

Excerpt from Canadian Entomologist July, 1931.

THE GENUS *ISONYCHIA* (EPHEMEROPTERA)*

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Owing to their general similarity the species of this genus have been much confused and for some time we have been accumulating material in the hopes of being able to straighten out the nomenclature. With the exception of *intermedius* Eaton from Arizona, which is entirely unknown to me, I find I can now satisfactorily tie down the existing names and incorporate therefore in the present paper the result of my studies.

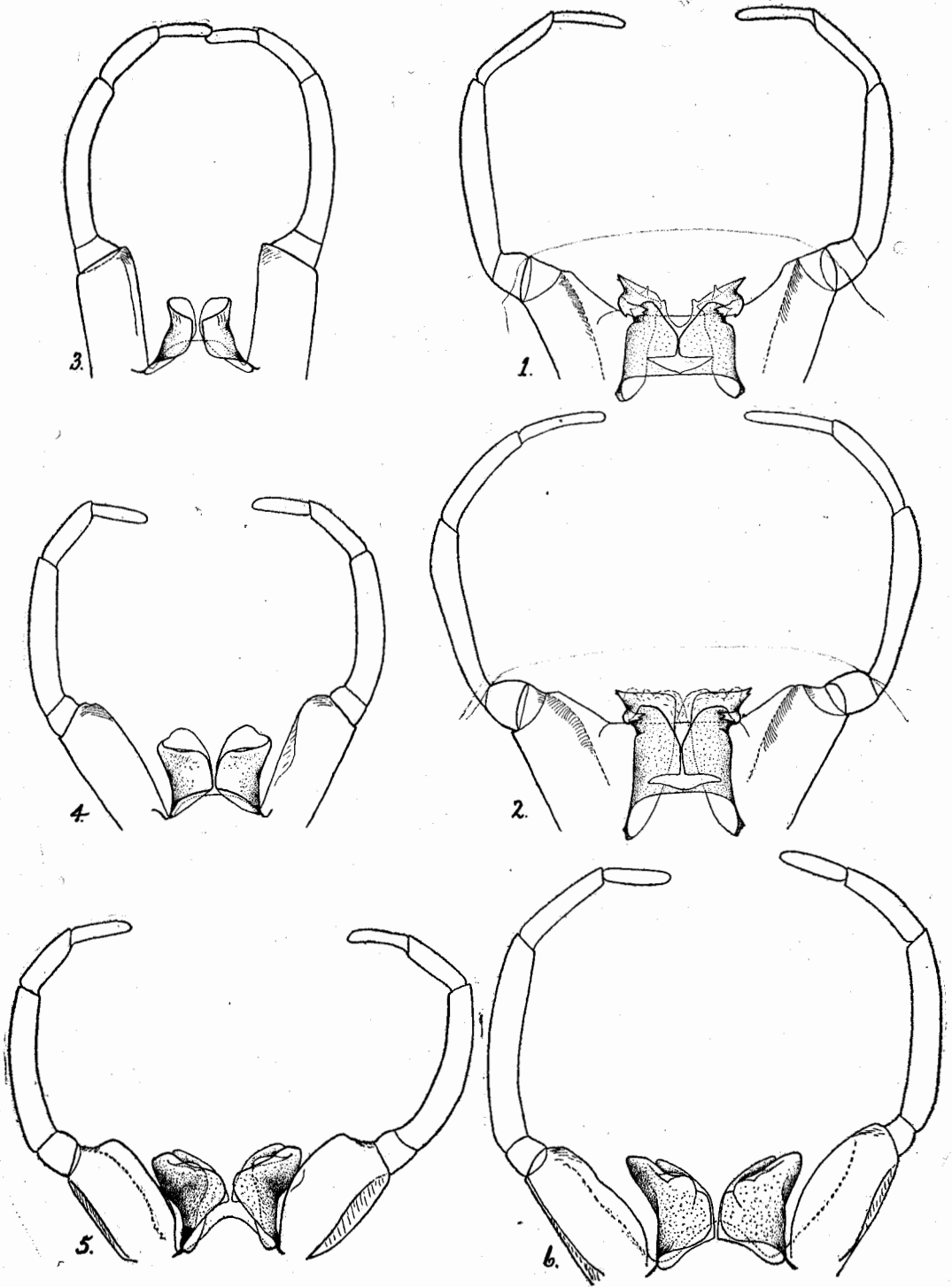
The main centre of distribution for the members of this genus seems to have been the mid-section of the Mississippi Valley region, no fewer than four species occurring in the vicinity of Davenport, Ia.; one of these, *arida* Say, is too rare for an attempt to be made to define its distributional area; a second, *sicca* Walsh, appears to have spread to the south and to the north-west, forming two more or less distinct races; a third, *bicolor* Walker (*albomanicatus* Needh.) extends in the opposite direction over eastern Canada and the United States whilst the fourth, *rufa* n. sp., is confined, as far as our present knowledge goes, to the eastern portion of the Great Plains area, between Kansas and Manitoba.

