length that of hind, its inner angle acute, its outer much more so and prolonged along the costa, so that the costal border is nearly half as long again as the posterior, and the outer border one-fourth as long again as inner; black, the portion of the costa bordering it and its costal border pale citron-yellow, as also the upper half of the outer border and a small part of the inner border.

Abdomen dark ochreous on dorsum, or pale yellow in younger specimens, laterally yellow. Segment 1 with a black dorsal quadrat spot and a lateral clouding of brown, 2 with a broad dorsal black band, abruptly constricted apicad and barely reaching the apical border, broadening sub-basally, 3–7 with both basal and apical ends black, this fading and blending imperceptibly into the dark ochreous of dorsum. In most specimens the dorsum is pale yellow with a basal and apical clouding of black, but this is due to immaturity. Remaining segments and anal appendages missing.

Female. Abdomen 27 mm. Hindwing 21 mm.

Very similar to the male, but darker and the costal colour more greenish. The postocular spots blue, the ground colour of thorax pale blue, changing to yellowish on the sides. In the one complete female, the abdomen, except beneath, is black; in others slightly immature, the abdomen closely resembles that of the male, but the second segment has a basal and an apical black ring instead of the complete dorsal thick stripe.

Pterostigma in both wings equal, pale brown framed in black serrures. A well-developed spine on the ventral aspect of segment 8.

Type male and co-type female in Bishop Museum, Honolulu. Closely related to J. abietigera but distinguished by shape of pterostigma in forewings of male.

11. Armophostigma armstrongi Fras., l.c. (Text-figs. 2, c and d; 5, viii.).

A large number of both sexes have been collected by Armstrong and Buxton since the types were first described. The former has taken the insects among sedges along the banks of Lake Laniu'o, 1900 ft., and also along the banks of a stream flowing at the bottom of a deep gully near Malololele, the sides of which are thickly covered with vegetation. The species also occurs commonly at or about sea-level, at Apia, and in other parts of Upola Isl., in taro swamps and
other places. E. H. Bryan took it at Salaula, Savaii Isl., 18.v.24, and Pago Pago, Tutuila Isl., 12.iv.24. Dates on which both sexes were taken at Malololelei, Upolu Isl., are as follows: 5.i.24, 12.iv.25, 25.iv.24, 4-19.v.24, 31.xi.24, and 5.xii.25, from 2,000-3,300 ft.

Dr. Clarence H. Kennedy, of the University of Ohio, Columbus, Ohio, U.S.A., has kindly examined and reported on the penis of this species and of *Pacificoscorion laschrymosus*, showing them to be typical of *Ischnura*. This confirms my remarks as to their probable relationships, made in the Trans. Ent. Soc. Lond., i.e., where I placed the genus *Amorphothigma* next to *Ischnura*.

12. *Amorphothigma auricolor*, sp. nov. (Text-figs. 3, c and d; 5, iii.).

Male. Abdomen 31 mm.

Hindwing 20.5 mm.

**Head.**—Labium dirty yellow; labrum bright orange, with its base narrowly glossy black; epistome reddish-brown, followed behind by a broad transverse stripe of violaceous on the frons, and including the front of the basal segments of the antennae. Rest of head matt black, except for a large round pale yellow peduncular spot on each side (possibly blue during life).

Prothorax black on dorsum, the lower half of sides and the posterior border of posterior lobe very finely bright ochreous.

Thorax black on dorsum, with a bronzed reflex, marked with a narrow yellow anterhumeral stripe. Laterally yellow with a broadsh black line on the postero-lateral suture, and the vestige of another on the upper part of the first suture. On the anterior border of mesothorax are seen two small horns, one on either side, and partially hidden by the overhanging posterior lobe of prothorax.

