

## PRELIMINARY REPORT ON ODONATA COLLECTED IN SAMOA, 1985

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**Abstract** — A list of spp. collected during July-August on the islands of Tutuila (American Samoa) and Upolo and Savai'i (Western Samoa) is presented. Fraser's "*Ischnura* complex" of Samoa, the status of Brauer's "*Pericnemis annulata*" and the nature of *Anax gibbosulus* Ramb. are discussed. It is not clear whether the latter represents a sibling sp. derived from *A. guttatus* Burm., or it is merely a local high-altitude morph of this wide-spread lowland sp.

### Introduction

During July and August, 1985, I and my family spent three weeks on the Samoan Islands of Tutuila (American Samoa) and Upolo and Savai'i (Western Samoa). Our primary objective was to examine Fraser's "*Ischnura* complex" (FRASER, 1925, 1927, 1953) in the field and to further study an odonate fauna on purely oceanic islands.

### Hydrologic characters of hot-spot island chains

The Samoan islands are a typical "hot-spot" chain, with clearly defined oldest (eastern) and youngest (western) ends. There has been major volcanic activity on Savai'i about 70 years ago; the eastern islands have rocks of a few million years of age. Thus, the ages are comparable to the exposed Hawaiian chain.

Geologically the islands are typical of "hot-spot" basalt-volcanic chains, except that in all other Pacific chains west of the East Pacific Rise, the youngest centers are at the eastern end.

Basaltic islands have hydrologic characteristics of great importance to odonate communities. The youngest islands (examples: Savai'i, Hawaii) tend to have very limited surface water. Some crater lakes will be filled, but generally stream courses will be dry and ephemeral. Most of the considerable rain that falls passes quickly through porous, cracked lava flows and the more abundant basaltic pyroclastic beds into

underground aquifers. Such streams that exist will occur at low elevations. A typical landscape will consist of thickly forested slopes with dry watercourses.

Ground water emerges at low elevations in the form of springs near the coast. In most places fresh water occurs above a salt-water "wedge" near the shoreline. The abundance of fresh water near the coast is staggering. So powerful and persistent are the springs that many apparently salt-water lagoons along the coast are completely fresh- even some openly (but narrowly) connected to the sea! On the beaches fresh water can be seen percolating through the sand, leading to over-pressured "quicksand" conditions. Were a gravid *Ischnura aurora* Brauer or *Pantala flavescens* (Fabr.) to deposit eggs within 10 cm. of the edge of the sea, there is a high probability that these eggs might mature in a completely fresh micro-environment!

Thus, young islands have abundant habitats highly suitable for pond odonates, and the abundance and wide range of the above species as well as *Tramea transmarina* Brauer, *Anax guttatus* Burm., *Tholymis tillarga* (Fabr.), *Agricnemis exsudans* Selys, *Anaciaeschna jaspidea* (Burm.), *Orthetrum sabina* (Drury), and *Diplacodes bipunctata* (Brauer) reflects these widespread habitats.

Older islands have different characteristics. The porous nature of the basalt flows and ash disappears with deep weathering, and surface water becomes conspicuous. Deep erosion creates the high cliffs and deep canyons associated with the more spectacular Pacific Islands (examples: Tutuila, Kauai, Bora Bora). The presence of streams leads to an increased importance of the stream odonate fauna, which is essentially absent from the youngest islands.

A reasonable scenario for the colonization of a new basaltic chain would be for the pathfinder species to exist in either sea-level pond or specialized epiphytic (or terrestrial) larval habitats, and then secondarily spread into upland stream habitats. Thus, stream species of genera such as Fijian *Nesobasis* and *Melanesobasis*, Hawaiian *Megalagrion*, or Samoan "*Ischnura*", *Amorphostigma*, and *Pacificagrion* might all have been derived from terrestrial progenitors.

Another habitat especially well developed on the Samoan islands (compared to the Fijian and

Hawaiian islands) is the crater lake. These occur at the highest elevations and provide sites of opportunity for several characteristic species of the Samoan group. I should stress that there is no habitat gradation between these upland lakes and the near sea-level lagoons; the intervening slopes simply have no standing water habitats, save a few very recently impounded ponds.

