THE MACROLEPIDOPTERA FAUNA OF ACACIA IN THE KENYAN RIFT VALLEY (PART1)

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Abstract - *Acacia* (s.l.) spp. are the dominant natural woody plants in the Kenyan Rift Valley, the exact species depending upon the altitude and water table. Lakes, in particular, support relatively thick fringing woodland, from which Lepidoptera have been collected, reared and identified. The significance of *Acacia* woodlands for biodiversity is discussed.

Keywords: Lepidoptera, larvae, *Acacia*, Kenya, Rift Valley, Naivasha, Elmenteita, Bogoria, Baringo

INTRODUCTION

Acacia trees are very well known as a major constituent of arid and semi arid parts of Africa. They are important for providing food for many animals (Coe & Beentje, 1991) and firewood and animal stockades for humans.

Botanists have recently divided the genus *Acacia* into smaller genera. Those in Africa are either *Senegalia* or *Vachellia* (Orchard & Maslin, 2003) but for the purpose of this paper Acacia *sensu latu* will be used since it is well known and conveys meaning as the English name for these trees.

A research project on the Kenyan Rift Valley lakes, funded by the Earthwatch Institute (freshwater lakes Naivasha and Baringo) and the Darwin Initiative (soda lakes Bogoria and Elmenteita) under the leadership of DMH was in operation from 1987 to 2007. The primary interest was the aquatic biodiversity, broadened to include that of their fringing woodlands. In the immediate surroundings of the lakes, Acacia are the principal trees, taking advantage of the higher water table. These Acacia trees both depend on the lakes and contribute very substantially to their biodiversity.

Acacias are host to a large invertebrate community, much of which has not been fully investigated. There have been a number of studies on ants and their relationship with the trees (Jolivet, 1996) or their symbiotic relationship with Lycaenid butterflies (Stanton et al. 1999), but attempts to survey the wider insect fauna are few. Krüger & McGavin (1997) surveyed the fauna of six Acacia species in Mkomazi, Tanzania and identified 11 species of Lepidoptera accounting for just 0.5% of the biomass; however, the method used was fogging the canopy and no attempt was made to identify Lepidoptera larvae. Many larvae would not be detected by such a method since they are protected within leaf spinnings, webs or other shelter. The adults recorded by this method are not necessarily dependent on the Acacia, for they may just be taking shelter.

In this study, larvae were collected from Acacia trees and allowed to mature and develop into adult insects. In this way we can be sure that they were using the Acacias for food, although some species may well have a broad host range and feed on other trees as well. Larvae use many different parts of the tree besides the foliage – flowers, seeds, pseudo-galls and fungus galls (cf. Krüger, 1998). Rearing Lepidoptera from larvae has the added advantage that specimens were normally in good condition and it was easier to associate together males and females of the same species.

DESCRIPTION OF STUDY AREA

Around Lakes Naivasha, Elmenteita and Nakuru, all of which are at higher altitude than other lakes - 1800-1900 m, the dominant species is *Acacia xanthophloea*, the yellow-barked Acacia or Fever tree. Near Lake Naivasha on higher and drier ground, *Acacia drepanolobium* also occurs. Above Lake Elmenteita there is much *Acacia gerrardii* and a few specimens of *Acacia seyal*, the same two species occurring near Lake Nakuru. Lake Bogoria and Lake Baringo are at lower altitude, *circa* 1000m, and the dominant species are *Acacia tortilis*, *A. reficiens* and *A. mellifera*, with stands of *A. senegal*. Other species occur in smaller numbers; *A. seyal* ssp. *fistula* and a few *A. xanthophloea* where the feeder rivers enter the lakes. In the resuts (Table 1), all species bred from *A. xanthophloea* and *A. gerrardii* are from higher altitude, and all species bred from *A. tortilis, A. mellifera, A. senegal, A. reficiens* and *A. seyal* are from lower altitude.

The collections were made from the four locations on the following expeditions:

1. Lake Naivasha, 9 – 25 April 2003
2. Lake Naivasha, 29 October – 13 November 2003
3. Lake Bogoria, 1 – 16 November 2004
4. Lake Elmenteita 12 – 26 April 2005
5. Lake Bogoria, 8 – 23 November 2005
6. Lake Bogoria, 13-29 November 2006
7. Lake Baringo/Lake Bogoria, 8-23 August 2007

During the last three expeditions, trees of *A. tortilis* along the feeder rivers to Baringo, the river Molo and river Perkerra, were also sampled.

