I captured another *N. sparganii* in my garden on 30th August. At Mucking on 6th September a perfect specimen of *Acherontia atropos* L. was in the trap, and the 7th brought me the fairly scarce *Chilodes maritima* Tausch., and on the 9th there was a vagrant insect from the south of Europe, a *Leucania vitellina* Hübn.

The trap at Mucking is ideally situated to receive night flying insects, migratory or otherwise, for there are no competing lights for at least a mile in any direction. Talking of migratory moths, it is perhaps worth recording that the trap at Mucking caught an example of *Rhodometra sacraria* L. on 27th September, and another on the following night, and a female *N. obstipata* on the 30th. Other insects during this period were a *P. pruinata* subsp. *atropunctaria* Walker on the 27th September and *N. sparganii* on the 29th and a *Cirrhia gilvago* Schiff. on 2nd October. I caught other lepidoptera after that date but nothing of note. All in all, not a bad year for a local collector.

A word on my portable generator might not come amiss here; as mentioned it is the Honda E IV 300 and I have used it for two years now, and can thoroughly recommend it as a compact, dependable and safe power unit; it measures only 14″×10″×13″ and weighs 40 lbs. The engine is a 4-stroke 55·4 cc, and so quiet that one can hold a normal conversation, without shouting, while it is running. It has other uses and, if it is a poor night and one feels that way, one can plug it in to a television set and watch that (Perish the thought!).

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English Entomological Methods in the Seventeenth and Eighteenth Centuries*

PART III: MOSES HARRIS' *THE AURELIAN*

By Ronald Sterne Wilkinson, F.L.S., F.R.E.S.

Previous parts of this study have traced the development of English entomological methods from the mid-seventeenth century to the publications of Benjamin Wilkes and James Dutfield. The next source in which collecting and rearing procedures were discussed was that *nonpariel* of eighteenth-century English entomological books, *The Aurelian.*

Lisney has shown that Moses Harris was born in 1730 and died *circa* 1788[1], but we know surprisingly little about his early years. He explained in the preface to *The Aurelian* that his uncle, also named Moses Harris, was a member of the original Aurelian Society. Young Moses attempted to join the group, probably in 1742, but as he was only twelve years of age he was obliged 'to defer it" until experience furnished him with "sufficient Sagacity"[2]. He may, however, have gained some inspiration from the several noted collectors who graced the membership of the Society. There was the artist Benjamin Wilkes, whose *Twelve New Designs of English Butterflies* appeared in 1742, along with the sheet of

collecting instructions (see Part II) which Harris certainly read. Wilkes announced in 1742 that "any Gentleman or Lady may See His Collection of Insects"[3], and doubtless the precocious young Moses Harris was able to gain *entrée*.

There was also the elderly Joseph Dandridge, *doyen* of English collectors in 1742, yet still willing to give advice to beginners of a much later generation. Dandridge could trace his career to the previous century and the beginnings of scientific entomology in England, for he had worked with John Ray and James Petiver; his stories of 'the early days' must have enlivened many meetings of the Aurelian Society[4].

The fire of 1748 that destroyed the Society's rooms in the Swan Tavern, Cornhill, put a temporary end to Harris' hopes for membership. Yet, as the preface to *The Aurelian* tells us, he continued to "take all Opportunities, to get Knowledge in the Times, Seasons, and Manner of breeding" insects. While beginning his career as miniature-painter, he produced coloured drawings of many species of Lepidoptera, and developed an interest in wing venation that was to lead to his early efforts at classification by that method[5].

Harris' *Proposals for Engraving by Subscription a Collection of Prints of Butterflies & Moths* evidently appeared in 1758, although Lisney (no. 224) did not date the sheet. The *Proposals* announced that a fascicle, priced at half-a-crown and consisting of a plate with its text in English and French, would be published each month. By December of that year the first part of *The Aurelian* was being sold. Lisney's copy of the first part (Lisney 225) did not have a printed cover. Yet the printed cover that appeared with the second part (Lisney 226) was surely originally designed for the first part, for it reads "London, Dec. 16, 1758. Number I. of the Aurelian . . .", giving us in a round-about way the date of appearance of the original number. The same printed cover was used for the second part and the third (Lisney 227), the required information being amended in ink. The second part (Lisney 226) appeared on "February 9th 1759", according to the inserted ink date. Lisney's dates of 1758 for the second and third parts should certainly be amended to [1759]. Publication dates of subsequent parts are uncertain, and copies have been located of parts 1-4 only.

