ODONATA COLLECTED FROM THE TAMBOPATA-CANDAMO RESERVED ZONE, SOUTHEASTERN PERU, AUGUST 1992 - JANUARY 1993

M. BUTT
2 Springfield Lane, Elburton, Plymouth, PL9 8QQ, United Kingdom

Abstract – 108 spp. were collected, 9 of these had not previously been recorded from Peru, viz. *Heteragrion bariai* De Marmels, *Argia infumata* Sel., *Telebasis rubricaudata* Bick & Bick, *Triacanthagyna trifida* (Ramb.), *Elga leptostyla* Ris, *Fylgia amazonica lychnitina* De Marmels, *Micrathyria occipita* Westfall, *Oligoclada heliophila* Borror, and *Perithemis rubita* Dunkle. Species distribution and the importance of the reserved zone as an area of exceptional Odonata diversity are briefly discussed.

Introduction

The total number of Odonata known from Peru currently stands at around 350 species (TSUDA, 1991), nearly 30% of all South American species. Peru shares its main land types, Pacific coastal desert, Andean mountains and Amazon rainforest, with other countries in the region and only 20% of the species currently known are endemic. However, collections in this large and biologically rich country have been very patchy and the rate of new additions to the national list suggest that it is far from complete.

The Odonata species listed below were collected from the Tambopata-Candamo Reserved Zone (TCRZ), SE Peru, between August 1992 and January 1993. The reserved zone covers almost 1500 km² of tropical moist forest, encompassing a wide range of habitats within the pre-montane forest of the Andean foothills and the lowland rainforest of the Amazon basin. Designated in January 1991 the reserve is under considerable pressure, mainly from the farming, gold mining and hunting activities of settlers from other parts of the country. This pressure is intensifying as the Trans-Amazon highway, which runs along the reserve's northern boundary, nears completion. At the time of this study a planning committee was set up, under the auspices of Conservation International, to produce a zonation proposal for the reserve. The pre-feasibility study produced by this committee (INRENA, 1993) concludes that a substantial proportion of the reserve should receive full protection as a National Park. Their final report will be submitted to the Peruvian government.

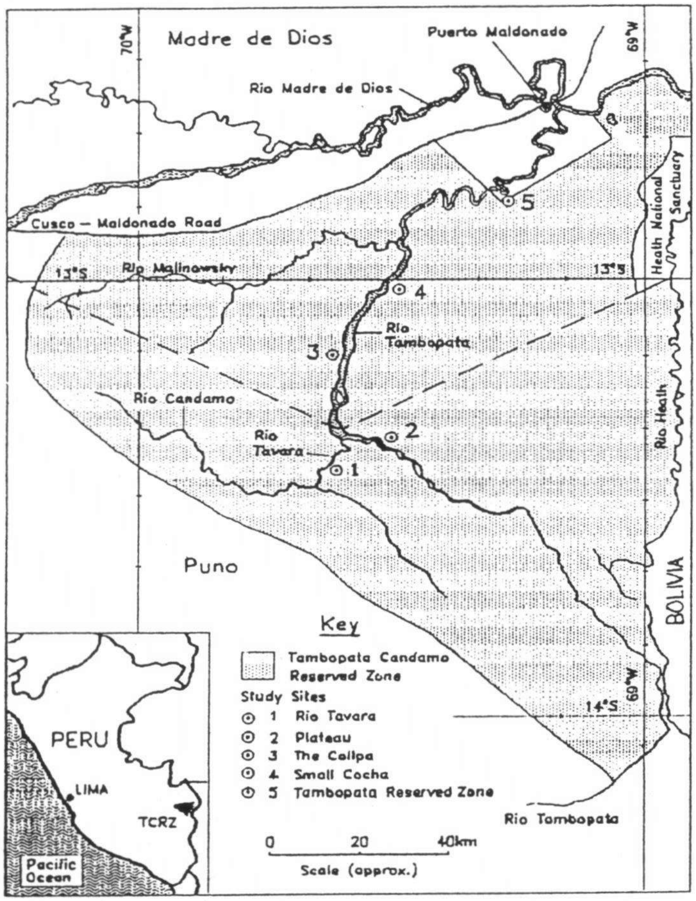

Fig. 1. The Tambopata-Candamo Reserved Zone, showing study sites.

