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HEMIPHLEBIA MIRABILIS SELYS: SOME NOTES ON DISTRIBUTION AND CONSERVATION STATUS (ZYGOPTERA: HEMIPHLEBIIDAE)

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H. mirabilis is in a taxonomically isolated position and the opinion is widely held that it is the oldest relic among living odonates. The species seems to have died out in the area of its original known haunts in Australia, due to farming, and it was probably last seen there in the late 1950ies. It is listed as endangered in the I.U.C.N. *Invertebrate Red Data Book* (1983). A strong colony has been found this year in S. Victoria. A brief history of the species is given and an opinion on its survival prospects.

INTRODUCTION

A recent journey which took me through Victoria, Australia, provided an opportunity to make a brief reconnaissance for *Hemiphlebia mirabilis*. This very small, metallic-green damselfly (approx. span 22 mm, length 24 mm) was described from more than 20 specimens sent to Selys by "mon honorable collègue M. Weyers" (SELYS, 1877), together with a female of *Synlestes weyersii* Selys, from Port Denison, Queensland.

Selys recognised unique features in *Hemiphlebia* ("...ce genre extraordinaire...") which are reflected in the specific name he allotted. The species was not seen again until about the turn of the century, when Captain Billinghurst of Alexandra, Victoria (about 160 km N.E. of Melbourne) sent specimens (also *Caliagrion (Pseudagrion) billinghursti* and *Austrocnemis splendida)* from the Goulburn river lagoons to Réné Martin who said (MARTIN, 1901) "Cette jolie petite espèce, considerée longtemps comme très rare, semble assez répandue dans certaines localités de la province de Victoria". Although more than 20 years later TILLYARD (1928a) said "...the only known localities for it so far being Port Denison (Bowen), Queensland and Alexandra, Victoria", he had explored widely

in Queensland and Eastern Australia for it without success and declared (TILLYARD, 1937-40) that there was no suitable habitat there for it. Indeed it is no longer believed to have existed at Port Denison and actually Selys's series from Weyers are not labelled Port Denison but just "Q'land", except one specimen at the British Museum (paratype, ex Selys, ex McLachlan). Nor is it believed to have been in Queensland although in the light of the nature of the niche described below I would not agree with Tillyard's views about unsuitability. With regard to *Synlestes weyersii,* this also turned up in due course in Victoria and certainly would not occur in Queensland because north of its Victoria-NSW range it is replaced by other species of *Synlestes.* It is supposed that Port Denison was the place of export of Weyers's material. Be that as it may, TILLYARD (1913) found the species in 1906 at Billinghurst's Alexandra locality; other specimens pre-1906 at the Brussels and British Museums are ex-Martin (Victoria) from Billinghurst.

TILLYARD (1913) described a fascinating and curious behaviour pattern of the male waving its abdomen up and down to expose the long white feathery inferior appendages to draw the attention of females; without this signal the insect is very difficult to see, camouflaged in the reeds. On seeking larvae in 1927, TILLYARD (1928a) gave the impression that there was only one *Hemiphlebia* lagoon, although the wide Goulburn valley has a great number of lagoons and ox-bow lakes as it meanders north as a tributary of the Murray river. Tillyard had difficulty in finding the lagoon, "About two hours were spent on the Saturday evening searching for the original locality but without success..." The party found the place the following day. Tillyard could hardly not have looked at other lagoons in 1906; indeed Tillyard gave his opinion later that this lagoon was different in having deep holes as a reservoir of water while other lagoons periodically dried up. From photographs of the area taken by Tillyard this lagoon was cleverly rediscovered by a party in 1954 (BURNS, 1955) and specimens found in good numbers. Some years later no specimens were found there nor in the valley of the Yarra river (Dr A. Neboiss, pers. comm.) where there were colonies, at least one of which was still in existence to the end of the 1950ies (NEBOISS, 1962); a pair taken there in 1959 (Healesville) by B.P. Moore is in the British Museum. This area is on the other (South) side of the West end of the Great Dividing Range, from where the Yarra runs West into Melbourne; the Yarra also had numerous lagoons a century ago, now built over, farmed or polluted. My pilgrimage round the area in 1985 was odonatologically most depressing. Before farming took away the niches *Hemiphlebia* may well have been widespread among the thousands of lakes in the several river valleys. The cow must be *Hemiphlebia*'s worst enemy.