Lisney's assertion that "it is probable that the publication of the work in separate numbers ceased" after No. 4 (p. 162) does not square with his seeming acceptance of Hagen's evidence that 14 plates had appeared by 1765 (p. 158). It would seem rather that parts of *The Aurelian* continued to appear despite various delays, but that original parts beyond 1-4 (which survive in single known copies) are no longer extant or have not yet been discovered. This is by no means remarkable, as a similar work that appeared in parts, James Dutfield's *New and Complete Natural History of English Moths and Butterflies* (London, 1748-9), is known only by six fascicles at the British Museum (Natural History), and I know of *no* surviving parts of Benjamin Wilkes' *The English Moths and Butterflies*.

Covers of the early numbers of *The Aurelian* indicated that Harris had "made this Part of Natural History his Study", and had "bred most of the Flies and Insects for these twenty Years". The inference is that Harris began his rearing activities at the age of eight—a prodigious performance indeed. By this time *The Aurelian* was published in complete form in 1766, Harris had been instrumental in founding the second Aurelian

Society, which, "Phoenix-like", arose "out of the Ashes of the Old", and was secretary of the group[6].

The excellent illustrations in *The Aurelian* depict a miscellany of equipment. The frontispiece shows the author holding a clap-net in his lap and a chip-box filled with insects in his left hand, while an identically dressed figure (probably Harris, also) demonstrates the use of the net in the background. A title vignette contains a clap-net, probe or 'prowler' for larvae searching, chip-box with lid, beating sheet, two racket nets and breeding cage. Other devices are cleverly integrated into the colour plates, as shall be seen. There is a long and interesting passage in the preface explaining Harris' use of various nets:

"There are several Sorts of Nets made Use of to catch Insects, to wit, the Batfolder, the Racket, and the Scithers Net: The Batfolder is made of Musketta Gauze, and is form'd like the Batfolding Net made Use of to catch Birds; these may be had at the Fishing-Tackle Shops, by asking for them; they call them Butterfly Traps[7].

The Method of using the Batfolding Net is thus: On seeing the Insect come flying toward you, you must endeavour to meet it, or lay yourself in its Way, so that it may come rather to the right Side of you, as if you intended to let it pass; then having the Net in Your Hands, incline it down to your right Side, turning yourself a little about to the Right, ready for the Stroke; not unlike the Attitude in which a Batman in the Game at Cricket stands, when he is ready to strike the Ball, only his Bat is lifted up, but your Nets must incline rather downward: When the Fly is within your Reach, strike at it forcibly, receiving the Fly in the Middle of your Net, as it were between the two Sockets of the Benders, that being the Part of the Net which best receives the Insect; and not only so, but should the Fly strike against the Belly or wider Part of the Net, the Course of Air caused by the Motion of the Nets, would carry the Fly with it out of the Net between your Hands, which I have often experienced. The Motion of your Hands in catching, must be from your Right Hip to your left Shoulder, not at all retarding the Motion, 'till 'tis as it were spent, closing the Nets in the Motion.

You are likewise to remember never to give the Stroke over-handed, unless the Situation of the Place oblige you to it. Having closed the Net with the Insect in it, immediately grasp both the Sticks in your left Hand, and with your Right lay hold of the bottom part of your Net, pulling the Gause pretty tight, giving that also to the Gripe of the left Hand, this confines your Fly from struggling. Put then your Hand against the Fly on one Side, and bringing the Top of your Forefinger on his Body, and with your Thumb on the other, squeeze him gently, then lay your Nets on the Ground, and take out your Fly by a Horn or a Leg, and holding him in an advantageous Manner by the Body in your left Hand, run a Pin thro' the thick Part of the Body, or Chest, perpendicularly and put it in your Box.