The Tambopata Reserved Zone (TRZ), a 5.5 km² area of lowland forest now incorporated into the TCRZ, has been intensively studied over the past 20 years, including several dragonfly collections (PAULSON, 1981), and the results show an exceptionally high biological diversity. However, little is known of the rest of the TCRZ and the "TReeS Tambopata-Candamo Expedition' (TReeS, 1994) was undertaken in 1992 to gather biological data for submission to the planning committee. Odonata collecting for this study began as part of the expedition at five study sites within the reserve (see Fig. 1) during August and September 1992 and continued as a separate study at the fifth study site until January 1993.

Study sites

(1) Rio Tavara, east bank (13°25'02"S, 69°38'58"W). Pre-montane forest in Andean foothills rising to cloudforest at 1200 m, very hilly terrain with a number of small streams draining into the rio Tavara, no permanent standing water.

(2) The Plateau, rio Tambopata, N bank (13°21'46"S, 69°33'59"W). Lowland rainforest adjacent to Andean foothills with a distinctive raised plateau, including floodplain forest, several small streams, marshy and swampy areas.

(3) The Collpa, rio Tambopata, W bank (13°08'

31"S, 69°36'46"W). Lowland rainforest with a tourist lodge and trail system, including floodplain forest, several small streams, Mauritia palm swamp (Aguajal), temporary pools and marshy areas.

(4) The Small Cocha, rio Tambopata, E bank (12° 59'59"S, 69°29'58"W). Lowland rainforest, including floodplain forest, one large and several small streams, ox-bow lakes, temporary pools and marshy areas.

(5) Tambopata Reserved Zone, rio Tambopata, E bank (12°50'18"S, 69°17'59"W). Lowland rainforest with a tourist lodge and extensive trail system, including floodplain forest, many small streams, large ox-bow lakes, Mauritia palm swamp, temporary pools and marshy areas.

Habitat types

(a) Stream; clear, steep, shallow pools and riffles, < 3 m wide, over sand, gravel and rock substrate in heavy shade.

(b) Stream; clear, steep, shallow pools and riffles, < 3 m wide, over sand and gravel substrate, in light shade.

(c) Stream; clear, slow flowing, < 3 m wide, over sand and gravel substrate in heavy shade.

(d) Stream; clear, slow flowing, < 3 m wide, over silt, clay and sand substrate in heavy shade.

(e) Stream; brown, fast flowing, 5-10 m wide, over silt, clay and gravel substrate, unshaded.

(f) River; brown, fast flowing, > 10 m wide, margins mainly over silt and clay substrate, unshaded.

(g) Pool; brown to black temporary standing water, < 2 m deep, over silt and clay substrate with high organic content, heavily shaded margins with little aquatic vegetation.

(h) Ox-bow lake; brown permanent standing water, > 2 m deep in parts, over silt and clay substrate with high organic content, extensive marginal beds of floating vegetation.

(i) Marsh; brown, mainly permanent standing water, over silt and clay substrate with high organic content, dense aquatic vegetation with little open water, only margins shaded.

(j) Swamp; black, temporary or permanent standing water, over silt and clay with very high organic content, high in tannins and acidic, few dominant tree species and little herbaceous growth, light shade.

(k) Dry forest; high forest with no long term standing water.

(l) Flooded forest; high forest with long term standing water, usually for most of rainy season.

(m) Lodge clearing; large clearing in forest with huts, drainage ditches and open field area.

The descriptions given above apply to what is usually observed during dry periods. The flow rates and depth of tropical forest water bodies increase dramatically for one or two days following rains.

Species list

DICTERIADIDAE – *Heliocharis amazona* Sel., 4 ♂: 3c, 5d.

POLYTHORIDAE – *Chalcopteryx rutilans* Sel., 22 ♂, 7 ♀: 2b, 3c, 5d; – *Polythore boliviana* (McL.), 4 ♂, 2 ♀: 1a, 2b.

CALOPTERYGIDAE – *Hetaerina laesa* Hag., 6 ♂: 5d; – *H. rosea* Sel., 9 ♂, 12 ♀: 2d, 5i; – *Mnesarete aenea* (Sel.), 9 ♂: 2b, 3c, 5d; – *M. cupraea* (Sel.), 13 ♂: 2d, 3c,d, 5c,d.

