

Habitat use by the Seychelles fineliner damselfly (*Teinobasis alluaudi*) on Silhouette island, Seychelles

Dennis Harding & Jackie Thompson,
School of Biological Sciences, University of Sussex,
Falmer, Brighton BN1 9QJ, U.K.

Abstract: The Seychelles fineliner damselfly, *Teinobasis alluaudi* was collected in 1909 and then not until 1997 when it was rediscovered on Mahé and subsequently on Silhouette. In 2002 research on Silhouette located four sites for the species, providing new data on appearance, vegetation use by teneral and adults, colour development, egg laying. Apparent preferences for alien vegetation (*Clidemia hirta* and *Paraserianthes falcataria*) is attributed to males preferring an open vegetation structure.

Key words: *Clidemia*, conservation management, Odonata, *Paraserianthes*, structure.

The Seychelles fineliner damselfly *Teinobasis alluaudi* (Martin, 1896) was collected by the Percy Sladen expedition of 1908 (Campion 1913). It was thought extinct soon after and rediscovered on Mahé 1997, with subsequent sightings on Silhouette (Samways 2001). The species appears to be very restricted and little is known of its biology. Between March 9th and 16th 2002 research was conducted on Silhouette on behalf of the Nature Protection Trust of the Seychelles (NPTS) with the aim of determining some of its ecological requirements and conservation needs. The main focus of research was to determine the distribution of *T. alluaudi* on Silhouette, provide a description of the sites, identify any vegetation preferences and collect any information relevant to the conservation of the species.

Methods

Searches were made for *T. alluaudi* at all sites where the species had been observed in 1997-2001. All located populations were observed for 3-6 hours and notes made of all interactions and movements. The habitat characteristics of each site were noted. The area of habitat used was estimated in order to provide approximate population density calculations.

Results

T. alluaudi was easily recognised in the field by its extremely slender abdomen and distinctive red colour, this does not appear to have been recorded previously. The female is a duller shade of red than the male.

Population and Distribution

Three previously reported sites were confirmed: Grande Barbe, the pool near Belle Vue and the clearing at Belle Vue. The site named 'Belle Vue extra' was on the other side of the clearing at a sufficient distance to warrant a separate record. A fifth unexplored site, at the north western end of the settlement at Grande Barbe is similarly isolated and classed as a distinct site (see Fig. 1).

Numbers recorded at each site and estimated population densities are shown in Table 1. In total 31 individuals of *T. alluaudi* were observed. In addition, Justin Gerlach also noted *T. alluaudi* at a separate location at the other end of Grande Barbe. Due to time constraints, it was not possible to investigate this sighting further and it is not included in this analysis. A breakdown of these figures shows many more males than females were recorded at the sites (12:4 of the sexed adults).

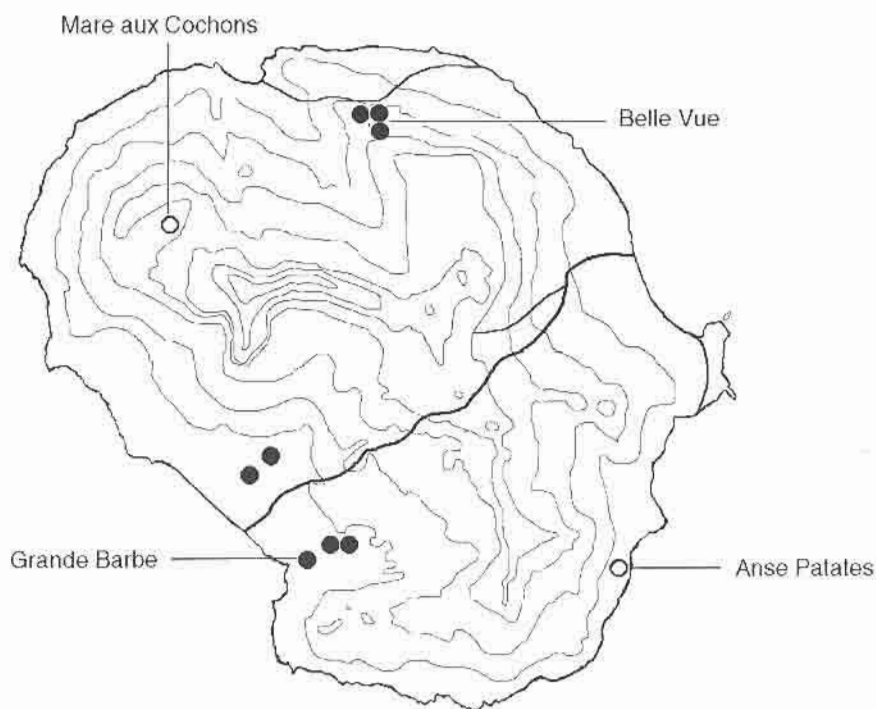


Fig. 1. Distribution of *T. alluaudi* on Silhouette island; filled circles - 2002 records, open circle - pre-2002 (Mare aux Cochons 1908; Anse Patates 1997)