Legs very robust, very short, bright ochreous with very short robust black spines (4-6 on hind femora).
Wings hyaline; 11 postnodal nervures in forewing, 10 in the hind; quad angle of forewing with costal side half the length of the posterior, that of hind three-fifths the length; are at outer antenodal nervure in forewing, a little distal to it in the hind, at midway between the two antenodals and meeting at a little distal of where the latter joins the hinder border of wing. Pterostigma of forewing made up of 2 cells, the outer of which appears to be the normal pterostigma, and is of the conventional lanceolate shape; the inner double the length of outer cell, and slightly narrower. The combined cell forms a very elongate, narrow pterostigma which is rich opaque golden-yellow in colour, its anterior border brighter citron-yellow, including that part of the costa bordering it, the hinder and inner border black, the inner side very oblique and forming an inner prolongation by fusion with the hinder nervure, which is clouded with black for some distance internal to the pterostigma. Finally the cell on the outer side of the pterostigma bears some slight traces of chitinization of its membrane. Pterostigma of hindwing normal, lujowge-shaped and dark brown.

Abdomen ochraceous to warm reddish-brown, the terminal segments marbled with blue. Segment 1 with dorsum broadly black, this extended at base as a narrow ring completely encircling segment, segment 2 and base of 3 broadly black on dorsum. segments 3-6 with the apical ends diffusely black changing to brown towards the base, segment 7 very broadly black on dorsum throughout its whole length, 8 black at base, its apical third azure blue, this colour extending basad for a short distance on dorsum, 9 entirely blue save for a small lateral elongate basal spot of black extending for half the length of segment, 10 blue laterally and on dorsum with a sharply defined sub-dorsal stripe of black, which by meeting a fine apical bordering of black, encloses a transversely oval spot of blue on the dorsum.

Anal appendages black, about as long as segment 10, inferiors equal in length to superiors, broad at base, rapidly tapering, rater this and cylindrical and ending in a blunt point. Seen from beneath, they are a little concave towards one another, their apices inclining slightly inwards; viewed in profile, they slope gently down and back. Superiors much more robust, and of heavy muscular build, shaped like the muzzle of a gun, at first directed straight back, a little constricted and cylindrical, then turned abruptly down towards the inferiors, the ends rounded, bulbous and glossy black. In profile, the extreme apex is seen to be turned in so form a short blunt point, directed towards the
anal end of abdomen. The 10th abdominai segment comes to a point at the apical end of the dorsal carina, but there is nothing like the bident tubercle seen in *Ischnura*.

**Female. Abdomen 29-35 mm. Hindwing 23-3 mm.**

**Differ** rather widely from the male, the body also more robust.

**Head.**—Large, the postocular part enormously swollen and produced backwards as a large bulbous swelling on either side. Labium pale; labrum pale glossy yellow, cheeks and bases of mandibles pale greenish-yellow; face and from light brown to silvery; rest of head black except for a pale blue postocular spot on each side.

**Prothorax** as in male, but pulverulent white laterally in one specimen. **Thorax** as in male, the sides more blush and pulverulent at the lower part in adults, as also are the coxae and trochanters.

**Legs** yellow, rather darker than in the male. The femora with a macular strip on the external surfaces.

**Wings** hyaline; 13-15 postnodal nerves in forewing, 12 in the hind; pterostigma normal in all wings over about 1 cell, dark brown, framed first in pale yellow and this again in thick black bordering nerves.

**Abdomen** robust, segments 1-7 marked as in male, but the black on dorsum more extensive on 3-6, and the ground colour more reddish-brown than ochreous. Segments 7-10 black; in one specimen with obscure blue markings on mid-dorsum of 8 and 9, and more clearly on apical border of segment 10. In the other female the blue markings better defined; 8 has an apical macking shaped like the ace of clubs, extending halfway to base, 9 has a similar marking but more extensive, the middle leaf of the club extending broadly up to base of segment. Segment 10 has the dorsum and sides broadly blue, and there is an elongate black lateral stripe separating the lateral from the dorsal blue. Segments 8, in the same specimen, has its apical and basal ends metallic green, and there are traces of this colour at the base of segment 9 also.

**Vulvar scale** ochreous, long and overlapping the end of abdomen.

**Distribution.**—Malololeti, Upolu, W. Samoa. Two males and two females, collected by J. B. Armstrong, 14-17.vii.25.

**Distinguished from** *A. armstrongi* by its much larger size, and by the pterostigma being bright golden-yellow instead of bright blue, and made up of two cells instead of four. The anal appendages also differ widely.
ODONATA (FAMILY COENAGRIONIDÆ).

