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A REVISION OF THE ARGENTINE SPECIES OF *Callibaetis* EATON (BAETIDAE; EPHEMEROPTERA)

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RESUMEN

Revisión de las especies argentinas de* Callibaetis *Eaton (Baetidae; Ephemeroptera).

Se informa sobre un estudio de los tipos de las especies de *Callibaetis* descriptos de Sudamérica austral por L. Navás. Sobre la base de este trabajo y del estudio de material recientemente colectado en Uruguay y Argentina, se han establecido las siguientes nuevas sinonimias:

C. fasciatus (Pict.), 1843	= *C. trifasciatus* Esb.Pet.,1912
	= *Baetis gloriosus* Nav. 1923
C. guttatus Nav., 1915	= *C. apicatus* Nav., 1917
	= *C. bruchius* Nav., 1920
	= *C. zonatus* Nav., 1929
C. jocosus Nav., 1912,	= *C. jaffueli* Nav., 1918
	= *C. rimatus* Nav., 1932
	= *C. spegazzinus* Nav., 1920
	= *C. stictogaster* Nav., 1915
C. radiatus Nav., 1920	= *C. venulosus* Nav. 1932
C. sellacki (Wey.), 1883	= *C. lineatus* Nav., 1932
C. willineri (Nav.), 1932	= *C. alegre* Trav., 1944
C. zonalis Nav., 1915	= *C. amoenus* Nav., 1930
	= *C. apertus* Nav., 1917
	= *C. depressus* Nav., 1922
	= *C. sobrius* Nav., 1916
	= *C. vitreus* Nav., 1915
	= *Baetis opacus* Nav., 1915
	= *Baetis virellus* Nav., 1915

Además, *Cloeon gonzalezi* Nav., 1934, se transfirió al género *Callibaetis*. Se da una clave para la identificación de los adultos de las nueve especies ahora reconocidas como propias de esta región.

INTRODUCTION

The study of this ubiquitous New World genus of mayflies has been greatly hampered by the multiplicity of species created by L. Navás in the early decades of this century. Many of the descriptions he gave are so brief as to be almost useless, while

others are based on subimagines, some of them, as he himself admitted, in very poor condition. In his valuable catalogue of South American Ephemeroptera, Hubbard (1982) listed 29 species of ***Callibaetis***, the majority of them described by Navás. If the list is restricted to species from Argentina, Chile, Paraguay and southern Brazil, i.e. to the region more or less south of the Tropic of Capricorn, some 24 species remain to be considered.

During the autumn of 1984 I was able to study the collection of mayflies made by C. Bruch during the first quarter of this century and now held by the Museo Argentino de Ciencias Naturales "B. Rivadavia" in Buenos Aires and by the Museo de la Ciencia Natural in La Plata. This important collection contains a number of specimens of species described by Navás, labelled "Typus" by Bruch. Dr. A. O. Bachman kindly informed me that Bruch used the term `type' in rather a loose way since it was his custom, apparently, to send one specimen to Navás for description and to keep another, assumed to be the same, in his collection. Thus, his specimens are not usually types in the strict sense of the word. The term type or typus used in the account of the genus below refers, therefore, to one of the type series which may be either the holotype, a paratype or a syntype. The part of Bruch's collection held in La Plata also includes several specimens labelled "Typus". From notes on some of the specimens it appeared that they had been examined in 1963 by Dr. George F. Edmunds Jnr., whose opinion helped me in deciding the synonymy of some of Navás's species.

As reported by Alba Tercedor and Peters (1986), Navás's main collection is now housed in the Museu de Zoología, Ayuntament de Barcelona. In October, 1985, through the kindness of Dr. O. Escolá I was able to examine nearly all of Navás's types and associated specimens of ***Callibaetis***. Normally only one specimen of each species carried the red "Typus" label, although in at least one instance two named specimens of the same species bore the type label. As noted above, specimens of the same species collected by Bruch and labelled "Typus" occur in collections both in Argentina and Barcelona. Similarly, labels bearing the numbers 189 or 190 occur on some of Bruch's specimens from Provincia Buenos Aires in all three collections.

In January, 1986, I visited the Museum National d'Histoire Naturel in Paris where a number of Navás's types are also held. Finally, the readiness of Sr. M.Fritz of the Instituto Entomología de Salta at Rosario de Lerma to send me the types of four of Navás's species held in the Institute was of inestimable value.

Apart from the Museum collections studied, Dr. E. Dominguez of the Instituto Miguel Lillo sent me valuable material collected by himself, including one new species, which is described below. I myself was also able to collect specimens of a number of species in the field in Argentina and Uruguay, which provided useful confirmation of the range of variation occurring within certain taxa. An account of the results of these studies follows.

TYPE MATERIAL STUDIED

The type material examined of Navás's species is listed below, the current location of types being given in brackets afterwards. The names of the institutions are abbreviated as follows: Museo Argentino de Ciencias Naturales - MACN, Museo de la Ciencia Natural de La Plata - MLP, Museu de Zoología de Barcelona - MZB, Museum National d'Histoire Naturel in Paris - MNHN, Instituto Entomología de Salta - INESALT.

C. amoenus (INESALT), ***apertus*** (MACN, MZB), ***apicatus*** (MACN, MZB), ***bruchius*** (MACN), ***depressus*** (MZB), ***guttatus*** (MACN), ***jaffueli*** (MZB), ***jocosus*** (MZB), ***lineatus*** (MNHN), ***radiatus*** (MNHN), ***rimatus*** (INESALT), ***sobrius*** (MNHN), ***spegazzinus*** (MZB), ***stictogaster*** (MACN, MLP, MZB), ***venulosus*** (INESALT), ***vitreus*** Nav., 1915 (MACN, MZB), ***vitreus*** Nav., 1919 (MLP), ***willineri*** (INESALT), ***zonalis*** (MACN), ***zonatus*** (MACN, MZB). In addition, the types of ***Baetis opacus*** (MLP), ***B. virellus*** (MACN) and ***Cloeon gonzalezi*** (MNHN), species all now known to be ***Callibaetis***, were also examined.

The opportunity was also taken of examining the types of several tropical species of ***Callibaetis***, namely ***camposi***, ***gregarius*** and ***Cloeon grisoli***.

The list appearing below, modified from Hubbard (1982), gives the manes of ***Callibaetis*** species currently described from sub-tropical and temperate South America, together with the synonynies established here.

LIST OF *Callibaetis* SPECIES FROM SUBTROPICAL AND TEMPERATE SOUTH AMERICA

1. Species treated as ***Callibaetis*** by Hubbard (1982)	Names recognized here	
C. abundans (Navás, 1912)	nomen dubium	
C. alegre Traver, 1944	***willineri*** Nav.	syn. nov.
C. amoenus Navás, 1930	***zonalis*** Nav.	syn. nov.
C. apertus Navás, 1917	***zonalis*** Nav.	syn. nov.
C. apicatus Navás, 1917	***guttatus*** Nav.	syn. nov.
C. bruchius Navás, 1920	***guttatus*** Nav.	syn. nov.
C. depressus Navás, 1922	***zonalis*** Nav.	syn. nov.
C. fasciatus (Pictet, 1843)	***fasciatus*** (Pict.)	
C. guttatus Navás, 1915	***guttatus*** Nav.	
C. jaffueli Navás, 1918	***jocosus*** Nav.	syn. nov.
C. jocosus Navás, 1912	***jocosus*** Nav.	
C. lineatus Navás, 1932	***sellacki*** (Wey.)	syn. nov.
C. radiatus Navás, 1920	***radiatus*** Nav.	
C. rimatus Navás, 1932	***jocosus*** Nav.	syn. nov.
C. sellacki (Weyenbergh,1883)	***sellacki*** (Wey.)	
C. sobrius Navás, 1916	***zonalis*** Nav.	syn. nov.
C. spegazzinus Navás, 1920	***jocosus*** Nav.	syn. nov.
C. stictogaster Navás, 1915	***jocosus*** Nav.	syn. nov.
C. trifasciatus Esben-Petersen, 1912	***fasciatus*** (Pict.)	syn. nov.
C. venulosus Navás, 1932	***radiatus*** Nav.	syn. nov.
C. vitreus Navás, 1915	***zonalis*** Nav.	syn. nov.
C. willineri Navás, 1932	***willineri*** Nav.	
C. zonalis Navás, 1915	***zonalis*** Nav.	
C. zonatus Navás, 1929	***guttatus*** Nav.	syn. nov.