Also recognising the unusual features of the species, Tillyard sent material to Kennedy, who, from examination of the penis stated (KENNEDY, 1920). "It certainly has no near relatives among known Odonata". Tillyard obtained larvae in 1927 and from his studies (TILLYARD, 1928a) said "It will thus be seen that

the progress of researches on the order Odonata... has picked out this obscure Australian genus from a mass of unrelated forms and set it up as one of the key-genera for the right understanding of odonate phylogeny". He went on to make detailed studies of tracheation and venation (TILLYARD, 1928b) and related the species to early lestids, particularly to synlestids, (among which are the only other extant genera with an open base to the discoidal cell, i.e. *Chorismagrion risi* Morton and, as an aberration, in *Synlestes* itself). He drew several other possible connections, such as the biramous mandibles being not unlike those of Epallagidae (Euphaeidae) and Polythoridae; these families have (with Calopterygidae) a complete pterothoracic interpleural suture but somehow they failed to find Australia (ignoring a recent incursion by *Neurobasis* from the North); but they must be of separate lineage from very far back because *Hemiphlebia* is conventional in this regard (ASAHINA, 1957). The larval gizzard showed archaic structure, and features of venation Tillyard related to the Triassic fossil *Permagrion falklandicum.* He also sent "an ample supply" (over 40 specimens) to Fraser, who also discussed the implications of the venation (FRASER, 1938) but showed that the "double-barrelled" anal vein plus wing border was not special to *Hemiphlebia.* TILLYARD (1937-40) elevated *Hemiphlebia* to superfamily status.

At a time when there was no known colony of *Hemiphlebia* still existing, a single specimen was identified among some Odonata found at Wilson's Promontory on the S. Victoria coast, 230 km S.E. of Melbourne in 1977 (Dr Rosser Garrison, pers. comm.), but unknown to me at the time of my recent visit! The capture was made by a dipterist and hence its significance was not recognised.

OBSERVATIONS

In January 1985 I looked along the S. Victoria coast from Sale in the East, via Lake Denison, to Wilson's Promontory in the West, where a strong colony of *Hemiphlebia* was found. Lake Denison was explored because of the possibility of confusion with Port Denison, but with the lapse of time the possibility of any firm connection will have gone. In the 1860ies Lake Denison was a large (3 km x 1km) sandy-bottomed, reedy fresh water lake. I have the whole fascinating history of this lake from its present owner, Mr David Borthwick. After floods the lake fills and is let out by a gap made through an artificial cutting between the sand dunes to the sea. The sea then builds a new sand bar up to 2.5 m high in a few weeks. This rapid accretion has led to numerous such fresh water lakes and lagoons all along the coast from Sale to Wilson's Promontory. The area was settled for farming in the 1850ies, and the more easterly Gippsland lakes were opened to the sea in 1889. Many marshes, even still marked on current maps, have been drained and sucked dry with wind pumps for cattle. In addition several rivers draining South into the Bass Strait, e.g. the Tarwin, show traces (from the air) of extensive meanders

and ox-bow lakes. Thus, very little damp ground was found in January 1985 (although it was a "late" season) East of Wilson's Promontory; earlier than January there had been a few areas of wet marsh.

Wilson's Promontory itself is composed of a row of hills, the highest being 755 m, formerly islands but attached in very recent geological time to the mainland by sandbanks. The hills drain to the sea through extensive areas of marshy reeds on sand. The area became a National Park in 1905; a tract to the North (Yanakie Isthmus) was added to the Park in the 1960ies.

It was with surprise and delight that I spotted the first specimen there, a male, catching my eye by waving its long feathery appendages as Tillyard described; the abdomen is curled up, much as in many calopterygines when calling attention to themselves; in *Hemiphlebia* the inferior appendages are separated out laterally into a wide V form and the movement is made repeatedly at about 2 per second. The specimen obligingly allowed itself to be picked up between thumb and forefinger for inspection; on release it flew gently to the nearest reed and continued signalling, ("Do not travel far if a short distance will suffice" — old Welsh proverb wrongly attributed to Confucius).

The general area is forested with large Manna gums and smaller trees and shrubs, Coast Banksia, Drooping She-oak, Coast Wattle, Swamp Paperback and Coast Tea-tree. Wet areas are difficult to penetrate having dense reeds up to shoulder height in shallow marsh, ankle deep to 1 m or more. Patches sheltered from the wind had an abundance of specimens, I estimated as many as a hundred in 10 m^2. These were perched, more or less horizontally when active or flying about the Tea-trees and lower among the reed masses, which were in water not over 0.2-0.3 m deep. They extended, dense or sparse according to wind exposure, over an area of about 100 m^2. The stance was very characteristic, females were easy to see in silhouette horizontally perched around the tops of the shrubs which had more or less vertical, rather than spreading, growth style. Females responded to male signalling by revealing their own snow-white appendages also.

