ART. 15.—*A Study of the Venation of the New Zealand Species of Micropterygidae.*

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THE Micropterygidae are represented in New Zealand by fourteen species. These are all quite small forms, the largest having a wing-expanse of about 12 mm. and the smallest barely reaching 6 mm. As the species are not of very active habits and frequent low herbage, it is probable that many more forms await discovery. The family being one of exceptional interest, and having a very important bearing on the origin of the Lepidoptera, collectors would do well to pay particular attention to the group. Our present knowledge points to the Hepaticae (liverworts) as being the food-plants of the larvae, and the imagines should be looked for near these plants; sweeping the low herbage in the vicinity is the most likely method of making captures.

At present the New Zealand Micropterygidae are placed in two genera—*Sabatinca* Walker, 1863, type *incongruella* Walk.; and *Micropardalis* Meyrick, 1912, type *doroxena* Meyr.* The former genus contains thirteen of the species, the latter being monotypic. On the venation alone, however, *Micropardalis* can hardly be sustained, Meyrick, who had but a single specimen, having fallen into error regarding the most important character, the condition of R_1 in the hindwing. Possibly, when the other structural characters are taken into consideration, the genus may prove a valid one, in which case systematic value may be placed on the point of origin of R_{4-5} in the forewing, which in *doroxena* alone is sessile on the cell.

Treating, then, for the purposes of this paper, the whole of the species as belonging to one genus, we find that this genus can be divided into three sections, the differentiating character being the condition of R_1 in the hindwing. In all the species the upper half or third of this vein has been captured by Sc_2. In two of the species, *S. lucilia* Clarke and *S. calliarcha* Meyr., the free basal portion of R_1 is present unaltered (fig. 1); in two others, *S. rosicoma* Meyr. and *S. zonodoxa* Meyr., all trace of the free part of R_1 has been lost (fig. 2); in the remaining ten forms the apical portion of the free part of R_1 occurs as a stump or "recurrent" vein projecting from Sc_2 (fig. 3). This recurrent piece varies in length in the different species, but never extends farther back than just basad of *rf'*. In *S. chrysargyra* Meyr. (fig. 4) the free end of the recurrent vein curves downwards and is connected with the radial sector by a weak cross-vein. This appears to be a secondary development confined to the one species, as a

* I do not include the genus *Mnesarchaea* Meyr., as I think that Tillyard (*Proc. Linn. Soc. N.S.W.*, vol. 44, p. 118, 1910) has shown sufficient reason to justify its removal from the family.

weak cross-vein connects Rs and Sc at about $\frac{1}{3}$, probably marking the point at which R_1 originally left the radial sector. This latter cross-vein occurs in several of the species.

When we come to examine the venation in detail we find that the condition of R_1 is the only factor that can be used to separate the three

