

OCCASIONAL PAPERS OF THE MUSEUM OF
ZOOLOGY

UNIVERSITY OF MICHIGAN

ANN ARBOR, MICHIGAN

PUBLISHED BY THE UNIVERSITY

A REMARKABLE NEW GENUS OF COENAGRIONIDAE
FROM BRAZIL, WITH DESCRIPTIONS OF
THREE NEW SPECIES (ODONATA)

BY E. B. WILLIAMSON AND J. H. WILLIAMSON

Acanthallagma, new genus

Species small. Legs short and armed with relatively few short spines. Head robust, the lateral ocelli not relatively widely separated, in dorsal view the postocular lobes relatively conspicuous and the line of the eye and the epicranium, if produced, meeting its fellow near the front edge of the labrum rather than far in front of the head; frons not inflated or angled and not overhanging the base of the clypeus, and the clypeus obtusely angled, not relatively distinctly shelved above and undercut below; the apex of each side of the cleft median lobe acute, the outer margin straightened; posterior border of labium a truncated triangle; second joint of antenna less than twice the first in length. Hind lobe of prothorax not strikingly modified in either sex, the hind border smooth, semi-circular. Tarsal claw distinctly toothed. Male appendages and penis Acanthagrion-like. Female with a strong vulvar spine; valves with the ventral border thin, armed in at least the apical two-thirds with minute teeth in a single row.

Wings short and wide, the hind border uniformly convex; more than the basal half densely pigmented; M_4 and Cu_2 zig-zag in their distal half or more; base to nodus about two-sevenths the wing length; petiolation remarkably short, to about half the distance from wing base to cubito-anal crossvein, the basal marginal cell posterior to the subquadrangle very wide; the costal border, between the wing base and the antenodals, distinctly concave; stigma small, rhomboidal, covering less than one cell, the costal side the longest; quadrangle nearly regular, the medio-anal link but slightly differentiated from the crossveins distal to it, the slight irregularity of the quadrangle due largely to the strong angling of the arculus; the basal side of the quadrangle longer than the remainder of the arculus, in the front wing slightly shorter than the anterior and distal sides which are about equal, in the hind wing nearly equal to the distal side; in the front wing the anterior and distal sides are each distinctly shorter than the posterior side, in the hind wing the anterior side nearly equals the posterior side, and each is much longer than the basal and distal sides; A and Cu_2 slightly out of line in the front wing, and from in line to slightly out of line in the hind wing; second antenodal transverse to the long axis of the wing and about midway between the wing base and the nodus, in line with the arculus; first antenodal oblique with its anterior end basal to its posterior end, placed nearer the second antenodal than the wing base, its posterior end about on the level of the cubito-anal crossvein, which latter is basal to the arculus a distance equal to or less than the length of the basal side of the quadrangle; three (very rarely four) postquadrangular antenodal cells; posterior branch of the nodus oblique; R_s arising at and M_3 distinctly basad to the subnodus; M_2 arising between the fourth and sixth, usually at or near the fifth postnodal in the front wing, and between the third and fifth, usually at or near the fourth in the hind wing; M_{10} arising at or near the eighth to the eleventh postnodal in the front wing and at or near the seventh to the tenth in the hind wing; ten to thirteen postnodals in the front wing, nine to twelve in the hind wing.

Habitat: Brazil, South America; type, *Acanthallagma strohmi*, new species.

The classification proposed by Kennedy¹ will be made the basis for the discussion of the relationships of *Acanthallagma*. Parenthetically it may be stated that when the Brazilian collections were first received specimens of this remarkable little insect were sent to several students. Three of these students, when acknowledging the specimens, made some comment on their first hand impressions of them. Dr. Ris, before our specimens were sent, had had a single male from another source. This he had studied from time to time but he very kindly relinquished all priority rights in the matter to us. His impression was that they belonged in the *Argia* series. Dr. Kennedy several years ago studied a single male belonging to Cornell University. Writing about the specimens received from us he referred them to the *Enallagma-Acanthagrion* series. Dr. Tillyard was struck with their resemblance to the *Platycneminae*. Personally at first glance there was something (probably the wing coloration) suggesting some of the *Argia* series and even some of the *Agrionidae*. Later study led us to agree with Kennedy, and when at a still later date he examined the penes of the three species and found them essentially *Acanthagrion*-like, we came definitely to the conclusions discussed in the following paragraphs.

Acanthallagma has the wings less petioled than any known member of the *Zygoptera* except some of the richly veined *Agrionidae*. In its own family, the *Coenagrionidae*, its only rival is the African genus *Metacnemis*, with which genus it is also unique in the regularity of the quadrangles, excepting possibly a few genera of the *Platycneminae*, especially the protoneurine-like genus *Chlorocnemis* and the *Protoneurinae* with even more regular quadrangles. The regularity of the quadrangle in the *Protoneurinae* is probably the convergence of several distinct phylogenetic lines, this regularity resulting

¹ The Phylogeny of the *Zygopterous* Dragonflies as Based on the Evidence of the Penes, *Ohio Jour. Sci.*, Vol. XXI, No. 1, Nov., 1920, pp. 19-29.

from or associated with the reduction of veins posterior to the quadrangle.