13. Pacificagriam lachrymosa Fas. (Text-fig. 6, viii.).


Only the male of this interesting and freakish dragonfly has been described. Among the new material sent by Dr. Armstrong is a single female, which is remarkable for its large size, being quite the largest Coenagrionine yet discovered in the Samoan islands.

**Female.** Abdomen 31 mm. Hindwing 24 mm.

**Head.** Labium yellowish-white; labrum blue, broadly bordered at base with glossy black; antennae, cheeks and bases of mandibles blue; epistome glossy black. A broad dark olivaceous stripe traversing frons (possibly blue during life); rest of head matt black with an obscure dark reddish-brown marking at base. The postocular space not tumid as in *Amorphostigma*.

Prothorax broadly black on dorsum, bluish on the sides.

Thorax broadly matt black on dorsum, with a rather narrow yellow antepenultimate stripe on either side (probably bluish-green during life), laterally yellow changing to bluish behind and below. A vestige of an upper black line on first lateral suture, and a fine black stripe on the postero-lateral suture.

Legs yellow, the middle and anterior pairs of femora and tibiae black on extensor surfaces, the posterior pair of femora dark brown on the same surface.

Wings hyaline; 15-16 postnodal nerves in forewing, 12-13 in the hind;

petiolation beginning at the level of the basal antennal nerve; venation rather close at the apices of wings, and occasional double nerves found in the costal space distad to protostigma; the latter dark brown, that of forewing almost square, as long as broad, its inner and hinder borders equal, the costal border a little longer, the outer strongly rounded; that of hindwing much longer and narrower, about twice as long as broad.

Abdomen black, the sides of segment 1 blue, of 2-8 ochreous along the ventro-lateral border, and a spot of the same colour on the sides of 6. Narrow yellow rings at base of segments 3-6.

Anal appendages black, very short, conical, blunt.

Vulvar scale short, robust, not extending to end of abdomen. The apical border of segment 8 angulated below and ending in a blunt point not amounting to a spine (as seen in *Ischnura sens. str.*).

which somewhat resembles it, by its larger size, by the angulation of the apical border of segment 8, by the pterostigma being different in forere- and hind-wings, by the absence of postocular spots, and of blue markings on the anal segments of abdomen. The angulation of the apical border of segment 8 may be taken as evidence of a rudimentary Iachinurine spine.


I place here with some doubt, a single male from Lanuto'o Lake, 1600 ft., Upolu Isl., coll. J. S. Armstrong, 26.vi.84.

The marking on the frons is less extensive than in typical *A. gibbosulus*, and yet too extensive for *A. guttatus*. It is present as a basal line, with a thick prolongation forwards right up to crest of frons, where it spreads out for a short distance very finely on either side. The face is bright green, as also the thorax.

Abdominal segment 3 is more constricted than is usual in *A. guttatus*, and the orange markings of abdomen are distinctly smaller than in *A. guttatus* from India and Java, while segments 9 and 10 are quite unmarked.

The anal appendages are much broader and bullier, especially near the base, than in *A. guttatus* from India.

The saffronated patch lying between the trigone and node in the hindwing is darker and more richly coloured than I have so far seen in Asiatic specimens belonging to the group, and there is a corresponding saffronated area in the forewing, which is absent in *A. guttatus*.

The specimen probably represents a local race of *A. gibbosulus* Ramb., but I believe that it would be possible to collect a series showing an uninterrupted passage from *A. guttatus* to *A. gibbosulus*, in which the present specimen would be one of the intermediary forms. The measurements are slightly larger than the average for *A. guttatus* from India.

15. Anaciaeschna jaspidea Burm.


A single female from Lotofaga, Upolu, W. Samoa, coll. J. S. Armstrong, 5.viii.84. Not differing from type in structure, but the wings are markedly
ODONATA (FAMILY ABRSHNIDAE).

saffronated, far more so than in any specimen that I have seen from India or Malaysia. In the hindwing, the base, proximal to the trigone, is uncolored, but from that level to as far as the apex of wing, the membrane is richly saffronated. In addition, both pairs of wings are enshrouded, leaving occasional cell-middles clear here and there.