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2. Species treated as ***Baetis*** by Hubbard (1982)		
B. gloriosus Navás, 1923	***fasciatus*** (Pict.)	syn. nov.
B. opacus Navás, 1912	***zonalis*** Nav.	syn. nov.
B. virellus Navás, 1915	***zonalis*** Nav.	syn. nov.

3. Species treated as *Cloeon* by Hubbard (1982)

Cl. gonzalezi Navás, 1934 — *gonzalezi* (Nav.)

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4. New species described here

C. dominguezi sp. nov.

IDENTIFICATION OF THE ARGENTINE SPECIES OF *Callibaetis*

As a result of this study of Navás's types and other material, as recorded below, I am recognizing 9 species of *Callibaetis* as occurring within the region. It appears that the adults of the genus can be usefully grouped as follows:

Group I. Costal and subcostal areas of female fore wing strongly pigmented, wing field posterior to vein R2 unpigmented, except sometimes across wing base. Male wings largely unpigmented (except in *C. dominguezi*).

C. dominguezi sp. nov. — *C. willineri* Nav.
C. gonzalezi Nav. — *C. zonalis* Nav.
C. radiatus Nav.

Group II. In both sexes, wing field posterior to vein R2 with varying degrees of pigmentation, not forming discrete bands.

C. guttatus Nav. — *C. jocosus* Nav.

Group III. In both sexes, fore wings with oblique or transverse, pigmented bands.

C. fasciatus (Pict.) — *C. sellacki* (Wey.)

No nymphs of South American *Callibaetis* have been described except that of *C. willineri* which, under the name *alegre*, was figured and briefly described by Traver (1944). Identification, therefore, rests solely on the adults. The following key has been constructed, which it is hoped may assist the worker to identify most imagines from the southern parts of the continent. Its validity depends on the species definitions that I have introduced in this paper. This may be modified with further studies of the genus so that, to this extent, the key should be regarded as a preliminary one.

KEY TO THE ADULTS OF *Callibaetis* FROM SOUTHERN SOUTH AMERICA

1. Fore wings with marginal intercalaries single, except sometimes for 1 or 2 spaces at tip or base of wing.....2

--- Marginal intercalaries mostly double 3

2. In female, vitta without clear windows round cross-veins, pigment extending broadly across base of wings to inner margin (fig.16); in outer one-third of wing field, posterior to vein R2, 13-15 cross-veins; basal half to one-third of hind wings tinted brown .....*C. gonzalezi*

--- Vitta with numerous clear windows, pigment overlapping extreme bases of main veins, not extending to inner margin (fig. 4); outer wing field with 7-9 cross-veins; hind wings hyaline .....*C. radiatus*

3. Fore wings in both sexes with conspicuous, oblique or transverse, pigmented bands, leaving broad, clear areas between (fig. 12) 4

--- Wings without clearly defined bands; if banding present, this takes the form of lines of narrow windows in an otherwise lightly pigmented wing field 5

4. Fore wings with 3 more or less discrete bands (fig. 12) .....*C. fasciatus*

--- Fore wings with 2 main bands, the outer one parallel with the posterior margin of the wings (fig. 14).....*C. sellacki*

5. Hind wings without cross-veins; in female fore wings, vitta restricted to costal and subcostal areas, without windows (fig. 20); in male, outer one-third of wings uniformly tinted brown (fig. 18) .....*C. dominguezi*

--- Hind wings with 6-20 cross-veins; vitta extending at least partly to area posterior to vein R1, with numerous windows; male fore wings clear or with a small spot in stigma.....6

6. Mid and hind tibiae with 2 dark spots in basal half in addition to sub-apical spot; abdominal sterna with dark anterolateral streaks but without paired submedian markings; fore wing pigment not diffused over whole membrane, in male unpigmented except sometimes in stigma 7

--- Tibiae may be dark at knee or apex but not showing 2 discrete spots in basal half; abdominal sterna with paired, submedian dash-dot markings (fig. 24) in addition to anterolateral streaks; fore wings diffusely and lightly pigmented throughout, sometimes with lines of clear windows round all cross-veins (fig. 10) .....*C. jocosus*

7. Fore wings in both sexes with extensive spotting over general wing field (Figs. 6,8), occasionally reduced to a series of spots along posterior margin .....*C. guttatus*

--- In female, pigment of fore wings confined to a broad vitta along anterior margin; in male, wings either hyaline or lightly pigmented in stigma 8

8. In female, basal half of vitta of fore wings overlapping vein R1 as far as R2 in less than 1/2 of its length (fig. 2); in male, stigma of fore wings often with a patch of smoky pigment; no median markings on abdominal sterna.....*C. zonalis*

--- In female, basal half of vitta of fore wings overlapping vein R1 as far as R2 in 1/2 or more of its length (fig. 1); in male, fore wing entirely hyaline; a median, maroon dash usually present on sterna II-VIII.....*C. willineri*

TAXONOMIC NOTES ON THE NAMED SPECIES

Callibaetis abundans (Nav.)

Baetis abundans Navás, 1912:194.

Callibaetis abundans, Ulmer, 1943:34.

In his description of ***Baetis abundans*** from Paraguay Navás gave few details that could be of value for specific determination beyond the fact that the wings were unpigmented and that the hind tibiae had two dark rings. Ulmer (1943) examined the type, a male, in the Munich Museum and noted that it was in very poor condition with no hind wings, only one (hind) leg and the abdomen partially destroyed. His redescription of the specimen as he found it provided little in the way of specific characters, although he was able to establish that it belonged to the genus ***Callibaetis***. A further male was present at that time in the Museum in Vienna. Dr. E.G. Burmeister kindly informed me that the type is still in the Zoologische Staatssamlung, Munich, but in a very poor state of preservation. Since it seems impossible to establish the identity of the type specimen of this species I am treating ***abundans*** as a nomen dubium.

Callibaetis alegre Traver

Callibaetis alegre Traver, 1944: 46.

In her very detailed description of all stages including the nymph of this species from the extreme south of Brazil, Traver (1944) remarked "the exact combination of characters does not exactly fit any previously-described species from Brazil, Paraguay or Argentina". While it is perfectly true that none of Navás's descriptions would enable one to recognize Traver's species from them, I produce evidence here to show that this statement is not quite correct and that ***C. alegre*** is to be regarded as a synonym of ***C. willineri*** Navás.

The males of both species have unpigmented wings, even in the stigma, and share the same markings on the legs and abdominal sterna. The female of ***C. willineri*** has not been described, but the same leg and sternal characters were shown by Traver to be present in ***C. alegre***. Thus it appears that the male of Traver's species, as well as material of mine collected in Provincia Buenos Aires, had already been described by Navás under the name ***willineri*** and that ***C. alegre*** falls in synonomy with it.

In both ***C. alegre*** and ***C. willineri*** the female closely resembles ***zonalis***, but differs from it in the following two

characters. Firstly, the pigmented area of the wing extends quite broadly into the area posterior to vein R1 (fig. 1). This is particularly marked in the basal half of the wings, where the pigment extends backwards as far as vein R2 over more than a quarter of the total length of the vitta. Secondly, on the abdominal sterna, in addition to the pair of chocolate-brown streaks in the anterolateral corners of segments II-IX, there is nearly always a median, maroon dash on the anterior part of sterna II-VIII surrounded by a window in the stippling that otherwise covers the entire venter (fig. 23). In *C. zonalis*, on the other hand, the extension of the pigment in the female wings is much less than in *C. alegre* (fig. 2). In the basal half of the wings the pigment extends backwards as far as vein R2 in less than, usually much less than a quarter of the length of the vitta. On the abdominal sterna the median, maroon dash is absent on all segments. Between the males of *C. willineri*(=*alegre*) and *C. zonalis* there are also distinct differences. The stigma of the wings is unpigmented in *C. willineri*, whereas in *C. zonalis* there is usually a variable amount of blackish-grey pigment. Differences in the sternal markings are as in the female. The markings on the legs, as described by Traver for *C. alegre*, appear to be the same in both species.

