VII. *On the genus* Acentropus. By J. W. Dunning, M.A., F.L.S., &c.

[Read 4th March, 1872.]

I have to announce the capture of *Acentropus* almost in the heart of London, about a furlong from the Regent's Park canal. Between nine and ten o'clock one evening, in the latter half of July, 1871, an insect attracted my attention, chiefly by the peculiarity of its flight round the lamp near which I was sitting; in colour and general appearance it was insignificant enough, and might have been a small *Crambus;* but it had not the weak and vacillating motion of a *Crambus,* for it flew with decision and in circles, or rather semi-circles, alighting constantly on the table for a moment, then flitting off to perform another round. When it sat for an instant, the horizontal and deltoid pose of the wings, and an indescribable sprawl of the legs, reminded me of *Hydrocampa.* I had not recognized the insect as *Acentropus,* and it was only on the following morning, when I had killed the specimen, that I found out what it really was. But the living insect was certainly to my eye a moth, and it produced upon my mind the impression of a Cramboid *Hydrocampa.*

In 1791, Olivier gave a short description of what is supposed to be our insect; he placed it in his third section of the Order Neuroptera, and called it *Phryganea nivea;* at the same time he remarked, that the *Phryganeæ* form a link between the *Phalænæ* and other four-winged insects. Latreille followed Olivier, and apparently was acquainted with *P. nivea* only from Olivier's description.

In 1829, Stephens introduced into his 'Systematic Catalogue of British Insects,' the name "*Acentria nivosa* (*Ph. nivea,* Oliv. ?)" and placed it in the Neuroptera, amongst the *Perlidæ.* In the same year, Curtis in his 'Guide to the Arrangement of British Insects,' introduced the name *Acentropus Garnonsii,* as distinct from *Acentria.* And in 1833, Stephens, in the second edition of his 'Nomenclature,' gave *Zancle Hansoni* as distinct from *Acentria nivosa.* But there was no description of any of these.

In 1834, in vol. xi. of 'British Entomology,' Curtis characterized the genus *Acentropus,* and on pl. 497 he

figured the male *A. Garnonsii*. He placed the genus in the Order Trichoptera, fam. *Phryganeidæ*; but he remarked that, "so near an approach does *Acentropus* make to the Lepidoptera, that if the palpi were broken off, it would not be easy to decide to which Order it belonged, whether to the Trichoptera or Lepidoptera. The mealy texture of the insect might induce an opinion that it was Trichopterous, whilst the contour and neuration of the wings would be in favour of its relation to the Lepidoptera. The absence of a proboscis proves nothing, since it is sometimes wanting in the *Bombycidæ* and other groups. I do not, however, remember any instance amongst the Lepidoptera in which the maxillary palpi are strongly developed, and the labial absent; yet such appears to be the case in *Acentropus*."

In 1835, in the first volume of our 'Transactions,' Westwood, after examining the original specimens, identified *Acentria nivosa* with *Acentropus Garnonsii*, and mated them with *Zancle Hansoni* as the female. And in the same paper he pronounced the insect to belong to the Lepidoptera, relying not only on the scales of the wings, but particularly on the presence of the thoracic tippets, and the bristle at the base of the hind-wing.

In 1836, Stephens, in his 'Illustrations,' adopted Westwood's conclusion as to the identity of *Acentria*, *Acentropus*, and *Zancle*, and united the three under the name *Acentropus niveus*. It is manifest also that he thought the genus belonged to the Lepidoptera, but "having completed the Lepidoptera," he "temporarily" placed the "*Acentropidæ*" at the beginning of the Trichoptera, "rather than omit all notice of this singular family."

In 1840, Westwood, in his 'Introduction,' returned to the subject, and unhesitatingly placed *Acentropus* in the Order Lepidoptera.

In 1843, Boitard mentioned *Phryganea nivea*, but he simply reproduced (with a verbal alteration) the brief description given by Latreille, and does not appear to have known anything about the insect itself. In 1848, Kolenati, and in 1852, Walker, rejected *Acentropus* from Trichoptera, and referred it to the Lepidoptera.

In 1856, Brown again called attention to the Order to which this genus belongs; and afterwards, in a paper read before the Northern Entomological Society, having

discovered the earlier stages, he said the pupa and pupa-case were those of a moth. In 1857, Hagen pronounced the insect to be truly Lepidopterous; and Newman arrived at the same conclusion (Zool. p. 5629). In the 'Entomologist's Annual' for 1858, Stainton figured *Acentropus niveus*, as "having been finally handed over by the Neuropterists to the Lepidopterists." In the same year Kolenati again considered the question, and treated the insect as an indubitable Lepidopteron. In 1859, the genus was inserted in Stainton's 'Manual of British Moths,' but was omitted from Doubleday's 'List of British Lepidoptera.' In 1860, Möschler described an *Acentropus latipennis*, and sent it to Herrich-Schäffer to be figured with other new Micro-Lepidoptera; in the following year Herrich-Schäffer figured it as such, and Staudinger and Wocke included the genus in their Catalogue of European Lepidoptera.

In 1861, Scott renewed the enquiry "Is *Acentropus niveus* a moth? or does it belong to the *Phryganidæ*—genus *Chimarra?*" M'Lachlan denied that it was a *Chimarra*, but seemed at that time undecided whether it was Lepidopterous or Trichopterous, perhaps near *Sericostoma*. Newman again expressed doubt, and demanded further investigation. In 1862, Cooke again enquired, "Does it belong to the Lepidoptera or the Phryganeina?" inclining to the former view; the effect, however, of his discussion, was to make Newman retract his "rash guess"* that the insect was Lepidopterous, and "to leave the question as far off a solution as ever."

In 1863, Brown devoted a chapter in 'The Natural History of Tutbury' to the genus *Acentropus;* as already mentioned, he had discovered the larva and pupa, and founding his conclusion mainly on the primary stages, he considered it as no longer admitting of doubt that the genus belongs to the Lepidoptera. Haliday also (according to Brown) regarded the pupa and pupa-case

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* One would suppose, from this expression, that Newman had himself been the originator of the idea that *Acentropus* was Lepidopterous. In truth, however, his "rash guess" was arrived at from an examination of specimens transmitted by Brown (see Zool. 1857, p. 5629), whilst, for more than twenty years previously, the Lepidopterous view had (as we have seen) been advocated by Westwood, Kolenati, Walker, Brown, and Hagen successively.

as conclusive. In 1865, Heinemann included the genus in his 'Klein-Schmetterlinge;' in the same year, M'Lachlan, having got the better of his former doubt, spoke of *A. niveus* as one of "two species of Lepidoptera erroneously described as Trichoptera;" and in 1868, Brauer did not include *Acentropus* in his 'Verzeichniss der bis jetzt bekannten Neuropteren im Sinne Linné's" (Verh. z.-b. Gesell. Wien. xviii. 359).

In 1867, Zeller, and in 1869, Nolcken, Speyer, de Graaf, Snellen, and Tengström, all agreed in referring *Acentropus* to the Lepidoptera, and Speyer went elaborately into the question (Stett. Ent. Zeit. 1869, p. 400). He examined the mouth most carefully, and confirmed Westwood's view, that the large 3-jointed palpi are the labial and not the maxillary palpi (thereby removing the main ground upon which Curtis rested); a pair of one-jointed maxillary palpi are present, but very small,* attached at the upper side of the base of the large palpi, and they are mentioned by Kolenati as "a brown tuft on the outside at the base of each palpus," and by Westwood as "a pair of small lateral appendages of the palpi;" and a pair of minute thread-like maxillæ may also be detected. The difficulty of a correct determination of the parts of the mouth, in addition to the smallness and imperfect development of the maxillæ and maxillary palpi, depends really upon the circumstance that they are placed unusually close to one another, and take their rise almost at the same spot; it required careful examination to make certain that, in fact, the base of the large palpi occupied the nethermost place. Speyer also detected a peculiar appendage to the fore-tibiæ, which is found in many Rhopalocera and most Heterocera, but so far as is known, does not occur in any Trichoptera; he observes that the tegulæ or scapulæ are large, and of the typical Lepidopterous form; he notes likewise the fixing apparatus of the wings, the strong simple bristle of the hind-wings, the erect hair-scales at the base of the fore-wings on the underside, and the formation of the hinder parts of the abdomen, which is quite similar to that of many Lepidoptera, *e. g. Sphingidæ*. He concludes,

* M'Lachlan states (Intell. ix. 132) that in the female all the palpi are rudimentary. This is scarcely correct; the labial palpi, though smaller than in the male, are large in comparison with the maxillary, and are accurately figured by Brown.