Another female from Apia, coll. P. A. Buxton, 13.X.24, came to light at night. In this the wings are clearer than in the first specimen, while its size is greater than that of specimens that I have seen from India and Java. *A. jaspida* is often crepuscular in its habits, and this may account for this particular specimen coming to light; the failure to collect more examples may be ascribed to the same cause. In India I have obtained all my specimens by keeping them up from reeds during daylight.

16. *Cynacantha spiaensis,* sp. nov.

Male. Abdomen 47 mm. Anal superior appendages 7 mm., inferior 15 mm.

Hindwing 46 mm.

Head. Lips, face and frons dark reddish-brown, no marking on upper surface of frons.

Thorax dark purplish velvety brown, unmarked.

 Legs light reddish-brown.

Wings, long and narrow, evenly and closely enshrouded throughout, many cell-middles paler, giving a stippled appearance; no basal markings; pterostigma rather long and narrow, over 4-5 cells, pale brown between black nerves; membrane white. Nodal index 21-24 22-23, 24-19 19-23. Anal triangle 3-celled; 4 rows of cells between *Rs* and *Rsp.* *M* and *Rs* slightly convex towards the costa; space between *M* and *M* with a long row of 2 cells in all rings.

Abdomen very dark reddish-brown, changing to blackish-brown on the terminal segments. Segment 3 markedly but not excessively constricted near its base, dilated thereafter and gradually tapering to the end. Ocelli moderately large, armed with 5 robust spines behind.

Anal appendages very long and slim, the inferior rather more than one-third the length of superiors, reddish-brown, darker towards the apex. Superiors a little sinuous, the outer border very shallowly concave to near apex, the inner border at first broadly convex, then shallowly concave and finally convex at apex, which ends on the outer side in a sharp point. The basal two-thirds
narrow and of even thickness, the apical third one-third broader. The inferior triangular, bluntly pointed.

**Distribution.**—Apis, W. Samoa, col. J. S. Armstrong. A single male. The species is probably not uncommon, but being crepuscular is not often seen on the wing. Specimens of *Gynacantha* are usually secured by beating these up in the daytime from cane or clumps of bamboo.

16a. *Gynacantha stevensoni*, sp. nov.

**Male.** Abdomen 53 mm. Appendages 7 mm. Hindwing 47 mm.

*Head* as in *G. apiacensis*, except that the frons bears a well-defined black T-shaped marking on its upper surface.

Thorax and legs colored exactly as in *G. apiacensis*.

Wings evenly enfumed brown, but not so deeply as in *G. apiacensis*; nodal index 19–24, 24–18; trigones with 7 cells in forewings, 5–7 in the hind; 7 cubital nervures in forewings, 6 in the hind; hypertrigones traversed 5–6 times in forewings, 4–5 in the hind; loop 10–celled; a single row of cells between Cu1 and Cu2 in hindwings; anal triangle 4-celled.

Abdomen dark reddish-brown, almost black on the hinder segments; segments 3–6 with dorsal linear spots bordering the apical side of the jugal sutures, 3 and 4 also with small sub-dorsal apical spots, all these markings gradually decreasing in size from segment 3 to segment 6.

Anal appendages blackish-brown, the inferior paler; the superiors long, narrow and straight for rather more than their basal two-thirds, inner and outer borders parallel. The apical ends slightly dilated, the extreme ends bevelled outwardly and ending in a fine point. Inferior appendage less than one-third the length of superiors, narrowly triangular, truncate.

Gnatelets moderately large; 3rd segment markedly constricted near its base.

**Distribution.**—A single male from Nuakalofa, Tonga. 17 ii. 25, coll. G. H. H. Hopkins. Differs from *G. apiacensis* in the anal appendages, the inner border of the superiors in the latter being markedly sinuous and the apical third gradually dilated. There are several differences in the venation, mainly the single row of cells between Cu1 and Cu2 in the hindwings, the smaller and loop and the lower nodal index.