Callibaetis amoenus Navás

Callibaetis amoenus Navás, 1930: 131.

Described from a single male from Martinez, Buenos Aires, the type of this species is now in INESALT in Salta. Although most of the abdomen and half of the legs are missing, the wings are still intact. The stigma of the fore wings shows the grey tinting figured by Navás that is characteristic of many males of *C. zonalis* Nav., including some that I caught myself in the same Province and at the same time of year. The dark spots on the femora and tibiae are also as in that species. *C. amoenus*, therefore, is to be regarded as a synonym of *C. zonalis*.

Calllibaetis apertus Navás

Callibaetis apertus Navás, 1917: 190.

Navás described the subimago from specimens collected in the Province of Buenos Aires, 4, and 27.October, 1916. There is a female subimago in MNCN, labelled Typus, 27.X.16, and another in MZB, with a red Typus label, 4.X.16. Both are in poor condition with the wings either crumpled or missing on one side. The legs are as in *C. zonalis*, i.e. with the tibiae bearing basal and subapical dark spots and an intervening dark area. The one examinable wing shows the costal and subcostal areas somewhat darker than the rest of the wing field. There is also a male imago, determined by Navás, in MNHN in Paris and collected in Asunción, which has clear wings and a line of sinuous veinlets in the stigmatic area. The legs are as in *C. zonalis*. Spieth (1943) attributed a female imago from Surinam to this species.

Callibaetis apicatus Navás

Callibaetis apicatus Navás, 1917: 189.

Navás described the male from Provincia Buenos Aires, 15.

May and 6. October, 1915. One male is in MACN, labelled Typus, another in MZB also with a red Typus label, with dates corresponding to the above. Both show faint pigmentation of the outer third of the costal and subcostal areas and elsewhere in the wing field, particularly over marginal intercalaries. Navás's figure shows the same feature in the apex of the wings, on which grounds I am treating *apicatus* as a synonym of *C. guttatus*.

Callibaetis bruchius Navás

Callibaetis bruchius Navás, 1920b: 55.

In the collection of MACN there is a female imago from the Cordoba hills, Argentina, labelled Typus. The specimen is in fair condition and the fore wings show a series of dark spots on the veins in transverse bands, corresponding in position to the more continuous distribution of pigment across the veins in *C. guttatus*. The hind wings have a band of pigment behind the spur and the suggestion of a spot centrally. These characters agree well with *C. guttatus*, of which it is clearly a synonym.

Callibaetis camposi Navás

Callibaetis camposi Navás, 1930b: 18.

Although this species comes from outside the region covered by the present study, having been described from Guayaquil, Ecuador, I took the opportunity of examining the type in MZB. The specimen, a female imago, is in fair condition. The costal, subcostal and R1 areas of the fore wings are strongly pigmented with well marked windows and with discrete extensions of the pigment posterior to this. From a brief examination it appeared that all marginal intercalaries were single. It seems, therefore, to be a well defined species.

Callibaetis depressus Navás

Callibaetis depressus Navás, 1922: 59.

Navás gave this name to a female subimago from Santiago del Estero, Argentina, the body of which had become distorted and the tip of the abdomen turned down. I have examined the type in MZB and find it cannot be separated from the subimago of *C. zonalis*. It falls in synonymy, therefore, with that species.

Callibaetis dominguezi sp. nov.
(figs. 18-22, 25)

Male imago. Eyes red, body generally dark brown. Outer one-third of fore wings tinted dark brown, more heavily marked in stigma (fig. 18); no cross-veins in costal area basal to stigma which contains 9-11 cross-veins; those in mid wing field strongly pigmented; marginal intercalaries double except in basal two cubital spaces. Hind wings (fig. 19) without any cross-veins either between longitudinal veins or linking them to the margins. Fore and hind legs not preserved; mid femora and tibiae cream, tarsus brown, a dark preapical femoral spot present. Abdominal terga

dark brown, on II-IV with small, anteromedial, pale triangles. Sterna cream, strongly stippled with chocolate-brown spots; II-IX each with chocolate-brown, anterolateral dashes extending a little less than half length of segment and, internal to this, much smaller spots, both becoming broader on basal 2 segments (fig. 25). Forceps dark brown, terminal segment elongate (fig. 22). Caudal filaments not preserved.

Female imago. Occipital area of head cream with a pair of brown, submedian spots; pronotum pale brown with a singe small red spot laterally and an indistinct transverse red streak; mesonotum pale brown with a very fine, median red streak anterior to scutellum. Costal and subcostal areas of fore wings lightly tinted brown, not overlapping vein R1 at any point; no costal cross-veins basal to stigma; vitta without windows; about 13 slanting cross-veins in stigma. Hind wings as in male. Legs not preserved. Abdominal terga pale brown, IV-VII paler anteriorly, II-VII with brick-red anterolateral dashes, VIII with lateral margins broadly dark brown. Sterna cream, strongly stippled, on II-V stippling more heavily marked in a band across posterior margin of segment; anterolateral dashes and spots much as in male, but those on II rather larger. Caudal filaments not preserved.

Wing, male 8,0 mm, female 9,5 mm; body, male 8,0 mm, female 9,0 mm.

Material examined. Male imago, holotype (in Instituto-Fundación Miguel Lillo), Argentina, Prov. Jujuy, Calilegua, 1.180m, Mesada de las Colmenas, 13.VIII.81, E. Dominguez. Female imago,allotype, ibidem, 13.VIII.81, E. Dominguez, Paratypes, 2 males, 4 females (damaged), ibidem, 13.VIII.81, E. Dominguez. In alcohol.

C. dominguezi possesses a number of unusual characters that distinguish it from all other South American species. Of particular note is the fact that the pigmentation of the wings in the male is more extensive than in the female and that it forms a broad apical band in the male while the female has the more usual vitta along the anterior border of the wings. The absence of cross-veins in the costal area of the fore wing, apart from the stigma, and the absence of cross-veins in the hind wings are also distinctive features of this species.

Callibaetis fasciatus (Pictet)

Cloe fasciata Pictet, 1843: 262.

Callibaetis fasciatus, Eaton, 1885: 197.

Callibaetis trifasciatus Esben-Petersen, 1912: 339. (syn. nov.).

Baetis gloriosus Navás, 1923: 2. (syn. nov.).

Callibaetis gloriosus, Navás, 1930: 360.

There are 8 females in MNBA, labelled Prov.Buenos Aires, C. Bruch. forming part of a series apparently examined by Navás and identified by him as *C. trifasciatus* Esb.Pet. There are a further 3 specimens with the same provenance in MZB, labelled *C. trifasciatus* Esb. Pet. by Navás. I also have 3 males, a female imago and a female subimago collected recently in Dpto. Maldonado,

Uruguay.

Pictet gives a clear figure of a wing of *C. fasciatus* which, coupled with Esben-Petersen's detailed description and figures of *C. trifasciatus*, leaves little doubt about the synonymy of the latter species. Figs. 12,13 show the wings of one of Bruch's specimens. A further distinctive character lies in the pair of median, blackish, dash-dot markings on each of abdominal sterna I-IX (fig. 26). Navás (1923a) gives a figure of a wing of *Baetis gloriosus* Nav. from Chile which, together with his description, makes it clear that this taxon is also a synonym of *C. fasciatus*. In fact, in a later paper (Navás, 1930d) he tacitly acknowledged his error in placing the species in *Baetis* when he referred to a further specimen from the same locality in Chile as '*Callibaetis gloriosus*'.

Callibaetis gonzalezi (Navás) new comb.

Cloeon gonzalezi Navás, 1934: 27.