"*Acentropus* is, then, a genuine Lepidopteron, with some peculiarities no doubt, but having nothing contrary to the character of the Order, and capable, without offence, of being included in it, and only in the Lepidopterous type. A rudimentary sucker, or even the entire absence of a sucker, is not uncommon in moths, and the maxillary threadlets of *Acentropus* have, in fact, a resemblance to the aborted sucker of many other moths. Considerable development of the always 3-jointed labial palpi, in contradistinction to the smallness of the maxillary palpi, is the rule in Lepidoptera, and little or nothing can be detected, in many moths, of the mandibles and the other feeding apparatus. The only thing which, to my knowledge, occurs in the same fashion in no other part of the Order, is the close approximation of the two pairs of palpi to one another, the removal of the labial palpi up to the base of the maxillæ and maxillary palpi. In all other Lepidoptera which I have examined, the two pairs of palpi are separated by a considerable interval, while the labial palpi are placed much further back, on the under-surface of the head. But this is the only important thing which is peculiar to *Acentropus*, whilst the rest of its organization collectively shows the Lepidopterous type, and in some of its characteristic parts in a very pronounced form. Thus, the fastening of the wings, and the tegulæ, which occur in such perfection neither in the Phryganeina nor in any other Order of insects. Then the wing-veins, with their simple discoidal cell, the complete covering of scales, and the appendages of the fore-tibiæ. Moreover, the habit of the imago has nothing Phryganeous about it, and it is, in fact, scarcely conceivable, how people can have mistaken the Lepidopterous nature of the creature. It cannot even be considered as an approach of the Lepidopterous type to that of the Phryganeina, as in the interest of Darwinianism I had hoped, since it has with the latter group nothing in common but the mode of life and the gill-bearing larva, which is found in so typical a Lepidopteron as *Paraponyx stratiotata*. Other families of moths, as the *Psychidæ*, and especially the *Tineina* with long maxillary palpi, above all, the *Micropterygidæ*, have much more essential characters in common with the Phryganeina than *Acentropus* has. The characteristic difference between Lepidoptera and Phryganeina lies in the totally different form of the parts of the mouth, and these organs in *Acentropus* in no way approach the type of the Phryganeina."

In a subsequent paper, 'Zur Genealogie der Schmetterlinge" (Stett. Ent. Zeit. 1870, p. 202) Speyer makes a detailed comparison of the structure and development of the Lepidoptera and Trichoptera, and again concludes that *Acentropus* is a true moth, which recalls the Phryganeina only by its aquatic and branchiiferous larva, whilst the imago has at most but a superficial resemblance to them, but has the typical character, both of wing and body, of a moth, and even in that which distinguishes it from other Lepidoptera, it does not approach the Phryganeina, nor in that particular which is most conclusive, the formation of the parts of the mouth.

After these quotations from Speyer, it seems almost surplusage to add, that in 1870, Millière figured *Acentropus* in his 'Iconographie de Lepidoptères,' and Knaggs included it in his List of Lepidoptera; and that in 1871, Ritsema, in his historical retrospect of the genus, published in the 'Tijdschrift voor Entomologie,' unhesitatingly considered the insect to be a moth.

But in 1872, Newman returns to the subject, and after informing us that 'it is nothing more than a conventional idea, or sometimes a convenient assumption," that wing-scales are confined to Lepidoptera, he adds, that "the assumption is utilized now and then to set up some hobby, such for instance as the Lepidopterous nature of *Acentria*, which assumption remains standing only until some one of more extended or more careful powers of observation, or more skilled in logical deductions, knocks it down again" (Entom. vi. 10).

We all know, that every periodical has a "some one" who is necessarily, and *ex officio*, of more extended and more careful powers of observation, and more skilled in logical deductions, than any other one who presumes to differ from him. But making due allowance for the "conventional idea" of the omniscience, and the "convenient assumption" of the infallibility of editors in general, (and speaking in all good-humour, and with every respect for my friend) I cannot characterize this sentence otherwise than as editorial "bounce." It was no part of my plan to have given the preceding sketch, but I have been led to do so by reading the remarks of the editor of 'The Entomologist,' which I have just quoted. Of course, Newman may be right, and all the world wrong; and equally of course, if Newman is wrong, he is entitled to retain his own opinion; but at the risk of repeating a

thrice-told tale, I have thought it worth while to show that, so far as published authority goes, there is an overwhelming preponderance of opinion against him, and that those who are against him have given very good reasons for their opinions. We are not told by whom the "convenient assumption" has been made; and though doubtless the presence of the wing-scales has been alleged as one ground, and an important one, for regarding *Acentropus* as a moth, yet it is but one circumstance among many, and it seems to me inaccurate to say, that any one has "utilized the assumption to *set up* the hobby" in question, for no author has relied exclusively or even mainly on the presence of wing-scales, but everyone has placed far greater dependence on other (less popular and more technical) characters. The tippets and wing-bristle originally set up the hobby. The passage about extended and careful observation and skill in logical deduction, leads one to enquire, Can Newman, when he penned it, have read the papers of Speyer?

Let me ask, what is to happen when the "standing assumption" is "knocked down again?" The assumption is, that wing-scales are confined to Lepidoptera. Let us get rid of that assumption (if anybody has made it), and let us assume the contrary, that wing-scales are not confined to Lepidoptera. From the premises, (1), *Acentropus* has wing-scales, and (2), wing-scales are not confined to Lepidoptera, are we expected to draw the conclusion that *Acentropus* is not Lepidopterous? I am not "skilled in logical deductions," but it seems to me, that when the assumed assumption has been knocked down again, the argument in favour of the Lepidopterous conclusion remains untouched.

But probably it is not the "assumption," but the "hobby" which is intended to be pugilistically dealt with. Let us, then, look for a moment at the arguments by which the "hobby" has been hitherto "knocked down." Newman's reasons are given at p. 8216 of 'The Zoologist,' and appear to be four in number:—(1), "scales far more like those of Lepidoptera occur on the elytra of a thousand beetles;" (2), the thoracic tippets do not "obtain throughout" the Lepidoptera; (3), the wing-bristle "tends as much to unite *Acentropus* with the Hymenoptera as with the Lepidoptera;" and (4), the characters in which the pupa of a moth differs from that

of a *Phryganea* require to be more distinctly pointed out. Westwood has dealt with these grounds *seriatim* (Proc. Ent. Soc. 1862, p. 101); and, so far as I can discover, these are the only reasons which Newman has published for doubting that *Acentropus* is a moth. As suggesting points for further examination and explanation, the four propositions are harmless enough; but to suppose that the enunciation of them has "knocked down the hobby," or that by the repetition of them, the hobby will be "knocked down again," is surely a miscalculation of the strength of the arguments. I understand the question to be "Is *Acentropus* lepidopterous, or is it trichopterous?" By the first proposition, the presence of wing-scales is admitted; it can scarcely be contended that their presence is an argument *against* the insect being lepidopterous, and it can hardly be intended to suggest that *Acentropus* is coleopterous; but unless such a suggestion is intended, the proposition is wide of the mark: there is no question about beetles, and to answer the inquiry "Lepidoptera or Trichoptera?" by saying "It is like Coleoptera" is no answer at all. Again, it can hardly be intended to suggest that *Acentropus* is hymenopterous; but unless such a suggestion is intended, the third proposition is only throwing dust in the eyes, and diverting attention from the real question, "moth or caddis-fly?" But the second proposition is, perhaps, the most curious of all: from the premises, (1), *Acentropus* has tippets, and (2), some Lepidoptera have not tippets, it can scarcely be argued, much less "logically deduced," that *Acentropus* is not lepidopterous.

Newman concludes (Zool. p. 8217) by indicating "the proper mode of proceeding in such a case as this," and finally asks for a "verdict solely on the evidence." I have only had an opportunity of examining the imago; but, bearing in mind, that "its mouth, wing-rays, thorax and legs should have especial care bestowed on them," the result of my own examination has been to satisfy me that it is a moth. The earlier stages confirm this view; the eggs are not enclosed in a jelly-like substance, as is usual with Trichoptera; and the larva and pupa have nothing of the trichopterous type about them. The mouth and head of the larva of *Acentropus* are unlike any known caddis-worm; whilst the mummy-like pupa is totally different from the pupæ of Trichoptera, with their free legs and antennæ, and their strong mandibles, with which

they gnaw their way out of their case. And though it is quite true that further details are required to give a complete "life-history of *Acentropus*," I have no hesitation in saying that, deciding on the evidence now forthcoming, the insect is a moth.

There is one point to which I may here allude—the presence or absence of ocelli in *Acentropus*. Curtis says "ocelli two, placed behind the antennæ," and his fig. P. shows the ocellus plainly enough. "Ocelli two," re-echoes Stephens.* In Westwood's figure of the head (Introd. ii. fig. 113, No. 12) there is an indication of what I take to be an ocellus. And Kolenati says, "two ocelli behind and between the insertion of the antennæ on the top of the head," and his fig. 4 shows them distinctly (Wien. Ent. Mon. 1858, pl. vii.).

On the other hand, Brown found no ocelli; Heinemann gives "ohne Ocellen" as one of the characters of the genus; and Nolcken and Speyer searched for them in vain.

I was unable to detect any ocelli in my own specimen. But in the autumn of last year, M'Lachlan, for my satisfaction, subjected several specimens to microscopic examination; after denuding the head of its scaly clothing, the result was that, on one specimen, he, Douglas, and I saw something—a kind of metallic disc, to all appearance —which may have been an ocellus. But it was not behind the antennæ, or between the antennæ; it was on the outside of the antenna, in a depression or excavation of the basal joint. I believe Douglas and M'Lachlan were satisfied that it was an ocellus: for myself, I doubt.

In the Lepidoptera, there are either two ocelli or none; in the Trichoptera, three or none. If, then, the positive evidence in favour of the existence of two ocelli be accepted, we have another reason for referring *Acentropus* to the Lepidoptera, and not to the Trichoptera. On the other hand, if the weight of evidence be held to disprove the existence of any ocelli, their absence affords no argument either way.