Table 1. Population data for the four main sites

	adult			teneral			nymph
	male	female	?	male	female	?	
Grande Barbe	4	1	8	0	0	0	0
Belle Vue pool	3	2	0	1	1	1	1
Belle Vue clearing	3	1	0	0	0	4	0
Belle Vue extra	2	0	0	0	0	0	0

	area (m ²)	density (m ² per individual)		
		male + female	male, female + tenerals	male only
Grande Barbe	100	7.7	7.7	25
Belle Vue pool	20	4	2.5	6.7
Belle Vue clearing	60	15	7.5	20
Belle Vue extra	9	4.5	4.5	4.5

Table 2. Habitat selection according to selected criteria

	distance to water	water flow	breeding evidence	<i>Clidemia</i> present	<i>Clidemia</i> structures	overhead shade
Grande Barbe	30m	Medium & slow	No	Yes	Closed and Varied	Light
Belle Vue pool	0m	Slow	Yes	Yes	Open and Varied	Medium
Belle Vue clearing	30m	Slow	Yes	Yes	Closed and Varied	Light
Belle Vue extra	5m	Zero	No	Yes	Closed and Varied	Light

The site areas vary from 9m² for the Belle Vue Extra to 100 m² for Grande Barbe and the area per individual also varies from a low of 2.5m² for the Belle Vue pool to 20m² for the Belle Vue clearing. When all adults are included all the sites show densities of less than 8 m² per individual. Figures for Belle Vue pool males are probably the most accurate given the physical location of the site. Therefore 3 males in an area of approximately 5x4m can be seen as more reliable as an indicator of population density. Note, however, the relatively closed territory which may be unique. Lower male densities for other sites may be due to their openness. The Grande Barbe male densities were based on cautious counting of males and the actual territories could be much smaller than suggested with possible densities being higher.

Habitats

The sites can be analysed according to certain criteria as summarised in table 2. Common factors of all the sites are the presence of slow to medium flowing water within 30m, *Clidemia hirta* present with an open or varied structure and light or medium shade.

There seems to be a relationship between the levels of light and the structure of *C. hirta*. The amount of shade provided by the canopy tree determines the growing structure of

the plant below (Begon *et al* 1996). The light shade given by the albizzia trees (*Paraserianthes falcataria*) allows *C. hirta* to develop a varied structure typified by a series of open landing sites at all heights. These open landing sites were too sparse in deep shade and become closed off due to excessive leaf growth in full sun. The majority of the interaction noted in all sites was in, on and around the open and varied structure given by *C. hirta* underneath light shade from trees such as albizzia. Few other trees gave the same shade. *C. hirta* grows all over Silhouette under a range of trees, but its structure is rarely as suitable for *T. alluaudi* as that growing under the light shade afforded by the albizzia.

C. hirta was present and used as a settling location at all sites. Other shrubs were present at all sites but only settled on at two. Light shading trees are present at all sites. Where present, agricultural plants were also used but not as frequently, and only as a temporary landing site. The structure of the various floral species was very different, giving further indications as to why *C. hirta* was preferred over the other available species. Cassava (*Manihot esculenta*) was scarcer, had fewer landing places and those used were above 2m in height. *Asystasia* sp. occupied a similar distribution to *C. hirta* under light albizzia shade but did not have as many open landing sites. The leaves tended to be less supportive and were angled less rigidly and more downward sloping than *C. hirta*. *Nephrolepis biserrata* ferns largely presented a closed structure, but when used it was on parts with a more open structure at lower heights typically 0.5m, before the leaf structure closed off possible landing sites.

Life history

No courtship behaviour prior to mating was noted. Mating was not seen, but egg depositing in tandem was observed for over 2 hours in two different locations 30 metres apart, although the same pair being responsible for both events is a possibility. A range of 'C' shaped abdominal contortions was noted as the female moved her ovipositor into suitable positions for egg laying.

The sites used for egg laying were described as: damp rotting vegetation, damp vegetation, damp leaf litter, damp litter, underneath of root, damp vegetation, root, twig, damp sand, damp soil. In all cases there was a strong preference for damp conditions.

A nymph collected from Belle Vue pool and hatched by Ron Gerlach died emerging. The colour of the female teneral developed within 24 hours to a pale red. Corbet *et al* (1960) estimated 10% of nymphs died in this way. The tenerals emerged and flew into the trees around the pool. Their resting heights were 3m, 4m and 6m. These are all much higher than the usual resting heights for all other observations.