I have examined the type, a female imago in good condition from Asunción, Paraguay, which is held in MNHN. The fore wing markings are much as figured by Navás, i.e. vitta orange-brown, without windows, extending broadly across base of wings to inner margin, marginal intercalaries single except for Cu2 and, on one side, MP2 where they are double. I could not find any trace of hind wings. Legs unmarked. Abdominal terga strongly stippled, sterna more lightly stippled with anterolateral chocolate-brown dashes on most segments.

It is not surprising that Navás placed this species in *Cloeon*, since the type apparently lacks hind wings and nearly all the marginal intercalaries are single. However, Dr. Dominguez has sent me 3 females from Salta, Dpto. San Martin, Aº Madrejones, 19.IV.83, which are clearly the same as Navás's species with the fore wings as in fig. 16. However, these specimens all have hind wings (fig. 17), in which the basal half is tinted brown. Accordingly, I am transferring *gonzalezi* to *Callibaetis*. The fore wing markings are distinctive and serve to distinguish it from all other known species in the region.

Dr. Dominguez also collected some *Callibaetis* nymphs from the same site as the females, in which the tarsal claws have two rows of unusually long teeth - about one-third the length of the claw (fig. 27). The hind wing buds are bicolorous, as in the adult hind wings, and the abdominal markings are similar to the females. It seems highly likely that these specimens represent the nymph of *C. gonzalezi*.

Callibaetis gregarius Navás

Callibaetis gregarius Navás, 1930c: 72.

This tropical species was described from 5 males (?) from Ipiranga, Amazonas. There is a male from this series in MZB with crumpled fore wings, absent hind wings and faded legs. Examination of the other male specimens, stated to be in 'Mus. Entom. de Berlin', will be necessary before the status of this taxon can be established.

Callibaetis grisoli (Berthélemy) nom. nud.

Cloeon grisoli Navás, 1965: 2.

In the 1965 issue of Eatonia, Berthemeley gave a list of Ephemeroptera types in the Natural History Museum in Paris, which included the name ***Cloeon grisoli*** Navás. I have examined this type, which is pinned and stuck down to a card and bears the label "***Cloeon grisoli*** Nav., det Navás, S.J. Venezuela, San Fernando de Apure, Mayeul-Grisol, 1924." The specimen, a female with well developed hind wings and a dark vitta in the fore wings, is clearly a species of ***Callibaetis***. However, I have been unable to find any description of this species in any of the 8 papers by Navás entitled "Insectos del Museo Paris" and published between 1925 and 1931, nor in any other of his publications. The name "***grisoli***" must therefore be regarded as a nomen nudum.

Callibaetis guttatus Navás

Callibaetis guttatus Navás, 1915b: 120.

Callibaetis apicatus Navás, 1917: 189. (syn. nov.)

Callibaetis bruchius Navás, 1920b: 55. (syn. nov.)

Callibaetis zonatus Navás, 1929a: 224. (syn. nov.)

There is a female imago, labelled Typus, in fair condition in the Bruch Collection in MACN, all wing of which is figured here. I also collected a series of females from Rosario de Lerma, Prov. Salta and from La Cumbre and Carlos Paz in the Cordoba Hills. Type material of ***C. apicatus***, ***C. bruchius*** and ***C. zonatus*** was also studied (q.v.).

This species is highly variable as regards the extent of pigmentation in the wings (figs. 6-9). A wing of ***C. guttatus***, as drawn from the type series, represents the minimal degree of wing spotting, while that of ***C. zonatus*** illustrates the more commonly seen condition. In some specimens from Provincia Salta the pigment is more extensive still and the hind wings are strongly banded. In specimens from the Cordoba Hills, the hind wings are partially banded or unpigmented. The males, as typified by the type specimens of ***apicatus***, have the pigment much more lightly marked than in the females, and the basal quarter of the costal and subcostal areas is almost unpigmented: a series of light spots are present along the margin, and traces of pigment can be made out in a band across the middle of the wings.

Callibaetis jaffueli Navás

Callibaetis Jaffueli Navás, 1918: 214.

This species was apparently described from a single male from Chile, now held in MZB. The specimen is in good condition and carries a red Typus label. The fore wings are strongly pigmented in costal, subcostal and radial 1 areas with 3 pale interruptions, broadening out posteriorly to give the appearance of pale bands. There are posterior extensions of pigment into the radial area and beyond, as well as several small infusions of dark pigment in the rest of the wing field. The venter has mar-

kings similar to those seen in *C. stictogaster*. This, in combination with the absence of spotting on the tibiae, leads me to regard *C. jaffueli* as another synonym of *C. jocosus*.

Callibaetis jocosus Navás

Callibaetis jocosa Navás, 1912: 195.

Callibaetis stictogaster Navás, 1915b: 121. (syn. nov.).

Callibaetis Jaffueli Navás, 1918: 244. (syn. nov.).

Callibaetis spegazzinus Navás, 1920: 36. (syn. nov.).

Callibaetis rimatus Navás, 1932: 113. (syn. nov.).

The type, a male labelled "S.Pablo (Br.), 8.IV.10", is now held in MZB, It is in a generally rather bad state with squashed head, no legs and the tip of the abdomen missing. However, the wings are well preserved and show diffuse, if faint, pigment over much of the wing field, as figured by Navás. In his description, in the less than two lines devoted to the female, there occurs the surprising statement - 'alis immaculatis'. The type series of *C. stictogaster* in MACN and MLP includes 4 females and one male, all of which have faintly tinted fore wings as described for the male of *C. jocosus*. In particular, the windows around the cross-veins between veins R1 and R3 are especially conspicuous. This establishes the synonymy of *C. stictogaster* with *C. jocosus* as well as allowing one to discount Navás's statement on the female wings.

Callibaetis lineatus Navás

Callibaetis lineatus Navás, 1932b: 82.

The type, a female imago in good condition from Marga-Marga, Chile, is in MNHN. The wings have two oblique dark bands, the outer of them parallel with the outer (= posterior) margin of the wings as in *C. sellacki* (fig. 14) and indicate its conspecificity with that species.

Callibaetis radiatus Navás

Callibaetis radiatus Navás, 1920c: 132.

Callibaetis venulosus Navás, 1932a: 114. (syn. nov.).

Although Alba-Tercedor and Peters (1985) stated that the type, a male, from Santa Fé, 18.VI.12, is present in the Navás collection in MZB, I was unable to locate it. However, in the same collection in Barcelona there are 3 females from Santa Fé, 18.VI.18. and Asunción, 1-15.X.19, determined by Navás as *Callibaetis radiatus*, none of them labelled as Type. Another female, from Santa Fé, 1.XI.18, is in MNHN, labelled Typus by Navás (1926b). Navás (1928) gives a further and later record of this species from Santa Fé.

Two of the Barcelona specimens (one from each locality) are imagines with the wings in good condition, although the legs and

caudal filaments are missing in one specimen. The pigmentation of the fore wings (fig. 4) is characteristic and clearly differentiates this species from the other two members of Group I. In particular, the wing area posterior to vein R1 is heavily infused with dark brown pigment, leaving only small windows round 1 or 2 cross-veins. In the basal half of the wings the pigment extends in a stepped fashion across the bases of all the other veins up to vein CuP. Further points of interest are the absence of cross-veins from the posterior portion of the fore wing except near the tip and the presence of single marginal intercalaries in all spaces except those at the wing tip behind veins R1 and R2. The hind wings (fig. 5) are rather unusual in shape, being narrow with a squared-off costal spur and slightly thickened and frosted cross-veins. The third specimen, a subimago from Asunción, is of doubtful identity. From the pallor of the radial area of the fore wing I judge it to belong to *C. zonalis* rather than *C. radiatus*.

From the presence of pigment in the fore wings it would seem that Navas's description was that of the female and that the male has not therefore been described. However, as recorded below, the type of *C. venulosus* has the same thickened cross-veins in the hind wings and the marginal intercalaries in the fore wings are all single. This clearly represents the unknown male of *C. radiatus*, from which it is concluded that the wings of the latter are unpigmented.

