Monograph on

Endemism in the Highlands and Escarpments of Angola and Namibia

Angola Cave-Chat *Xenocopsychus ansorgei*
Photo: M Mills

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Published with support and funding from:

Ongava Research Centre (ORC)
Namibian Chamber of Environment (NCE)
Centro de Investigação em Biodiversidade e Recursos Genéticos (CIBIO)
B2Gold Namibia
TotalEnergies

Language editor: Carole Roberts
Design and layout: Alice Jarvis

NJE Namibian Journal of Environment

2023: Volume 8 www.nje.org.na

ISSN: 2026-8327 (online)

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The Neuroptera of the highlands and escarpments of Angola and Namibia

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URL: https://www.nje.org.na/index.php/nje/article/view/volume8-mansell
Published online: 15th December 2023

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ABSTRACT
Of the 17 families of Neuroptera (lacewings) worldwide, ten families represented by 148 species have been recorded from Namibia, and five families with 36 species from Angola. In Namibia, 17 endemic species are known, of which two are known from high-elevation escarpment localities. However, very few surveys dedicated specifically to Neuroptera have been carried out in Namibia and none in Angola, so it is therefore not possible to assess the importance of the highlands and escarpments to Neuroptera. Recommendations are made for further surveys and research.

Keywords: Angola, escarpments, highlands, lacewings, Namibia, Neuroptera

INTRODUCTION

The Neuroptera, generally referred to as 'lacewings', is one of 28 orders that comprise the animal class Insecta – the insects. The Neuroptera includes 17 families distributed worldwide, with exceptionally diverse faunas in southern Africa, especially in South Africa and Namibia which are both endowed with a rich diversity of families and species, reflecting a recent evolutionary diversification in the southern part of Africa. Ten families of Neuroptera have been recorded from Namibia and five from Angola.

GENERAL BIOLOGY OF NEUROPTERA

The name 'Neuroptera' is derived from the Greek *neuron* which means nerve or sinew and *ptera* which means wings, thus the name means 'nerve-winged insects' referring to the characteristic lace-like pattern of veins in the wings. The adults can be easily recognised by the two pairs of similar diaphanous wings that are held in a roof-like manner over the body when the insects rest with the wings folded. The antennae are also definitive, ranging from long, multi-segmented and filiform, to short and stout, to long and clubbed; features that clearly separate them from the similar-looking dragonflies and damselflies.

Adult lacewings are either predacious with biting and chewing mouthparts, or pollen and nectar feeders having mouthparts adapted for pollen and nectar collection, especially the Nemopteridae.

Lacewing larvae, by contrast, are all obligate predators, with piercing and sucking mouthparts, comprising a complementary combination between the mandibles and the lacinia of the maxillae, the latter slotting into a groove on the ventral surface of the mandibles to form a tubular canal (Figure 1) through which saliva, containing digestive enzymes can pass. The resulting liquid food can then be drawn into the alimentary canal. This feature is a highly evolved, albeit ancient, evolutionary advance which is unique to the Neuroptera, and provides the autapomorphy (i.e., specialised character or trait that is unique to a monophyletic taxonomic group) that defines the lacewings as a monophyletic evolutionary lineage. When a lacewing larva detects prey, it uses its mandibles to seize the prey, and then injects proteolytic enzymes into the prey's body. Once the internal organs are liquified, the resultant fluid is sucked into the alimentary canal of the larva, where further digestion takes place. This digestive process is highly efficient and the larvae do not excrete solid matter during the entire larval life, which can last from a few weeks to several years, depending on the species. Accumulated solid matter is voided as a single meconial pellet when the larva metamorphoses into an adult and emerges from the cocoon. This digestive system has also enabled the Malpighian tubules to depart from their normal excretory

Figure 1: *Lacewing larvae are all obligate predators with piercing and sucking mouthparts, comprising a complementary combination between the mandibles and the lacinia of the maxillae, the latter slotting into a groove on the ventral surface of the mandibles to form a tubular canal. Ventral view of head of* Palpares inclemens.

function and to evolve into silk-producing glands, another unique autapomorphic feature of the Neuroptera. All lacewing larvae spin a spherical silken cocoon in which to pupate. The cocoon protects the metamorphosing larva from parasites and predators, by affording camouflage and reducing dehydration.

While evolutionary advances such as these often lead to very limited possibilities of further biological advances, or even evolutionary cul-de-sacs, lacewings have used them to adapt to a variety of ecological niches, leading to further evolutionary adaptations and advances. They consequently provide numerous examples of habitat, biological and behavioural diversifications, which have ensured their survival by diversification through specialisation.