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* But there is strong intrinsic evidence that Stephens' description was not drawn up from personal examination, but was copied from Curtis's. A word is varied here and there, just sufficient to escape being a mere transcript; but the phraseology produces (in my mind, at least) conviction, that one description was taken from the other.

Of course, the generic name *Acentropus* was given to the insect in allusion to the supposed absence of tibial spurs. But according to Nolcken, *Acentropus* is a misnomer, the legs possessing spines, which render the name inapplicable. Under the microscope, he found at the end of the mid-tibia one, and on the hind-tibia, not far from the middle, one, and at the end another, small spine. All previous authors had agreed in describing the tibiæ as without spurs or spines, and Speyer (whose specimens were sent to him by Nolcken) in his first paper (Stett. Zeit. xxx. 405) spoke of the spur-less legs; but subsequently (xxxi. 222, n.) he says that he has confirmed Nolcken's statement, but the spurs are minute and fragile. For myself, I see, but only on one or two specimens, very small and very short spurs.* But as between Lepidoptera and Trichoptera, how stands the argument, so far as the armature of the tibiæ is concerned? If the middle and hind-tibiæ are spurred (as must now be admitted to be the fact), this is the rule in one Order as much as in the other; but if they were not spurred, this would be as much at variance with the rule in one Order as in the other. And either the presence or the absence of spurs leaves the question unanswered.

A few words next as to the various positions in the Order Lepidoptera which have been assigned to *Acentropus*.

Stephens spoke of the *Tineidæ* as "the only family to which it can be allied;" and in 1840, Westwood placed it provisionally in that family, between the genera *Euspilopteryx* and *Gracilaria*. Five years later, in his 'British Moths,' we find the genus at the very end of the *Tineidæ*, following the Trichopteroid genus *Eriocephala* (*Micropteryx*), *Euspilopteryx* and *Gracilaria*, and coming immediately before the *Pterophoridæ*; but it is noted, at the same time, that it is "probably nearer to some of the *Hyponomeutidæ*." In 1848, Kolenati expressed an opinion that *Acentropus* belonged to the *Pyralidina*, and the pupa and habit of the larva at first led Brown also to consider it allied to *Hydrocampa*, an opinion which he subsequently changed. In 1859, Stainton placed it in the family *Hy-*

* When this paper was read, Westwood exhibited drawings of *Acentropus*, made in 1860, from specimens given him by Brown; and these drawings fully confirm Nolcken and Speyer as to the presence of the minute spines on the mid- and hind-tibiæ.

*drocampidæ;** and Hagen and Zeller appear to have regarded it as belonging to the *Crambina*. In 1861, Staudinger and Wocke adopted the "china-mark" theory, and catalogued the genus between *Cataclysta* and *Nymphula;* and Westwood thought it "most nearly allied to the family *Crambidæ*." In 1862, Cooke reverted to the Tineine hypothesis, and suggested its affinity to *Chimabacche, Epigraphia,* and *Exapate.*† In 1863, Brown arrived at the conclusion that its true place is amongst the *Bombycina,* but that for an insect altogether so anomalous, a special family must be constituted. In 1865, Heinemann included the genus in the *Botidæ,* placing it at the end of the family, immediately after *Hydrocampa, Paraponyx,* and *Cataclysta;* and Zeller, in reviewing Heinemann, agreed that its proper position is between these aquatic moths and the *Chilonidæ*. In 1869, Tengström catalogued the genus between *Cataclysta* and *Nymphula;* de Graaf and Snellen placed it in *Pyralidina;* and Speyer, recognizing the fact that the insect stands heterogeneously in the *Botidæ,* as indeed everywhere, proposed that it should rank as a separate family between the *Botidæ* and *Chilonidæ*. In 1870, Knaggs catalogued the "*Acentropidæ*" between the *Hydrocampidæ* and *Botydæ;* and Millière figured *Acentropus* as belonging to the *Crambina*. Finally, Staudinger and Wocke, in 1871 (merging the *Crambina* in the *Pyralidina*), placed the family *Acentropodidæ* between the *Pyralididæ* (of which the last genera are *Hydrocampa, Paraponyx,* and *Cataclysta*) on the one hand, and the *Chilonidæ* and *Crambidæ* on the other hand.

Thus, we have a Tineine, a Pyralidine or Crambine, and a Bombycine view; and, of course, there is something to be said in favour of each. I believe it is not doubted that *Micropteryx* belongs to the *Tineina,* and, perhaps, of all moths, that genus is the most like the Trichoptera; it seems natural, therefore, that *Acentropus* and *Micropteryx* should not be placed far apart, though, in fact, their technical characters are considerably different. Whether Westwood considered *Acentropus* to

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* In 1858, the present writer, in a letter to Stainton, enquired whether *Acentropus* should not come near *Hydrocampa*. On the 13th of March, 1858, Stainton replied, "*Acentropus* will probably be placed near *Hydrocampa*, but I have not yet definitively settled its position."

† Heinemann transfers *Exapate* from the *Tineina* to the *Tortricina*.

connect the *Tineina* and *Pterophorina*, I do not know; it may be fancy on my part, but I do fancy I detect an affinity between *Acentropus* and *Agdistis*. The approximation to the *Hyponomeutidæ* does not appear to me so manifest; I suppose the recurved or drooping palpi are the principal thing relied on; but in Knagg's 'Cabinet List' the *Hyponomeutidæ* are the next family to the *Micropterygidæ*. Again, there is plausibility in the suggestion of relationship between the phryganoid *Acentropus* and *Chimabacche phryganella*; next to the *Epigraphiidæ* or *Chimabacchidæ*, the *Psychidæ* are also placed by those who regard that family as *Tineina*, and it scarcely needs to be added that the *Psychidæ* are very like *Phryganeina* in some respects, and have, indeed, been classified with Neuroptera; moreover, the existence of wingless or but partially-winged females in *Acentropus*, is a feature which that genus possesses in common both with *Chimabacche* and *Psyche*. So far as I am aware, Brown is the only author who has referred the genus to the *Bombycina*; it is to this group that the *Psychidæ* are relegated by those who expel them from the *Tineina*, and Brown would place them in the same section of the *Bombycina*; but the families with which he suggests that *Acentropus* has the nearest affinity are the *Hepialidæ* and *Zenzeridæ*, agreeing with the former "in the general shape of its larvæ, in the absence of spines on the legs of the imago [see, however, p. 130], and in the substitution for them of hair, in the want of a labrum, and in the almost total absence of maxillæ;" and with the *Zenzeridæ* "in the shape of larva, small development of maxillæ, and general form of the palpi." On the other hand, the general appearance of the imago is strongly suggestive of a *Crambus*, but the retrorse palpi and the neuration of the wings do not agree with those of the *Crambidæ*; whilst the aquatic habit of the insect, the mode of life, and the metamorphoses, are so plainly indicative of affinity to *Hydrocampa*, that I willingly go with the current of recent opinion, and recognize the true place of the *Acentropodidæ* to be where Staudinger and Wocke have placed them, that is to say, in the *Pyralidina*, leading up to the *Chilonidæ* and *Crambidæ*.*

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* Knaggs suggests that the *Pterophorina* should follow next after the *Pyralidina* (Cab. List Lepid. p. 11). If this be so, it brings *Agdistis* into close proximity with *Acentropus*.

Let us now bring together, as a connected narrative, the scattered observations on the habits of *Acentropus*.

Olivier and Latreille say nothing about its mode of life, but from its having been described as a *Phryganea*, we may infer that it was found in the neighbourhood of water. "Found on willows," near a canal, was Stephens' account; "in an osier bed," was Brown's first report. Kolenati, however, in 1846, discovered that the imago affected certain species of *Potamogeton*, and suspected that the pond-weeds were the food-plant of the larva; informed by Haliday of Kolenati's observations, Brown, who in 1855 and 1856 captured the moth flying over the river Trent, was enabled to find pupæ in 1857, and in the following year to obtain both larvæ and pupæ.

Previously to this, Curtis and Dale had found, at Glanville's Wootton, what they supposed to be the eggs of *Acentropus*; they were exhibited at the Meeting of this Society on the 4th of September, 1854, and are described in the 'Proceedings' as "a large mass of white and very elongated eggs." The oviposition was not actually seen, but the eggs were found at a spot where *Acentropus* abounded, and near a female specimen which was captured, and exhibited at the same meeting; and there cannot, I think, be any reasonable doubt that they were really the eggs of *Acentropus*. I suppose these eggs have gone to the Antipodes with the rest of Curtis's collection; but Hagen saw them, and has described them as "a number of white roundish eggs, lain thickly together on a *Potamogeton* leaf." There is, however, a discrepancy between the two accounts as to the shape of the eggs. In 1861, Knaggs had some eggs laid on his setting boards, by specimens captured at Hampstead; he described them as having "a most striking resemblance to those of *Paraponyx stratiotalis*." Herrich-Schäffer, in the same year, figured the female specimen on which Möschler based the species *A. latipennis*, and he depicts her with a string of eggs at her tail; M'Lachlan has shown me one of his Hampstead examples with a similar string, and Knaggs has a continental *A. latipennis* with eggs attached. In these cases, the colour of the egg is dirty-white, or yellowish; and the shape is "roundish," rather than "very elongate."