Acanthallagma has the quadrangle even more regular than *Metaenemis* and in neither case has this regularity any relation to vein reduction, quite the reverse being the case, especially in *Acanthallagma*.

Thus on venational grounds *Acanthallagma* finds its closest ally in *Metaenemis*. They are in accord in the position and direction of the antenodal crossveins, the position of the cubito-anal crossvein and of the arculus, the form of quadrangle and the petiolation of the wing, not to mention other more general characters. But they differ in two characters, the peculiarly shaped wider wings and the slightly more angled sectors of *Acanthallagma*.

Ris (Od. S. Africa) has recently called attention to the fact that *Metaenemis* does not belong to the *Platycneminae* but rather to the *Coenagrioninae*, and in the latter it seems to find its closest allies, because of robust body, head shape and leg spines, in the *Argia* series. It is in certain members of this series that the nearest approach to the regular quadrangle, the straightened sectors and the alignment of A and Cu_2 of the *Platycneminae* occurs.

On venational grounds then we find *Acanthallagma* most closely related to the *Argia* series of *Coenagrioninae*. These venational characters hinge largely on apparently progressive changes in the position of the medio-anal link. From its position associated with a fairly regular quadrangle, it may have the anterior end swing basad and the posterior end distad, resulting in a very irregular quadrilateral, pulling down M_4 , so the medio-anal link leaves it as a symmetrical fork, and pulling up Cu_2 out of line with A. As in the *Protoneurinae* we have suspected a convergence of several phylogenetic lines to produce the resultant protoneurine wings, so at the other extreme, the most irregular quadrangles, the possibility of a similar convergence must not be disregarded.

Referring now to other organs than the wings we find in *Acanthallagma* the head shape, leg size and armature, form

of male abdominal appendages, penis characters, and female vulvar spine not only of the *Enallagma-Acanthagrion* series but even of *Acanthagrion* itself. Not only are the male appendages *Acanthagrion*-like, but equally striking is the similar modification of the apex of the dorsum of segment 10 in the same sex, and in one species of *Acanthallagma* there are distinct mesepisternal fossae at the extreme anterior border of the mesepisterna of the female. These fossae have heretofore been detected only in certain species of *Acanthagrion*. In fact were the wings lost we believe that students would agree that the body probably was that of some species of that genus just as the same students with only the wings before them would as certainly pronounce *Metacnemis* its nearest ally. We have seen that through activities about the medio-anal link the venational characters of the *Acanthagrion* wing may be derived from the more *Argia*-like wing of *Acanthallagma*. But as has been pointed out this gives us no basis to assume the derivation of the *Enallagma-Acanthagrion* series from the *Argia* series. In fact we believe the characters of *Acanthallagma* viewed in toto are evidence against such an assumption and the distinctness of the *Argia* and *Enallagma-Acanthagrion* series is rendered more probable. Incidentally this study has greatly disturbed our faith in the value of venational characters for phylogenetic analysis in the *Coenagrionidae*.

For the present therefore we may regard *Acanthallagma* as at the base of the *Enallagma-Acanthagrion* series. Its habits of flight throw an interesting and confirming light on this view. Someone, we believe Dr. Kennedy, has called our attention to the changes in flight which must have taken place among the grass and sedge dwelling *Zygoptera* since their ancestors antedated the appearance in the Cretaceous of these now widely spread and dominant families of plants. The *Acanthallagmas* rested with closed wings on the tops of grass or sedge plumes or on the leaves of bushes six feet or more above the ground or water and when disturbed they flew up and away in a manner suggesting a butterfly or bee or fly, rather than a dragonfly. Excepting for the closed wings when

at rest this primitive dragonfly differs strikingly from its more modern relatives in its habits of flight. Possibly its habits are those of the Miocene ancestors of our present-day dwellers of the sedgy growths, habits which may have been generally common among the coenagrionids before the development of grasses and sedges made possible the meadow-like expanses where most of the family live today.

At the same time there exists of course the possibility that the flight habit of *Acanthallagma* is a recent specialization. The following note, contained in a letter from Major F. C. Fraser, on a very different Indian dragonfly, *Rhyothemis triangularis*, is of interest in this connection: "This species flies and looks like a dark blue bee, as only the metallic blue at the base of the wings is then visible. There is a dark metallic blue bee common about here and one mixes them up occasionally."

SPECIFIC DIFFERENCES WITHIN THE GENUS

Male abdominal appendages. In the discussion of the relationships of *Acanthallagma* attention has been called to the Acanthagrion-like male appendages; in fact there is a closer resemblance between the appendages of the males of *Acanthallagma* and of certain small species of the *gracile* group of Acanthagrion than there is between the appendages of some of these small species and the appendages of some of the larger species in the same group of Acanthagrion. Not only are minute details in the appendages of *Acanthallagma* duplicated in these small Acanthagrions, but as species of Acanthagrion differ among themselves, so identical differences occur in *Acanthallagma*. For example Acanthagrions usually have a dorsad directed projection on either inferior abdominal appendage but this is strikingly absent in *indefensum*. In *Acanthallagma*, *strohmi* and *caeruleum* have this projection of the inferior appendage conspicuously developed, but in *luteum* it is quite wanting and thus parallels *indefensum*. In *luteum* also the superior appendage is distinct from those of *strohmi* and *caeruleum* in lacking an acute spine on the inner apical angle.