METHODS

DJLA and three or four volunteers collected larvae in a systematic way during each expedition. Trees were searched for evidence of larvae feeding in spinnings or leaf-mines or in other concealed places for 10-15 minutes and the possible spinnings etc. were collected, pooled and labelled. Then each member of the team would beat branches of the tree onto a black beating tray, an estimated 2m² of foliage being sampled by each person. All would search the tray for larvae which were collected and labelled (Fig. 3). The pooling of samples collected in this way meant that any variation due to recorder effort was minimized. This process was repeated at intervals along a transect; usually

four such samples were collected in a morning. In the laboratory the samples were sorted, the spinnings etc. were examined in order to check on the presence of larvae, the external feeding larvae were assigned to readily recognizable categories, such as "hairy", loopers etc. These larvae were then kept in plastic boxes in the laboratory, cleaned and fed as necessary, until they had pupated. Collections of flowers were made whenever the Acacia bushes were in flower, which was not predictable. Flowers were placed in a plastic box for several days and when larvae became visible they were transferred to a smaller box and reared in the same way as the others. Seeds were collected on occasion and placed in a box until signs of feeding showed, i.e. frass, but very few larvae resulted from this method. Young pseudo-galls were collected from *Acacia drepanolobium* and *Acacia seyal fistula* and then opened in the laboratory to search for signs of larvae, if present these were retained in a box with the galls. Any still in the larval stage at the end of the expedition were cared for by DJLA or Joseph Mugambe at the National Museums of Kenya in Nairobi. When adults emerged from the pupae, samples of each species were preserved for identification, duplicates being released into the place of origin where possible. Identification of adult moths was carried out by DJLA, using the collections and library in the Natural History Museum, London and consulting international specialists where such exist for particular families.

RESULTS

The number of larvae collected on each expedition lasting 14 days varied between approximately 500 and 1500. Many microlepidoptera species have not yet been identified, but the provisional number of species stands at 92. In this paper only the "macrolepidoptera" are dealt with. It is hoped that the microlepidoptera families can be described in later papers. They are much less well known and a large proportion of them are undescribed species. Macrolepidoptera is a loose term often used for the larger species.

Of these species, 87 macrolepidoptera were bred, including 6 new species which are treated in a separate paper in this issue; a further 6 species are unidentified (listed as A – F) and probably new, but since there is in most cases only a single known specimen, these are not formally described. Many are newly recorded as feeding on *Acacia* and most were formerly without life history information. When taken together with the microlepidoptera, the total number of Lepidoptera bred is greater than all those known on *Acacia* from previous studies in sub-Saharan Africa. The results are shown in Table 1. The families and genera are listed in the order used by Vári et al. (2002). Frequency is designated as follows:
if encountered just once – 1
if a few (1-5) specimens met with – f
if several (5-15) specimens – s
if many (>15) specimens – m

Phenology

It was not possible to sample at all times of year since visits had to be supported by Earthwatch expeditions, but where possible sampling took place during rainy seasons. In the Naivasha – Nakuru area of the Rift Valley rains normally occur in March – April and October – November, whereas in the Lake Baringo – Lake Bogoria area, they are normally during April – November, but are much less predictable. In dry seasons there are no leaves on the Acacias on which larvae can feed. Even when sampling was carried out at the same time in successive years at the same locality, the difference between the species encountered was very marked, many species being encountered on one expedition only. It appears that the presence of larvae is related to rainfall and budburst, rather than date.

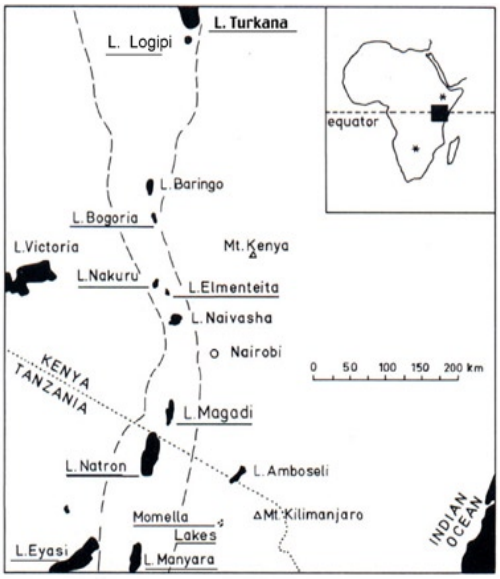

Fig. 1. Location of the eastern Rift Valley lakes showing the four in this study (soda lakes underlined)

DISCUSSION

We have shown, for the first time, that the lepidopteran biodiversity value of riparian woodlands in the semi-arid tropics is very considerable. It is comparable to that of birds (Kimani, unpublished) yet these are a well-studied taxon, unlikely to yield new species, in comparison to the 6 new species of this list. It is thus likely that the lakeside locations and the banks of permanent rivers provide important concentrations of diversity, but this cannot be tested without comparative samples from other areas. Life history data are scarce for insects in the Afrotropical region, except for those described by Townsend (1937, 1938, 1942, 1945, 1952) from the Nakuru area, and for new species to be described with host plant information is still unusual. Approximately 163 species are known to feed on Acacia spp. in Africa (described in Robinson et al. (2001), Larsen, (1996), Krüger (2001), Fletcher (1974) and Pinhey (1975)), whereas at least 179 species have resulted from this study.