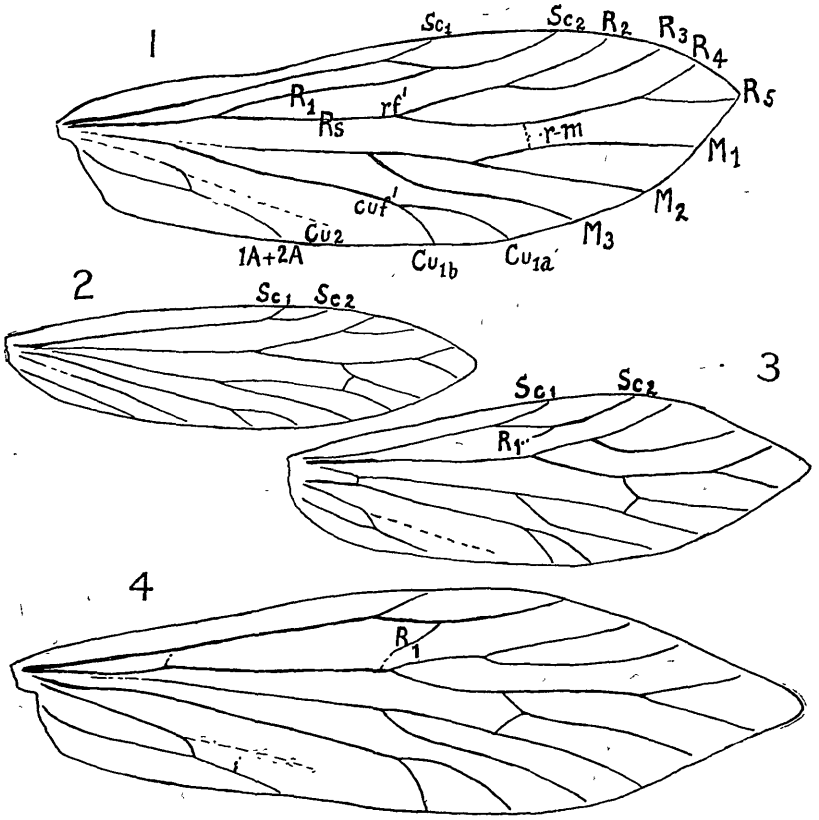

FIG. 1.—Hindwing of *Sabatinca lucilia* Clarke. (Lettering: 1A, 2A, first and second anals; Cu_2, second cubitus; Cu_{1a} and Cu_{1b}, branches of the first cubitus; *cuf'*, secondary cubital fork; M_1, M_2, M_3, primary branches of the media; R_1, primary branch of the radius; R_{2-3}, R_{4-5}, secondary branches of the radial sector; Rs, radial sector; *r-m*, radio-median cross-vein: *rf'*, secondary radial fork; Sc_1, Sc_2, branches of the subcosta.)

FIG. 2.—Hindwing of *Sabatinca rosicoma* Meyr. Note entire absence of R_1 as a free vein. (For lettering see fig. 1.)

FIG. 3.—Hindwing of *Sabatinca incongruella* Walk., to show "recurrent vein," R_1. (For lettering see fig. 1.)

FIG. 4.—Hindwing of *Sabatinca chrysargyra* (Meyr.). Note the joining-up of the stump of R_1 to the radial sector by formation of a cross-vein. (For lettering see fig. 1.)

sections. A good deal of variation occurs between the different species, but nothing that can be said to be definitely correlated with the state of development of the basal part of R_1 in the hindwing.

I now give a list of the species, and a detailed account of the venation of the genus, with figures to illustrate certain specific variations.

LIST OF SPECIES.

Sabatinca incongruella Walk., *Cat. Brit. Mus.*, vol. 28, p. 511, 1863; *Palaeomicra chalcophanes* Meyr., *Trans. N.Z. Inst.*, vol. 18, p. 182, 1886.
—— *chrysargyra* (Meyr.), *Trans. N.Z. Inst.*, vol. 18, p. 182, 1886.
—— *zonodoxa* (Meyr.), *Trans. N.Z. Inst.*, vol. 20, p. 91, 1888.
Micropardalis doroxena (Meyr.), *Trans. N.Z. Inst.*, vol. 20, p. 92, 1888.
Sabatinca caustica Meyr., *Trans. N.Z. Inst.*, vol. 44, p. 124, 1912.
—— *calliarcha* Meyr., *Trans. N.Z. Inst.*, vol. 44, p. 124, 1912.
—— *quadrijuga* Meyr., *Trans. N.Z. Inst.*, vol. 44, p. 126, 1912.
—— *rosicoma* Meyr., *Trans. N.Z. Inst.*, vol. 46, p. 118, 1914.
—— *aurella* Huds., *Ent. Mo. Mag.*, vol. 4, p. 62, 1918.
—— *barbarica* Philp., *Trans. N.Z. Inst.*, vol. 50, p. 132, 1918.
—— *eodora* Meyr., *Trans. N.Z. Inst.*, vol. 50, p. 134, 1918.
—— *lucilia* Clarke, *Trans. N.Z. Inst.*, vol. 52, p. 35, 1920.
—— *ianthina* Philp., *Trans. N.Z. Inst.*, vol. 53, p. 342, 1921.
—— *demissa* Philp., this volume, p. 154.

VENATIONAL VARIATION.

The Forewing.

Humeral Veinlet (*hm*).—The humeral veinlet varies greatly in strength. Its condition has some reference to the shape of the wing at the base; where the costa is deeply hollowed out, or the wing narrowed in some other way, as in *Sabatinca calliorcha*, *S. chrysargyra* (fig. 5), or *S. barbarica*, *hm* has almost disappeared.