Such a spine is also wanting in certain Acanthagrions (*kennedii*, for example), and conspicuously present in others (*adustum*, for example). The differences above noticed (absence of inner apical spine on the superior and of a dorsal projection on the inferior appendage) at once distinguish *luteum* from *strohmi* and *caeruleum*. In *luteum* moreover, the apical and inferior part of the superior appendage is yellow, as sharply contrasted from the black basal and superior part of the appendage as an inlay of some other material. Differences in the appendages of *strohmi* and *caeruleum* are almost negligible. The only difference noted is that in supero-interior view the apex of the superior appendage of *strohmi* is more broadly rounded than in *caeruleum*.

Dorsal apex of segment 10 in the male. In Acanthallagma the development of this part is comparable again to that found in the smaller Acanthagrions. In *luteum* the apex is a triangle about .22 high and .35 wide. In *strohmi* and *caeruleum* the apex has about the same dimensions but is semicircular in *strohmi* and somewhat constricted to give it a more circular form in *caeruleum*.

Penes. The penes of the three species of Acanthallagma are essentially Acanthagrion-like, according to Kennedy. Moreover the three show two strikingly different forms of penes, thus resembling Acanthagrion, where the diversity within a single genus is remarkable. The penes of *strohmi* and *caeruleum* are very similar but, in Kennedy's opinion, specifically distinct; that of *luteum* is strikingly different.

Body colors. The three species are distinct in this character. In *strohmi* pale colors are greatly reduced and these are obscure and of several colors, yellowish, greenish and bluish. In *caeruleum* there are some areas with obscure colors, but there are also extensive areas of bright blue; and in *luteum*, similarly patterned, the extensive areas are bright orange or yellow. It may be noticed that a similar range of body colors occurs in Acanthagrion.

Wing and venational colors. Here there are two distinct types, the basally black and highly metallic wings of *strohmi*

and *caeruleum* with black venation throughout, and the basally yellow ocher and less metallic wings of *luteum* with the basal veins of the same color, deepening apically into black.

NOTES ON CERTAIN CHARACTERS

Interpolated postnodals are often present in the first series usually distal to the fourth or fifth postnodal. In so far as it is customary to count those in the first series in determining the number of postnodals, the same series has been used in designating the origin of M_{1a} . Such a designation is faulty in indicating in some cases a relatively more distal origin of this vein than actually exists if the wing as a whole is considered. For example, in one specimen of *A. strohmi*, M_{1a} arises at the eighth postnodal in the one front wing and at the tenth postnodal in the other; as a matter of fact M_{1a} arises at identically the same level in the two wings. But often there is a real difference of one cells' length in the origin of M_{1a} in the two front wings or two hind wings of some specimen, and more rarely, and accompanied by apparently abnormal conditions, there may be a real difference of two cells' length. In the future it would be well for students to designate which series of postnodals are considered in describing the origin of M_2 and M_{1a} with reference thereto, and it is recommended that the second series be employed though in this paper we have used the first series.

Obvious malformations of the legs due probably to accidents at the time of emergence are not rare. In the same way from less obvious but probably no less fortuitous causes there is considerable variation in the number of spines on the femora and tibiae in addition to the very probable normal variation one might expect. One such variation noticed was in the posterior row of spines of the second and third tibiae, the increase being due to a crowding of spines near the apex of the tibia. In another case the anterior row of spines of the second femur numbered five, while in the corresponding row of the opposite leg there were nine. On the first femur the spines diminish in size basally to zero and the number detected will therefore

depend on their magnification. In our study we have used a Zeiss binocular usually with eyepiece 2 and objective a_2 .

ACKNOWLEDGMENTS. We are indebted to Dr. Kennedy for the drawings of penes and for suggestions as to relationships, and to Captain Strohm for the wing photograph reproduced in this paper. Mr. Kahl kindly loaned us a series of specimens belonging to the Carnegie Museum which was collected by S. M. Klages in Brazil, and these represent all the known specimens of the species described in this paper and named *caeruleum*. Dr. Ris has had for many years a specimen of this genus, probably *luteum*. When we sent him specimens of *strohmi* he wrote us of the results of his study of the two species and generously waived all priority rights in the matter of describing and naming. Dr. Tillyard sent us an interesting and valuable letter of comment on the characters of *strohmi* of which we had sent him a specimen of each sex. Through the kind cooperation of the University of Michigan Museum of Zoology the expedition to Brazil, which resulted in the discovery of two of the species here described, was made possible.²

DESCRIPTIONS OF SPECIES

Thorax distinctly patterned black and orange or yellow—*A. luteum*.