This species resembles *C. gonzalezi* in certain respects, notably in the extension of pigment across the base of the wing and in the mainly single marginal intercalaries. However, in the latter species the pigment extends as far as 1/4-1/3 of the distance from the base of the wing to the middle of the posterior margin, whereas in *C. radiatus* it is very much less extensive.

Callibaetis rimatus Navás

Callibaetis rimatus Navás, 1932a: 113.

This species was described from two females from Santa Fé and San Miguel, Prov. Buenos Aires. The two specimens are now in the collection in INESALT, one an imago, the other a subimago and both in poor condition. The imago, labelled "Tipo", has one wing intact, which agrees well with the figure given by Navás and is identical with that of *C. jocosus*. *C. rimatus* therefore falls in synonymy with *C. jocosus*.

Callibaetis sellacki (Weyenbergh)

Cloe Sellacki Weyenbergh, 1883: 164. (syn nov.)

Cloe Lorentzii Weyenbergh, 1883: 167.

Callibaetis sellacki, Eaton, 1885: 198.

Callibaetis trifasciatus (partim), Navas, 1915b: 120 (syn. nov.).

Callibaetis fasciatus, Ulmer, 1921: 246 (syn. nov.).

Callibaetis lineatus Navás, 1932b: 82 (syn. nov.).

There are 6 specimens in MACN in the Bruch Collection from Prov. Buenos Aires, that form the bulk of the series labelled *C.*

trifasciatus and referred to under that name by Navás (1915). There is also a female subimago, by now badly damaged, in MLP labelled *C. trifasciatus* `cotypus' and bearing the later label `not *trifasciatus*, det. G.F. Edmunds, 1963'. There is also a single male specimen from the same series in MZB, identified as *C. trifasciatus* Esb.Pet. by Navás. In addition, I collected 4 males referable to this species in Dpto. Maldonado, Uruguay.

Previously confused with *C. fasciatus* this species is readily distinguished from the former by the two-banded appearance of the fore wings (fig. 14). The paired ventral markings on the abdomen are generally similar to those of *C. fasciatus*. Weyenbergh evidently drew the wings of his specimens while they were still attached to the insect so that the hind wing spur was not visible. However, the characteristic banding of the fore wings is well shown and makes it possible to refer other specimens to this taxon. The differences in size and minor features of wing pattern, used by Weyenbergh to distinguish *C. lorentzii* from *C. sellacki*, should be regarded as falling within the range of variation shown by the latter.

Callibaetis sobrius

Callibaetis sobrius Navás, 1916: 61.

It would appear from Navás's account that this species was described from a male imago ('ala anterior vitrea, immaculata') from San Pablo, Brazil, 8.IV.10. However, the specimen labelled type in MHNH and carrying the above details is a female subimago. The specimen is in fair condition and the leg markings are typical of *C. zonalis*. As noted by Alba-Tercedor and Peters, there is a female and a bare pin (since discarded!) in MZB, both labelled *C. sobrius* by Navás. Neither of them carry type labels, but the collecting details are the same as the above. The wings and the leg markings are again characteristic of *C. zonalis*, of which species it is clearly a synonym.

Callibaetis spegazzinus Navás

Callibaetis spegazzinus Navás, 1920a: 36.

C. spegazzinus was described from two females from Asunción, Paraguay. Both are held in MZB, labelled as types. One has crumpled wings and is in poor condition, but the other is clearly a rather pale specimen of *C. jocosus*.

Callibaetis stictogaster Navás

Callibaetis stictogaster Navás, 1915b: 121.

The type material of this species, which is in the Bruch Collection from Prov. Buenos Aires, is distributed as follows: MZB, 4 female imagines including one with the red Typus label, MACN, one female imago, MLP, 1 male, two female imagines (one wingless) and one female subimago. All these specimens have the wing pigmentation characteristic of *C. jocosus* (fig.). The morphological feature that may have led Navás to apply the name *stictogaster* to material from Buenos Aires is the presence of

paired submedian markings on the abdominal sterna (fig. 24). The same markings are present on a male determined by him as *C. jocosus* in MZB coming from the type locality for that species, San Pablo. The synonymy of the two species is therefore confirmed.

Callibaetis trifasciatus Esben-Petersen

Callibaetis trifasciatus Esben-Petersen, 1912: 339.

Esben-Petersen's description is so detailed that, even without examination of the type, the synonymy of this species with *C. fasciatus* seems inescapable.

Callibaetis venulosus Navás

Callibaetis venulosus Navás, 1932a: 114.

This species was described from a clear-winged male imago from Santa Fé, characterized by rather unusual round-tipped hind wings with somewhat thickened cross-veins. The type, now in very poor condition, is held in the collection of INESALT in Salta. Much of the abdomen of this specimen, part of the wings and all of the legs except one fore leg are missing. The fore wings show lack of pigment in the costal brace, numerous cross-veins before the bulla, as well as in the stigma, and apparently all marginal intercalaries single. One hind wing remains, showing the thickened, slightly frosted appearance of the numerous cross-veins that were figured by Navás. The combination of single marginal intercalaries and thickened cross-veins in the hind wing shows that *C. venulosus* is the male of *C. radiatus*.

Callibaetis vitreus Navás

Callibaetis vitreus Navás, 1915b: 121.

Callibaetis vitreus Navás, 1919: 81.

Callibaetis vitreus Navás, 1919 (hom. syn.), Hubbard and Edmunds, 1977: 55.

This name has had a somewhat tangled history. Hubbard and Edmunds (1977) showed that Navás was guilty of the solecism of creating a junior synonym and a junior homonym of a species already named by himself. He achieved this by using the same name in two different publications for two series of specimens of *Callibaetis*, collected in the same Province of Argentina in the same month and year but by two different collectors. Hubbard and Edmunds also recorded that the name was subsequently used a third time for a North American species.

As regards type material, there is a female subimago in the Bruch Collection held in MACN, labelled cotypus, 4.X.15, C. Bruch. This would seem to be a paratype of *C. vitreus* Navás, 1919. As noted by Hubbard and Edmunds, further material of the Bruch Collection is held in MLP including a male subimago dated 20.IV.15. It carries a label in Edmunds's writing - "Type of *Callibaetis vitreus* Navás, 1918, homonym of *C. vitreus* Navás, 1915, synonym *Callibaetis zonalis* Nav.". I concur with both of these conclusions. On the other hand, in Barcelona (MZB) there is a

single male subimago with a red Typus label and the details "La Plata (R.A.) 12.11.15. Miraben leg." (= 12.IV.15?), indicating that it could be part of the type series of either *C. vitreus* Nav. 1915 or Nav. 1919. In either case the synonymy with *C. zonalis* stands. A further specimen in MZB (since discarded) was found to consist of a fragment of tissue on a pin, labelled in Navás's hand *"Callibaetis vitreus* Nav., Rio Paraguay (Paraguay) 11.20".

Callibaetis willineri Navás

Callibaetis willineri Navás, 1932a: 115.

Callibaetis alegre Traver, 1944: 46. (syn. nov.).

This species was described from a single male collected in San Miguel, Provincia Buenos Aires and now held in the collection in INESALT. The specimen, a male imago, is in good condition and has leg markings characteristic of *C. zonalis* and as described by Traver for *C. alegre*. The stigmatic area of the wing tip is clear, without any tinting of the membrane, as in *C. alegre*. The ventral surface is not easily examined owing to distortion, but it is possible to make out traces of the median dark streak on the sterna that were described by Traver as characteristic of *C. alegre*. The conspecificity of the two therefore seems established and, as shown above, the name *alegre* falls as a synonym of *willineri*.