The species fall into two distinct groups according to the shape of the subgenital plate in the male and may be further separated by noting characters of wing-venation, abdominal color and male genitalia.

KEY TO MALES

1. Subgenital plate shallowly excavated at apex2
 Subgenital plate deeply excavated, leaving lateral arms as long as the width
 of the plate3
2. Crossveins of forewings colorless*arida* Say
 Crossveins of forewings blackish*georgiae* n. sp.
3. Crossveins of forewings colorless4
 Crossveins brown-black or blackish5
4. Abdomen deep piceous in color*bicolor* Wlk.
 Abdomen bright reddish*rufa* n. sp.
5. Crossveins of forewings heavy and black*sicca* var. *manca* Eaton
 Crossveins of forewings thin and brownish6
6. Thorax black-brown, abdomen shiny rufo-piceous*sicca* Walsh
 Thorax ochreous brown, abdomen paler and duller brown
 *sicca* var. *campestris* n. var.

*Contribution from the Division of Systematic Entomology, Entomological Branch. Dept. of Agric., Ottawa.



Male genitalia of (1) *Isonychia arida* Say (2) *I. georgiae* McD. (3) *I. sicca* Wlsh. (4) *I. sicca* var. *manca* Eaton (5) *I. rufa* McD. (6) *I. bicolor* Wlk.

Isonychia arida Say

Baetis arida Say, 1839, Jour. Acad. Nat. Sci. Phil. VIII, 42; LeConte Edit. II, 412; Walsh, 1862, Proc. Acad. Nat. Sci. Phil. II, 370; *id.* 1863, Proc. Ent. Soc. Phil. II, 170.
Chironetes aridus Eaton, 1885, Rev. Mon. Rec. Eph. 206.

This species, evidently described from a female imago, was limited by Walsh and Eaton to a species in which the male subgenital plate has the posterior margin only shallowly excavated (*vide* Eaton, *op. cit.* Pl. XVIII, fig. 33e). In both sexes the veins and crossveins of the wings are pale and the male, at least, shows a series of dull yellowish subtriangular abdominal spots, based on the latero-anterior margin of each segment.

There is considerable doubt in my mind as to whether Walsh's limitation of this species was correct, but there seems nothing to be gained by altering his determination and changing the generally accepted idea of the species. As Eaton's figure of the finer details of the male genitalia is unrecognizable and evidently made from a dried specimen, I offer a fresh figure; the shape of the penes is reminiscent of certain *Heptagenia* species and it might be noted that the apical tubercle, indicated in my drawing by dotted lines, seems to be part of a very fine membrane which projects irregularly from the apex of the tubular penes and is not a definite chitinous spine.

The species is apparently rather rare and I have before me only a single pair, captured in Dane Co., Wisconsin by Professor W. S. Marshall.