Thorax distinctly patterned black and bright blue—*A. caeruleum*.

Thorax black with obscure paler markings—*A. strohmi*.

Acanthallagma strohmi, new species

Abdomen male 22–23, female 20–21; hind wing male 14, female 14–14.5; width of wing male and female about 3.6; stigma front wing male .5, female .5–.6; stigma hind wing male .45–.52, female .5–.6; width of head male and female 3.4; distance between posterior ocelli male and female .33; length of hind femur male and female 2.5; longest femoral spine male and female .35; longest tibial spine male and female .4.

² A collecting trip to Brazil, by Jesse H. Williamson, *Papers of the Michigan Academy of Science, Arts and Letters*, Vol. III, 1923, pp. 403–423.

Male.—Labium pale dull yellowish brown, lateral lobes and tips of the middle lobe darker, end and movable hooks of the lateral lobes dark to black, the middle lobe with a narrow median U-shaped incision for about one-third its length. Labrum black shading out to dull olive in the anterior border, the latter color sometimes occupying the anterior half. Clypeus black, the anteclypeus with traces of dull olive. Genae dull olive. Dorsum and rear of head black with some traces of olive on the frons contiguous to the postclypeus, these pale areas continuous with the pale color of the genae. Small, broadly isolated, irregularly round, yellow or yellowish post-ocular spots, from scarcely exceeding the lateral ocelli in size to twice that diameter. Antennae black.

Prothorax, thorax and legs black. A pale dull yellowish or greenish bar on the metepisternum along the first lateral suture, widening below across the sclerite, narrowing and constricted or interrupted above and broadly separated from the upper end of the sclerite; lower fourth and posterior third of the metepimeron pale dull yellowish or greenish brown. Sternum brown to black, palest posteriorly, coxae brown and black, legs black, tibiae and tarsi with more or less dark brown without definite pattern. Mesostigmal lamina black, roughly quadrangular, the long axis transverse to the body, and with the outer extremity narrower than the base; the posterior edge nearly straight and meeting the transverse basal carina at a slightly obtuse angle, the anterior border sloping concavely from the anterior horn of the basal carina into a long low lobe which is succeeded at the extreme outer end by a short and more convex lobe.

Abdomen and appendages black; 3-7 each with a narrow interrupted blue (or bluish) basal ring, which widens and fades into dull yellowish below and is narrowly extended posteriorly along the ventral margin of each tergum almost to the apex of the segment; at midheight the maximum width of these pale basal rings is about .25; extreme apex of 1 and 7-9 narrowly and obscurely ringed with pale yellowish; extreme ventral margin of the terga of 8 and 9 pale; posterior

face of dorsal apex of 10 dull yellowish to black; mesal faces of inferior appendages dull yellowish; sterna brown to black.

Legs moderate in size and in length and number of spines; the first femur has 3-4 spines in the anterior row and 5-6 in the posterior row; the second femur has 6-7 spines in each row; and the third femur has 8-9 spines in each row; in each row the spines increase in size from the base to the apex and in the case of each femur the spines of the anterior row are slightly longer than those of the posterior row; the first tibia has 2 or 3 basal unmodified spines in the anterior row and the usual comb of 7-10 modified spines, and 8-9 spines in the posterior row; the second tibia has 4-5 spines in the anterior row and 10-12 in the posterior row; the third tibia has 6-7 spines in the anterior row and 10-12 in the posterior row; the tibial spines decrease in length from base to apex; those in the anterior row of the second and third tibiae are longer than the more numerous spines in the posterior row but in the first tibia the spines of the posterior row are slightly longer than those of the anterior row.

Female.—Labium as in the male. Labrum brown, darkening to black at the base, sometimes only extreme base black. Anteclypeus dark brown, paler and dull olive below, postclypeus black. Genae as in the male, the pale color continuous with a long yellowish bar on the front of the frons on either side. Dorsum, rear of head and postocular spots as in the male, postoculars lacking in one female. Antennae black, the first joint yellowish brown in front.

Prothorax, thorax and legs black, as in the male except as follows: pale stripe on the metepisternum constricted above but not interrupted; tibiae largely brown shading into darker at base and along the ventro-anterior angle, with the extreme apex black.

Abdomen black, pale basal rings on 3-7 narrower than in the male but the ventral margins are more widely pale and 2 has the ventral margin pale on the basal two-thirds; ventral margin of 9 black; sterna black along the central line, the margins brown; the strong vulvar spine is pale brown, the minute acute apex black; genital valves pale brown.

Legs as in the male except color differences noted above.