Species of *Gynacantha* are very difficult to determine unless specimens are
actually compared; the present one most closely resembles G. kirlegii Karachi whereas G. apicenisis shows greater similarity to G. dohrni.

17. Hemicordulia pacifica Frua.
*Lc.* pp. 425, 426, 1925.

Owing to its small size and daintiness, this pretty insect, which is the smallest known *Hemicordulia*, is reminiscent of *Idiomyia* or *Macromidia*.


Judging from the number of specimens received, this species appears to be the dominant representative of its genus in the islands. The following are the data relating to the examples obtained: one female, Apia, W. Samoa, 13.iv.24; 2 females and 2 males, Lalomanu, Upolu Isl., 19 16.xi.24; 6 males, Mulifanua, Upolu Isl., 16.xi.24 and 9.xii.24; 3 males, Malololelei, Upolu Isl., 21.vi. t 2.vii.24; 6 females, Apia, 6.ix.24 and 27.x.24; one male, Tusafu, Upolu, 16.ix.2.
(Swazez and Wilder). Its season appears to extend from April to December, and it possibly occurs throughout the year. An insect of wide distribution throughout Oceania: Dr. Buxton also secured a female from Teurua, E fate Isl., New Hebrides, 4.vii.25.

19. Hemicordulia cupricolor, sp. nov. (Text-fig. 4).

Male. Abdomen with appendages 34 mm. Hindwing 33 mm.

*Head.*—Labium cinereous; labrums brown, heavily bordered with black; face and lower part of frons dark olivaceous brown; frons above and upper part of front, and the vestige metallic green; eyes emerald green; occiput dark brown; back of head and eyes black, with bronzed reflex.

Prothorax brown. Thorax of a beautiful uniform golden-green or coppery metallic, quite unmarked with paler or darker areas.

Legs long, the hind femora extending to the middle of 2nd abdominal seg-
v.-vii. 1
scent, black, the middle and anterior pairs of femora reddish-brown; tibial keels extending the whole length of the hind tibiae, and for nearly the distal half of the anterior pair.

Wings hyaline; pterostigma very small, over about one cell, dark blackish-brown; modal index 8-9:9-10; trigone of forewings traversed once; membrane pale brown; disconal field of forewing with 2 to 3 rows of cells, rather irregular.

Abdomen dark metallic green-bronze from segments 3 to base of 9, segments 1 and 2 dark reddish-brown, the apical half of 9 and the whole of 10 black. Segments 3-8 with obscure lateral reddish-yellow markings, which, on segments 3, begin apical to the jugal suture and run as a thick lateral stripe as far as apical border, on 4 and 5 a triangular basal spot continued as a narrow stripe along the ventral border, and on 6-8 as a mere baso-lateral spot.

Genitalia.—Hamules very stout, projecting, pyriform, ending at the apex rather abruptly as a short, stout, back-wardly curved spine; lamina flat and depressed; lobe narrow, tongue-like. Penis with a short, stout spine on dorsum.

Anal appendages black. The superiors, in profile, shallowly concave in the apical half, slightly convex upwards in the basal half, bluntly rounded at apex and rather sharply turned down at extreme base. Inferior nearly as long as superiors, curving very gently up throughout its whole length. Seen from above, the superiors are markedly constricted at base, dilating gradually and rather more so on the inner side than outer, then curved slightly out near apex and finally somewhat inwards. The appendages incline inwards towards each other, and the tips of superiors may touch. The inferior, from below, is narrow and triangular, tapering to a fine point, which at the extreme apex turns up rather abruptly. Superiors 3 mm. in length.

Female. Abdomen 34 mm. Hindwing 24 mm.

Body colouring exactly similar to that of the male. The yellow markings of abdomen absent on segment 3, narrower, but brighter and better defined.
The labrum dark yellowish-brown, the metallic green of the frons bordered below by a narrow bright ochreous stripe.

