INSTITUTE OF TERRESTRIAL ECOLOGY

(NATURAL ENVIRONMENT RESEARCH COUNCIL)

ECOLOGY OF INSECTS IN CAMEROON PLANTATION FORESTS

Fifth Consultancy Report to UK Overseas Development Administration (ODA) / GOC Office National de Dévéloppement des Forêts (ONADEF): Forest Management and Regeneration Project, Mbalmayo, Cameroon - Visit Report March 1994.

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1 Introduction

The overall aim of this consultancy has been to design and implement a monitoring programme on insects, particularly potential insect pests and their natural enemies, in plantations of commercially important trees in Cameroon. Particular emphasis has been placed on insects in plantations of *Terminalia ivorensis* and *Triplochiton scleroxylon* in the Mbalmayo Forest Reserve, where plantation plots have been established in different ways: complete clearance, line planting and other partial clearance treatments, and taungya.

The previous four reports have combined details of the consultants' visits to Cameroon together with data which had become available from laboratory analysis since the previous report. Since the last report a considerable amount of laboratory sorting of insect samples has been done, but only some of the data made recently available will be presented here since further sorting and analysis will be done over the next 2 months. Instead, this report concentrates on the status of the FMRP insect monitoring programmes in the Mbalmayo Forest Reserve, additional observations of insect damage, and the relevance of these and published information on a) the risk of insect damage to plantation trees in Cameroon and b) the impact of silvicultural practice on insect abundance and diversity.

2 Effects of silvicultural treatment on insect damage

2.1 Introduction

The insect programme can be divided into the monitoring of damage to *Terminalia ivorensis* and *Triplochiton scleroxylon* (Section 2), and monitoring of insect abundance and diversity in plantations of *T. ivorensis* and uncleared forest (Section 3). Since November 1992, damage assessments have been carried out by both the consultants and FMRP technicians and this has provided a preliminary but extremely valuable evaluation of the risk of insect damage, particularly to *T. ivorensis*. in particular, to insect damage.

In this report, we present a progress statement on the damage assessment programme, a summary of the March 1994 assessment, a re-appraisal of the risk of insect pests, and a discussion on the continuation of the damage monitoring.

2.2 Monitoring of damage

The damage monitoring programme consists of the following monthly assessments of the impact of gall-forming mites, and leaf-chewing, leaf-mining, and shoot-boring insects to *Terminalia ivorensis* in the following treatments in Eboufek:

complete clearance
line planting

These assessments started in December 1992. In December 1993, assessments of insect damage were started on *Triplochiton scleroxylon* in Eboufek:

complete clearance
line planting
taungya

In most months these assessments have been carried out to schedule. One concern with visual assessments of damage by insects to plants is the assessment of percentage leaf area affected by different damage-causing agents might vary between observers, and when several observers are used, any variation in recorded damage may be more due to inter-observer variability than seasonal variation. Worse still, inter-treatment variation may be obscured. As on previous visits, therefore, a joint damage assessment was carried out. The agreement between estimates of different categories of damage was extremely close, and it is clear from this and an examination of the damage assessment records that the work has been carried out to a high standard.

However, the assessment of damage to *Terminalia ivorensis* is becoming extremely difficult because the trees in Eboufek, particularly in the line planting plots, are becoming too large to adequately assess damage by shoot-borers and gall-forming mites. Since this problem will worsen during 1994, and because shoot-borers appear to pose the most serious risk to this tree species in the Mbalmayo Forest Reserve, then the methods used to assess damage to this tree have to be reconsidered.

Assessments of damage to *Triplochiton scleroxylon* also appears to have been carried out to a high standard, and the trees at Eboufek are small enough to adequately survey for the rest of 1994. Nevertheless, some modifications of the assessment programme are suggested (see below) in order to concentrate on the more potentially serious forms of attack.

In conclusion, the damage assessments have been carried out to a reliable standard but the size of the trees in some plots at Eboufek means that the methodology will have to be changed for future assessments.

2.3 Damage monitoring March 1994

As on previous occasions, the degree of damage caused by leaf-chewing, leaf-mining, gall-forming and shoot-boring insects (and mites) was assessed in 4 plots of *Terminalia ivorensis* in Eboufek (planted 1992). The results are summarised in the following table.