An adjacent area more or less dry had none; another adjacent area at least as large, but 0.5-1.0 m deep in water and extending on to several km of marsh, had only an occasional wanderer, (not teneral). A return visit 10 days later, intended to extend the observations and survey, was rewarded only in a negative way: a careful search of the whole area of the colony revealed nothing! The patch had dried up; but somewhere in there was the seed of next year's crop as they had not moved to other areas of deeper water nearby. Indeed it is hard to imagine with such weak flight that any substantial population movements would take place; life down in the reed beds does not reveal routes to places distant by any measure of relocation. Sharing the reed bed, but in more open parts, was a number of common species, *Procordulia jacksoniensis, Nannophya dalei, Austrolestes psyche, A. analis, Ischnura heterosticta, Austrocoenagrion lyelli* and others.

Fig. 1. *Hemiphlebia mirabilis* Selys. Typical "active" position as seen in S.Victoria coast colony 15 January 1985: male (top), female (bottom).

DISCUSSION

The wet areas of Wilson's Promontory are extensive, amounting to 50 km². or more as seen on a current (1983 printed) 1" to 1 mile map. That is probably obsolete information, however, as on the ground much of it is rarely wet or is actually dry and perhaps the effective wet area is nearer half that shown; of this a good proportion would seem suitable for *Hemiphlebia* but the right depth of water may constitute the essential niche. Cows have been taken in for seasonal grazing since 1852 but are now confined to the North part added in the 1960ies. This facility is likely to be stopped in the next few years: the sooner the better. It is a most fortunate circumstance that the colony(ies) is in the Park. At least the area is not threatened by drainage; the dry areas which are wet on the maps appear to have dried by natural events of recent (geological —) time, indeed 1:100,000 scale maps of the area claiming data of 1965 (printed 1971) actually show lagoons in the Park area some of which are now thick scrub.

An intriguing question is whether the species needs permanent water as Tillyard supposed, or can accept a degree of seasonal desiccation as suggested by my observations and indeed already hinted at by NEBOISS (1962). I do not think the thousands of specimens I saw flew away across a wide sward and roadway to wet ground elsewhere when their patch dried out in the hot weather. I suspect the eggs are protected in reeds but oviposition has not yet been seen; if this is the case then there may be some places along the coast between Melbourne and Sale still supporting colonies; a few places exist, other than saline lagoons, which rarely get dry. On general grounds a long-term survivor through geological time is most unlikely to be unable to survive a seasonal dry spell. But long term prospects for any such colonies are poor; maximum cattle density is determined by how many can be brought through the dry season, hence the intensive drainage and wind pumping.

Current 1:100,000 maps of the Goulburn/Yarra regions still show marshy ground: the data are claimed to be 1965. These areas were dry in January 1985 and are not marshes now. Nevertheless some dry but reedy patches in out-of-the-way corners had species of *Austrolestes* lurking about (*A. psyche* and *A. analis*); did they have *Hemiphlebia* earlier in the season? I doubt it, but if they did, long term prospects there are as bad or worse than the South coast farming areas. In Europe grazing land tends to retain good odonate fauna in its drainage system while that of arable land has lost nearly everything from carrying all the field dressings. It may be different in Victoria where farm animal urine, especially, with its high soluble nitrogen content, may accumulate in dry seasons and be inadequately diluted by seasonal rain so as to contaminate, unduly, the water courses. That is, at least, what those watercourses look like. I favour this over an explanation through dung being washed away, rather than beetle-buried for re-cycling.

With regard to control of communal emergence, a good candidate would be a

high critical temperature reached in shallow water in Summer before drying out. *Hemiphlebia* was absent from areas of deeper (cooler) water. but was possibly waiting there for emergence later in the season. Sandy coastal lagoons are a speciality in Australia, indeed more than half of the total coastline of Australia is formed of sand dunes and sand ridges and at least several odonates have speciated in that niche (e.g. *Orthetrum boumiera* Watson & Arthington; *Austrolestes minjerriba* Watson; *Argiolestes parvulus* Watson).

Protected from drainage, as at Wilson's Promontory, the *Hemiphlebia mirabilis* niche is safe for the foreseeable future. On the large scale there is adequate marsh with a range of depths. On the small scale the niche is difficult for predators to penetrate between the dense reeds. I recall at a dune lake in Queensland the carnage of little *A. minjerriba* by cohorts of *Orthetrum sabina, O. boumiera, O. villosovittatum* and *O. caledonicum,* bits in jaws, bits floating about; but a few of the Lestids still safe among the thickest reeds.

We are no nearer knowing where Weyers obtained the specimens he sent to Selys; I thought it might have been Lake Denison but I have only confirmed the suitability of the place up to a century ago. *Hemiphlebia* has now been "re-discovered" by Billinghurst (MARTIN, 1901), by TILLYARD (1907), by Messrs Burns, Dobson & Neboiss (BURNS, 1955) and by Garrison and the present author (1977 and 1985). Let us hope that this precious insect will not need rediscovering again.

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