#### The "*Ischnura* complex" of Samoa

We found relatively few of Fraser's species, in spite of thorough collecting in the immediate vicinity of previous collections (by Buxton and Armstrong, mainly), and at the same time of the year. We paid special attention to tiny streams, small water falls, and tiny ponds among the boulder debris found in the heavily vegetated, nearly impassible Samoan bush. On Upolo *Amorphostigma armstrongi* Fraser was widespread and occurred in a variety of small to medium-sized stream habitats. We were unable to find any other species of the complex on that island.

The island of Savai'i yielded no species of this complex, though I have seen a few museum specimens of *Amorphostigma* from there. There are very few streams on that island.

On Tutuila we found an undescribed, larger species of *Amorphostigma* which prefers wet rock faces, which could be called tiny water falls. We also took a few specimens of a new *Pacificagrion* and found Fraser's *Ischnura chromostigma*. All of the Tutuila species prefer wet rock faces along tiny streams. We found larvae of the *Pacificagrion* and perhaps the undescribed *Amorphostigma* on a wet rock face. We reared one of the former in our hotel room.

We cannot explain the scarcity of damselflies of this complex on Upolo. Habitat degradation seems improbable; we examined a number of nearly pristine small streams and found none of these insects. Nor does the time of the year seem to have been unfavorable. Other odonates were plentiful, and Tutuila yielded all three genera. A possible explanation is that introduction of some animal by man has caused the inadvertent destruction of much of the stream odonate fauna. A possibility is an introduced crayfish from French Polynesia.

I will not pursue the relationships of the "*Ischnura* complex" at this time, except to say

that I see no reason for placing the Samoan genera with this genus. Further, I am unwilling to speculate whether they have an Old- or New-World derivation. I believe tentatively that NEEDHAM's (1932, 1933) two Marquesas species "*Coenagrion interruptum*" (the genus assignment is bizarre; the species name must fall by homonymy) and *Pseudagrion demorsum* (probably not in this genus) possibly belong to this group. The larva of *Pacificagrion* resembles that of *Nesobasis*, but I believe the resemblance may be the result of convergence.

**The status of "*Pericnemis annulata*" on Samoa**  
Brauer's species *Pericnemis annulata* was correctly shown by LIEFTINCK (1959) to belong to *Nesobasis*; further he credited it to the species *flavilabris* Selys, comparing it with Selysian material at the Leiden Museum. Lieftinck was probably correct; however, the Selysian material at Leiden includes two closely related species: *flavilabris* and *corniculata* Tillyard, which Selys did not distinguish. DONNELLY (1984) subsequently set these species aside on the genus *Melanesobasis*.

Lieftinck, however, seemed to confound with *annulata* the female of *Nesobasis erythroptis* Selys (= *Thalassagrion rufilabris* nom. nud.); the two species are widely different.

Although the Brauer species *annulata* has priority over *flavilabris*, the poor condition of the specimen (it is very teneral and lacks the terminal segments of the abdomen) makes any determination of synonymy with *flavilabris* impossible. I believe further that there is a strong possibility that the specimen was mislabeled and belonged with the other Godeffroy Museum specimens collected in Fiji a few years previously (including the true *flavilabris*).

#### **The genus *Anax* on Samoa and other oceanic islands**

One of the most interesting groups found in this trip were the two species *Anax guttatus* Burm. and *gibbosulus* Rambur. I follow LIEFTINCK (1942) for the distinction between the two species. Fraser's mention of the species *gibbosulus* at a crater lake on Upolo was confirmed on this trip; the species is abundant at that locality (Lanoto'o; 2400') and was seen at several streams at

high elevation. On the other hand, *guttatus* is abundant at lagoons at low elevation.