The larva is of a light green colour, and like those of *Hydrocampa*, *Paraponyx*, and *Cataclysta*, it lives on

aquatic plants below the surface; it has gills, and lives freely in the water. It has been figured by Brown. It appears to feed exclusively on the pond-weeds, but has been found on several species; thus Kolenati (who, however, was acquainted with the imago only) mentions *Potamogeton heterophyllus* and *perfoliatus;* Brown and Heinemann mention *P. pectinatus* and *perfoliatus;* Ritsema mentions *P. crispus;* and Millière mentions *P. pectinatus* and *lucens*. When fully fed, in June or July, the larvæ may be found "in silken cocoons, which are strengthened by small pieces of the leaves incorporated longitudinally in the fabric, and which are placed in the submerged axils" of the thread-like leaves of the *Potamogeton*. Brown found only fully-fed larvæ, but Ritsema and Reutti found them in various stages of growth.

The pupæ are described by Brown as "of the masked character, and the external case enables one to see clearly which will produce males and which females;" both the male and female pupæ are figured by him, and exhibit three remarkably prominent spiracles on each side. To acquire the pupæ, Knaggs recommends dragging the stream or pond with a water-net, where *Potamogeton* grows, examining it on the shore for the small silken cocoons.

The imago appears in June, July, and August; though not continuously for the whole period. During the three months mentioned, the insect may be found in all its four stages of egg, larva, pupa, and imago; and it would seem that about ten months of the year (including the winter months, as with *Hydrocampa* and *Paraponyx*) are passed in the larval state, and about one month in the pupa.

The male imago is much more common, or more commonly observed, than the female; occasionally it is found in swarms. Kolenati captured forty-two specimens in the Neva, all males; Nolcken went to the same locality, and took something like 150, again all males. Zeller had it in numbers from Pomerania, but only of the male sex. Hagen had seen it in numbers, but could not remember a single female taken in Prussia. Dale, in the last letter I had from him (within three months of his death, when the veteran entomologist was over eighty), wrote "the males were in great abundance, the females very rare." Brown, in a recent letter, writes "I have seen, I should almost say, hundreds of males on the wing at a time. Ritsema took fifty specimens near Haarlem, all males.

Unless disturbed, they are inactive by day, but fly briskly in the evening over the surface of water. Kole-

nati found them sitting sluggishly on the *Potamogeton*, close to the water, the majority on the flowers and young seeds; when active, they ran on the surface of the water. According to Dale, "they flew nearly on the surface of the water, sporting about in various directions." Brown found them quietly sitting on leaves, or other objects which protruded from the stream, whilst others flew slowly, or, as he elsewhere expressed it, were "skipping along over the surface" of the Trent. Reutti's observation is, that the male flies always close to and on the water, by day only involuntarily, but by night briskly. M'Lachlan records that between eight and nine, p.m., in June, "they began flying rather rapidly over the surface of the water, and close to it, occasionally coming on to the wet mud." Knaggs mentions that "it skims along the surface of the water," but although the usual habit is to fly close to the water, he has "occasionally seen it mount perpendicularly into the air, rising higher and higher, until lost to sight." M'Lachlan tells me that he too saw the male thus mount into the air, but only when caught by a current of wind, so that it was an involuntary act. Boyd tells me that he observed the females to fly, as a rule, at a greater height above the water than the males. Nolcken found them, either sitting drowsily on floating pieces of *Potamogeton* or other objects, often two or three so close together that at first he thought they were *in coitu*, or fluttering about in small circles close to the surface, then raising themselves a few inches above it, but descending again immediately, so that their feet were almost always touching the water. Barrett "found some faggots sunk with stones in one corner of a pond, leaving some of the twigs above water; and on the underside of these twigs *niveus* swarmed, sometimes clustered four or six in a bunch; they were very sluggish, and, if knocked off a twig, only buzzed along the surface of the water till they found another." Ritsema describes them as sitting by day on the stems of plants close to the water, and when disturbed, coming quickly to rest again, but in the evening, flying nimbly in large circles over the surface, touching the water itself, and settling but rarely. Corbin describes the flight as most peculiar, "as it never seems to leave the surface of the water, but swiftly flutters its tiny wings, and in the dusk of the evening looks almost as if it was swimming about here and there; . . . . but in the day-time it will be found

settled on the underside of leaves, &c., close to the water's edge." I have already mentioned that it was the circular flight of the insect (a male) round a lamp and over the surface of a table, which first attracted my attention to the specimen which gave rise to this paper; de Graaf captured two males which were similarly attracted to a lamp and performed their antics on a tablecloth; and Stainton, some years ago, took a female specimen at Lewisham which flew to a gaslight fixed outside his house. Brown, Dale, and Barrett all mention to have seen many dead specimens floating on the pond-weed, or on the surface of the water; and during the daytime, Knaggs and M'Lachlan found that the living specimens might readily be fished out from off the *Potamogeton*, by means of a shallow net with a long handle.

The form originally named *Zancle Hansoni* by Stephens has been already mentioned as the female; this form has fully developed wings, and it was not until 1854 that the existence of an apterous form of the female of *Acentropus*, or one with only rudimentary wings, was established. Simultaneously with the above-mentioned discovery of the eggs, Curtis and Dale found this second form of female; and the event is somewhat meagrely reported in our 'Proceedings' as follows: "Mr. Curtis exhibited specimens of *Acentropus Garnonsii* from Glanville's Wootton, including the apterous female,"—as if the apterous female, instead of being a novelty, was a familiar creature. The Dorsetshire females (as I was informed by Dale) were not absolutely apterous, but had rudiments of wings. In 1858, Brown found at Burton-on-Trent a pupa from which an apterous female emerged; the Burton females (as figured by Brown) were absolutely apterous, without a vestige of wing. In 1860, Möschler* described *A. latipennis* from a female example from Southern Russia, which was amply winged; and his description mainly consists of a comparison with another winged insect which he supposed to be the female of *A. niveus*.† In

* Brown (Nat. Hist. Tutbury, p. 401) erroneously attributes the description of *A. latipennis* to Kolenati.

† Upon this Brown remarks, that "it is manifest the insect he describes as *A. niveus* is of the male sex; the comparative characters are, therefore, useless." In other words, Möschler's comparison only shows the distinction between the sexes. I do not quite see, however, why the insect with which the ♀ *latipennis* is compared, may not have been a winged female of the *Zancle* form.

1865, Heinemann described the female of the *Acentropus* from the Bodensee (Lake of Constance) as having very short pointed rudiments of wings. And in 1871, Ritsema bred from a pupa found near Haarlem a female with rudimentary wings.

In 1859, Hagen remarked, "it is a matter of interest that it appears to have two forms of female, one with short, the other with long upper-wings; of both forms, Stainton's and Stephens' collections contained specimens." I suppose the "form with short wings," refers to the specimens with rudimentary wings, captured by Curtis and Dale at Glanville's Wootton: for so far as I can gather, the Dorsetshire specimens are the only known British specimens that have rudimentary wings, and Brown's Burton specimens are the only known specimens that are absolutely apterous. The female specimens in Stainton's collection are all fully winged, and as Stephens died in 1852, before the apterous form was discovered, I fancy that Hagen, writing from memory, must have erroneously attributed to Stainton's and Stephens' collections what he actually saw in Curtis's. Stephens' collection is now incorporated with the general collection of British insects in the British Museum, and *Acentropus* has been transferred from Neuroptera to Lepidoptera; that collection contains four females of *Acentropus*, but all are fully-winged.* In addition to the British Museum and Stainton's collections, I have been permitted to examine those of Bond, Boyd, Knaggs, M'Lachlan, Stevens and Wormald; they contain none but fully winged females; in short, I have been unable, in any of the London collections, to procure a sight of the apterous or partially apterous form; and Westwood does not possess it at Oxford. Dale (*in litt.*) described his rudimentary female, as "rather shrivelled, and I should say was merely undeveloped;" and Nolcken was at first disposed to think that the rudimentary wings were attributable to accidental crippling, and were merely cases of stunted growth: but Brown, though at first surprised to see an apterous specimen, says that "it was subsequently

* M'Lachlan assures me that he remembers to have formerly seen an apterous, or nearly apterous, female of *Acentropus* in the British Museum, thus corroborating Hagen. I made two visits to the Museum last autumn in order to see it, but it was not to be found.

discovered to be very easy to separate the female pupæ * from those of the male, by the external characters." I think, therefore, that we must take it to be a fact, that the wingless or stumpy-winged female is a natural form.

The mode of coition of the winged female does not appear to have been observed ; but Reutti, as recorded by Heinemann, reports that the wingless female swims on her back under the water by night, that coition takes place in the water, the female laying hold of the male, and drawing him down with her.

Millière and Peyerimhoff (Mill. Iconog. iii. 161) are sceptical as to this, and, no doubt, it is, at first sight, improbable. But let us see if there be not some corroborative evidence.