PERILESTIDAE – *Perissolestes remotus* (Wllmsn & Wllmsn), 1 ♂: 3c.

MEGAPODAGRIONIDAE – *Heteragrion bariai* De Marmels, 7 ♂, 1 ♀: 2c,d, 5k; – *H. inca* Calv., 9 ♂, 6 ♀: 3c,d,k 5d; – *H.* sp. nr *inca*, 11 ♂, 1 ♀: 1a, 2b, 4d, 5d; – *Heteragrion* sp.; – *Phylogenia boliviana* Bick & Bick, 1 ♂: 2k.

PSEUDOSTIGMATIDAE – *Mecistogaster buckleyi* McL., 3 ♂: 3l; – *M. jocaste* Hag., 2 ♀: 3l, 5d; – *M. linearis* (Fabr.), 1 ♂, 4 ♀: 3l,g, 4k, 5d,k; – *Microstigma rotundatum* Sel., 1 ♂: 3k.

PROTONEURIDAE – *Epipleoneura peruviensis* (Fraser), 5 ♂: 5d; – *E. pallida* (or nr) Rácenis, 3 ♂: 2d, 5d; – *E.* sp. nr *machadoi*, 5 ♂: 4h, 5h; – *Epipleoneura* sp.; – *Neoneura rubriventris* Sel., 4 ♂: 4d, 5d; – *Phasmoneura exigua* (Sel.), 5 ♂: 3l; – *Protoneura tenuis* Sel., 6 ♂, 2 ♀: 3c,d, 5d,g; – *Psaironeura tenuissima* (Sel.), 14 ♂, 2 ♀: 3l, 4d, 5d.

COENAGRIONIDAE – *Acanthagrion apicale* Sel., 13 ♂: 3d,g,j,l, 4d, 5g,j,k,l; – *A. ascendens* Calv., 25 ♂, 5 ♀: 3i, 4d,h, 5g,h,i; – *A. lancea* Sel., 4 ♂: 4h, 5h,i; – *A. minutum* (or nr) Leonard, 2 ♂: 5h; – *A. obsoletum* (Först.), 22 ♂, 3 ♀: 2d,i, 3i,j,l, 4d, 5g,i; – *A. phallicorne* Leonard, 10 ♂: 3g,i, 5g,i; – 2 x *Acanthagrion* spp.; – *Aeolagrion* *dorsale* Burm., 3 ♂: 5j; – *Argia* sp. nr *adamsi*, 1 ♀: 5k; – *A.* sp. nr *cuprea* [undescribed], 9 ♂, 4 ♀ : 2b, 3c; – *A. huanacina* Först., 1 ♂: 5i; – *A. indicatrix* Calv., 11 ♂, 7 ♀: 3l, 5d; – *A. infumata* Sel., 3 ♂: 2b; – *A. nigrior* Calv., 1 ♂, 1 ♀: 1a, 2i; – *A. thespis* Hag., 20 ♂, 7 ♀: 3c,g, 5d,k; – *Calvertagrion* sp. [possibly undescribed], 4 ♂: 5i; – *Leptobasis raineyi* (Wllmsn), 3 ♂, 3 ♀: 5g,k; – 3 × *Metaleptobasis* ssp.; – *Telebasis* sp. nr *fluviatilis*, 5 ♂: 3l; – *T. rubricaudata* Bick & Bick, 2 ♂: 5h; – *T.* sp. nr *rubricaudata*, 1 ♀: 5k; – 2 × coenagrionid spp.

AESHNIDAE – *Gynacantha gracilis* (Burm.), 1 ♂, 2 ♀: 3k, 5l,m; – *G. interioris* Wllmsn, 2 ♂: 3k, 5m; – *G. litoralis* Wllmsn, 2 ♀: 5f,m; – *G. membranalis* Karsch, 4 ♂: 5k,l; – *G. nervosa* Ramb., 2 ♂: 5m; – *Staurophlebia reticulata* (Burm.), 2 ♂: 4g, 5g; – *Triacanthagyna ditzleri* Wllmsn, 2 ♀: 5m; – *T. trifida* (Ramb.), 6 ♀: 3k, 5m.