Isonychia georgiae n. sp.

Fig. 2

Very similar to *arida* but most easily distinguished by the fact that the veins and crossveins of both wings are very decidedly blackish. The thorax is deep brown with some blackish shading anteriorly. The abdomen is deep ruddy brown, somewhat paler and brighter posteriorly, and the dorsum shows traces of black, broken, longitudinal, subdorsal and lateral lines, most distinct on the posterior segments. The forelegs are smoky and the two hind pairs of legs pale yellowish. The size is that of *arida*.

Holotype—♂, Rabun Co., Ga., July, 1910, (W. T. Davis); No. 3250 in the Canadian National Collection, Ottawa.

The type of genitalia is distinctly that of *arida* but the minor differences may be readily noted on reference to the figure.

Isonychia sicca Walsh

Fig. 3

Baetis sicca Walsh, 1862, Proc. Acad. Nat. Sci. Phil., 371; 1863, Proc. Ent. Soc. Phil., II, 170, *Chironetes siccus* Eaton, 1885, Rev. Mon., Rec. Eph., 208 (partim).

Sicca was stated to differ from *arida* in the *shorter* forelegs, *fuscous* wing venation and presence of dark intersegmental rings on at least the basal joints of the setae. Eaton amplified Walsh's description by giving a figure of the male genitalia but it seems probably that he confused two closely allied species and that his figure (Pl. XVIII, fig. 33d) should be referred to the species described later on by Needham as *albomanicata*.

From material collected by Mr. G. S. Walley at Davenport and Pleasant Valley, Iowa, (July 4, 5), localities situated directly across the Mississippi river from Rock Island, I have picked out a series of 3 ♂, 6 ♀ which agrees well with Walsh's characterization; I have further 1 ♂, 5 ♀ from Vincennes, Indiana (June 28) and 2 ♀ from Fulton, Ill. (July 20). Quite characteristic for

the species is the short foreleg in both sexes, the allied species mentioned above, and which occurs together with *sicca* at Pleasant Valley, having as long a foreleg as *arida* and also a pale wing venation. The veins of *sicca* are fine, especially the crossveins but, except for a few in the apical area of primaries, distinctly dark-tinged. It might further be noted that in the male the ventral surface of the abdomen is paler and ruddier than the dorsal one which is piceous, slightly paler and ruddier along the lateral flange, and generally with traces of longitudinal dark dashes in the spiracular area, most distinct on posterior segments. The two posterior pairs of legs are rather a clear light yellow with at times ruddy tinges, and the fore tarsi are smoky and with a distinct whitish area on the basal two-thirds of the first joint. The genitalia (fig. 3) are distinctive; the subgenital plate, in contradistinction to that of *arida*, being deeply emarginate and the penes short and rather truncate apically. In the female the crossveins of the forewing are slightly heavier and darker than in the male, notably in the apical area; the abdomen is ruddier but still shows traces of the dark lateral dashes, the legs are very similar in both color and length to those of the male and the dark or ruddy setal rings are slightly better defined. The head is light yellowish, variably shaded with light brown, a subtriangular ruddy (not black) patch is situated next each eye, adjacent to the posterior ocelli and in each posterolateral angle is a small blackish spot.

***Isonychia sicca* var. *manca* Eaton**

Isonychia manca Eaton 1871, Trans. Ent. Soc. Lond. 134 (♀ nec ♂)

Chirotonetes manca Eaton 1885, Rev. Mon. Rec. Eph. 206.

The name was based on a female specimen from Texas, collected by Bel-fragre, probably in Bosque Co. I have matched the description very well with females from Lawrence, Kan., part of a series of both sexes collected in July and August by Mrs. L. W. Brown. On account of the similarity of the male genitalia I am inclined to consider *manca* as merely a race of *sicca*, inhabiting the southern portion of the Great Plains area.