In the first place, be it remembered, that the pupa is under water, so that the moths, both male and female, are born in the water. Then Kolenati says, "I saw one female dive, and crawl down the stem of the *Potamogeton*," and I shall, hereafter, have occasion to show that this was, in all probability, a winged female. Ritsema expressly mentions that the males settled on the water, "or on floating plants below." Brown saw the male "on one occasion deliberately enter the water, and after creeping down a pond-weed stem for an inch or two, it emerged again with unwetted wings; this act was probably done in pursuit of the virgin female;" and again, referring probably to this same occasion, Brown writes (*in litt.*, 5th Oct., 1871) "I have also seen the male deliberately enter the water, which must, I should think, be for no other purpose than that of searching for the apterous female." M'Lachlan informs me, that at Hampstead (where the only females captured were winged females), he frequently noticed that specimens drawn below the surface, either on the net, or on patches of floating weeds, came up again none the worse for their submersion. Barrett reports that, if accidentally immersed, they "took no notice whatever of the ducking." And Corbin says "it is truly a water insect, as often only its head is above the surface." It seems, indeed, to be common ground with all who have had frequent opportunities of observing it, that the male is constantly on, or (at least partially) in, the

* Westwood's drawings (mentioned at p. 130, n.) corroborate this.

water. And Speyer has pointed out that several of the peculiarities of the male appear to have for their object the facilitating a short sojourn and an onward movement in the water. The front of the body, he says, is relatively very strongly built; the wings are narrow, pointed, firmly fastened, almost fin-shaped, and when at rest bent backwards, and the scales lie smoothly on, and are fixed uncommonly fast; and, finally, the large and long palpi would be a hindrance to motion under water if they had extended forwards instead of being directed backwards. In short, Speyer explains the peculiarities in mode of life and organization of *Acentropus*, by regarding it as the representative of an older branch of the original stock of moths, the other members of which branch have disappeared; the primitive insect forms must be sought in water, the atavi of the Lepidoptera rose from the water to the land, and adapted themselves to terrestrial and aerial life; and *Acentropus*, the most distinctly aquatic of all known moths, is, from this point of view, the primeval type, the nearest extant representative of the grand ancestor of all the Lepidoptera.

But to return from the region of speculation to the domain of fact, I say that, knowing what we do know of the habits of *Acentropus*, I have no great difficulty in accepting Reutti's account of the apterous female, or rather of the female with rudimentary wings, for it is of the intermediate form that Reutti speaks. And I go a step further—for if the winged male can exist under water, whether he voluntarily, as Brown thinks, descends like Orpheus in quest of his Eurydice, or whether, as Reutti records, he is dragged down by the female, like Hylas by the water-nymph, there can be no reason why the winged female should not have the same habit as her unwinged sister; it is less unlikely that the winged and unwinged should be two forms of the female of the same insect, having the same sexual habit, than that they should be the females of two different insects with males undistinguishable by the eye, one of which indulges in aerial, and the other in aquatic, copulation.

This brings me to the question which it is the main object of this paper to open for discussion; namely, how many known species are there of the genus *Acentropus?*

For six and twenty years after, Westwood mated *Acentropus* and *Zancle*, but one species of the genus was

recognized. At the end of 1858, Kolenati published an account of his capture at St. Petersburg twelve years before, and having detected a minute difference in the shape of the wing-scales* from the shape as represented in Westwood's figure (Introd. ii. 409), he says that he attributes the disagreement to the wood-cut; "were this not the case, we must announce our forty-two examples as a new species, and name it *A. Newæ*,"† but he did, in fact, announce his Neva specimens as *A. niveus;* and it was not until 1860 that the second species *A. latipennis* was described by Möschler (and figured by Herrich-Schäffer in 1861). In 1863, Brown came to the conclusion that, under the name of *A. niveus*, at least three species were confounded, (1) *A. niveus*=*Garnonsii* of Curtis, (2) *A. Hansoni*, and (3) *A. Nevæ*, of which it was thought probable *latipennis* would prove to be the female. In 1869, Nolcken, after discussing the subject at some length, remarked (Stett. Zeit. xxx. 279) that the separation of *A. niveus* into several species "rests upon the supposition that all the characters given in the different descriptions really exist in nature, and will stand examination. But it is not so; for after careful and close scrutiny of the specimens, I have found many erroneous statements, particularly in Kolenati's description and figure of *A. Nevæ;*" and when, towards the conclusion of his paper (p. 282) he wrote, that the characters upon which *A. niveus* was to be divided into several species "have for the most part not been verified, and it has not been my fortune, by way of compensation, to find other

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* *Not* a difference between the outline of the wings, as Brown puts it (Nat. Hist. Tutbury, p. 401), judging, doubtless, from Kolenati's figure, which is erroneous.

† In the case of *Bardell* v. *Pickwick*, in Dickens' Reports, the following occurs:—

"What's your name, sir?" enquired the judge.

"Sam Weller, my lord," replied that gentleman.

"Do you spell it with a V or a W?" enquired the judge.

"That depends upon the taste and fancy of the speller, my lord," replied Sam, "I never had occasion to spell it more than once or twice in my life, but I spells it with a V."

Here a voice in the gallery exclaimed aloud, "Quite right too, Samivel, quite right. Put it down a *we*, my lord, put it down a *we*."

So with Kolenati's *Newæ*, "I spells it with a V."

more positive ones," I confess I was not quite prepared for the conclusion, that it is "advisable provisionally to separate the forms from different localities," which separation Nolcken proceeded to make, as follows:—

(1) *A. niveus*. Paris. Female unknown.

(2) *A. Hansoni*. Female with ample wings.

(3) *A. Garnonsii*. Female wingless (or with rudiments ?).

(4) *A. badensis*. Lake of Constance. Female with short rudiments of wings.

(5) *A. germanicus*. Stralsund. Female unknown.

(6) *A. Nevæ*. St. Petersburg, in the Neva. Female unknown.

(7) *A. latipennis*. Both sexes with ample wings. From its colour, shape of wings, &c., certainly a good species.

Of these seven, he says, at least three may be regarded as certain and well-founded species.

In the same year (1869) Tengström indicated the Finnish form as *A. obscurus*, var. of *A. Nevæ*.

In 1870, Millière figured *A. niveus* and *latipennis* (Iconog. pl. cxv. f. 21, 22); and Knaggs inserted *A. niveus* and *latipennis* in his 'List of British Lepidoptera.' Finally, Staudinger and Wocke, in 1871, split the difference between Nolcken's three certain and seven possible species, and enumerated the five as follows:—

(1) *? niveus*, Oliv., Latr.	Paris.
(2) *Hansoni*, Ste., Nolck.=*A. niveus*, Ste. Ill.	England.
(3) *Garnonsii*, Curt., Nolck.	England.
(4) *Nevæ*, Kol., Nolck.	St. Petersburg.
a. ? *badensis*, Nolck.=*niveus*, Hein. . .	Lake of Constance.
b. ? *germanicus*, Nolck.=*niveus*, Mill. (sp. diversa ?)	Pomerania.
c. var. *obscurus*, Teng.	Finland.
(5) *latipennis*, Mösch., Mill.	Sarepta, on the Volga.

I will make a few remarks upon each of these. And first I may say that the ? prefixed by Staudinger and Wocke to *A. niveus* is not unwarranted; for Stephens recognized the insect, not from Olivier's description, which was meagre enough, but from Latreille's abbreviation of that—"blanche, ailes ciliées; partie supérieure de l'abdomen obscure"—and to identify a species from such a description must be the merest guess-work. Westwood, however, tells us, that Haworth had a speci-

men which was ticketted "*alba*, Oliv.;"* there is no *Phryganea alba* of Olivier, but *alba* is the first word of the diagnosis of *Phryganea nivea;* and I presume, therefore, there must have been an oral tradition attached to Haworth's, and, perhaps, other specimens, that they were the "frygane blanche" of the French authors, and by this means Stephens was satisfied that his *Acentria* was identical with Olivier's insect. Perhaps some of our friends on the banks of the Seine will take the pains to re-discover Olivier's *nivea*; as Millière says "it is hardly known in France." And, at all events until such re-discovery is made, it must remain a matter of considerable doubt what the *Phryganea nivea* really was. But if it was not identical with the species (or one of the species) of *Acentropus* which we have in this country, it has dropped out of knowledge altogether; it is a name, and nothing more.

Brown's view is, that Curtis's *Garnonsii* is the *niveus* of Olivier; he attributes to this species the specimens obtained by Dale and Curtis at Glanville's Wootton, and by himself at Burton-on-Trent; "the female (he says) is apterous." And speaking of *A. Hansoni*, he says that the female "so far from being apterous, is furnished with wings of twice the area of those of the male." Now Brown admits that, as regards the males of *Garnonsii* and *Hansoni*, "the difference is so slight, that, if specimens of the two species once become intermixed in the cabinet, it is almost impossible to separate them;" and I venture to say that, but for his belief that the female of one is always amply winged, and the female of the other always without wings, Brown would not have dreamt of regarding them as two species. The only ground alleged for separating the two is, that the males being indistinguishable, one has a winged, and the other an apterous female; the argument is, that at Glanville's Wootton and Burton only the apterous female is found, and at London and Reading only the winged female is found. And Speyer says the female seems to occur of two forms, "which, perhaps, belong to different species."