When you pursue a Fly you must catch him when in your Reach, in the same Manner, except its Course is along a Ditch, on the Left-hand Side of you, and then you will be able to touch it, the Position being very aukward; in this Case you must overtake it, and turning nimbly about, the Position will then be as in the first Case; the Fly then coming to the right Side of you. I having given you sufficient Instructions for the Use of the Batfolder, I shall next proceed to the Racket Nets, Which are

form'd of Wire about the Size of a Raven's Quill, turned round to a Circle, bending the Ends outwards by way Shanks[8], which are made fast in a Brass Socket; this Circle or Ring of Wire is covered with Gause, and bound round with Ferret[9]; a round Stick of about two Feet in Length is fitted to this Socket, by Way of Handle. These Sort of Nets are what an Aurelian should at all Times carry about him; a Pair of these of about six Inches Diameter are the most convenient for that Purpose. The chief Use of these Sort of Netts are for catching Moths, sitting against a Tree, Wall, or Pales; or a Moth or Fly sitting on a Leaf, may be conveniently caught between a Pair of these.

The Scithers Net are no more than a small Pair of these Racket Nets, fixed on two Pieces of Iron which are rivetted across each other, with two of the Ends turn'd round in the Form of Rings, for the Admittance of the Thumb and Finger; in short, a Pair of Toupee Irons, or Curling Tongs, such as is used by a Hair-Dresser, are very well adapted for this Purpose, with a round Net fixed to the End of each Tang with binding Wire, or small twine well waxed; these Nets are principally adapted to take small Moths, etc."[10].

Thus in the years between Wilkes and Harris, which were only fourteen to sixteen in number, the English collector's complement of nets had been increased by several sorts. We have examined the problem of James Petiver's mysterious net in an earlier part[11]; it may have been either a bag-net or the 'scithers' of Harris (called 'forceps' by most later authors) which may have gone out of fashion in the interim or was simply not mentioned by Wilkes. My research in the Petiver papers since outlining the problem in 1966 provides evidence for the former thesis, that Petiver's 'Muscipula' was the Continental bag-net, which must have been temporarily overshadowed by the application of the clap-net to entomological collecting.

The bag-net, wholly lacking in Wilkes' list of apparatus, appeared (or reappeared) in *The Aurelian* in modified form. Explaining the difficulty of taking the adult *Apatura iris*, Harris suggested that the collector provide himself "with a Pole fifteen Feet long, with a Net at its upper End, the Mouth of which, when you have covered the Fly, is drawn together by a String, as a Purse is "[12]. The matter sounds simple, but presumably few *iris* were taken by this apparatus! Years later Adrian Haworth (in his *Lepidoptera Britannica*) lengthened the unwieldy pole and divested the 'purse' of its string; the bag-net continued as a requisite for *iris* but did not come 'down to earth' in its present form until well into the nineteenth century, notwithstanding its Continental popularity all along.

Undoubtedly the authority of such writers as Wilkes and Harris helped to fix the clap-net so immovably in the English *repertoire* that it could not be dislodged from its primal position until after 1850 and did not disappear entirely until about 1900. A photograph conveniently reproduced by Richard Ford shows a group of entomologists, *ca.* 1900, with a clap-net that must surely have been among the last[13]. As may be expected, the design had to be defended at an early date against the claims of its European rival. It is true that the clap-net could be used as a beating-tray, and in experienced hands it was adequate for most needs. Yet the last argument was always one of tradition, and to-day no one will doubt that the demise of the 'batfolder' was a blessing. The wonder is that it

survived as long as it did, as Harris pointed out its defects in the same pages of *The Aurelian* that described its use.

The clap-net described by Harris was at least more portable than Wilkes' early design. It was constructed "to take in Half, or put to gather at Pleasure, by a Brass Socket in the Middle[14], and carried convenient with the Benders in a Canvas Bag under the Coat"[15], presumably, as Kirby and Spence phrased it sixty years later, to avoid being "stared and grinned at by the vulgar"[16]. The necessity of keeping the net under one's coat was not new even to Harris; when collecting at Cadiz in 1701, Jezreel Jones wrote James Petiver that he had "been suspected for one that studys witchcraft, necromancy and a madman" by those who saw him "following butterflies"[17]. Two other nets were mentioned in *The Aurelian*, making a total of six; there was the water net which Harris "fixed to the End of a long Stick" and used to take up mud and weeds in search of dragonfly larvae[18], and a "beating Net" of uncertain provenance[19].