Subcostal Vein (Sc).—The upper fork (Sc_1) is well developed in all the species.

Subcosto-radial Cross-vein (Sc-r).—This cross-vein is present in *lucilia*, *ianthina*, *doroxena*, *calliarcha*, *caustica*, *quadrijuga*, *eodora*, and *chrysargyra*. In the last three it is usually very weak. It is absent in *incongruella*, *aurella* (a trace sometimes), *barbarica*, *demissa*, *rosicoma*, and *zonodoxa*. In the last two there is not even a bend in the veins to indicate where the cross-vein originally joined.

Radius (R).—The radius forks into R_{1a} and R_{1b} before $\frac{1}{2}$ in all species; both branches are strong, well-developed veins.

Radial Sector (Rs).—The radial sector is twice dichotomically forked, giving rise to the branches R_2 to R_5. In *lucilia* the secondary radial fork is situated farther basad than in any other species, the next farthest being *calliarcha*. The forking of R_{2-3} is fairly uniform as to position in all the species, but that of R_{4-5} varies considerably. In *demissa*, *rosicoma* (fig. 6), *zonodoxa*, and *caustica* R_{4-5} is short-stalked; in *eodora*, *barbarica*, *calliarcha*, and *incongruella* the stalking is medium (about halfway); in *chrysargyra*, *aurella*, and *quadrijuga* the vein is long-stalked; in *lucilia* and *ianthina* the branches are connate in origin, while in *doroxena* fig. (7) the forking is basad of the discocellular cross-veins—that is, the branches are sessile on the cell. The branching of R_{4-5} is in general correlated with the breadth of the apical portion of the wing, those species in which the wing is narrowest having the shortest forks.

Fourth Median Vein (M_4).—M_4 usually rises from M_3 a little distad of *mf'*; it connects with Cu_1 at the forking of the latter so that in some cases its apex is farther distad than its base. This arrangement is most noticeable in *lucilia* and *calliarcha*. In *rosicoma* and *zonodoxa* the point