But is this the case? Let us look into this a little more closely. It is quite true that apterous females (or rather

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* The identical specimen was exhibited by Westwood when this paper was read; it is unquestionably a male *Acentropus Garnonsii*.

females with rudiments of wings, which, for brevity, we will call apterous*) were found at Glanville's Wootton; but it is equally true that winged females were found at Glanville's Wootton. Curtis and Dale took the two forms of female together; and though the London collections do not contain a single apterous specimen, there is no lack of amply winged females from Glanville's Wootton. Then, what is the state of affairs at Burton-on-Trent? Brown bred the apterous female, but never "had an opportunity of studying its habits in a state of nature;" in a recent letter, he writes, "I may further add, that it is my firm conviction that winged females, with wings so ample as those found in London, cannot exist amongst our examples without their having been seen." But to this I reply, that M'Lachlan has a female with wings as ample as any of those found near London, and this female, he assures me, was captured by himself, not in the Trent, it is true, but in the Canal, at Burton. So that in both the localities in England, in which the apterous females have occurred, the winged form has likewise occurred. It is true that (so far as I know) near London the apterous form, and on the Lake of Constance the winged form, has not yet been found; but negative evidence of this sort is of very slight value. Finally, Ritsema found a number of pupæ near Haarlem in 1870; from these only two females emerged, and one had rudimentary, the other well-developed wings. Was one of these *Garnonsii*, and the other *Hansoni?* two species out of the same batch of pupæ, or two forms of the female of one and the same species? There are females without any trace of wings, females with rudiments of wings, and females with ample wings; and if these forms occur together, and the males are all alike, it seems to me that we require something more than the difference in the alar development of the female sex, before we can assert that there is more than one species. I submit that unless some other distinction can be pointed out, beyond the greater or less growth of wing of the female sex, the old view is the sound one, and Hagen was right when he regarded the winged and the unwinged females only as two forms of the same species.

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* "A semi-apterous form of the female," is M'Lachlan's expression (Intell. ix. 132).

But it will be said there are other differences; and Brown describes the apterous female as being furnished "with long silky white fringes to its hinder tibiæ," from which he presumes it "to be endowed with active swimming and diving powers." But a reference to Brown's figures shows that the winged female has the tibial fringes as strongly developed as the wingless female, and that, so far, she is equally well endowed with swimming and diving powers, unless her wings act as impediment. As to this, I may recall Lubbock's exhibition of *Polynema fuscipes*, swimming by means of its wings (Proc. Ent. Soc. 1862, p. 93), a Hymenopterous insect with large fore-wings profusely fringed all round, whose motion through the water is due entirely to a sharp jerking action of the wings: and, to return to *Acentropus*, I have already suggested that the female which Kolenati saw descend into the water in 1846 must have been a winged female; but, however this may have been, it is abundantly clear, that the winged male can exist under water; and if the winged male, why not the winged female? if the winged male deliberately descends into the water in pursuit of the apterous female, why not also in pursuit of the winged female? With reference to these tibial fringes, I may mention, that not a trace of them was to be seen on the (winged) specimens which first came under my examination; I thought, therefore, that they might be confined to the apterous female, and that there might have been an error in Brown's figure of the winged female (figs. 7, 9). But in reply to enquiries, Brown informs me that a winged female from London, now in his collection, "has the brushes at the present moment of full size as depicted." And I have since had the pleasure of seeing winged females from Cheshunt, which exhibit traces of the fringe, and a continental female of *A. latipennis* which shows it quite prominently.* It seems clear, then, that like the leg spurs of the male, these fringes are easily deciduous: but if so, how about their use in swimming?

I pass on now to *A. Nevæ*, of which I have seen specimens given by Nolcken to Stainton. Judging from

* Nolcken thought he saw a trace of the fringes on a *male* from Stralsund; but he could not feel certain about this.

Kolenati's figure, which he reproduced, Brown thought this a distinct species. He says "the upper and under wings have different relative proportions, and the body is shorter and more hairy, whilst a very definite difference exists in the two blunt teeth on the hinder tibiæ, of which I cannot detect any trace in *A. niveus*." To which I may add that in Kolenati's figure the cell of the hind-wings is represented as open; and Kolenati, as a Trichopterist, would naturally be supposed to pay particular attention to neuration. Now Curtis's figure of *Garnonsii* distinctly represents the hind-wings, as well as the fore-wings, with a long closed cell; Westwood's wood-cut, and Brown's two figures, all agree in showing a closed cell in both pairs of wings. Heinemann places *Acentropus* in the *Botidæ*, and gives "hind-wing-cell closed," as one of the characters of the family. Nolcken finds numerous errors in Kolenati's description and figure, though I cannot find that he specifically mentions the open cell. Speyer (whose specimens were from the Neva) says, that the wing-veins are very inaccurately figured by Kolenati; but expressly adds "the central cell of the hind-wings is open:" yet he says, that Heinemann's description is accurate, and that Westwood's figure agrees with his specimens! The difference between a closed cell and an open cell, if constant, would be a generic, if not a familiar distinction: but in truth, it is not constant, but merely accidental: the closed cell is the normal form of the hind-wing, and just as Kolenati and Speyer happen to have alighted on a specimen in which the hind-wing-cell was open, I have found one, and one only, which seems to present the same aberration. With regard to the different proportions of the wings, not one of Nolcken's one hundred and fifty specimens from the Neva agreed with Kolenati's figure; they had the same shape and relative size as the specimens from the Bodensee and other localities. Again, Nolcken was unable to discover the two blunt teeth depicted by Kolenati on the hinder tibiæ of *A. Nevæ*, and nobody else has had any better success, so that I think this must be taken to be one of the numerous inaccuracies of Kolenati's figures, unless, indeed, Kolenati detected the spurs on the hind-tibiæ, and these teeth are a rough and inaccurate representation of the spurs. But to pass from Kolenati's figures to his own words: he says that "in Westwood's wood-cut, everything agrees well with our examples" except the

form of the wing-scales; and Nolcken says that the shape of the scales, as figured by Kolenati, is not true to nature. Speyer points out that Westwood (Introd. ii. 324) expressly denies the existence of the inner spine or appendage to the fore-tibiæ which he observed in *A. Nevæ*, and adds, "Since all my specimens show it, this circumstance is only explicable to me by the supposition, that the English species is not identical with that of the Neva. Westwood's other characters, as well as Stainton's short description, certainly as to the rest agree very well with Russian examples." But surely where the spurs on the mid- and hind-tibiæ have been looked for in vain by so many observers (including Speyer himself, at the time he penned the sentence I have quoted), it is too much to say that, because Westwood's specimen did not exhibit this minute appendage to the fore-tibiæ, therefore *A. Nevæ* must be a different species from his. Be it remembered, too, that out of all the specimens from the Neva, nobody but Speyer has ever been able to detect this object; though told what to look for, I cannot find it on any English specimen; but it seems far more likely that this appendage, like the other leg-appendages, is deciduous and easily lost, than that there should be two species, alike in everything else, down to the minutest particular, but distinguished, one by the possession, and the other by the absence, of this spine. In truth, this difference, if it really existed, would be something more than a specific difference, it would be a generic distinction. And the same remark applies to the ocelli; Nolcken mentions the ocelli of *Nevæ* as if their presence would serve to distinguish it from the English species, apparently forgetting that both Curtis and Stephens say "ocelli two," so that there is, at least, as much evidence in favour of their existence in *Garnonsii* and *Hansoni* as in *Nevæ*; at the same time, Nolcken doubts the existence of any ocelli in *Nevæ*, and considers that Kolenati was in error. But again I say, this difference, if it really existed, would be a generic, not a specific distinction; and, for myself, I cannot doubt, that if one *Acentropus* has ocelli, they all have. In 1864, after an abstract from the Natural History of Tutbury, Newman (Zool. 8920) said, "the species *A. Nevæ*, distinguished by the broad velvet-umber belt round the abdomen, is the one most commonly seen in cabinets; the beautiful belt has been mistaken for *grease*

by some of our entomologists;"* I presume this refers to English cabinets, at all events it is true that most of the English specimens have the middle segments of the abdomen darker than the rest, but I feel confident that no one who examines a series of *Acentropus* would think of resting a new species upon that alone. The value, however, of Newman's note is, that he recognizes the Neva insect as an English species, and the one most commonly seen in our Cabinets. Hagen had previously told us (Stett. Zeit. 1859, p. 203) that specimens from England were identical with one of Kolenati's specimens from St. Petersburg which was sent to him, and that Kolenati's doubt on the subject was unfounded. Lastly, Heinemann cites Stainton's insect and Kolenati's insect as identical with what he calls *A. niveus;* and Snellen (Tijd. voor Ent. 1871, p. 170) considers that the Dutch specimens agree perfectly with English examples, and with those collected by Nolcken in the Neva, and that the whole are referable to one and the same species.

Of *A. Nevæ* Nolcken says "female unknown," and this is true. But Kolenati says, "I saw one female dive and crawl down the stem of the *Potamogeton*." Now this was in 1846, ten years after Stephens in his 'Illustrations' had given the winged *Hansoni* as the female of *niveus*, and eight years before the existence of an apterous female was dreamt of. Under these circumstances, I think we may fairly infer that the female which Kolenati saw was a winged female: had it been apterous, so startling a novelty would scarcely have been unnoticed. Even when writing his account of the insect (which was not published till 1858), Kolenati would seem to have been unaware of Curtis and Dale's discovery of the apterous female in 1854, and the record thereof in our 'Proceedings' may well have escaped his notice; whilst Brown's history of the genus was not given to the public until 1863, and then in the form of an Appendix to a local Natural History, so that it was scarcely likely to attain that extended circulation on the Continent which the interest attaching to its contents rendered so desirable.