Harris carried the inevitable pincushion, as well as a clasp-knife, needle and thread for repairing the nets, and chip boxes to serve as collecting receptacles. These were double-corked like Wilkes', but were papered as an added refinement. He used a beating sheet, and directed that for tall trees it "should at least be seven Yards long, and five broad"[20]. A prowler was employed for probing high branches, "near sixteen or eighteen Feet long" for "vast oaks"[21]. This is probably the lengthy apparatus pictured in the title vignette. Two sorts of modified chip-boxes were described as field receptacles for larvae, one "in the Lid of which should be cut a Hole, as large as will about admit your Thumb to go in easily; this must be stopt with a Cork close fitted"[22]. Another and more elaborate box appears on plate XIX, fitted with "a thin Brass sliding Cover" over the "oblong Hole in the Lid"[23].

Harris' method of assembling was somewhat improved over that of Dutfield and Wilkes, as he not only put out decoy females in gauze-covered boxes but practised 'tying' as well. He explained that for such large moths as *pavonia*, *populi*, *tiliae* and *ligustri*, "the usual Method is, to tie the Hen to a Tree, Bush, etc., lightly tied or fastened round the Body with a Piece of sewing Thread, and there to be left all Night, and in the Morning, when you return, you will almost be certain to find Madam accompanied by her Spark, who will not desert his Mistress, though her Favours be ever so easily obtained"[24]. The lantern is also mentioned as a method for attracting moths, and it is interesting to note that Harris searched for nocturnal larvae with a lantern after noting the location of their frass during the day[25].

The breeding cages described in *The Aurelian* are light, open and modern, being truly cages instead of mere boxes. Harris knew that some larvae would drown themselves if allowed, and cautioned that in such cases the sprig of foodplant "should fit the Mouth of the Bottle very nicely"[26].

Like Wilkes, Harris used cork-veneered setting boards without grooves, and card 'braces'. His description of setting is very similar to that of Wilkes, and close examination reveals more than a casual debt[27], although Harris' boards were covered with paper in the same manner as his boxes. In the era before the discovery of relaxing techniques, small

insects often had to be set in the field, and Harris suggested that braces should be taken along for that purpose, "otherways 'tis impossible to do it afterwards"[28]. His plate of *Smerinthus tiliae* shows that insect set out in a collecting box, so apparently larger species were thus treated when time allowed[29].

Harris seems to have been the first English entomologist to make a thorough study of the museum beetle and its depradations. The various stages of that insect are depicted on plate V of *The Aurelian,* and in the text the author explained that he had given up camphor as a preservative because it was not a sure preventive and was supposedly harmful to the colours of specimens[30]. He advised treating cabinet drawers before corking by placing them "some Distance from the Fire, so as to obtain a little Warmth", then rubbing them "with a small Quantity of *Unguentum Serulium* . . . on a woollen Rag". Harris' *unguentum serulium* [*recte cærulium*] or 'steel-blue ointment' was a common medical preparation of the day, composed principally of metallic mercury and hog's lard. Gum arabic was to be used when papering drawers instead of paste, which was attractive to pests[31].

Although Moses Harris produced several important volumes after 1766, which will be discussed in the next part of this study, most of his contributions to entomological technique were made in the pages of *The Aurelian.* His advice was followed by generations of naturalists, who treasured their copies of the lovely work and called for three further editions—the final as late as 1840[32]. His methods were little modified until the first decades of the nineteenth century, and a copy of *The Aurelian* (should the collector be lucky enough to obtain one) is still the corner-stone of any library of early English entomological books.

Notes

*The first part of this paper (to 1720) appeared in *Entomol. Rec.* LXXVIII (June, 1966), 143-151. The second part (Wilkes and Dutfield) was printed in LXXVIII (December, 1966), 285-292.