The female of *C. willineri* (=*alegre*) closely resembles *C. zonalis*, but differs from it in the following two characters. Firstly, the pigmented area of the wings extends quite broadly into the area posterior to vein R1 (fig. 1). This is particularly marked in the basal half of the wings, where the pigment extends backwards as far as vein R2 over more than a quarter of the total length of the vitta. Secondly, on the abdominal sterna, in addition to the pair of chocolate brown streaks in the anterolateral corners of segments II-IX, there is nearly always a median, maroon dash on the anterior part of sterna II-VIII surrounded by a window in the stippling that otherwise covers the entire venter. In *C. zonalis*, on the other hand, the extension of the pigment in the female fore wings is much less than in *C. willineri* (fig. 2). In the basal half of the wings the pigment extends backwards as far as vein R2 in less than, usually much less than a quarter of the length of the vitta. On the abdominal sterna the median, maroon dash is absent on all segments. Between the males of *C. willineri* and *C. zonalis* there are also distinct differences. The stigma of the fore wings is unpigmented in *C. willineri*, whereas in *C. zonalis* there is usually a variable amount of blackish-grey pigment. Differences in the sternal markings are as in the female. The markings on the legs, as described by Traver for *C. alegre*, appear to be the same in both species.

In MZB there is a female in good condition from Prov. Buenos Aires, 15.V.15, C. Bruch, labelled by Navás as *C. zonalis*. However, the pigmentation in the wing shows it to be *C. willineri*. Both *C. zonalis* and *C. willineri* occur together. For instance, I collected specimens from Departamento Maldonado, Uruguay and Provincia Buenos Aires, some of which agree in every respect with Traver's description of *C. alegre* and some with Navás's material of *C. zonalis*.

Callibaetis zonalis Navás

Callibaetis zonalis **Navás, 1915a: 13.**

Baetis opacus **Navás, 1915a: 12. (syn. nov.).**

Baetis virellus **Navás, 1915b: 119. (syn. nov.).**

Callibaetis vitreus **Navás, 1915b: 121. (syn. nov.).**

Callibaetis sobrius **Navás, 1916: 61. (syn. nov.)**

Callibaetis apertus **Navás, 1917: 190. (syn. nov.)**

Callibaetis vitreus **Navás, 1919: 81 (nec *vitreus* Navás, 1915). (syn. nov.)**

Callibaetis deprensus **Navás, 1922: 59 (syn. nov.).**

Callibaetis amoenus **Navás, 1930a: 131. (syn. nov.).**

I have been unable to locate the type of *C. zonalis*, which was collected in La Plata, March 1913 and preserved in alcohol. However, there are numerous pinned specimens collected at later dates and determined as *C. zonalis* by Navás in all three major collections, distributed as follows: in MZB 4 females from Prov. Buenos Aires, in MLP 1 female from Prov. Buenos Aires. I also have a series of males and females recently collected in Provincia Buenos Aires and Departamento Maldonado, Uruguay.

Apart from the 5 species and one homonym of *Callibaetis* described by Navás and synonymised here with *C. zonalis*, two of his species of *Baetis* also need to be considered. In the same paper in which the description of *C. zonalis* appeared, Navás described *Baetis opacus* from an imperfect female subimago in alcohol from La Plata, iii.13. I was not able to locate the specimen. However, there is a pinned female subimago in MLP determined by Navás as *B. opacus* from Prov. Buenos Aires, no date. It carries a later label with the inscription "*Callibaetis zonalis* Navás, G.F. Edmunds, 1963, synonymy". The fact that the very inadequate description of *B. opacus* has page priority over *C. zonalis* is of secondary importance compared with the well established concept of *C. zonalis* that Navás left us. I therefore agree with Edmunds's conclusion and am treating *B. opacus* as a synonym of *C. zonalis*.

Baetis virellus Navás was also described from Prov. Buenos Aires, no date. A female subimago, labelled Typus, is present in MACN, which may well be the holotype. The specimen is clearly a species of *Callibaetis* with the hind wings stuck down onto the thorax, and it seems likely that Navás's figure was drawn from one of these partly obscured hind wings. The fore wings, the markings on the abdomen and the one remaining leg are typical of *C. zonalis*, and I am treating *B. virellus* as another synonym of this species.

The separation of this species from *C. willineri* has been discussed above. Further study of the species-pair, *zonalis-willineri*, would be desirable. For example, I have a series of males caught swarming at Hurlingham, Prov. Buenos Aires in April, 1984, which shows a highly variable degree of pigmentation of the stigma, ranging from complete absence to most of the apical part of the costal and subcostal areas being lightly pigmented blackish-grey and sometimes overlapping slightly onto the area

posterior to vein R1. The sternal markings on the abdomen are as in the females of *C. zonalis* and I am referring them to this species.

Callibaetis zonatus Navás

Callibaetis zonatus **Navás, 1929a: 224.**

The type of *C. zonatus* is in MZB, with a red Typus label and the provenance given as Alta Gracia (R. Arg.), 17.II.29. The actual year written on the label is probably a lapsus calami since the date of collection in the description is given as 8 and 17.II.27. Another female, dated 8.II.27 Alta Gracia, is in MACN, together with two other specimens from the Cordoba hills caught at a later date. A wing of the co-type is shown in figs. 8,9, and is clearly within the range of variation of *C. guttatus*, with which it is synonymised.

ABSENCE OF CLOEON LEACH FROM SOUTH AMERICA

The transfer of *Cloeon gonzalezi* to *Callibaetis* leaves two taxa, originally placed in *Cloeon*, on the South American list. As shown above, one of these, *Cloeon grisoli* is a nomen nudum applied to a specimen of *Callibaetis*. The position of the other, *Cloeon peterseni* Hubbard, is more problematical. I have not seen the type, but Esben-Petersen's figure of the male forceps of his *Cloeon brunneum* from Mendoza, renamed by Hubbard, strongly suggests that it belongs in some other genus, possibly Pseudocloeon. On these grounds, it seems reasonable to conclude that no species of *Cloeon* is known to occur in South America.