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* For instance, by Newman himself: "it is curious that the basal segments of *Acentria nivea* become greasy very shortly after the insect has been shut up in a camphored drawer" (Zool. 5629). I apprehend that the beautiful belt is Olivier's "partie supérieure de l'abdomen un peu obscure."

The *A. badensis* of Nolcken, of which I have seen a male sent by Reutti to Stainton, is the insect given as *niveus* by Heinemann, who treats *Nevæ* as identical therewith; and as the only locality mentioned by Millière for his *A. niveus* is the Lake of Constance, I should have thought that his fig. 20 represented *badensis*, but according to Staudinger and Wocke it represents *A. germanicus*, if not a "species diversa," distinct (I suppose) not only from *germanicus* and *badensis*, but from *Nevæ* also. As to *badensis*, Nolcken says, "the female has short rudiments of wings, so that this species cannot be identical with the English species, which has a wingless female;" we have seen that many of the English females have short rudiments of wings, but on this point I refer back to what I have said under the head of *Garnonsii* and *Hansoni*. He also remarks that the absence of the long hairy fringes of the hind tibiæ (for he cannot believe that Heinemann would have overlooked them) distinguishes it from the English species; but the caducity of these fringes has already been referred to, and doubtless Heinemann does not mention them for the same reason that every author except Brown has omitted to mention them. Lastly, Nolcken says that the absence of the two teeth on the hind-tibiæ of the male distinguish it from *A. Nevæ*, but as he himself, like everybody else, has been unable to discover these teeth anywhere but in Kolenati's figure, it is rather too much to adduce their absence as a proof of the distinctness of *badensis*. And as Staudinger and Wocke do not consider *badensis* entitled to specific rank, I think we shall not go far wrong in agreeing with them on this point.

The *A. germanicus* of Nolcken, from Pomerania, must be the insect which Zeller had in numbers (Stett. Zeit. 1867, p. 192) without its occurring to him that it was specifically distinct, and as Nolcken gives no reason for regarding it as distinct, I again agree with Staudinger and Wocke in refusing it specific rank. I am unable to make out why Staudinger and Wocke consider Millière's *niveus* to be Nolcken's *germanicus*, and not *badensis*.

There remains only *A. latipennis*, of which Knaggs has lent me a continental pair (♂ and ♀) sent to him by Staudinger. Möschler himself says, that *A. latipennis* "cannot easily be distinguished from *A. niveus*:" the only distinctions which I can gather from his description

are a slight difference in the length of the antennæ, some difference in colour and size, and the broader, rounder wings. "Both sexes with ample wings; by its colour, shape of wing, &c., a good species," says Nolcken. Herrich-Schäffer figured the original specimen, but his figure does not throw much light upon the subject: he mentions, however, that the palpi [of the ♀] are much shorter than in *niveus* [♂], the legs so far anomalous that the tibiæ of the four hindmost and the tarsi of the middle ones have long hairs [this is not peculiar to *latipennis*], and the thighs of the hindmost pair are only a little shorter than their tibiæ; also the antennæ are shorter, thinner, and scarcely perceptibly ciliate. I cannot find any published description of the male of *A. latipennis*. Millière's figures are too small to be of much use, and they are erroneous in the neuration of the hind-wings; but they are characteristic, and show the difference in the shape and outline of the wings very well; I imagine, however, that his fig. 21 represents a ♀ *latipennis*. The only recorded locality on the Continent for *A. latipennis* is Sarepta, on the Volga; but Knaggs has introduced the name into his 'British List,' manifestly considering it to be identical with the Hampstead form with the winged female. And of this, I think there is no doubt. An examination of the specimens sent by Staudinger shows that the female *latipennis* is only our old friend, the *Zancle Hansoni* of Stephens; in other words, Möschler's insect is identical with our London insect with the amply-winged female.

To slight differences in colour and size, I attach no importance. Hagen mentions that the colouring of the male *Acentropus* is variable in Prussia, the fore-wings being sometimes more and sometimes less flushed with brown (Stett. Ent. Zeit. 1859, p. 203), and he refers (*ib.* 1870, p. 316, n.) to specimens from Russia and East Prussia which had the wings marked with brown. Tengström (Not. Faun. Fenn. Förh. 1869, p. 324) says that Reuter captured specimens of *A. Nevæ* which in colouring resembled *latipennis*. And Ritsema (Tijd. voor Ent. 1871, p. 34, n.) reports that "the colour varies between snow-white and gray." I have not seen any specimen which could be appropriately described as snow-white; but I do observe differences both in colour and size in our English insects. These differences, however, do not

serve to distinguish *latipennis* (*Hansoni*) from *niveus* (*Garnonsii*), but are common to both forms; the English *latipennis* exhibits as great a range of variation, both in size and colour, as the English *niveus*; specimens from Cheshunt are precisely like those sent by Staudinger, and of the uniform dull tint depicted by Herrich-Schäffer, whilst others from Hampstead are of lighter hue, and prettily mottled, or flushed with deeper brown. The important point is, undoubtedly, the broader rounder wing of *A. latipennis*, and though the winged females agree well with one another, from whatever locality they come, there certainly is a difference in the shape of the wings of the male, which is very perceptible when the narrowest and the broadest winged specimens are contrasted; and some of the Hampstead examples are larger insects, and have even broader wings than the Continental *latipennis*, differing in this respect as much from *latipennis* as the latter does from *niveus*. But other males captured at the same time and place, and specimens taken elsewhere consorting with amply-winged females, exhibit the narrower wing which is supposed to distinguish *niveus*; and, in fact, there is every gradation, the extremes may be connected by intermediate forms, and I do not think the breadth of wing can be depended upon as a test of their specific distinctness.

If this be so, I submit that there is, after all, but one species of *Acentropus*; with a wide European range, and exhibiting perhaps slight modifications in different localities, but gradual modifications, the extreme forms being connected by intermediate links. Its geographical range extends from about 4° W. to 45° E. longitude, and from 48° to 61° N. latitude; even those who advocate the separation into several species admit that *A. Nevæ* ranges from the Gulf of Bothnia to the Bodensee, whilst *A. latipennis* occurs alike in England and South-Eastern Russia. And indeed, with the exception of the isolated Sarepta, on the Volga, there is a continuity about the localities which favours the idea of the unity of the species; thus starting from St. Petersburg, we pass along the North coast of the Gulf of Finland, then along the Prussian shore of the Baltic, and inland to Frankfort-on-the-Oder, then to Holland, England, France, and the southermost part of Baden or the northern confines of Switzerland. The insect is so insignificant in appearance that it may well be overlooked; if searched for, I have no doubt it would be found wherever a pond-weed grows.

There is one point to which I have not referred, because no use has hitherto been made of it, for the discrimination of the supposed species of *Acentropus*. I mean the shape of the genital organs and anal appendages, in which Trichopterists so much delight. Nolcken finds fault with the figures given both by Kolenati and Brown; and they are certainly wanting in detail. Hagen and Douglas have remarked upon the certainty which an examination of these organs would give, but to arrive at this certainty it is desirable that fresh specimens should be examined. From such examination of a few dried-up examples as I have been able to make, I find nothing which, in my view, warrants any separation into different species; but with newly captured insects, the result might be different.*

Nolcken himself, to whom we are indebted for the greatest amount of subdivision, admits that amongst the males of all the forms reported to be *A. niveus*, he could not find any trustworthy differences. In the case of forms so nearly allied, I think the *onus probandi* ought to lie upon those who assert their specific distinctness. And believing that, by simply asking an abstract question, I am less likely to provoke investigation and discussion, than by expressing an opinion which can be contradicted and disproved, I will conclude by expressing an opinion—to which I am not wedded, and from which I shall be glad to be converted—but still an opinion founded on such evidence as I have been able to obtain, namely, that all the forms of *Acentropus* heretofore attempted to be distinguished are, in fact, referable to one and the same species, for which, in the present state of our knowledge, I shall retain the name that is in vogue, *Acentropus niveus*.

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* Since this paper was read, M'Lachlan has examined the anal appendages of specimens from various localities. See the result stated in the next following paper.

The synonymy will stand as follows :—

LEPIDOPTERA PYRALIDINA.

Fam. ACENTROPODIDÆ.

Acentropidæ, Stephens, Ill. Mand. vi. 150 ; *Acentridæ*, Speyer, Stett. Zeit. 1869, p. 405.

The name *Acentropidæ*, which Stephens first applied to the family, (though formed on the analogy of *Megalopidæ* from *Megalopus*, which had the sanction of no less an authority than Lacordaire), has been amended into *Acentropodidæ ;* for this sesquipedalian word Speyer proposes the shorter *Acentridæ*. For myself, I prefer to take the name of the family from that of the typical genus. Moreover, the inappropriateness which modern discovery has shown to exist in the word *Acentropus*, though an insufficient ground for displacing a name that has obtained currency for forty years, is a sufficient ground for declining to admit the new name *Acentridæ*, which is just as inappropriate as *Acentropus*.