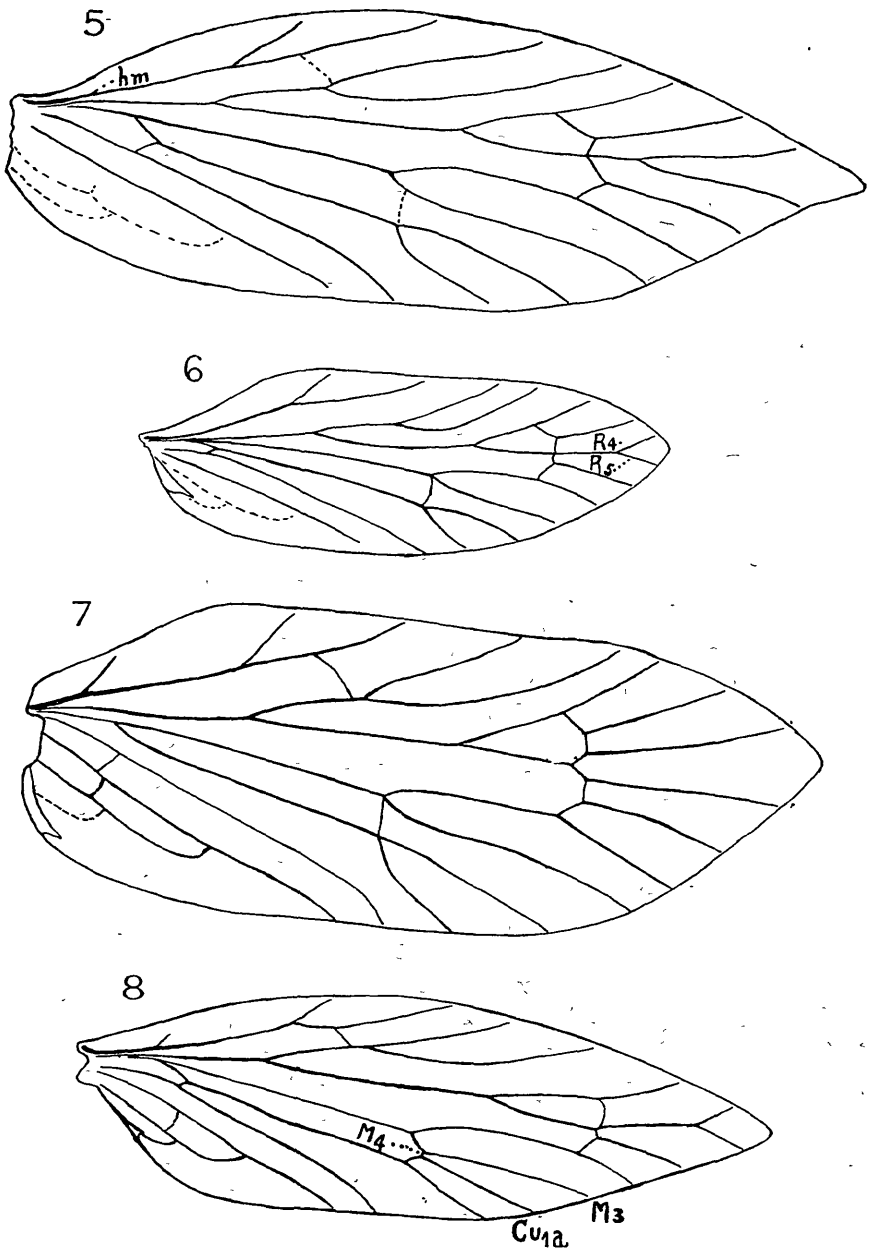

FIG. 5.—Forewing of *Sabatinca chrysargyra* (Meyr.). Note reduction of *hm.* (For lettering see fig. 9.)
FIG. 6.—Forewing of *Sabatinca rosicoma* Meyr. (For lettering see fig. 9.)
FIG. 7.—Forewing of *Micropardalis doroxena* (Meyr.). Note origin of R_{4-5}. (For lettering see fig. 9.)
FIG. 8.—Forewing of *Sabatinca caustica* Meyr., to show reduction of M_4.

of origin of M_4 is *mf'*. In *caustica* (fig. 8) M_4 is very short, rising well along M_3 and connecting almost at once with Cu_{1b}, which bends strongly towards the former vein. A very slight further reduction of M_4 would mean its total disappearance, resulting in the connection of M_4 and Cu_{1b} at the point.

Cubito-median Y-Vein.—In several species the cubito-median Y-vein is more or less obsolete. It is fairly well developed in *lucilia, calliarcha, doroxena, chrysargyra,* and *aurella*—that is, in those forms in which the

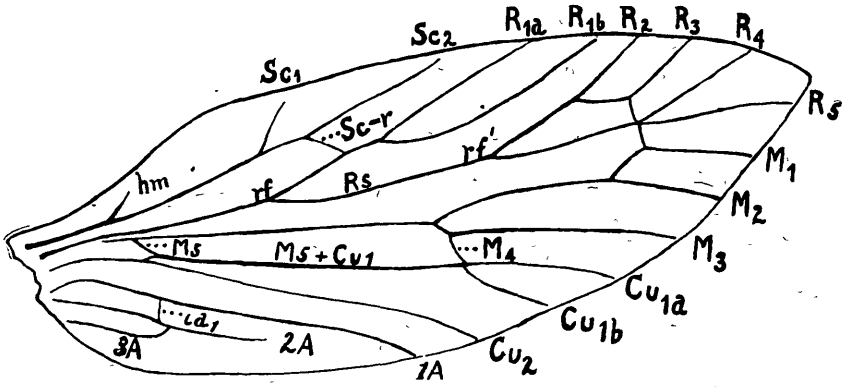

FIG. 9.—Forewing of *Sabatinca ianthina* Philp. (Lettering: 1A, 2A, 3A, first, second, and third anals; Cu_1, Cu_2, primary branches of the cubitus: Cu_{1a}, Cu_{1b}, branches of Cu_1; *hm*, humeral veinlet; ia_1, first inter-anal cross-vein; M_{1-5}, primary branches of the media; Rs, radial sector; *rf*, primary radial fork; *rf'*, secondary radial fork; R_{1a}, R_{1b}, branches of R_1; R_{2-3}, R_{4-5}, branches of the radial sector Sc_1, Sc_2, branches of the subcosta; *sc-r*, subcosto-radial cross-vein.)