Male and female.—Wings black, with chalybeous reflections, from the extreme base to the third to fifth postnodal, usually between the fourth and fifth, the distal margin of the colored area usually nearly straight, slightly convex, and at right angles to long axis of the wing; venation black; stigma light to dark brown in the male, light brown in the female; under the microscope the dark color of the wings is a uniform chestnut brown. Three post-quadrangular antenodal cells in the front wing in 10 male and 9 female wings, four in 1 female wing; in the hind wing three in 10 male and 9 female wings, four in 1 female wing; M_2 in the front wing arising at or near the fourth postnodal in 2 male and 1 female wings, and at or near the fifth in 8 male and 9 female wings; in the hind wing at or near the fourth in 10 male and 9 female wings, and midway between the fourth and fifth in 1 female wing; M_{1a} in the front wing arising at or near the eighth postnodal in 1 male and 3 female wings, at or near the ninth in 5 male and 7 female wings, at or near the tenth in 3 male wings, and at or near the eleventh in 1 male wing; in the hind wing at or near the seventh in 2 male wings, at or near the eighth in 5 male and 6 female wings, and at or near the ninth in 3 male and 4 female wings; postnodals in front wing ten in 1 male wing, eleven in 6 male and 6 female wings, twelve in 4 female wings and thirteen in 3 male wings; in the hind wing nine in 1 male and 4 female wings, ten in 8 male and 4 female wings, and eleven in 1 male and 2 female wings.

Abuná (official name Presidente Marquez), Matto Grosso, March 8–21, 1922, 17 males, 13 females, type male March 10 and allotype female March 21, all in coll. E. B. W. Named for Captain John W. Strohm, United States Army, Retired, who as a member of the University of Michigan-Williamson Expedition to Brazil, collected the first specimens of this handsome and interesting species.

Near kilometer post 216 at Abuná the railroad crosses a stream fifteen to twenty feet wide and varying greatly in depth during the rainy season. At one time it was only hip-deep; a

few days later it was out of its banks, too deep to wade, and running knee-deep through the adjoining forest. At the railroad bridge it was full of long, wavering, under-water vegetation whose leaves at the lower water stages protruded slightly above the surface. For several hundred feet back from the track the forest had been cleared away. Here the immediate banks of the creek were covered with clumps of bushes and scattered grass stalks eight to ten feet high. The bed and banks of the stream were mucky forest soil. *A. strohmi* rested with folded wings on the tips of the grass or flew above the bushes and grass in irregular jerky flight. They also rested on the leaves of bushes, especially a clump at the center pier of the railroad bridge. The following notes were made on March 21, the date when the largest number of specimens was collected: Generally seen about the tops of bushes or high grass stems six feet above the creek and in the sun. Today females were also observed flying low over the water, probably to oviposit in water plants which now reach the surface in waving green masses. Current in creek about three miles an hour. On the wing these dragonflies look like flies; at rest they are inconspicuous, resting with folded wings in a variety of positions. On March 10 the following notes on the species were made: Flies six feet high over the water and alights, wings folded, on top of leaves or twigs generally six to eight feet above the water. Found on sunny parts of the creek, most of them near the railroad bridge. Hard to see and to catch. On the wing does not look like a dragonfly.

***Acanthallagma caeruleum*, new species**

Abdomen male 23, female 21-22; hind wing male 14, female 14-15; width of wing male and female about 3.8; stigma front wing male .54-.6, female .6-.65; stigma hind wing male .55-.6, female .6-.67; width of head male and female 3.6; distance between posterior ocelli male and female .33; length of hind femur male and female 2.8; longest femoral spine male and female .3-.35; longest tibial spine male and female .45.

Male.—Labium similar to that of *strohmi* but darker. Labrum black, shading out to brown at the extreme anterior border. Clypeus black, narrowly olive against the labrum. Genae dull olive. Dorsum and rear of head black with large, broadly isolated, irregularly round, bright blue postocular spots, each with its longest diameter about .4. Antennae black.

Prothorax black, front lobe with a dorsal bright blue geminate spot. Thorax black, marked with bright blue as follows: a nearly straight antehumeral stripe about .26 wide, wider than the black area between it and the humeral suture and narrower than the black area between it and the middorsal carina; a still wider stripe partly on the mesepimeron and partly on the metepisternum, ending above in a short spur on the mesepimeron, which is widely separated from the wing base, and in a broad expansion on the metepisternum, which is very narrowly separated from the wing base; below, this broad blue stripe is rust colored; in this blue stripe is a minute brown or black spot exactly as described in the broad yellow stripe of *luteum*; and a broad stripe on about the posterior two-thirds of the metepimeron which passes below and along the latero-ventral angle into rust color. Sternum brown, coxae brown and black, legs black. Mesostigmal lamina black, roughly triangular, the front border straight, and at right angles to the body, the hind border slightly convex.

Abdomen and appendages black; 1 with a narrow apical ring and a mid-lateral crescent or hemispherical spot, blue; lower margin of 2 pale with bluish traces; 3-7 each with a blue basal ring which widens and fades into dull yellowish below and is narrowly extended posteriorly along the ventral margin of each tergum to a varying degree but in no case to the extreme apex of the segment except possibly on 3; at mid-height the maximum width of these pale basal rings is about .5; 7-9 with the extreme apex ringed with blue; extreme ventral margin of 8 and 9 pale; posterior face of dorsal apex of 10 blue; sterna largely black with traces of brown especially at the base and apex of each segment.