Wings enuned, especially the hind and anterior part of apices of fore wings; nodal index 7-9/8-6.

Vulvar scale broad and short, cleft to its base into two small equilateral triangular processes.

Anal appendages black, conical, pointed, as long as segment 9.

Distribution.—One pair from Malololelei, Upolu Isl., W. Samoa, 2.vii.24, 2 males, 14.vi.25, and 2 females 7.vi.25, from the same locality. One male from Mata Vanu, Savaii, 1000 ft., 22.xi.24. Two specimens from Savaii, 23.v.2 (E. H. Bryan), are rather larger than the type, and the nodal index is higher the forewing is both is broadly tinted with saffron at the apex. One female captured on the wing at Malololelei, came to light about 300 ft. within a cave 4.v.24. This incident is surprising, since the species of *Hemicordulia* are essentially sun-loving insects and by no means crepuscular in their habits. It is possible that this particular specimen was at rest within the cave.

19A. Hemicordulia, species ?

One male, Tau Island, Manua group, 23.ii.26 (A. F. Judd in Bishop Museum, Honolulu).

In the absence of the five terminal segments of the abdomen, and of the anal appendages, I am not prepared to identify this specimen. However, it resembles *H. tau* Selys, and I do not think there can be much doubt of its identity. The upper frons and vesicle are a beautiful metallic blue, the thorax vivid metallic green; in other details also it resembles *H. tau*.

20. Lathiecista asiatica asiatica (Fabr.).


Three males from Fagamalo, Savaii, 17.xii.25, and four males from Vailel Marsh, Apia, W. Samoa, 16.xii.23 and 2.ii.24, coll. P. A. Buxton and J. I. Armstrong. Four females, and one male, Nukualofa, Tonga, Feb. 1925; on Male, Vavau, Tonga, 4.iii.25, G. H. E. Hopkins. I refer these specimens to *L. asiatica* rather than to the sub-species feste, since they do not differ in any marked way from the typical form. The species ranges from India to Oceania.
21. Diplacodes bipunctata (Brauer).

Diplacodes bipunctata Brauer. Reise d. Neuen, Neur., p. 86, 1863; Tribesния bipunctata Kirby, Cat. Odon., p. 18, 1890; etc.

A large number of this very common species was taken on Upolu, Tutuila, in the Ellice Isl., and at Vavau, Tonga. From the dates of capture, it is evident that a series of emergences take place throughout the year, since hardly a month failed to furnish its quota. The species is distributed throughout Australia and the Pacific Islands.

22. Rhyothemis regia chalcopilón (Brauer).


Curiously enough, neither Dr. Armstrong nor Dr. Buxton took or even saw this species, the type of which came from Samoa. There is a specimen in the British Museum collection labelled "Type," but this apparently merely refers to Kirby’s type of R. praecepta, a synonym of R. chalcopilón. The species, which is found on several of the Pacific Islands, is characterized by the very extensive brown markings on both wings, obliterating almost the whole of the usual hyaline areas. Is it not possible that the attribution of this species to Samoa rests on wrongly labelled material? Many of the earlier collectors in the Pacific made gross and frequent errors in locality labels.—P. A. Buxton.

23. Rhyothemis regia exul Rüd.

Cat. R. de Selys (Indes). Specimens were collected by Drs. Armstrong and Buxton on the following dates: Apia, 2 males, 24.iv.24;Pago Pago, Tutuila Isl., Samoa, 4 males and 1 female, 16.xi.24, 20.xi.24, 2.xii.24; one male, Apia, 14.vi.24, 3 males and 2 females, Upolu Isl., 14.xi.24, and 1 male, Apia, 4.xi.24. Specimens in the Bishop Museum, Honolulu, were collected 13.x.23. Apia; 9.x.23, Pago Pago. The species, in which the wing markings are intensely dark with a brilliant coppery reflex, appears to occur from November to April. The hyaline parts are suffragnated, except for the clear apex in the wings of the female. The large spot over Rpl is variably confluent or detached from the apical marking, and in one female very broadly so and completely enclosing a hyaline spot. This is the first record of the occurrence of this species in the islands. The type is from the Kei Is., near New Guinea.
24. Tramea limbata (Dej.)