Plots	Leaf-chewer damage (%)	Gall-former index	Leaf-miner damage (%)	Shoot-borer (% plants attacked)
Complete clearance	0.9	0.7	0.7	43
Line Planting	0.8	0.4	2	40

Damage by leaf-chewing insects has declined since late 1993 to insignificant levels, the amount of damage caused by leaf-miners has increased but not appreciably, and attack by gall-forming mites although at the highest level recorded, is also at a low level (an index value of 1 represents presence of galls). However, the number of trees attacked by shoot-borers continues to rise.

Regarding differences between plot treatments, the major point to emerge from this assessment is that between-treatment differences in shoot-borer attack have disappeared.

The monthly assessments of damage to *Triplochiton scleroxylon* were carried out late in the consultant's visit and the data have yet to be analysed. Nevertheless, it is clear that attack by leaf-chewing insects, principally *Zonocerus variegatus,* has declined markedly over the last few months.

The consultant completed additional surveys of damage to plots outside the monitoring programme and found: a) widespread shoot-borer attack on *Terminalia ivorensis* in other treatment plots established in both 1992 and 1993, and b) that *Triplochiton scleroxylon* were generally free from serious insect attack. *Zonocerus variegatus* was again found to be the major insect threat to *Triplochiton scleroxylon,* and, although overall not as abundant as before, was found to be more common in the more open sites at Eboufek.

2.4 Discussion: insect damage to *Terminalia ivorensis* and *Triplochiton scleroxylon*

The following points are emerging from recent monitoring of insect and mite damage to trees in the Mbalmayo Forest Reserve:

- as previously concluded, damage by insects and mites to *Terminalia ivorensis* leaves is of minor importance (serious leaf-chewer damage to lower leaves was frequently observed but is unlikely to have a significant impact on tree growth);

- shoot-borers have become very abundant in Eboufek and pose a serious threat to the growth of *Terminalia ivorensis*;

- damage by *Zonocerus variegatus* to *Triplochiton scleroxylon* has been less serious than expected - the reason for this is unclear (see below).

Future monitoring and research activities on the pest problems associated with these tree species will be considered in more detail in our final report, but three points are worth emphasizing now:

i Shoot-borers on Terminalia ivorensis

The pest status of *Mussidia* sp. shoot-borer depends as much on the response of the tree to attack as on the biology of the insect. The tolerance of different genetic material of this tree species to shoot-borers should be monitored and investigated further.

ii Zonocerus variegatus on Triplochiton scleroxylon

Despite the recent decline in damage by the variegated grasshopper to ayous, previous experience and published reports indicate that this threat should continue to be evaluated. Two areas need to be considered:

- are there seasonal patterns of feeding activity by this pest, and can this tree recover rapidly after attack during these periods?
- how does weed management affect the susceptibility of ayous to grasshopper attack? (Weed growth is thought to encourage grasshoppers but weed clearance is likely to concentrate grasshopper feeding activity on trees.)

iii The general threat of pest attack to timber trees

Damage monitoring at Eboufek has identified only two potentially serious pests of timber trees in the Mbalmayo area, but published information (see previous report) suggests that other insects could pose problems for these and other trees in southern Cameroon. It is important that for the duration of this phase of the FMRP and in the future phase that a 'watching brief' is kept on insect damage to trees in the Eboufek area. Bearing these three factors in mind, an amended damage assessment monitoring programme is outlined below.

2.5 The damage monitoring programme

Attached to this report are two amended damage assessment sheets for the separate monitoring of damage to *Terminalia ivorensis* and *Triplochiton scleroxylon*, drawn up after discussion between ADW and Jacqueline Fanguem (Appendix 4). The former emphasises the impact of shoot-borers on tree growth, and the second concentrates on the threat of variegated grasshoppers. Both contain space for observers to note any other forms of pest attack.

3 Effects of silvicultural treatment on insect abundance and diversity

3.1 Introduction

During this consultancy visit no additional insect collections were made, other than of butterflies, because the remaining staff time on the project will be fully occupied in the laboratory analysis of material already collected. Instead, the consultant's time on this visit was spent assessing the effectiveness of the ongoing insect collection programme and collating information on insect diversity made available since the previous visit.

3.2 Monitoring insect abundance and diversity

The insect collection programme, designed to evaluate the impact of silvicultural practice on insect abundance and diversity, has been run by FMRP staff for approximately one year. This has clearly been done to a high standard, but the work has been hindered by the theft of several of the Malaise traps, and sporadic vandalism of the others. Some of the information from this collection programme will be evaluated by Marcel Mboglen (FMRP technician) during 1994 while he is based at ITE and the Natural History Museum.