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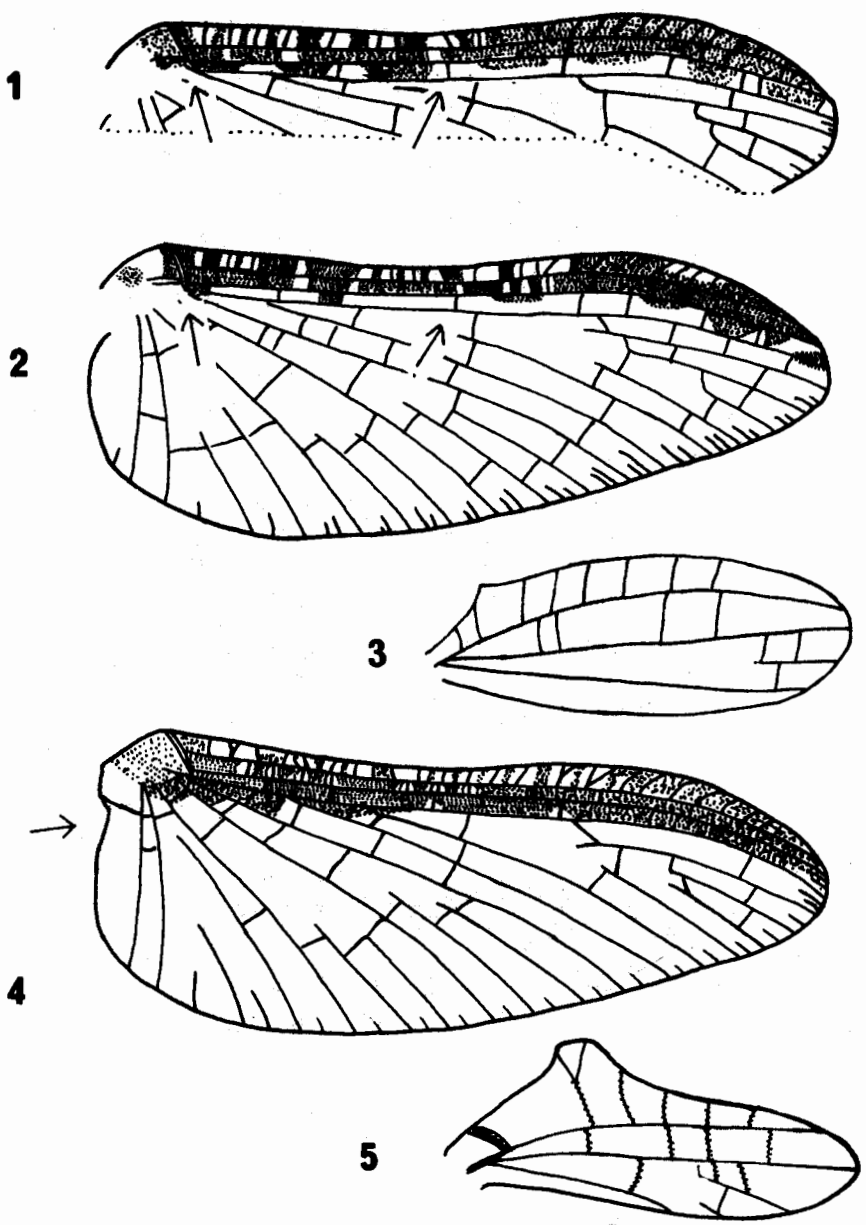
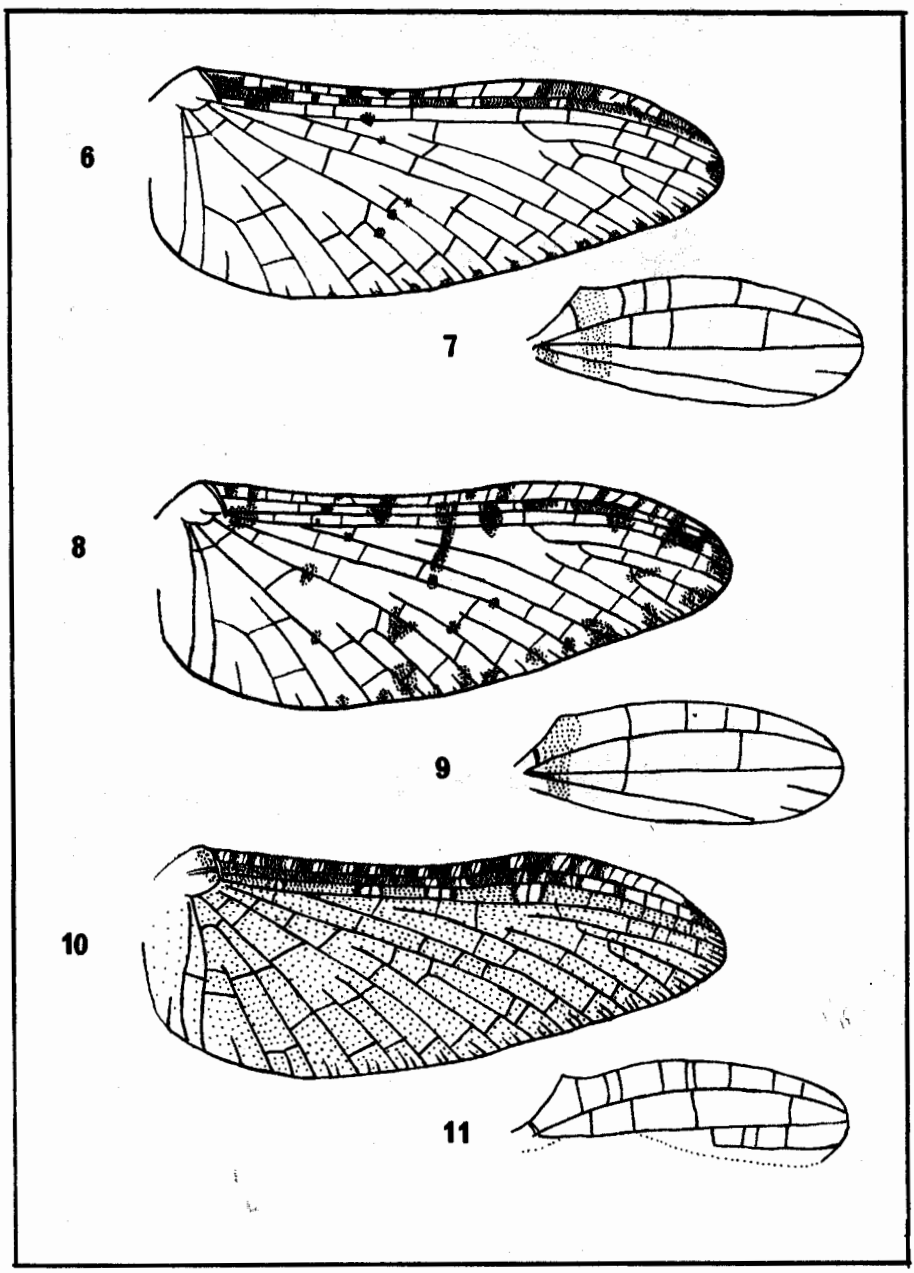
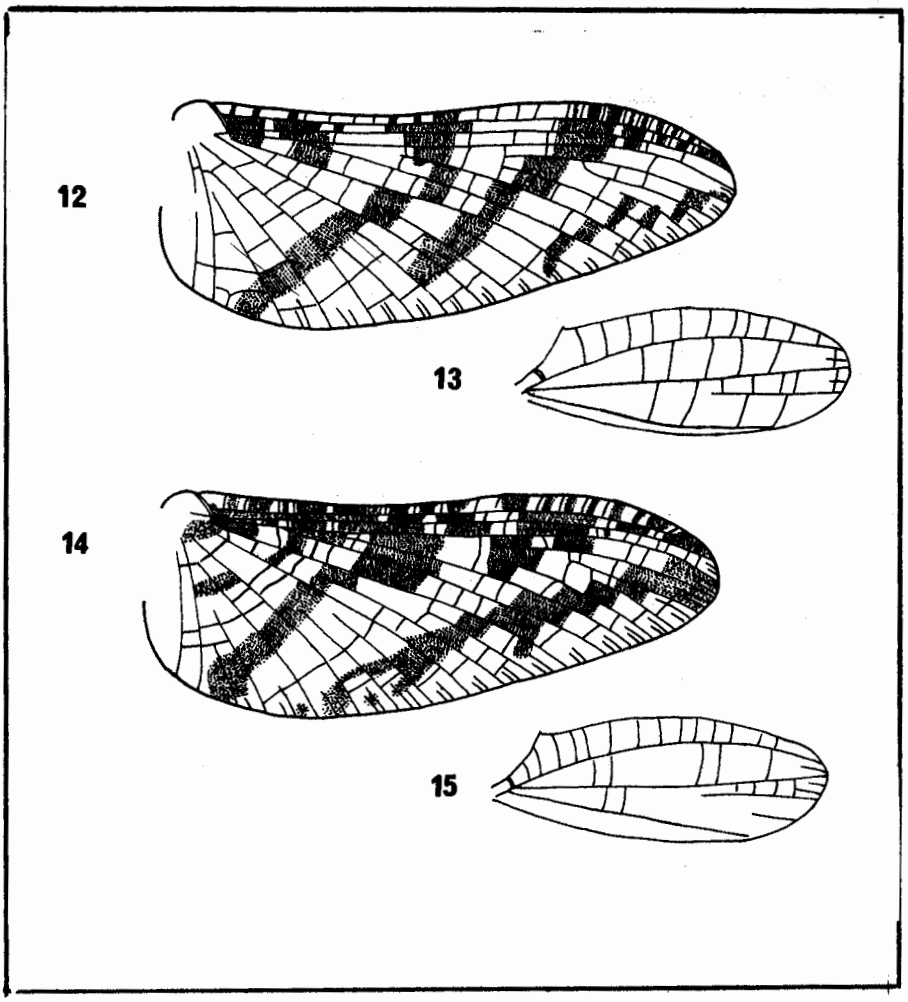