Ten males and three females collected on the following dates: Atelepata Upolu, April to May; Malololelei, Upolu, 2,000 ft., 14.vi.25; Apia, W. Samoa 10-17.iii.23 and 16.xii.22. Also collected by Mr. Hopkins in Tonga, at Vava'u 8 and 9.iii.23, and Nukualofa, 29.ii.25.

Brauer's types of T. samoensis and T. transmarina were male and female of the same insect, and differ from the types of the species principally in the much smaller basal marking of the hindwing.

25. Pantala flavescens (Fabr.)


A cosmopolitan species, found throughout the world in tropical and sub-tropical areas. Many specimens received from Tutuila and Upolu, taken principally during September, when the species indulges in migration. Also collected at Vava'u and Nukualofa, Tonga, Feb. and March, 1925, G. H. E. Hopkins. It is the dominant dragonfly of the world.

26. Thynnis tillarga (Fabr.)

Libellula tillarga Fabr., l.c., p. 285, 1768; Bush. Ensl. N. Am., p. 29, 1842; Kirby, i.e., pp. 265, 1866; Id. Cat. Odon., p. 1, 1860; etc.

Has a distribution nearly as extensive as the former species, but has not so far, been taken in the New World, where it is represented by T. cirtina. Hag. Specimens of both sexes were taken by Dr. Armstrong on the same dates and in the same localities as P. flavescens. The wing markings are rather darker and better defined than usual.

27. Macrodiplax cors (Brauer).

Diplax cors Brauer, i.e., Bd. xvii, p. 20, 1867; Kirby, i.e., Vol. xii, pp. 281, 282, 1889; Id. Cat. Odon., p. 23, 1860.

In Samoa, this species was only taken by Dr. Armstrong. It is apt to be mistaken for Pantala as the wing, which may explain why it was overlooked by other collectors. Pantala, Tramea and Macrodiplax are occasionally seen in flight together, and some discrimination is then necessary to tell which is

* I know nothing of these migrations, in Samoa.—P. A. Buxton.
which. Specimens of both sexes were taken at Apia, over marshes, 2–16.i.32.
One male collected at Vava'u, Tonga, 5.i.32, G. H. E. Hopkins.

29. Orthetrum sabina Drury.
Lebidia sabina Drury, Ill. En. Enc., t. 46, f. 4, 1773; Bank. Ins. Nov., p. 47, 1842; Orthetrum sabina Kirby, l.c., t. 50, f. 5, 1830; etc.

One pair from Apia, W. Samoa, coll. P. A. Buxton, 4.i.34. Several collected in the same locality by J. S. Armstrong. A common species, extending from Africa, through Asia, to the Pacific Islands in tropical and sub-tropical areas. Samoa is, so far, the most eastern limit.

ORDER OF THE ODONATA FAUNA OF SAMOA

The whole of the Anisopterae species are immigrant, with the exception of two species of Hemicornis and Gymnocordia apicifera. Pantala flavescens is cosmo-tropical, whilst Orthetrum sabina, extending from West Africa to Samoa, has a distribution almost as wide. Laphria aranea, Tramea limbata, Macromadagasora, Tholymis tillargei, Anax gibbosus, and Anacorhynchus japaides have all been found on islands far removed from continental masses, a clear proof of their migratory tendencies. Rhyothemis regis and its cousin R. r. chalcopteron, along with Dipiocera bipunctata, are of Nearctic origin, the former coming from Papua and Australia, the latter from Australia; R. r. chalcopteron, however, appears to be confined to the Pacific Islands, although intimately related to Paupan form. Laphria aranea is the most arcatic of the Libellulids found in the islands, and probably originated in South Asia. Hemicornis is also an old genus, and may well have originated in the ancient submerged Western Pacific continent. It has but a single representative in Asia, the remaining species occurring in Australia, Papua and the Pacific Islands, H. euprotick being unknown outside Samoa, and H. jaapidae being confined to Samoa and Tonga.