3.3 Butterfly monitoring

This activity, started in November 1993, was continued in collaboration with a student from Imperial College, Diane Srivistava. The previous survey resulted in the identification of 125 different species, and an estimate of 700 species in the area.

3.4 Assessment of insect diversity

Insect sorting and identification is currently in progress in the UK and will continue over the next few months. Particular emphasis has been placed on the ants, as previously discussed, because of their potential impact on insect pests, and because they represent a useful target group for the assessment of diversity. Identification of the ants, by Barry Bolton at the Natural History Museum, is still in progress, but attached are lists of ants collected from leaf litter and tree trunk sampling in November 1993 together with a complete list of ant species identified to date (which includes the ants recorded from the canopy in November 1991) (Appendices 1-3). This list, of over 150 species, demonstrates the richness of this family of insects in the Mbalmayo Forest Reserve. In our final report we will present the data broken down according to silvicultural treatment to demonstrate the impact of silviculture on the diversity of this group, as well as butterflies, beetles and overall insect abundance.

4 Acknowledgements

We thank Gerry Lawson, Colin McBeath, Paulinus Ngeh, Andy Roby, Zak Tchoundjeu, Julius Tipa and Julia Wilson for their help and encouragement.

Appendix 1 - Species recorded from tree-trunk survey Ebogo 1993 (60 species in total):

Anochetus traegaordhi
Atopomyrmex cryptoceroides
Axinidris 3
Camponotus vividus
Camponotus 1
Camponotus 4
Camponotus 5
Camponotus 6
Camponotus 7
Cataulacus guineensis
Cataulacus kohli
Cataulacus mocquerysi
Cataulacus 1
Cataulacus 3
Cataulacus 4
Cataulacus 5
Crematogaster africana
Crematogaster buchneri
Crematogaster clariventris
Crematogaster gabonensis
Crematogaster striatula
Crematogaster 1
Crematogaster 2
Crematogaster 4
Crematogaster 5
Crematogaster 6
Crematogaster 7
Lepisiota 1
Monomorium egens
Monomorium tanysum
Odontomachus troglodytes
Oecophylla longinoda
Pachycondyla soror
Paratrechina 1
Paratrechina 2
Phasmomyrmex paradoxa
Pheidole 2
Pheidole 3
Pheidole 4
Platythyrea modesta
Polyrhachis alexisi
Polyrhachis concava
Polyrhachis decemdentata
Polyrhachis laboriosa
Polyrhachis militaris
Polyrhachis weissi
Rhoptromyrmex opacus
Tapinoma 1
Tapinoma 2
Technomyrmex 1
Technomyrmex 2
Technomyrmex 3
Tetramorium aculeatum
Tetramorium camerunense
Tetramorium crypicum
Tetramorium gegaimi
Tetramarium psymanum
Tetramorium quadridentatum
Tetraponera mocquerysi
Tetraponera ophthalmica

Appendix 2 - Species recorded from leaf litter samples, Eboufek, Ebogo and Bilik (112 species in total):