As compared with *sicca* the males, heretofore undescribed, are characterized by a more decided ruddy tinge to the abdomen; the forelegs are much the same in color but slightly longer, due to a lengthening of the tarsal joints, the entire tarsus being generally fully equal in length to the tibia; the crossveins of the forewings are decidedly thicker and blacker in color and are generally rather more numerous, the apical region, however, as in *sicca*, showing pale crossveins. In the genitalia the penes are stouter and generally longer, extending more than halfway to the apex of the lateral arm of the subgenital plate, the apical area is also slightly differently shaped, as a reference to the figure will show; these differences however, do not seem to be entirely constant.

The female shows the same venational characteristics as the male, the crossveins, however, in the apical region being blackish. The head generally (but not constantly) has the double median brown stripe mentioned by Eaton; the dark triangular patch in the corner between the eye and the posterior ocellus is deeper in color than in *sicca*, being blackish and not ruddy; the posterior dark spot is very small and the width of the occiput is somewhat greater. The fore-tarsi, on the whole, are rather paler than those of *sicca*. The size is somewhat larger.

***Isonychia sicca* var. *campestris* n. var.**

I propose the above name for the form common in southern Alberta. As compared with typical *sicca* the males differ in their generally paler color; the thorax is light brown (not the deep rufo-piceous of *sicca*) shaded somewhat with ruddy and black-brown on the posterior prolongation; the abdomen dorsally is rather dull brown, with a slight rufous tinge, shaded laterally with deeper brown, giving the appearance of poorly defined dark patches, below which the lateral edge appears quite pale brown; ventrally light brown, somewhat paler than the dorsum. Setae pale whitish-yellow, finely ringed with red-brown on basal segments. Foreleg entirely rufo-piceous, the tarsi somewhat paler; two hinder pairs of legs a rather dull yellow with slight rufous shading on the femora. Wings as in *sicca*.

The female is in general similar to the male; the head is pale yellowish with traces (in some absent, in others well-defined) of a geminate median brown stripe; the triangular patch in the angle between eye and ocellus is well-developed and black-brown in color but the black lateral spots on the occiput are wanting. The subanal plate is pale yellowish and shaped as in *sicca*.

Holotype—♂, Medicine Hat, Alta., Aug. 6, 1929, (J. H. Pepper); No. 3252 in the Canadian National Collection, Ottawa.

Allotype—♀, same locality, Aug. 9.

Paratypes—1 ♂, 1 ♀, same data as holotype and allotype; 4 ♂, 3 ♀, same locality, Aug. 22-24, 1930; 1 ♂, Lethbridge, Alta., Aug. 15, 1928. (J. McDunnough); 8 ♀, Lethbridge, Alta., Aug. 1, 4, 5, 13, 1929, (Pepper); 1 ♂, 3 ♀, Milk River, Alta., Aug. 23, 1929, (Pepper).

The male genitalia show no appreciable difference from those of *sicca*, the length of the penes varying considerably. The form extends eastward into Saskatchewan (Saskatoon, Aug. 18, 26) and Manitoba (Aweme, July 17, Aug. 25; Treesbank, July 18) and in this latter province can easily be confused with *rufa*, especially in the female sex; the darker venation in *campestris* is the most easily noted character, and the lack of the lateral black spot on the female occiput is also useful as a means of separation.

***Isonychia bicolor* Wlk.**

Fig. 6

Palingenia bicolor Walker, 1853, List Neurop. Ins. Brit. Mus., III, 552.

Siphylurus bicolor Eaton, 1885, Rev. Mon. Rec. Eph., 221.

Chirotenetes albomanicatus Needham, 1905, Bull. 86, N. Y. Sta. Mus., 31.