CORDULIIDAE – corduliid sp.

LIBELLULIDAE – *Anatya guttata* (Erichson), 1 ♂, 1 ♀: 4k, 5m; – *Argyrothemis argentea* Ris, 7 ♂: 3j,l; – *Dasythemis esmeralda* Ris, 4 ♂, 2 ♀ : 3j,l; – *Diastatops intensa* Montg., 6 ♂: 5h; – *Dythemis sterilis* Hag., 1 ♂: 3i; – *Elga leptostyla* Ris, 2 ♂, 1 ♀: 2d,i, 5d; – *Erythemis attala* (Sel.), 1 ♂, 1 ♀: 5k,m; – *E. haematogastra* (Burm.), 2 ♂: 5g,i; – *E. vesiculosa* (Fabr.), 1♀: 5i; – *Erythrodiplax amazonica* Sjöst., 2 ♂: 3j; – *E. anatoidea* Borror, 1 ♂: 5j; – *E. basilis* (Kirby), 10 ♂, 5 ♀: 2i, 5h,i; – *E. castanea* (Burm.), 9 ♂, 1 ♀: 2i, 3j,l, 5k; – *E. connata* (Burm.), 3 ♂, 1 ♀ : 5g,i; – *E. kimminsi* Borror, 3 ♂: 2i; – *E. umbrata* (L.), 1 ♂: 5i; – *E. unimaculata* (DeGreer), 11 ♂, 1 ♀: 2i, 3g,i, 4h, 5g,i; – *Fylgia amazonica lychnitina* De Marmels, 3 ♂: 3g; – *Macrothemis musiva* Calv., 1 ♂: 5i; – *M. pumila* Karsch, 1 ♂, 2 ♀: 2i; – *Micrathyria caerulistyla* Donnelly (or nr), 8 ♂: 2i, 5i; – *M.* sp. nr *caerulistyla*, 1 ♂: 2i; – *M. didyma* (Sel.), 1 ♀: 5g; – *M.* sp. nr *dunklei*, 1 ♂: 5j; – *M. hippolyte* Ris, 10 ♂, 1 ♀: 5g,j,l; – *M. mengeri*-group Ris, 4 ♂: 5g,i,l; – *M. occipita* Westfall, 18 ♂: 3g,i, 4h,i, 5h,i; – *Micrathyria* sp.; – *Misagria parana* Kirby, 1 ♂, 2 ♀: 3j,l; – *Nephepeltia* sp.; – *Oligoclada heliophila* Borror, 5 ♂: 2d, 5g; – *O. pachystigma* Karsch, 11 ♂: 2i, 4h, 5h,i; – *Orthemis biolleyi* Calv., 9 ♂, 3 ♀: 2i, 4h, 5i; – *O. cultriformis* Calv., 21 ♂, 5 ♀: 1a, 2i,j, 3c,i,j,l, 4d, 5g,h,i,m; – *O. ferruginea* (Fabr.), 6 ♂: 2i, 3g,i, 5g,i; – *O.* sp. (nearest *ambinigra*) [undescribed], 4 ♂: 3i, 4h; – *Perithemis cornelia* Ris, 7 ♂: 3g, 4d, 5g,i; – *P. electra* Ris, 8 ♂, 1 ♀ : 3g, 4g,h 5g; – *P. lais* (Perty), 1 ♂: 5h; – *P. parzefalli* Hoffmann, 10 ♂: 3g, 4h, 5h,i; – *P. rubita* Dunkle, 3 ♂: 3g, 4g; – *P. thais* Kirby, 9 ♂: 1a, 3c,d,g, 4d, 5g; – *Tauriphila argo* (Hag.), 2 ♂: 5h; – *Tramea cophysa* Hag., 1 ♂: 5h; – *Uracis fastigiata* (Burm.), 13 ♂, 21 ♀: 2k, 3k, 4k, 5g,i,k,l,m; – *U. infumata* (Ramb.), 15 ♂, 3 ♀: 2k, 4k, 5k,l; – *U. siemensi* (Kirby), 1 ♀: 3c; – *Zenithoptera fasciata* (L.), 1 ♂, 1 ♀: 2b, 5j.