Acropyga 1
Anochetus africanus
Anochetus bequaerti
Anochetus katonae
Anochetus traegaordhi
Anoplolepis tenella
Asphinctopone silvestrii
Calyptomyrmex nummuliticus
Camponotus brutus
Cardiocondyla emeryi
Cataulacus kohli
Centromyrmex sellaris
Cerapachys foreli
Cerapachys nitidulus
Cerapachys sp
Crematogaster buchneri
Crematogaster clariventris
Crematogaster striatula
Decamorium decem
Discothyrea mixta
Dorylus 1
Epitritus roomi
Glamyromyrmex africanus
Glamyromyrmex ravidurus
Glamyromyrmex sistrurus
Glamyromyrmex tetragnathus
Hypoponera 1
Hypoponera 2
Hypoponera 3
Hypoponera 4
Hypoponera 5
Leptogenys bubastis
Leptogenys n.sp.
Monomorium bicolor
Monomorium cryptobium
Monomorium exigium
Monomorium floricola
Monomorium invidium
Monomorium spectrum
Odontomachus assiniensis
Odontomachus troglodytes
Oligomyrmex 1
Oligomyrmex 2
Oligomyrmex 3
Oligomyrmex 4
Oligomyrmex 5
Oligomyrmex 6
Oligomyrmex 7
Oligomyrmex 8
Pachycondyla ambigua
Pachycondyla brunoi
Pachycondyla caffraria
Pachycondyla fugax
Pachycondyla pachyderma
Pachycondyla soror
Pachycondyla tarsata
Paedalgus rarus
Paratrechina 1
Paratrechina 3
Paratrechina 4
Paratrechina 5
Pheidole 1
Pheidole 5
Pheidole 6
Pheidole 7
Pheidole 8
Pheidole 9
Phrynoponera bequaerti
Phrynoponera gabonensis
Polyrhachis rufipalpis
Prionopelta amieti
Pristomyrmex africanus
Pristomyrmex orbiceps
Probolomyrmex guineensis
Serrastruma concolor
Serrastruma dotaja
Serrastruma ludovici
Serrastruma lujae
Serrastruma n.sp.
Serrastruma serrula
Smithistruma arahana
Smithistruma cavinasis
Smithistruma enkara
Smithistruma malaplax
Sphinctomyrmex rufiventris
Strumigenys bernardi
Strumigenys dotaja
Strumigenys ettillax
Strumigenys petiolata
Strumigenys rogeri
Strumigenys tetraphanes
Technomyrmex 1

Technomyrmex 2
Technomyrmex 3
Technomyrmex 4
Technomyrmex 5
Tetramorium antrema
Tetramorium camerunense
Tetramorium capillosum
Tetramorium coloreum
Tetramorium furtivum
Tetramorium gabonense
Tetramorium geminatum
Tetramorium muralti
Tetramorium muscorum
Tetramorium n.sp.
Tetramorium pinnipilum
Tetramorium quadridentatum
Tetramorium rhetidum
Tetramorium weizeckeri
Tetramorium zambesium
Tetramorium zapyrum

Appendix 3 - Complete ant species list
Mbalmayo Forest Reserve 1991-3

Acantholepis sp.1
Acropyga sp.1
Anochetus africanus
Anochetus bequaerti
Anochetus katonae
Anochetus traegaordhi
Anoplolepis tenella
Asphinctopone silvestrii
Atopomyrmex cryptoceroides
Axinidiris nigripes
Axinidris n.sp.
Axinidris sp.3
Calyptomyrmex nummuliticus
Camponotus brutus
Camponotus sp.1
Camponotus sp.2
Camponotus sp.3
Camponotus sp.4
Camponotus sp.5
Camponotus sp.6
Camponotus sp.7
Camponotus vividus
Cardiocondyla emeryi
Cataulacus centrurus
Cataulacus egenus
Cataulacus erinaceus
Cataulacus guineensis
Cataulacus huberi
Cataulacus jeanneli
Cataulacus kohli
Cataulacus lujae
Cataulacus mocquerysi
Cataulacus pullus
Cataulacus sp.1
Cataulacus sp.3
Cataulacus sp.4
Cataulacus sp.5
Centromyrmex sellaris
Cerapachys foreli
Cerapachys nitidulus
Cerapachys sp.
Crematogaster africana
Crematogaster buchneri
Crematogaster clariventris
Crematogaster gabonensis
Crematogaster sp.1
Crematogaster sp.2
Crematogaster sp.4
Crematogaster sp.5
Crematogaster sp.6
Crematogaster sp.7
Crematogaster striatula
Decamorium decem
Discothyrea mixta
Dorylus sp.1
Epitritus roomi
Glamyromyrmex africanus
Glamyromyrmex ravidurus
Glamyromyrmex sistrurus
Glamyromyrmex tetragnathus
Hypoponera sp.1
Hypoponera sp.2
Hypoponera sp.3
Hypoponera sp.4
Hypoponera sp.5
Lepisiota sp.1
Leptogenys bubastis
Leptogenys n.sp.
Monomorium bicolor
Monomorium cryptobium
Monomorium egens
Monomorium exigium
Monomorium floricola
Monomorium invidium
Monomorium spectrum
Monomorium tanysum
Myrmicaria exigua
Odontomachus assiniensis
Odontomachus troglodytes
Oecophylla longinoda
Oligomyrmex sp.1
Oligomyrmex sp.2
Oligomyrmex sp.3
Oligomyrmex sp.4
Oligomyrmex sp.5
Oligomyrmex sp.6
Oligomyrmex sp.7
Oligomyrmex sp.8
Pachycondyla ambigua
Pachycondyla brunoi
Pachycondyla caffraria
Pachycondyla fugax
Pachycondyla pachyderma
Pachycondyla soror