Legs moderate in size and in length and number of spines; the first femur has 5 to 7 spines in the anterior row and 4 in the posterior row; the second femur has 6 to 9 spines in the anterior row and 7 or 8 in the posterior row; and the third femur has 8 or 9 spines in the anterior row and 9 in the posterior row; in each row the spines increase in size from the base to the apex and in the case of each femur the spines of the anterior row are slightly longer than those of the posterior row; the first tibia has 2 or 3 basal unmodified spines in the anterior row and the usual comb of 6 to 8 modified spines, and 9 or 10 spines in the posterior row; the second tibia has 5 to 9 spines in the anterior row and 12 to 17 in the posterior row; the third tibia has 7 or 8 spines in the anterior row and 12 to 15 in the posterior row; the tibial spines decrease in length from base to apex; those in the anterior row of the second and third tibia are longer than the more numerous spines in the posterior row but in the first tibia the spines of the posterior row are slightly longer than those of the anterior row.

Female.—Labium as in the male. Labrum brown, darkening to black at the base or largely black. Anteclypeus brown, paler and olive below; postclypeus black. Genae as in the female of *strohmi*. Dorsum and rear of head as in the male. Antennae as in the female of *strohmi*.

Prothorax and thorax as in the male, the blue on the posterior thoracic sutures duller. Legs as in the female of *strohmi*.

Abdomen similar to that of the male with the blue duller, inclining to yellowish, 7-9 apparently lacking the blue at the extreme apex of each segment (possibly due to post-mortem changes) and 9 with the extreme ventral margin dark at base, less than the apical half pale edged; sterna, vulvar spine and genital valves as in the female of *strohmi*. Legs as in the male except color differences as noted above.

Male and female.—Wings black, with chalybeous reflections, from the extreme base to the fourth or sixth postnodal, usually about the fifth, the distal margin of the colored area usually nearly straight, slightly convex, and at right angles to the long

axis of the wing; venation black; stigma black in the male, brown in the female; under the microscope the dark color of the wings is uniform dark chestnut brown. Three postquad-rangular antenodal cells in the front and hind wings of 10 male and 8 female wings; M_2 in the front wing arising at or near the fifth postnodal in 9 male and 2 female wings, midway between the fifth and sixth in 1 male wing, and at or near the sixth in 6 female wings; in the hind wing at or near the fourth in 5 male and 2 female wings, midway between the fourth and fifth in 2 male wings, and at or near the fifth in 3 male and 6 female wings: M_{1a} in the front wing arising at or near the eighth postnodal in 1 female wing, at or near the ninth in 4 male and 1 female wings, at or near the tenth in 5 male and 5 female wings, and at or near the eleventh in 1 male and 1 female wings; in the hind wing at or near the seventh in 1 male and 2 female wings; at or near the eighth in 4 male wings, and at or near the ninth in 5 male and 6 female wings: postnodals in front wing eleven in 1 male and 4 female wings, and twelve in 9 male and 4 female wings; in the hind wing ten in 5 male and 7 female wings, eleven in 4 male and 1 female wing, and twelve in 1 male wing.

Nova Olinda, Rio Purús, Brazil, June, 1922, S. M. Klages, coll. Carnegie Museum, Acc. 6962, 12 males, 4 females, type male and allotype female designated from this material. We are indebted to Mr. Kahl for the loan of these specimens. The Purús is the next large southern affluent of the Amazon above the Madeira. It is probable *caeruleum* lives on small tributaries of the Purús as the other two species, *strohmi* and *luteum*, were found on tributaries of the Madeira.

Acanthallagma luteum, new species

Abdomen male 20–21.5, female 20–20.5; hind wing male 13–14, female 14–14.5; width of wing male and female about 3.75; stigma front wing male .4–.5, female .66; stigma hind wing male .52–.6, female .63–.7; width of head male and female 3.5; distance between posterior ocelli male and female

.33; length of hind femur male and female 2.5; longest femoral spine male and female .3; longest tibial spine male and female .4.

Male.—Labium slightly paler and yellower than in *strohmi*; lateral lobes little if any darker, otherwise similar. Labrum dull orange shading into black over the basal half or less. Anteclypeus dull orange, a black spot on either side; postclypeus black. Genae orange above, paler below. Dorsum of head anterior to a transverse line through the median ocellus largely orange, black as follows: (1) a median triangular black area enclosing the median ocellus and terminating anteriorly on the frons in a triparted expansion; on either side of this median triangular black area are two anteriorly directed black areas, which like the median black area are continuous posteriorly with the black of the rear of the dorsum of the head, one of them (2) opposite to and extending anteriorly to the base of the antenna, the other (3) between this one (2) and the median black (1); an irregular area (4) on the inner side of the base and the first joint of the antenna; and a still more irregular area (5) between this spot (4) and the median ocellus. One paler male has 2 reduced so the black along the first joint of the antenna extends posteriorly to the apex of that joint but does not reach the black of the rear of the dorsum of the head. In darker specimens the areas 2, 3, 4, and 5 enlarge and fuse, enclosing on either side a yellow spot inside and opposite the apex of the first joint of the antenna, and from the other side of the apex of the first joint of the antenna a black bar extends to the eye. Posterior to the transverse line through the median ocellus and rear of the head, black, orange as follows: a small spot on either side between the median and lateral ocelli, and broadly isolated, irregularly round postocular spots averaging about .2 in diameter. Antennae black, the first joint with an anterior orange stripe its full length.