Interactions

The open and varied structure of *C. hirta* was used as the site for most of the observed interactions. All observations were of male-male and tandem pair- male interactions.

Movement occurred at a variety of heights, depending on the conditions found at each site. Flying heights at Grande Barbe were typically between 0.5 metres and 1.5m, Belle Vue Pool was similar but more frequent at lower heights, Belle Vue Clearing was 0.5m to 1.5m and the Belle Vue Extra site higher at 1.0m to 1.75m. These were all below the height of the *C. hirta* (2.0-2.2m). Movements were made through, and not over, the vegetation (only possible with the open structure of *C. hirta*). Male-male interaction was restricted to one

male 'buzzing' another male with no females present. Tandem (male and female flying as a pair) acting aggressively towards a second male were initiated by the male of the tandem pair once and by both male and female twice. A tandem pair landed 2cms from a second male whilst searching for an oviposition site. Teneral appeared to avoid interaction by flying away from male territories. No inter-specific interactions were noted.

Discussion

Each of the five sites was within 30m of an area cleared or previously cleared for the planting of agricultural plants. Perhaps clearing native forest creates higher light levels, which allows temporary colonisation by *C. hirta* and the development of a habitat for *T. alluaudi*. *C. hirta* is known to have colonised much of Silhouette but rarely grows under light shade.

Some individuals may have been counted more than once in the present study, even though attempts were made to do 'clean sweeps' of areas, counting all individuals within a short space of time to minimise the problem. The variation in population density estimates may suggest that these are inaccurate. The Belle Vue Pool site was a closed, easily observed area. Combined with known territory-holding behaviour of the male, it should represent a reasonably accurate estimate of the number of male territories in such an area. Observations suggest that this area supported one male in the pool territory, a second flying to the Belle Vue clearing and a third non-territorial interloper, with a total male density for the Belle Vue pool of one per 20m². Although this would seem to accord more with the figures for Grande Barbe and the Belle Vue clearing, this would seem to be a minimum estimate. Fewer females were observed than males at all sites. Possible explanations for this may include females spend most time away from these sites and visit to breed or there may be a biased sex-ratio.

Egg laying observations recorded that oviposition (or investigation) always occurred within 30cm of free flowing water, irrespective of whether or not surrounding vegetation lead into the water. Probing usually (but not always) occurred in damp matter. If conditions were dry there appeared to be probing on the underside, where damp soil could be reached. There was a general preference towards mossy area of roots and twigs. Leaf litter with egg laying sites were collected and analysed under a microscope but no eggs were found on the surface. Zygopterans often deposit their eggs endogenously (Longfield 1949). If this is the case with *T. alluaudi* eggs may have been overlooked in the plant tissue.

Nymphs need relatively clean water in which to catch prey and grow, although it is not known how long the nymphal stage takes. This information could be vital if a link is to be made between permanence of pools, creation of ponds and the seasonality of rainfall. How the rainfall regime affects all the sites over the whole of the breeding season will also be relevant to the egg laying of the adults. Observations indicate a range of sites used from dry to damp, but whether this is a condition maximising strategy or if all sites become damp is not known. The length of the breeding season and stages of development are also unknown.

The rate of colour formation of newly emerged teneral could be within 24 hours. If the rapid colour development of the female teneral is typical and not accelerated by the stress of unsuccessfully struggling to become free of its exuvia, then the observed pale female forms being mated could be less than 24 hours old. This would accord with the findings that they stayed close to the site of emergence and were mated soon after. No observations were made for female territories, so it is not known if females hold territory, the extent of their foraging

or their mating patterns. Teneral use high vegetation in immediate vicinity of emergence sites. Close proximity to slow flowing water and lightly shaded *C. hirta* appear to be the principal factors determining presence and distribution of males and breeding sites.

Preferential use of *C. hirta* as a resting place by *T. alluaudi* is due to sunlight being able to penetrate to parts of the plant, a range of suitable landing sites at heights of 0.5-2.0m. The open leaf structure provides landing and displaying sites, sufficient gaps between plants allows flights between sites and 'valleys' between plants allow territorial disputes to take place. There seems to be a very strong preference for *C. hirta* for male territory holding. Where these coincide with the presence of suitable water, it also becomes an egg laying and nymphal habitat. The interaction of tree shade and light levels on the structural growth of *Clidemia* would seem to determine the existence of this habitat. Albizzia and *C. hirta* are both non-native to Silhouette and both are regularly cut and cleared.

It is essential that further research be conducted to build up a more complete life history, exploring new sites and conducting a more lengthy study of the interaction between *Clidemia hirta* and *Teinobasis alluaudi* if it is to stand the best chance of long-term survival.

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