Discussion

This collection of 108 species is the result of around 46 days of fieldwork, at five study sites within the Tambopata-Candamo Reserved Zone (TCRZ), and represents about 30% of the species known from Peru. Of this total nine were previously unrecorded from the country, representing 8% of the collection, and a further 24% are potentially undescribed species (i.e. could not be identified).

The collection data clearly shows which habitats within the lowland rainforest and pre-montane forest of the reserve are more favourable to Odonata species, the most favourable being slow flowing streams and still water bodies. These habitats have in common several features which may favour Odonata reproduction and development including; at least patchy sunlight; "cover" for larva in the form of vegetation, roots, stones, etc; and a high organic component to the substrate. Oxbow lakes, pools, marshes and flooded forest have these features in greatest abundance and show correspondingly high species diversity and population sizes. They are especially rich in libellulid and coenagrionid species such as *Erythrodiplax basilis*, *Perithemis parzefalli*, *Acanthagrion apicale* and *A. ascendens* with few representatives of other families. In contrast, the slow flowing streams have many more zygopteran families present with characteristic species such as *Chalcopteryx rutilans* and *Mnesarete aenea*. Interestingly, the permanence of water bodies does not seem to have an effect on species diversity, with pools and flooded forest, which are most likely to dry up outside the rainy season, having the highest adult diversity and abundance. Perhaps this is due to colonisation from permanent water bodies together with rapid larval development which is a feature of tropical climates.

The habitats which have the lowest species diversity and population sizes are the fast flowing streams and rivers in which little organic matter can settle and little aquatic vegetation can survive. Swamps, with very acidic waters high in tannins, and dry forest, with water only occasionally and temporarily held in places such as leaf sheaths and bromeliad leaf whorls, are also highly unfavourable. A few species such as *Aeolagrion dorsale* and *Dasythemis esmeralda* are found in swamp and *Microstigma rotundatum* in dry forest.

The collection data also shows considerable variations in species distribution between the five study sites surveyed. Site (1), the only location within the pre-montane forest of the Andean foothills, predictably has a distinct fauna. The paucity of species collected from this site is in part due to poor weather during the fieldwork but is probably mainly a reflection of the predominance of unfavourable dry forest and fast stream habitats. The four lowland sites might be expected to have a higher proportion of species in common but this does not appear to be the case. Differences in species diversity and abundance between the sites can possibly be explained in terms of the particular combination of more or less favourable habitats at each site. Sites (2), (3) and (5) show the highest species diversity and abundance and each has all of the most favourable habitats present in addition to uncommon habitats such as bamboo forest at sites (3) and (5) and plateau forest at site (2), each of which will have a characteristic set of species. Site (4) is the least species rich and lacks both marsh and flooded forest and only has one stream type.

However, uneven distribution of individual species between the lowland forest sites is less easy to explain. Only 3% of the species collected were found at all four lowland sites (one species, *Orthemis cultriformis*, was found at all five sites), 21% at more than two sites and 41% at more than one site. Assuming that each site was reasonably thoroughly surveyed, this level of site specificity is remarkable considering that all the lowland sites lie within 75 km of each other and share so many similar habitats. It seems that many species are only found at one site, this may be due to habitat and geographical differences that are not immediately obvious. One factor which may be involved is the increasing proximity and climatic effect of the Andean mountains moving westward across the reserve. This may account for the occurrence of some species at sites beyond their usual altitudinal and geographical range.

Whatever the reason for the degree of site specificity, it helps to explain the level of species diversity and endemism for the reserve as a whole. Nearly half of the species recorded from the reserved zone have not been recorded from the two other well studied areas of Peruvian Amazonia in Manu and Iquitos (GARRISON, 1994). Furthermore, 26% of the species collected from study site five (the original 5.5 km² Tambopata Reserved Zone) which has been relatively well surveyed in the past (PAULSON, 1981) were new records for that site. Also 32% of the species in the whole collection were either new records for Peru, or potentially undescribed. Taken together, these figures suggest that the 1500 km² Tambopata-Candamo Reserved Zone has an exceptionally high Odonata diversity, the true level of which is much higher than is presently known, making it an area of great importance for dragonflies.

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