Prothorax black, orange as follows: front lobe with a large median spot, more or less divided posteriorly in the median line; middle lobe with a smaller median geminate spot and a

minute spot on either side near the margin; hind border with a median spot about as wide or a little wider than the geminate spot anterior to it, and a minute spot on either side, directly posterior to the lateral spot on the middle lobe; propimeron with a prominent orange spot, about as large as the median spot on the front lobe.

Thorax black, broadly marked with paler in alternating bands of color of about equal width: an orange antehumeral stripe on either side the full length of the mesepisternum; a paler orange stripe on the first lateral suture, forked above, the small anterior branch widely and the expanded posterior branch narrowly separated from the wing base, below, the stripe includes the extreme infero-posterior angle of the mesinfraepisternum; in the yellow stripe on the second lateral suture there is a small brown or black spot, usually smaller and paler in the male and larger and darker in the female, located at about two-thirds the height of the stripe and directly below the apex of the prong of black which divides the stripe into two parts above; and the posterior part of the metepimeron still paler yellow, with a brown bar, joined with the black of the second lateral suture, across its inferior end; the metinfraepisternum yellowish with the superior, anterior and inferior edges broadly black. Sternum light and dark brown, coxae brown and black, legs black, tibiae of some brownish. Mesostigmal lamina black with the outer anterior lobe yellow; similar in shape to that of *strohmi* but with the middle lobe on the anterior edge lower and less evident.

Abdomen and appendages black; 1 with a narrow apical ring and a small mid-lateral spot, yellowish, the latter sometimes wanting; traces of yellowish brown along the lower margin of 2; 3 and 4 each with a narrow pale yellowish basal ring, on 3 separated from the obscure brownish ventral margin, but on 4 continuous; 5-7 each with a narrow blue basal ring which widens and fades into dull yellowish below and is narrowly extended along the ventral margin of each segment to the extreme apex where it widens; at midlength the maximum width of the pale basal rings is about .2; extreme

ventral margin of 8 and 9 pale yellowish; posterior face of dorsal apex of 10 pale yellowish; sterna largely black with traces of brown especially at the base and apex of each segment. Superior abdominal appendages black with the distal posterior surface yellow.

Legs moderate in size and in length and number of spines; the first femur has 4 or 5 spines in the anterior row and 4 or 5 in the posterior row; the second femur has 5 to 9 spines in the anterior row and 7 or 8 in the posterior row; and the third femur has 6 to 8 spines in the anterior row and 8 or 9 in the posterior row; in each row the spines increase in size from the base to the apex and in the case of each femur the spines of the anterior row are slightly longer than those of the posterior row; the first tibia has 2 basal unmodified spines in the anterior row and the usual comb of 7 or 8 modified spines, and 7 to 9 spines in the posterior row; the second tibia has 5 or 6 spines in the anterior row and 10 or 11 in the posterior row; the third tibia has 6 spines in the anterior row and 11 or 12 in the posterior row. The tibial spines decrease in length from base to apex; those in the anterior row of the second and third tibiae are longer than the more numerous spines in the posterior row but in the first tibiae the spines of the posterior row are very slightly longer than those of the anterior row.

Female.—Labium, labrum, clypeus and genae as in the male. Dorsum of head slightly to much darker than in the darkest males; the small orange spot on either side between the median and lateral ocelli, present in every male, is wanting in every female; there is in the palest females a more complete fusing of areas 2-5 so the yellow spot on the inside of the apex of the second joint of the antenna is reduced to a point, and the black bar from the antenna to the eye widens and fuses with the black behind it to enclose a large yellow spot against the eye; in a darker stage 1 fuses with the other areas, 2-5, and the dorsum of the head is black with the following orange areas: the frons broadly and irregularly bordered in front, an oblong spot on either side of the median

ocellus, a smaller spot between this oblong spot and the apex of the first joint of the antenna, a large rounded spot opposite this smaller spot against the eye, and the postocular spot on either side; in the darkest female the frons is black with an oblique bar in front on each side which is continuous with the yellow of the gena, above and back of this, on the suture, is a narrow, short bar, there is a similar bar on the base of the antenna, two rounded spots between the median ocellus and the antenna, the larger near the ocellus, the much smaller one near the antenna, a large rounded spot opposite this smaller one and barely separated from the eye, and the postocular spot on either side. Antennae as in the male, in some cases the orange stripe of the first joint obliterated.

Prothorax, thorax and legs as in the male, with the following exception: in the female there are distinct mesepisternal fossae, their anterior edge on about the level of the posterior edge of the mesostigmal laminae and their mesal edges separated only by the middorsal carina; each fossa is slightly elliptical, nearly circular, and the long axis is about .14. No trace of mesepisternal fossae is found in *A. strohmi* or *caeruleum*.