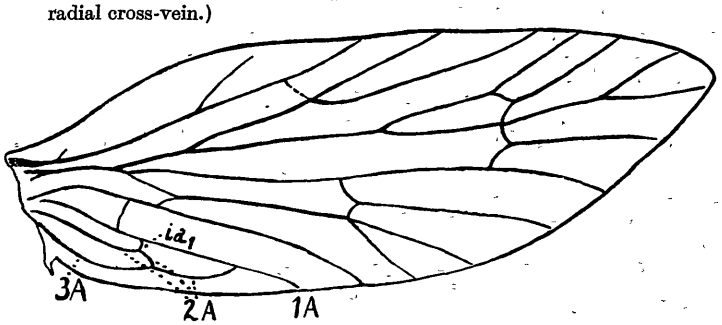

FIG. 10.—Forewing of *Sabatinca calliarcha* Meyr., to show modification of the anals. (For lettering see fig. 9.)

wing is broader basally—but in the narrower-winged species it has almost disappeared. The upper branch (M_5) is always the longer and more prominent of the two.

Cubito-anal Cross-vein (Cu-a).—This cross-vein is present in *lucilia, calliarcha, doroxena, barbarica, ianthina, rosicoma, incongruella,* and *demissa,* though very weak in the last five; it is absent in *zonodoxa, quadrijuga, eodora, caustica, chrysargyra* (a trace), and *aurella.* Its presence or absence does not seem to be of any significance, as it is not correlated with any other structure.

First Inter-anal Cross-vein (ia_1).—All the species have this cross-vein, except *demissa, barbarica, rosicoma,* and *zonodoxa.* Its absence is accompanied by a weakening of the anal veins.

Anal Veins (1A, 2A, *and* 3A).—The arrangement of the anal veins is very peculiar, and varies little throughout the genus. At about two-thirds of its length 2A curves sharply upwards and joins 1A, 3A following a similar course in relation to 2A. In one species, however, *ianthina* (fig. 9), 2A does not join 1A or curve towards it. In *calliarcha* (fig. 10) 2A bends towards 1A at *ia,* and from thence sharply downwards again, thus giving an unusual appearance to what is essentially the same structure. In some of the species the anal veins are very weakly chitinized, and can only be traced with difficulty.

The Hindwing.

Subcostal Vein (Sc).—Sc forks into Sc_1 and Sc_2 in all of the species. In a few of the forms an interesting feature is present in connection with the stalk of the vein. In *doroxena* this appears to consist of two veins lying closely alongside each other, but not fused, the condition being observable from the normal forking to near the base—that is, for at least four-fifths of the stalk. In *calliarcha* the division can be traced nearly to *rf,* and the vein is of double width for some distance basad of this. In *lucilia* the double nature of the vein is obscure near the normal forking, but becomes more pronounced farther basad, while in *ianthina* the division is apparent for about one-third of the apical portion.

The basal dichotomy of Sc is not known in any living insect, but Tillyard has shown (*Proc. Linn. Soc. N.S.W.*, vol. 44, p. 548, 1919) that in the fossil *Archipanorpa* (order Protomecoptera), though the basal part of the wing is missing, the apical portions of Sc are in such a position as to point to a junction far basad, while in *Aristopsyche* (order Paratrichoptera) the actual basal fork is observable. It is not, however, claimed that in this apparent double vein in the foregoing species we have an indication of the persistence of so remote an ancestral character as the basal forking of the subcostal vein. Dr. Tillyard, who has seen my preparations, suggests the following explanation: "The double formation is a specialization of the imaginal venation following upon an exceptionally strong splitting-back of the precedent subcostal trachea in the pupal wing. It is well known that in the order Lepidoptera the wing-tracheae tend to split back into separate tracheae running alongside one another to points far basad from the normal points of forking of the vein. If two such tracheae became slightly more separated, the superimposed chitinization at metamorphosis would produce a double vein in the imago. This seems to be what has actually happened in the case here under discussion."