[1]The most complete bibliographical *résumé* of Harris' works is given by Arthur A. Lisney in *A Biblography of British Lepidoptera, 1608-1799* (London, 1960), 156-75. There is a brief account of Harris in the *DNB.* His date of birth is usually given as 1731, but Lisney owned an original drawing that indicated the correct year.

[2]Moses Harris, *The Aurelian* (London, ([1758]-66), [v], hereafter cited as Harris.

[3]Wilkes kept his collection "against the Horn Tavern in Fleet Street", and extended his invitation in the text of the engraved "title-plate" to *Twelve New Designs.* See the discussion of him in the second part of this study.

[4]Dandridge has recently been discussed in several articles. D. E. Allen paved the way with "Joseph Dandridge and the first Aurelian Society", *Entomol. Rec.* LXXVIII (April, 1966), 89-94. William S. Bristowe's interesting "The Life and Work of a Great English Naturalist, Joseph Dandridge, 1664-1746", *Entomol. Gaz.* XVIII (April, 1967), 73-89, has been followed by his "More about Joseph Dandridge", *Entomol. Gaz.* XVIII (October, 1967), 197-201. Natalie Rothstein's "Joseph Dandridge, Naturalist and Silk Designer", *East London Papers* IX (Winter, 1966), gives information on his trade.

[5]The account of the Cornhill fire in *The Aurelian* tells us all we know of the demise of the First Aurelian Society; "the *Swan Tavern* was burnt down, together with the Society's valuable Collection of Insects, Books, etc., and all their Regalia : The Society was then sitting, yet so sudden and rapid was the impetuous Course of the Fire, that the Flames beat against the Windows, before they could well get out of the Room, many of them leaving their Hats and Canes; their Loss so much disheartened them that

altho' they several Times met for that Purpose they could never collect so many together, as would be sufficient to form a Society, so that for fourteen Years, and upward [*i.e.* until 1762 or 1763], there was no Meeting of that Sort"; preface, [v]. Harris' work on venation will be discussed in Part IV.

[6]Harris' office is mentioned on the title of *The Aurelian* and the rise of the second Society in the preface, [v]. The *Proposals* and covers of the early issues also give us Harris' address at the time, "Mr Biddles Watch Maker in New Bond Street" (*Proposals*), presumably the same address as "the Golden Head in New Bond-Street, two Doors from Conduit-Street" (*Aurelian*, early parts, printed cover).

[7]"batfolder", bat-fowler or clap-net (see Part II). The passage concerning clap-nets available at tackle shops as "Butterfly Traps" is the earliest notice we have of entomological collecting equipment *for sale* in England. It indicates that by 1766 'aurelians' were common enough to cause a demand for such things.

[8]"by way Shanks", *i.e.* by bending the ends outward to form 'shanks' or appendages ("A part or appendage by which something is attached", *OED.*).

[9]"Ferret", a stout cotton or silk tape.

[10]Harris, [x-xi].

[11]Part I, pp. 146-8.

[12]Harris, 7.

[13]R. L. E. Ford, *Practical Entomology* (London, 1963), plate 1. I am indebted to my friend Richard Ford for his information regarding this photograph, as well as for much advice about early collecting equipment described in these papers.

[14]*i.e.* connecting the two rods making up the net.

[15]Harris, [xi].

[16]William Kirby and William Spence, *An Introduction to Entomology* IV (London, 1826), 525.

[17]Jezreel Jones to James Petiver, 2 April 1701, Brit. Mus. MS. Sloane 4063, f. 76r.

[18]Harris, 54.

[19]Harris, 53.

[20]Harris, 39.

[21]Harris, 39.

[22]Harris, [xi].

[23]Harris, 40.

[24]Harris, 61.

[25]Harris, 44.

[26]Harris, 39.