Abdomen similar to that of the male, the pale basal rings on 5-7 yellowish with traces of blue, rather than blue as in the male, the ventral margin of 2-7 more widely pale, extreme ventral edge of 9 black basally for about one-third the length; sterna, vulvar spine and genital valves as in the female of *strohmi*.

Male and female.—Wings amber brown, with some chalybeous reflections, from the extreme base to the fourth to sixth postnodal usually extending a cell farther in the hind wing than in the front wing, the extreme edge of the colored area usually nearly straight, slightly convex, and at right angles to the long axis of the wing; veins basal to the level of the nodus are yellow ocher in color excepting the costa which is brown, distal to the nodus these pale colored veins gradually darken so before the apical limit of the colored area of the wing has been reached the veins are black, which color of veins prevails over the uncolored part of the wing; stigma

pale smoke gray, paler in the female than in the male; under the microscope the dark color of the wings is yellow ochre. Three postquadrangular antenodal cells in the front and hind wings of 10 male and 4 female wings: M_2 in the front wing arising about half way between the fourth and fifth postnodals in 3 male wings, and at or near the fifth in 7 male and 4 female wings; in the hind wing at or near the fourth in 10 male and 4 female wings: M_3 in the front wing arising at or near the eighth postnodal in 5 male and 1 female wings, at or near the ninth in 4 male and 3 female wings, and at or near the tenth in 1 male wing; in the hind wing at or near the seventh in 3 male wings, at or near the eighth in 4 male and 4 female wings, at or near the ninth in 1 male wing, and at or near the tenth in 2 male wings: postnodals in front wing ten in 4 male and 4 female wings, eleven in 5 male wings, and twelve in 1 male wing; in the hind wing nine in 6 male and 4 female wings, ten in 2 male wings, and eleven in 2 male wings.

Villa Murтинho, Matto Grosso, March 28, and April 2, 1922, 9 males, 3 females, type male and allotype female April 2, 1922, all in coll. E. B. W.

The following notes on this species were made on April 2, 1922: Alights on tips of leaves and twigs with wings folded, in full sun. Male:—eyes deep purple above, lighter purplish brown below; face orange and black, orange predominating; head above black, postocular spots orange; middorsum of thorax black, antehumeral stripe orange, humeral stripe black, stripe on first lateral suture lighter orange, stripe on second lateral suture black, metepimeron yellow, below pruinose; legs black; abdomen black with pale blue bands. Female:—eyes dull greenish gray with purple stripes on top, greenish gray below; head, thorax, and abdomen similar to those of the male, but segments 3–10 show more brown on the sides.

At Villa Murтинho a trail leading east from the railroad at kilometer post 312 passed through cleared land, second growth pasture fields, along mandioca and cornfields and then over a low brush-covered hill of decomposed red rock. Three kilo-

meters from the railroad it entered a palm forest and soon crossed a sandy bottomed creek two to four feet wide and ankle deep. Beyond this creek the trail led on through palm forest over several small hills and past an extensive new clearing into more forest and finally to a small clearing on the right bank of a large creek about twenty feet wide and five feet deep in mid-channel, with firm sand bottom and a swift current. This, we were told, was the same stream that entered the Rio Madeira just north of town. *A. luteum* was taken resting on leaves on the tips of bushes along the bank in the clearing, none being seen where both banks were forested.

PLATE I

- FIG. 1, wing photograph by Captain John Strohm.
FIGS. 3, 6, and 10, drawings by Dr. C. H. Kennedy.
FIGS. 1-5, *Acanthallagma luteum*.
FIGS. 6-8, *Acanthallagma caeruleum*.
FIGS. 9-12, *Acanthallagma strohmi*.
FIGS. 2-12, excepting 3, 6, and 10, all the same scale.
FIGS. 2 and 9, male abdominal appendages in lateral view.
FIGS. 3, 6, and 10, penes in lateral and ventral views.
FIGS. 4, 7 and 11, intero-posterior surface of the superior appendages of males, viewed so the largest possible plane of this surface is at right angles to the line of vision.
FIGS. 5, 8, and 12, left mesostigmal laminae of females in latero-dorsal view.
- FIG. 1, wings of *A. luteum*, male, Villa Murтинho, April 2, 1922.
FIG. 2, *A. luteum*, type male.
FIG. 3, *A. luteum*, Villa Murтинho, March 28, 1922.
FIG. 4, *A. luteum*, type male.
FIG. 5, *A. luteum*, female, Villa Murтинho, April 2, 1922, showing the mesepisternal fossae on either side of the anterior end of the middorsal carina.
FIG. 6, *A. caeruleum*, Nova Olinda, June, 1922.
FIG. 7, *A. caeruleum*, type male.
FIG. 8, *A. caeruleum*, female, Nova Olinda, June, 1922.
FIG. 9, *A. strohmi*, type male.
FIG. 10, *A. strohmi*, Abuná, March 10, 1922.
FIG. 11, *A. strohmi*, type male.
FIG. 12, *A. strohmi*, female, Abuná, March 16, 1922.