Pachycondyla tarsata
Paedalgus rarus
Paratrechina sp.1
Paratrechina sp.2
Paratrechina sp.3
Paratrechina sp.4
Paratrechina sp.5
Phasmomyrmex paradoxa
Pheidole sp.1
Pheidole sp.2
Pheidole sp.3
Pheidole sp.4
Pheidole sp.5
Pheidole sp.6
Pheidole sp.7
Pheidole sp.8
Pheidole sp.9
Phrynoponera bequaerti
Phrynoponera gabonensis
Platythyrea modesta
Polyrhachis alexisi
Polyrhachis concava
Polyrhachis decemdentata
Polyrhachis laboriosa
Polyrhachis militaris
Polyrhachis rufipalpis
Polyrhachis weissi
Prionopelta amieti
Pristomyrmex africanus
Pristomyrmex orbiceps
Probolomyrmex guineensis
Rhoptromyrmex opacus
Serrastruma concolor
Serrastruma dotaja
Serrastruma ludovici
Serrastruma lujae
Serrastruma maynei
Serrastruma n.sp.
Serrastruma serrula
Smithistruma arahana
Smithistruma cavinasis
Smithistruma enkara
Smithistruma malaplax
Sphinctomyrmex rufiventris
Strumigenys bernardi
Strumigenys dotaja
Strumigenys ettillax
Strumigenys petiolata
Strumigenys rogeri
Strumigenys tetraphanes
Tapinoma sp.1
Tapinoma sp.2
Technomyrmex mocquerysi
Technomyrmex sp.1
Technomyrmex sp.2
Technomyrmex sp.3
Technomyrmex sp.4
Technomyrmex sp.5
Terataner lutens
Tetramarium psymanum
Tetramorium aculeatum
Tetramorium antrema
Tetramorium camerunense
Tetramorium capillosum
Tetramorium coloreum
Tetramorium crypicum
Tetramorium furtivum
Tetramorium gabonense
Tetramorium gegaimi
Tetramorium geminatum
Tetramorium muralti
Tetramorium muscorum
Tetramorium n.sp.
Tetramorium opthalmica
Tetramorium pinnipilum
Tetramorium quadridentatum
Tetramorium rhetidum
Tetramorium weizeckeri
Tetramorium zambesium
Tetramorium zapyrum
Tetraponera mocquerysi
Tetraponera ophthalmica

Appendix 4 - Damage Assessment Monitoring Sheets

Observer: Date:	**Damage Assessment: Framire. Plot:**		
Tree number	Current shoot-borer attack (Y/N)	Shoot-borer damage to main stem (Y/N)	Comments:
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
25			
Approximate average level of damage by leaf-chewing insects		0-1%: 1-5%: 5-10%: Other (specify):	
Approximate level of damage by leaf-mining insects		0-1%: 1-5%: 5-10%: Other (specify):	
Comments:			

Observer: Date:	**Damage Assessment: Ayous. Plot:**	
Tree number	Percentage area damaged by leaf-chewing, leaf-mining and leaf-sucking insects	Comments:
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
Comments:		

Appendix 5: Itinerary March 1994

Monday 14 March	Travel from Edinburgh to Cameroon via London (Natural History Museum - discussions with N Stork and C Lyal) & Paris.
Tuesday 15 March	Arrive Cameroon, discussions with FMRP staff, discussions with TIGER termite research group.
Wednesday 16 March	Damage assessments Eboufek, visits to ITE Bilik plots and Parc de Bouturage.
Thursday 17 March	Butterfly diversity assessments ITE Ebogo plots, analysis of monitoring data.
Friday 18 March	Butterfly diversity assessments Eboufek plots, data analysis.
Saturday 19 March	Butterfly abundance monitoring Eboufek etc, data analysis.
Sunday 20 March	Damage assessment Eboufek etc, data analysis.
Monday 21 March	Discussions on ammending the monitoring programme, data analysis.
Tuesday 22 March	Report writing, discussions with FMRP staff.
Wednesday 23 March	Visits to Eboufek etc, data analysis, report writing, discussions with TIGER termite research group.
Thursday 24 march	Discussion with A Roby. Depart Cameroon for Paris.
Friday 25 March	Arrive Edinburgh.