The two forms are quite closely related sibling species. The species *gibbosulus* differs in its larger size, darker color, more restricted pale spots, and relatively heavier anal appendages, as detailed by Lieftinck. The differences could be summarized by noting that *gibbosulus* displays characters (except for the stouter appendages) that might be expected from adaptation to a climatically harsher (thermally, also ambient wind currents) habitat. The thermal differences are not immediately apparent, and could only be confirmed through body-temperature measurements. Although air temperatures are lower at higher elevations, the thermal regime of a dragonfly must include relative humidity, wind velocity, and cloudiness versus sunniness. Thus, I am only suggesting that such habitats are thermally different, and that *gibbosulus* might be derived from *guttatus* for life in a cooler habitat.

This relationship raises several questions. First, if *Anax* species show a morphological adaptation to different thermal regimes, why do not widespread species such as *A. junius* show similar adaptations? The answer might be that in continental situations there is widespread competition with other existing large odonates, such as species of *Aeshna*; thus in North America *Anax junius* simply does not exist in high-elevation habitats analogous to those of Samoa.

A second question is whether the derivation of *gibbosulus* from *guttatus* (suggested because the latter species is widespread at low elevations from India through Oceania, and the former is a more restricted island species) was a one-time event, or whether *gibbosulus* merely represents a high-altitude morph of *guttatus*. This view might require that selection of individuals for adaptation to high-altitudes might be a very fast and efficient process. If correct (which seems improbable) the colonization of an oceanic island by *Anax* might require only one species, *guttatus*, which might develop a high-altitude morph if suitable habitats were available.

#### **Other Odonata on the Samoan islands**

Common oceanic Odonata found in Samoa

that require no extended discussion were the following: *Ischnura aurora* Brauer, *Agrionemis exsudans* Selys, *Diplacodes bipunctata* (Brauer), *Rhyothemis regia chalcoptilon* (Brauer) (discussion in LIEFTINCK, 1959), *Tramea transmarina* Brauer (discussion in LIEFTINCK, 1942), *Pantala flavescens* (Fabr.), *Tholymis tillarga* (Fabr.), and *Orthetrum sabina* (Drury).

*Pseudagrion samoensis* Fraser was found at (Lake) Lanoto'o. Sight records of *Amorphostigma* by Armstrong (FRASER, 1927) are probably this species; the two are nearly indistinguishable in life.

*Anaciaeschna jaspidea* (Burm.) was seen frequently hawking over marshy ponds in the bright sun at mid-day. The eyes of the male are brilliant blue in life.

*Gynacantha apiaensis* Fraser is represented (supposition) by a female taken at a light.

*Hemicordulia hilaris* Lieftinck and *pacifica* Fraser were both found to be widespread on Upolo and the latter also on Tutuila. LIEFTINCK (1975) notes that Fraser's *H. oceanica* and *assimilis oceanica* "possibly also belong" to

*hilaris*. Paratypes of this species agree fully with the Samoan material. However, he also hinted that Fraser's species *pacifica* might belong here also. The smaller species on Upolo and Tutuila agrees fully with Fraser's description; I have no hesitation in calling it *pacifica*.

*Lathrecista a. asiatica* (Fabr.) was found at low elevations in Upolo and Savai'i. The specimens taken were as small as I have seen for this form, in contrast with the distinctly large Fijian form.

**References** — DONNELLY, T.W., 1984, *Odonatologica* 13: 89-105; — FRASER, F.C., 1925, *Trans. ent. Soc. Lond.* 1924: 429-438; — 1927, *Insects of Samoa* 7: 19-44; — 1953, *Proc. R. ent. Soc. Lond.* (B) 22: 119-126; — LIEFTINCK, M.A., 1942, *Treubia* 18: 441-608, 41 pls; — 1959, *Ent. Mitt. Hamburg* 21: 1-9, 1 pl.; — 1975, *Cah. O.R.S.T.O.M.* (Hydrobiol.) 9: 127-166; — NEEDHAM, J.G., 1932, *Bull. Bernice P. Bishop Mus.* 98: 111-114; — 1933, *Bull. Bernice P. Bishop Mus.* 114: 71-72.

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