[27]Harris, [xii]. His debt to Wilkes' instructions (which were reprinted in *The English Moths and Butterflies*, with very minor changes), may be seen as follows :

Wilkes	*Harris*
Take a Fly out of your Box : see if the Pin be run through it perpendicularly, if so, stick it on one of your setting Boards, and with the point of a Needle . . . extend one Wing leisurely, till such Time as the Point thereof is even with the Nose of the Fly you are setting. That done, fix one of your Cork Bracers gently on that Wing, to prevent its giving way; serve the other Wings in same manner, and your Fly will appear extended as in the Prints. Let the Bracers remain on the Wings of Butterflies a Fortnight, on those of great Moths a Month.	Take a Fly, and observing if the Pin be perpendicularly run thro' the Body, place it on the Setting-board, then take your Point and gently raise one of the upper Wings, 'till such time as the Tip be even with the Nose of the Fly; this done, fix one of your Card Braces on that Wing, to prevent its giving Way; do the same by the Wings on the other Side, and your Fly will be properly extended. Let the Brace remain on the Wings of Butterflies a Fortnight, on those of large Moths a Month.

I have quoted the *Instructions*, as it is not possible to determine which text was paraphrased by Harris.

[28]Harris, [xii].

[29]Harris, plate XX.

[30]Harris, 11.

[31]Harris, [xii]. The mercurial ointment, which "may be had at the Apothecaries . . . one Ounce is sufficient for twenty Drawers", was commonly mentioned in the dispensatories of the eighteenth and nineteenth centuries. For those dissatisfied with naphthalene or paradichlorobenzene, the formula follows from *The Dispensatory of the Royal College of Physicians, London* (London, 1746), p. 366 : "Take of tried hog's lard two pounds, of quicksilver [metallic mercury] one pound, of the simple balsam of sulphur [sulphur boiled lengthily with an essential oil] half an ounce. Rub the quicksilver with the balsam of sulphur, till the quicksilver no longer appears [as a metallic substance] : then add by degrees the lard warmed, and diligently mix them". Turpentine can be used instead of balsam of sulphur, and the yield is enough to prepare forty-eight twenty-drawer cabinets.

[32]There was a second issue of the first edition *ca.* 1773. The second edition appeared in 1778, with a second issue in the same year and a third *ca.* 1814. In 1794 a third edition was produced, with a second issue in the same year. The fourth edition, with additional material by J. O. Westwood, appeared in 1840, following advance copies in 1839; see Lisney for details.

Some Aspects of the Fauna of the Sahara

By J. L. Cloudsley-Thompson

During June and July 1967, accompanied by Mr. and Mrs. Robin Thelwall in a Land Rover, my wife and I drove across the Sahara in an Autounion (D.K.W) "Munga 4," along the Route du Hoggar, on our way from London to Khartoum. Our original intention had been to drive along the North African coast, but the Israeli war put a stop to that. Although shortage of time precluded lengthy halts and most of the daylight hours were spent in driving, the following observations may be of interest, not only to biologists who have had an opportunity of visiting this fascinating region of Africa, but to others who may intend to do so —especially as we found it almost impossible, before our departure, to obtain any information about the route which could aid us in our preparations. Knowledge of the problems we encountered may enable others to be better prepared for similar eventualities. Naturally we expected some difficulties, but not such unpleasantness from officials in ex-French territories. Nor, of course, would anyone have hoped for such kindness as we experienced in Nigeria and Sudan.

We drove through France and Spain via Barcelona, to Algeciras where we took the ferry to Ceuta. Thence we went through *Eucalyptus* groves and grassy plains to Rabat where we turned east through green glades and forests of cork oak, with cryptic jumping-spiders (Salticidae) on the bark, numerous wolf-spiders (Lycosidae) on the sandy soil beneath the trees and clumps of pine with cicadas singing in the branches. At Fez we saw snake-charmers, who appeared to treat their defanged serpents in an unnecessarily rough and brutal way, groups of dancers and various side-shows in the *sük*. East of Taza we entered a high plain, much overgrazed, mostly by sheep, and dissected everywhere with gully erosion; egrets and storks were numerous. Most of the low hills were dominated by ruined stone forts. Then to Sidi-bel-Abbès, a modern French-style town and Frenda, where the country-side consisted of rolling hills and wide plains. South of Tiaret we saw the first sandgrouse and camels. The latter were dark brown in colour and shorter in the leg