This is the common species of the Eastern States and Ontario and Quebec. Walker's original description was based on a female subimago from St. Martin's Falls, Albany River, Ont. and the identification might be open to some doubt were it not for the fact that there is apparently only a single species occurring in eastern Canada. It is extremely common in July and August in the Ottawa and St. Lawrence valleys, extending southward into the United States through southwestern Quebec and the Niagara Peninsula, Needham's *albomanicatus* being based on Ithaca, N. Y. specimens. My material shows that it ranges southward down the Appalachians to Tennessee (Knoxville) and westward to northern Illinois (Kankakee, Oakwood) and Iowa (Davenport); it is quite probably that Walsh confused it with *sicca*, and Eaton's figure of the

genitalia under this name (Pl. XVIII, fig. 33d) would certainly seem to belong here.

In localities where the two species occur together *bicolor* is best separated in the male sex by the entirely pale wing-venation and the longer fore-leg; the color of the abdomen is rufo-piceous (rufous in alcohol specimens) with the posterior margins of segments and the lateral edges marked with black, and the ventral surface is as deeply colored as the dorsal one. The genitalia show considerable differences; the penes are longer and more pointed apically and show on the inner side of the dorso-apical margin a chitinous flap; slides made from specimens from Illinois and Iowa show a slight difference in shape from those based on New York and Ontario material, the apices of the penes being less bent outward in the former specimens and the organ itself somewhat longer; I can find no differences in the adults and believe that these variations are of no specific value. In the female the crossveins are slightly tinted with brownish, especially in the apical area of the forewings. The head is often considerably suffused with brown, the angle between the eye and the posterior ocellus is filled in with ruddy brown and the black spots in the corners of the occiput are well-developed. The subanal plate is considerably broader and more rectangular than in *sicca* and the apices are bent down and under. The size is generally larger than that of typical *sicca* and close to that of *manca*.

Isonychia rufa n. sp.

Fig. 5

Male.—Eyes (living) ruddy chestnut; head light brown with the bases of ocelli black-ringed. Thorax ruddy brown. Abdomen dorsally bright reddish, paler and duller ventrally; no piceous shading except slightly along posterior margins of segments; forceps pale ruddy brown. Setae whitish-yellow, with traces of ruddy rings between the basal segments. Forelegs with coxae and femora deep ruddy, tibiae piceous and tarsi dull whitish-yellow with the apical portion of each joint shaded with smoky; the tarsus as long as the tibia and the whole leg slightly longer than in *sicca*. Mid and hindlegs rather a deep yellowish. Wings hyaline with pale venation. Length of body and forewing, 10 mm.

Female.—Very similar to the male in coloration. Head pale yellow with brown shading around the bases of the ocelli and in the angles between the eyes and the ocelli; a small lateral black spot on the occiput. Wings with at times a faint brownish tinge to the crossveins. Subanal plate as in *bicolor*.

Holotype—♂, Davenport, Ia., July 7, (G. S. Walley); No. 3251 in the Canadian National Collection, Ottawa.

Allotype—♀, Lawrence, Douglas Co., Kansas, May 5, (W. J. Brown).

Paratypes—1 ♂, Pleasant Valley, Ia., July 4, (Walley); 4 ♂, 3 ♀, Douglas Co., Kansas, June 12-16, (W. J. Brown); 8 ♂, Lawrence, Kansas, July-Aug., (Mrs. L. W. Brown).

The bright reddish color of the abdomen in dried specimens easily separates *rufa* from *sicca* and *bicolor*; the colorless venation separates it from *sicca* and allies it with *bicolor*, with which species it also shows considerable similarity in genitalia, the lateral arms, however, of the subgenital plate being shorter and chunkier. It would appear to replace *bicolor* in the Great Plains region

but in certain sections (Davenport, Ia.) occurs along with it, and for this reason I treat the species as a good one and not as a race of *bicolor*. Judging by the dates it would appear to have two generations at Lawrence, Kan. where it swarms to light along with *manca*; it ranges northward into Manitoba and I have a series of specimens before me from Treesbank, July 12, which are only slightly duller in color than my Kansas ones.