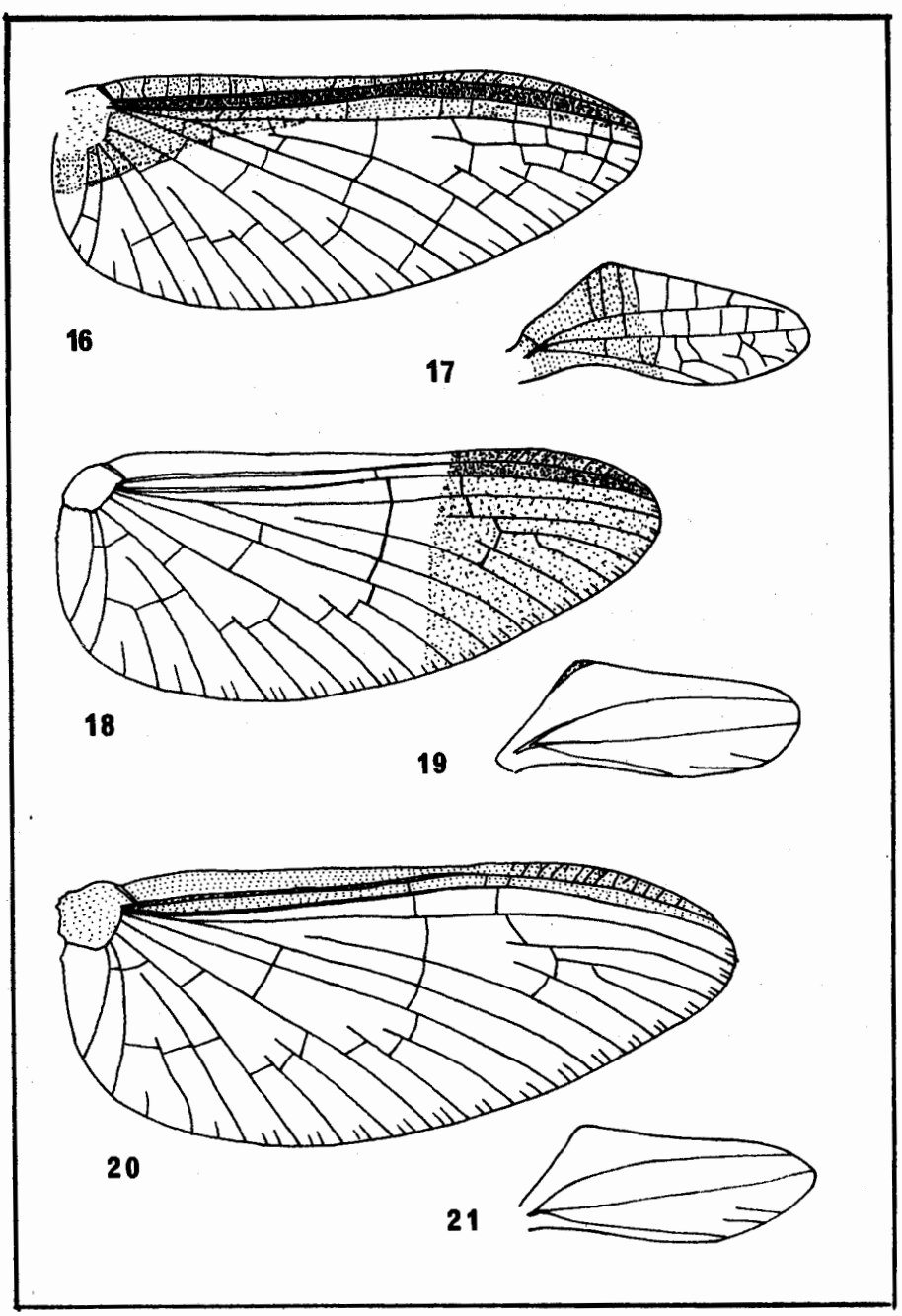
Figs. 1 - 5. Wings of Group I females (in part). 1, *C. willineri* (Uruguay). Arrows indicate basal half of vein R2; 2-3, *C. zonalis* (co-typus); 4-5, *C. radiatus* (paratype).



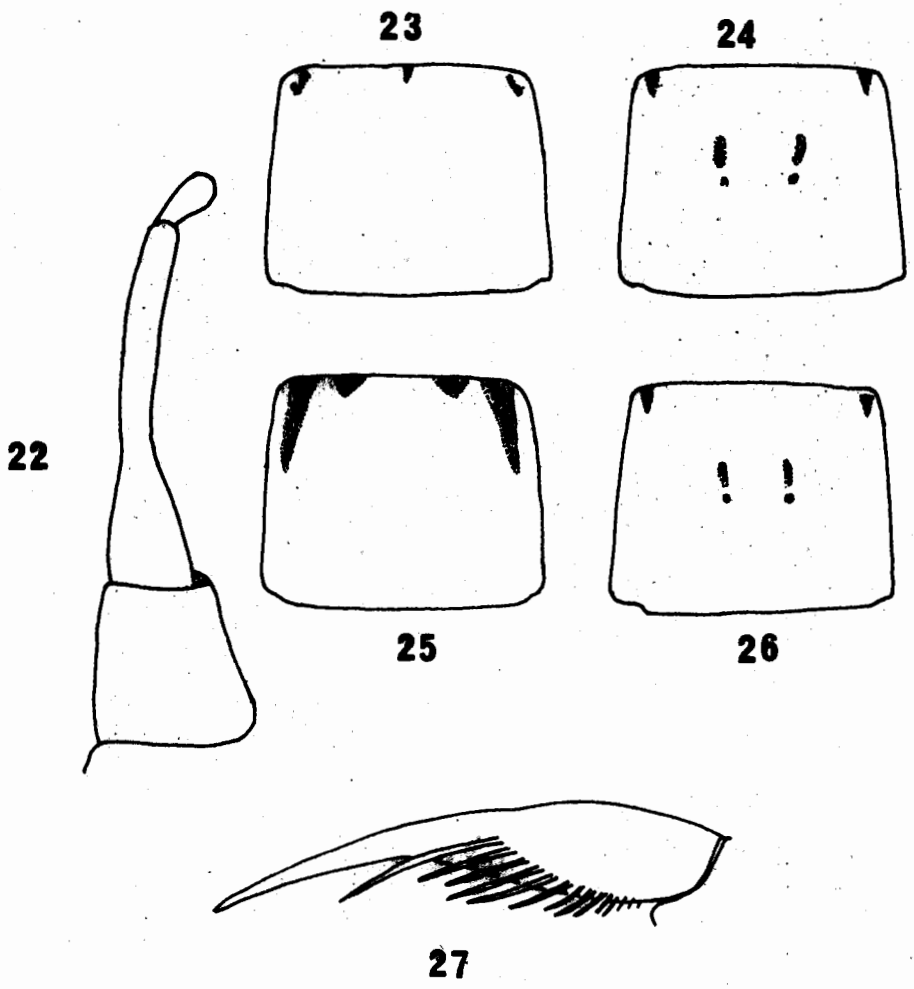
Figs. 6 - 11. Wings of Group II females. 6-7, *C. guttatus* (type). 8-9, *C. guttatus* (type of *C. zonatus*) to show variation; 10-11, *C. jocosus* (co-type of *C. stictogaster*), hind wing partly obscured.



Figs. 12 - 15. Wings of Group III. 12-13, *C. fasciatus* (La Plata, Bruch); 14-15, *C. sellacki* (Prov. B.A. Bruch).



Figs. 16 - 21. Wings of Group I (in part). 16-17, *C. gonzalezi*; 18-19, *C. dominguezi*, male; 20-21, *C. dominguezi*, female.



Figs. 22 - 27. 22, *C. dominguezi*, male forcep limb. 23 - 26. Abdominal sternal markings. 23, *C. willineri* (Uruguay); 24, *C. jocosus* (Type of *stictogaster*); 25, *C. dominguezi*, male, 26, *C. fasciatus* (La Plata, Bruch) 27, *C. gonzalezi* (assumed), tarsal claw of nymph.

pasó su hibernación en el último período ninfal, evitándose así la pérdida de continuidad entre la generación de un año y la del siguiente.

Sería conveniente ampliar estas observaciones y obtener mayor número de datos acerca de este hecho poco conocido.

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