Much more attention has been given to well known Afrotropical forests in Kenya, especially to Arabuko-Sokoke and Kakamega Forests, but this study shows remarkable diversity in the Lepidoptera fauna of Acacia woodlands. These riparian fringes, well as those in savannah biotopes, support a degree of biodiversity which should not be underestimated, but which has not been thoroughly researched. Not only is this

Species	Foodplant	Habits	frequency
LIMACODIDAE			
Coenobasis farouki Wiltshire	*A. tortilis*		s
LYCAENIDAE			
Anthene kikuyu Bethune-Baker	*A. xanthophloea, A. drepanolobium, A. gerrardii, A. tortilis*	on flowers and leaves	m
Anthene pitmani Stempffer	*A. xanthophloea*	on flowers and leaves	s
Anthene lunulata Trimen	*A. mellifera*	on flowers	l
Anthene definita Butler	*A. xanthophloea*	on flowers	l
Anthene amarah Guérin-Ménéville	*A. drepanolobium, A. tortilis*	on leaves & ant galls	f
Azanus jesous Guérin-Méneville	*A. xanthophloea, A. tortilis, A. mellifera, A. zanzibarica*	on leaves	s
Azanus ubaldus Cramer	*A. gerrardii, A. senegal, A. tortilis*	on flowers	f
Deudorix dinochares Grose-Smith	*A. tortilis*	in seeds	f
Spindasis victoriae Butler	*A. xanthophloea*	on leaves	f
Leptotes pirithous Linnaeus	*A. xanthophloea, A. mellifera*	on flowers and leaves	l
Chilades kedonga Grose-Smith	*A. drepanolobium*	in ant galls	l
LASIOCAMPIDAE			
Berelade pelodes Tams	*A. xanthophloea*	on leaves	s
Anadiasa affinis Aurivillius	*A. drepanolobium, A. xanthophloea, A. tortilis*	gregarious on leaves etc.	m
Pachyposa morosa Walker	*A. xanthophloea*	on leaves	l
Odontocheilopteryx myxa Wallengren	*A. xanthophloea*	on leaves	l
Odontocheilopteryx ungemachi Tams	*A. tortilis*	on leaves	l
GEOMETRIDAE			
GEOMETRINAE			
Prasinocyma nereis Townsend	*A. xanthophloea*	on leaves	m
Prasinocyma bifimbriata Prout	*A. xanthophloea*	on leaves	s
Prasinocyma immaculata Thunberg	*A. xanthophloea*	on leaves	l
Prasioncyma perpulverata Prout	*A. tortilis*	on leaves	s
STERRHINAE			
Traminda ocellata Warren	*A. xanthophloea*	on leaves	l
Traminda pallida Warren	*A. reficiens*	on leaves	l
Traminda neptunaria Guenée	*A. tortilis*	on leaves	f
LARENTIINAE			
Chloroclystis consocer Prout	*A. xanthophloea,*	on flowers	s
Eupithecia gradatilinea Prout	*A. xanthophloea*	on flowers	s
Eupithecia rubristigma Prout	*A. xanthophloea*	on flowers	s
Mesocopia nanula Mabille	*A. drepanolobium, A. tortilis*	on flowers	s
ENNOMINAE	*A. tortilis*	on leaves	
Acidaliastis micra Hampson	*A. mellifera, A. tortilis*	on leaves	s
Acidaliastis subbrunescens Prout	*A. tortilis*	on leaves	s
Chiasma b. brongusaria Walker	*A. xanthophloea*	on leaves	m
Chiasma semialbida Prout	*A. senegal, A. reficiens*	on leaves	s
Chiasma trizonaria Hampson	*A. gerrardii*	on leaves	l
Chiasma pulinda Walker	*A. tortilis*	on leaves	l
Chiasma s. subcurvaria Mabille	*A. xanthophloea*	on leaves	s
Chiasmia warreni Prout	*A. xanthophloea*	on leaves	m
Chiasmia trinotata Warren	*A. xanthophloea*	on leaves	f
Chiasmia ate (Prout)	*A. tortilis,*	on leaves	f
Chiasmia velia Agassiz	*A. tortilis*	on leaves	f
Chiasmia butaria Swinhoe	*A. tortilis*	on leaves	s
Chiasmia baringensis Agassiz	*A. tortilis*	on leaves	
Chlorerythra extenuata Prout	*A. tortilis, A. mellifera*	on leaves	m
Colocleora bipannosa Prout	*A. tortilis*	on leaves	f

In addition a specimen of Belenois zochalia agrippinides Holland emerged from the larvae collected from Acacia tortilis which was a surprise. Although it was beaten from Acacia and only given that for food we are advised by a reviewer that this species has never been recorded as feeding on Acacia and can travel a long distance before pupating, For this reason it is omitted from the table.