Radius (R).—As R_1 has been fully dealt with in the earlier part of the paper, the details need not be repeated here. The radial sector is twice dichotomically forked as in the forewing, but there is greater variation in the length of the stalk, particularly in regard to R_4 and R_5. In *doroxena* (fig. 11) R_4 and R_5 are connate; in *aurella* and *ianthina* they are short-stalked; in *barbarica, quadrijuga, incongruella, eodora,* and *zonodoxa* the forking is from about half-way; while in *rosicoma, lucilia, calliarcha, chrysargyra, demissa* (fig. 12), and *caustica* the stalk is long. R_2 and R_3 are more uniform in the length of stalk, but in the only specimen of *caustica* examined R_3 was absent; quite possibly, however, this was merely an individual variation.

Median Veins (M_{1-4}).—The secondary median fork (*mf'*) is basad to the secondary radial fork (*rf'*) in *incongruella, lucilia, caustica, barbarica, rosicoma,* and *zonodoxa*; in *calliarcha mf'* is distad to *rf'*, and in all the other forms the position of these forks is about equal. The relative position of the forks seems to be of little importance, as, if insisted on, it would divide such closely related forms as *lucilia* and *calliarcha.*

There is no trace of the fourth median vein in any of the species.

First Cubital Vein (Cu_1).—In *doroxena* Cu_1 is more remote from M_3 than in any other species: it may be noted that *doroxena* is the broadest-winged form. There is no cross-vein between Cu_{1a} and M_3 in any of the species.

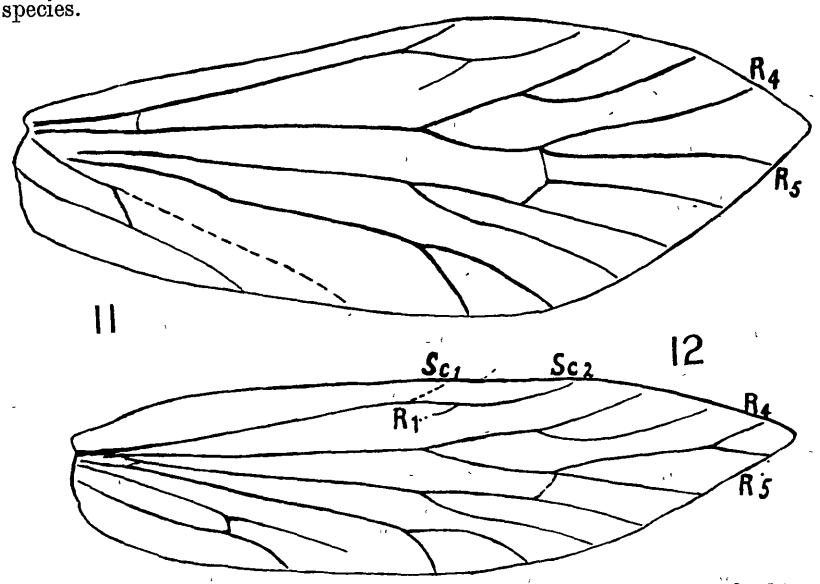

FIG. 11.—Hindwing of *Micropardalis doroxena* (Meyr.). (For lettering see fig. 1.)
FIG. 12.—Hindwing of *Sabatinca demissa* Philp. (For lettering see fig. 1.)

Second Cubital (Cu_2), *and Anal Veins* (1A, 2A *and* 3A).—Cu_2 is captured by 1A for about half its length, at which point it bends downwards and joins 2A, Cu_2 continuing alone as a very weak vein. This condition occurs in all the species except *rosicoma* and *zonodoxa,* in which forms the anal are very weak and 1A does not leave Cu_2 to connect with 2A.

In conclusion, I have pleasure in expressing my gratitude to Mr. G. V. Hudson, F.E.S., F.N.Z.Inst., and Mr. Charles E. Clarke, F.E.S., for specimens of some of the more rare forms of the genus, without the opportunity of examining which my paper must have lacked completeness. Mr. Clarke kindly supplied me with several specimens of *rosicoma,* and also with a pair of his *lucilia,* a form which I think must be regarded as the most primitive in the genus. To Mr. Hudson's generosity I am indebted for an example of *zonodoxa,* the gift being all the more appreciated as the specimen was one of the only two examples of this form in New Zealand collections. To Dr. Tillyard, Chief of the Biological Department of the Cawthron Institute, I am under a deep obligation for much valuable advice. To all these gentlemen I desire to express my best thanks.