Habitats and life strategies

The morphological and physiological adaptations have enabled lacewings, especially the larvae, to evolve into a diversity of habitats and life strategies, including: aquatic, where larvae feed on freshwater sponges; semi-aquatic on the borders of streams; as inquilines in the nests of ants and termites; as parasites in spiders' nests; as arboreals, living on branches and foliage; and living in tree holes, caves, rock overhangs and in sand.

Significance of lacewings in ecosystems

Insects are arguably the most significant component of the biodiversity and functioning of ecosystems. They render numerous ecosystem services, ranging from pollination, nutrient recycling through biodegradation of organic matter, to population control of other invertebrates and plants. Most plants are insect-pollinated and all depend on recycled nutrients. Insects are also vital components of the food chains of other animals, especially birds, fishes and other vertebrate animals. Adults of many Neuroptera are pollinators of indigenous plants, with some having co-evolved with certain plants. The larvae are all obligate predators and limit populations of other insects and invertebrates. They are also important indicators of ecosystem health and are a significant component of the biodiversity of many ecosystems, including arid areas.

NEUROPTERA IN NAMIBIA AND ANGOLA

Namibia

Of the 17 worldwide families of Neuroptera, 10 have been recorded from Namibia, with the largest representation being the families usually known as antlions (Myrmeleontidae), thread- and ribbon-wing lacewings (Nemopteridae) and green lacewings (Chrysopidae). Other families represented in Namibia include: silky or moth lacewings (Psychopsidae; three species), owlflies (Ascalaphidae; ten species), dusty lacewings (Coniopterygidae; eight species), sponge flies (Sisyridae; one species), beaded lacewings (Berothidae; three species), raptor lacewings (Rhachiberothidae; three species) and pleasing lacewings (Dilaridae; one species). All of these families are also known from South Africa, and other southern African countries.

The ten families of Neuroptera in Namibia are represented by 148 species. Of these, 50 species – more than one third – were originally described from Namibia and 17 are endemic to Namibia. The remaining 98 taxa are more widespread and are also known from neighbouring countries, especially South Africa, with a few also occurring in Botswana and Angola.

Figure 2 illustrates some of the species which are endemic to Namibia. Of the 17 Namibian endemics, only two, *Tjederia brevicornis* (Nemopteridae, Crocinae) (Mansell 1981) and an undescribed species of *Tricholeon* (Myrmeleontidae) are specifically known from high-lying escarpment localities. *Tjederia brevicornis* occurs in the mountains around Windhoek, while the *Tricholeon* species is the only endemic lacewing known from the Brandberg (Mansell & Aspöck 1990).

Namibian surveys

Until recently, very few surveys dedicated specifically to Neuroptera were carried out in Namibia:

- The British Museum expedition of southern Africa during the 1950s included sites in Namibia. Species from this expedition were described by the great Swedish neuropterist Bo Karl Herman Tjeder, in a series of fundamental works entitled "South African Animal Life" (Tjeder 1960, 1961, 1966, 1967).

- The current author, M Mansell, did surveys during 1970–1990, that were specifically focused on the study of larvae of thread-winged lacewings (Nemopteridae, Crocinae). A wide area was covered, which included mountainous areas in and near Windhoek and the Khomas Hochland (Mansell 1981).

- In 1988, the Third International Symposium on Neuropterology was held in South Africa and included a post-symposium excursion to Namibia during which some of the world's leading exponents of Neuroptera conducted limited collections (Mansell & Aspöck 1990).

Prior to these collections, F Gaerdes and S Braine collected many species of Neuroptera that contributed to the discourse, and provided several specimens upon which new species descriptions were based. More recently, surveys have been carried out by R Becker and A Moller through their Lacewing

Monitoring Project, and by the Skeleton Coast–Iona Transfrontier Park Technology for Conservation (SCIONA) Project of the Namibia University of Science and Technology.

The survey of the Brandberg by E Marais and A Kirk-Spriggs in 1998, is the only study that has specifically inventoried any inselberg or high-lying areas in Namibia. The Neuroptera were particularly well represented in the insect samples from these collections and were comprehensively documented by Mansell (2000). It included a complete list of the Neuroptera known from Namibia at that time, and specifically listed 40 species in seven families from the Brandberg. However, all of the species recorded from the Brandberg occur elsewhere in Namibia, with the exception of a solitary adult specimen of an undescribed species of *Tricholeon*, (Myrmeleontidae) which may prove to be a Brandberg endemic (Mansell 2000).