Gen. ACENTROPUS.

Acentropus, Curt. Brit. Ent. xi. 497. (*Acentria*, Ste. Cat. 316; *Zancle*, Ste. Nomencl. 118).

Sp. 1. ACENTROPUS NIVEUS.

Phryganea nivea, Oliv. Enc. Méth. vi. 536, 549 (1791). ♂.

Acentria nivosa, Ste. Cat. 316 (1829). ♂, sine descrip.

Zancle Hansoni, Ste. Nomencl. 118 (1833). ♀ alis amplis, sine descrip.

Acentropus Garnonsii, Curt. Brit. Ent. xi. 497 (1834). ♂ ; Proc. Ent. Soc. 1854, p. 24, ♀ alis abortivis.

A. niveus, Ste. Ill. Mand. vi. 150 (1836). ♂, ♀ alis amplis.

A. Nevæ, Kol. Wien. Ent. Monats. ii. 381 (1858). ♂.

A. latipennis, Mösch. Wien. Ent. Monats. iv. 55 (1860). ♀ alis amplis.

A. badensis, Nolck. Stett. Ent. Zeit. xxx. 283 (1869). ♂, ♀ alis abortivis.

A. germanicus, Nolck. Stett. Ent. Zeit. xxx. 283 (1869). ♂.

A. obscurus (var.), Teng. Not. Faun. Fenn. x. 324 (1869). ♂.

Hab.—France (Paris, *Olivier*).

England (Greenwich, *Stephens*; Reading, *Hanson*; Colchester, *Garnons*; Glanville's Wootton, *Curtis*, *Dale*; Burton-on-Trent, *Brown*, *M'Lachlan*; Hampstead, *Knaggs*, *M'Lachlan*, *Wormald*, *Piffard*; Lewisham, *Stainton*; Horning Fen, *King*; Wicken Fen, *Bond*; Haslemere, *Barrett*; Ringwood, *Corbin*; Oatlands, *Stevens*; Cheshunt, *Boyd*; Regent's Park, London, *Dunning*).

Scotland (*Leach*, according to Curtis and Stephens).

Russia (St. Petersburg, *Kolenati*, *Nolcken*; Helsingfors, *Palmén*; Pargas, *Reuter*; Abo and Nyland, *Tengström*; Sarepta, on the Volga, *Möschler*).

Germany (Greifswald, *Zeller*; Stralsund, *Hering*; Lenz, *Hagen*; Frankfort-on-the-Oder, *Zeller*; Bodensee, *Reutti*, *Heinemann*, *Millière*).

Holland (Leyden, *de Graaf*; Haarlem, *Weyenbergh*, *Ritsema*).

The following is a chronological list of the authors to whom I have referred:—

1791. Olivier, Enc. Méth. vi. 536, 549. *Phryganea nivea.*
1805. Latreille, Hist. Nat. Ins. xiii. 93. *Phryganea nivea.*
1829. Stephens, Syst. Cat. 316. *Acentria nivosa* (sine descrip.).
„ Curtis, Guide, 137. *Acentropus Garnonsii* (sine descrip.).
1833. Stephens, Nomencl. 118, ed. 2. *Zancle Hansoni* (sine descrip.).
1834. Curtis, Brit. Ent. xi. pl. 497. *Acentropus Garnonsii.*
1835. Westwood, Tr. Ent. Soc. i. 117.
1836. Dale, Naturalist, i. 14.
„ Stephens, Ill. Mand. vi. 150. *Acentropus niveus.*
1837. Curtis, Guide, 172, ed. 2.

1840. Westwood, Introd. Mod. Classif. Ins. ii. 324, 412; and fig. 113, 11-17.
1843. Boitard, Nouv. Man. d'Ent. iii. 130. *Phryganea nivea.*
1845. Westwood, Brit. Moths, ii. 257. *Acentropus niveus.*
1848. Kolenati, Gen. et Sp. Trichop. i. 6.
1852. Walker, Cat. Neurop. Brit. Mus. i. 136.
1854. Curtis, Proc. Ent. Soc. p. 24.
1856. Brown, Intell. i. 171.
1857. Douglas, Intell. ii. 59.
„ Newman, Zool. p. 5629.
„ Westwood, Proc. Ent. Soc. p. 76.
1858. Stainton, Ent. Ann. p. 102, f. 6. *Acentropus niveus.*
„ Brown, Zool. p. 5919.
„ Kolenati, Wien. Ent. Monats. ii. 381, pl. vii. *Acentropus Nevæ.*
1859. Hagen, Stett. Ent. Zeit. xx. 203.
„ Stainton, Manual, ii. 145. *Acentropus niveus.*
1860. Möschler, Wien. Ent. Monats. iv. 55. *Acentropus latipennis.*
1861. Herrich-Schäffer, Neue Schmett. Eur. iii. 123, fig. 155. *A. latipennis.*
„ Scott, Intell. ix. 125.
„ M'Lachlan, Intell. ix. 132.
„ Westwood, Intell. ix. 148.
„ M'Lachlan, Intell. ix. 156.
„ Newman, Zool. vol. xix. preface.
„ M'Lachlan, Zool. p. 7614.
„ Knaggs, Proc. Ent. Soc. p. 19.
„ Westwood, Report of Thirtieth Meeting of British Association, Transactions of the Sections, p. 123.
„ Wocke, Cat. Lep. d'Eur. p. 85. *A. niveus* and *A. latipennis.*
1862. Cooke, Zool. p. 8085.
„ Newman, Zool. p. 8216.
„ Westwood, Proc. Ent. Soc. p. 101.

1863. Brown, Nat. Hist. Tutbury, 393. *A. niveus, Hansoni,* and *Nevæ.*

1864. Newman, Zool. p. 8917.

„ Hagen, Verh. zool.-bot. Ges. Wien. xiv. 800, 865.

1865. Heinemann, Schmett. Deutschl. II. i. 2, p. 107. *A. niveus.*

„ M'Lachlan, Tr. Ent. Soc. III. v. 169.

1867. Zeller, Stett. Ent. Zeit. xxviii. 192.

„ Barrett, Ent. Mo. Mag. iv. 182.

1869. Nolcken, Stett. Ent. Zeit. xxx. 275. *A. niveus, Hansoni, Garnonsii, badensis, germanicus, Nevæ,* and *latipennis.*

„ Speyer, Stett. Ent. Zeit. xxx. 400.

„ De Graaf, Tijd. v. Ent. II. iv. 203.

„ Tengström, Notis. Faun. Fenn. Förh. x. 324, 358. *A. Nevæ,* var. *obscurus.*

1870. Speyer, Stett. Ent. Zeit. xxxi. 202.

„ Hagen, Stett. Ent. Zeit. xxxi. 316, n.

„ Douglas, Ent. Mo. Mag. vii. 43.

„ Millière, Iconog. de Chenilles et Lep. iii. 160, pl. 115, f. 20, *A. niveus,* f. 21, *A. latipennis.*

„ Knaggs, Cab. List of Lepid. of Gt. Britain and Ireland. *A. niveus* and *A. latipennis.*

1871. Wocke, Cat. Lep. d'Eur. p. 216. *A. niveus, Hansoni, Garnonsii, Nevæ, latipennis.*

„ Ritsema, Tijd. v. Ent. II. vi. 34, 157.*

„ Corbin, Entom. v. 421.

„ Knaggs, Lepidopterist's Guide, 68, 82, 86.

1872. Newman, Entom. vi. 10.

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* I am informed, April 10th, 1872, by the author of the "Geschiedkundig Overzigt van het Geslacht *Acentropus*," that a continuation thereof is in the hands of the editors of the "Tijdschrift voor Entomologie."

And in the "Petites Nouvelles Entomologiques" for April 15th, is a note by Ritsema, in which the author reiterates the opinion that there are but two known species of *Acentropus*, *A. niveus* and *A. latipennis*, "the latter having been met with only in Southern Russia." From what has been said above, it will be seen that this is not correct; *A. latipennis*

having been captured in England, quite as frequently as *A. niveus*. I am quite in accord with Ritsema when he says that *A. Hansoni*, *Garnonsii*, *Nevæ*, *badensis*, and *germanicus* are not specifically distinct from *A. niveus*; but I go a step further, and say that *A. latipennis* is identical with *A. Hansoni*.

With reference to *A. obscurus*, Ritsema appears to think that Tengström described it as a new species, and that Wocke has reduced it to the rank of a variety of *A. Nevæ*; the fact is, however, that Tengström never regarded *A. obscurus* as anything more than a variety of *A. Nevæ*, and he expressly described it as such.

Ritsema expresses surprise that Staudinger and Wocke have not adopted the name *Acentropidæ* for the family; but when the derivation of the word *Acentropus* is remembered, it is at once seen that there is no ground for surprise, and that the change of *Acentropidæ* into *Acentropodidæ* is only in accordance with the orthographic system which Wocke has followed throughout his part of the Catalogue. For instance, the familiar *Pyralidæ* have on the same principle been converted into the *Pyralididæ*. Staudinger on the other hand has retained the familiar *Pieridæ*, which, had it occurred among the Micro-Lepidoptera, would, I suppose, have been written in its correct form of *Pieridídæ*.