The three Anisopterae are Austro-Malayan species, A. jaapidae especially having a wide distribution throughout the whole of South Asia, Papua, and thence far into the Pacific.

In striking contrast to what is found in the Anisoptera, the Zygopterae are almost entirely endemic. The few exceptions are Agrionemus exuvia, known also to occur in New Caledonia, Agrionemus victorius from Fiji, and Ischnura
aurora, a small wind-carried form widely distributed throughout South Asia, Australia, and the Pacific Islands.

*Pseudargiovena sinensis* is very closely related to *P. pacifica*, of Fiji, and to Australian *P. australis*. *Argiovena interrupta*, peculiar to Samoa, is probably of modern development; its chief characteristic is its large size and correlated increased density of retention. It is quite the largest known species of the genus, and in this respect forms a parallel to *Argiovena* of Southern Asia. From the metallic colouring of the upper lip, the red tint of the terminal segments of the abdomen, and the shape of the anal appendages, it is clear that it is a descendant from the *pennata* group.

The remaining species constitute a group in themselves, and are of great interest in that they appear to represent the root of genus *Iodana*. The group, which includes *Iodana*, *Amorphostigma*, and *Pascargiovena*, may be said to possess all the characters of genus *Iodana*, e.g., that the dorsal anal tubercle or segment 10 of the male is not always present, and that the ventral spine on segment 8 of the female is invariably absent. I have examined a large number of species of *Iodana* from Asia, Europe, Africa, and America, and in none of them is the ventral spine ever absent. It is to be argued from this that the ventral spine is of modern development, for it is improbable that eight species,* differing so widely as to require the creation of two new genera, should simultaneously lack such an important and useful organ. It may be argued that these species are not jeshurnine at all, but have

* *I. e. five in *Iodana*, two in *Amorphostigma*, one in *Pascargiovena*,
developed along parallel lines. Against this we have the evidence of the penes, which, as shown in Fig. 5, are all typically Ichshurine in build. I have figured the penis of *I. semegalis* (Fig. 5. ii.), a cosmopolitan species ranging from West Africa to the Philippines, and closely resembling *I. bautoni* in appearance. It will be seen that the penes of this species and of *A. auricolar*, etc., are almost indistinguishable, although the insects are totally different in appearance and colouring.

The absence of the spine is sufficient evidence in itself to stamp the three Samoan genera *Amorphostigma*, *Pacificagryon* and *Ichshura* [without ventral spine] as distinctly archaic in nature, whilst the Ichshurine penis proves them to be the progenitors of the modern dominant genera. An analysis of the eight species shows that all agree in having the penis spined, the pterostigma of the forewing, in the male, differing from that of the hind, and lastly, the basal venation of wings Ichshurine in character. *Ichshura bautoni* most nearly approaches modern forms, *I. albifrons* and *I. haematostigma* following on. *Pacificagryon* and the two species of *Amorphostigma* probably branched off at a very early date, developing generic characters of their own. On the evidence of the penis, and colouring of the insects, I am inclined to think that *A. armstrongi* is generically distinct from *A. auricolar*, the former being the more archaic. The colouring of *A. armstrongi* and *P. lechrymosa* is quite foreign to *Ichshura*, and paralleled in several archaic genera of the Protochrysidæ.

**EXPLANATION OF TEXT-FIGURES**

Fig. 1. a. Anal appendages of *Pacificagryon semegalis* Fusz., from above.
   b. The same in profile.
   c. Anal appendages of *Aprioceras* interregia, sp. nov., from above.
   d. The same in profile.

Fig. 2. a. Anal appendages of *Ichshura haematostigma*, sp. nov., from below.
   b. The same in profile.
   c. Anal appendages of *Amorphostigma armstrongi* Fusz., from below.
   d. The same in profile.

Fig. 3. a. Anal appendages of *Ichshura bautoni*, sp. nov., from below.
   b. The same in profile.
   c. Anal appendages of *Amorphostigma auricolar*, sp. nov., from below.
   d. The same in profile.

Fig. 4. Anal appendages of *Ichshura haematostigma*, sp. nov., from above.