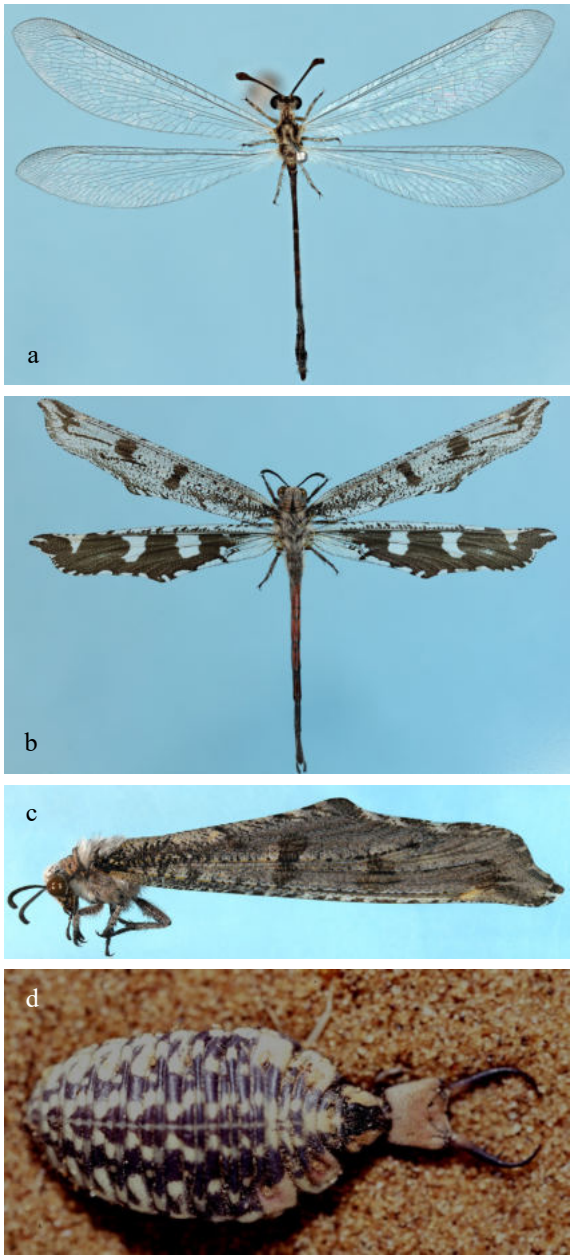

Figure 2: *A selection of Namibian Neuroptera species: a)* Isonemurus longipalpis*, a rare Namibian endemic (photo: M Mansell); b)* Crambomorphus namibicus*, a beautiful Namibian endemic, habitus (photo: M Mansell); c)* Crambomorphus namibicus*, profile, habitus (photo: M Mansell); and d)* Crambomorphus namibicus *larva, rarely encountered (photo: R Oberprieler).*

Angola

There has never been any attempt to survey Angola for Neuroptera, and all of the known species are the result of fortuitous bycatch. The neuropteran fauna of Angola is the most poorly known on the African continent and only five families have been recorded: Myrmeleontidae, Nemopteridae, Psychopsidae, Ascalaphidae and Rhachiberothidae. Most of these are known from very few records, three or fewer, in the literature. Of the 36 species known, 10 (almost one third) were originally described from specimens collected in Angola, and most are still only known by the unique type specimens. Nothing is, unfortunately, known about the Neuroptera of the escarpment areas in Angola.

DEFICIENCIES IN KNOWLEDGE, PRIORITIES FOR RESEARCH AND CONSERVATION

The main deficiency in terms of knowledge of Neuroptera in the highlands and escarpments of Angola and Namibia (HEAN) is obviously the lack of records from the highlands and escarpments of both countries. Without such records no assessment of the importance of the highlands and escarpments is possible. Thus dedicated surveys of specific areas are the first priority for research. Such surveys should target both adult specimens and larvae to gain a better understanding of their biology in particular areas. These could be conducted at the same time as surveys of other organisms, especially insects and other invertebrates. As there is essentially no knowledge of the Neuroptera in Angola in general, a wider priority should be to address this deficiency as well.

The author has expertise on the methods required to collect specimens and material for DNA analyses and could also provide taxonomic and biological information support for future surveys. Some databases are already available to provide some data, especially from Namibia. Regarding Angola, it would also be advisable to determine whether there are any specimens held in collections there, for example, in the museum in Luanda or other repositories.

For Namibian lacewings, an immediate priority would be to locate the larvae of the endemic species of *Tricholeon* in the Brandberg, and to determine

through larval collections whether this species also occurs elsewhere. As we already know what the larval requirements of other species in the genus are, this would be relatively easy to achieve in the short term.

ACKNOWLEDGEMENTS

The author is grateful to Rolf Becker, Alma Moller and Vera de Cauwer for enhancing knowledge by facilitating further collections under the auspices of the SCIONA and Namibian Neuroptera projects.

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