Ectropis delosaria Walker	*A. senegal*	on leaves	f
Heterostegane aridata Warren	*A. xanthophloea, A.senegal, A. tortilis*	on leaves	s
Heterostegane minutissima Swinhoe	*A. tortilis*	on leaves	m
Isturgia deeraria Walker	*A. tortilis*	on leaves	m
Isturgia exerraria Prout	*A. drepanolobium, A. seyal*	on leaves, in ant galls	m
Isturgia quadriplaga Rothschild	*A. drepanolobium, A. reficiens,A. tortilis*	on leaves	m
Isturgia sp.A	*A. xanthophloea*	on leaves	l
Xylopteryx inquilina Agassiz	*A. seyal, A. reficiens*	on galls or leaves	s
Zamarada ochrata Warren	*A. xanthophloea*	on leaves	m
Zamarada latilimbata Rebel	*A. tortilis*	on leaves	m
NOTODONTIDAE			
Stenostaura harperi Agassiz	*A. xanthophloea, A. tortilis*	on leaves	s
LYMANTRIIDAE			
Bracharoa mixta Snellen	*A. xanthophloea*	on leaves	l
Casama hemippa Swinhoe	*A. xanthophloea, A. tortilis, A. drepanolobium*	on leaves	m
Casama sp. B			
Dasychira diplogramma Hering	*A. seyal*	in pseudo-galls	l
Eudasychira georgiana Fawcett	*A. xanthophloea*	on leaves	f
Euproctis ? sp.C	*A. tortilis*	on leaves	l
Euproctis ? sp. D	*A. tortilis*	on leaves	l
Knappetra fasciata stellata Distant	*A. xanthophloea, A. tortilis*	on leaves in a web	m
Lymantriidae ? sp.E	*A. tortilis*	on leaves	l
Lymantrides xanthosoma Hampson	*A. xanthophloea, A. tortilis*	on leaves	s
Stilpnaroma venosa Hering	*A. xanthophloea*	on leaves	m
NOCTUIDAE			
CATOCALINAE			
Cortyta canescens Walker	*A. xanthophloea*	on leaves	s
Dugaria atrifusa Hampson	*A. senegal, A. tortilis*	on leaves	f
Ericeia congregata Walker	*A. tortilis*	on leaves	l
Heteropalpia robusta Wiltshire	*A. tortilis*	on leaves	s
Hypotacha isthmigera Wiltshire	*A. tortilis, A. senegal*	on leaves	l
Pandesma robusta Walker	*A. tortilis*	on leaves	f
Plecoptera polymorpha Hampson	*A. reficiens*	on leaves	f
Proconis abrostoloides Hampson	*A. tortilis, A. xanthophloea*	on leaves	f
Prionofrontia ? sp.F	*A. tortilis*	on leaves	
Rhesala moestralis Walker	*A. mellifera, A. tortilis*	on flowers and leaves	s
Sphingomorpha chlorea Cramer	*A. xanthophloea*	on leaves	s
Tytroca albuensis Wiltshire	*A. tortilis*	on leaves	s
Ulothricopus primulina Hampson	*A. xanthophloea*	on leaves	m
CHLOEPHORINAE			
Earias nr. *biplaga* Walker	*A. xanthophloea*	on flowers and leaves	f
SARROTHRIPINAE			
Pardasena virgulana Mabille	*A. xanthphloea, A. tortilis*	on flowers and leaves	f
Characoma submediana Wiltshire	*A. xanthophloea*	on leaves	f
NOLINAE			
Meganola jacobi Agassiz	*A. xanthophloea*	on leaves	s
Meganola reubeni Agassiz	*A. gerrardii, A. tortilis*	on flowers and leaves	m
Nola chionea Hampson	*A. tortilis*	on leaves	l
ACONTIINAE			
Eublemma gayneri Rothschild	*A. xanthophloea*	on flowers	f
AMPHIPYRINAE			
Ethiopica micra Hampson	*A. tortilis*	on leaves	l
Proxenus pectinifera Aurivilius	*A. senegal*	on leaves	f

Fig. 2. *Coenobasis farouki* (Limacodidae).

Fig. 3. Work with the beating tray. Sharp-eyed locals give their assistance! (Photo: Helen Fewster).

important for its own sake, but since Acacia woodlands often abut agricultural areas or are 'manicured' as gardens (e.g. around Lake Naivasha), knowledge of life histories can indicate when a species' primary host plant may be a wild tree rather than a cultivated legume. This woodland biotope is threatened by increasing population pressure with the associated demand for firewood, and so an appreciation of its biodiversity potential is important, before it is too late.

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