

ALTERNATIVE CROPS FUND (ACF)

FINAL REPORT

Survey of lace bug (*Tingidae*) and flea beetle (*Argopistes* spp.) species affecting olive trees in the Western Cape September 2022

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PROJECT INFORMATION

Project title	Survey of lace bug (<i>Tingidae</i>) and flea beetle (<i>Argopistes</i> spp.) species affecting olive trees in the Western Cape		
Project number			
Keywords	Olives, tingids, flea beetles, insect pests		
Start date (dd/mm/yyyy)	01/01/2020	End date (dd/mm/yyyy)	31/07/2022

FINAL PROGRESS REPORT

January 2020 to September 2022

EXECUTIVE SUMMARY

A survey of four groups of olive pests was conducted during the olive-growing seasons 2020 and 2021 – olive flea beetles, olive seed weevils, olive lace bugs and olive psyllids. The species diversity of olive lace bugs was higher than expected but the diversity of olive flea beetles was lower. Olive seed weevils were represented by a single species. Preliminary results on olive psyllids indicate that only one species is present. The results represent the most comprehensive of species diversity performed to date in these taxonomic groups in South Africa, associated with novel genetic data useful for monitorization of these olive pests and closely related species that may still be discovered. The majority of the results obtained in this project have already been published in peer-reviewed journals.

FINAL RESULTS

We collected a total of 350 olive lace bug specimens and 600 flea beetle specimens at 16 and eight different locations (respectively) in the Western Cape.

The MSc student performing the research graduated in December 2021, and the thesis was sent to SA Olive. The results of the Tingidae survey were published in the journal *Insects* in September 2021. The results of the preliminary survey of olive seed weevil were published in the journal *Insects* in July 2022. The results of the olive flea beetle survey are currently under review in the journal *Genes*. Details are given below.

OLIVE LACE BUGS

We found a total of four species, of which two are reported for the first time. Three species have been identified (*Plerochila australis*, *Neoplerochila paliatseasi*, *Cysteochila lineata*), and one species is still awaiting identification by Dr Eric Guilbert (National History Museum, Paris). Specimens were also sent to Dr Simon Van Noort (Iziko Museum, Cape Town) for high resolution imaging and deposit in the Museum's entomological collection.

We sequenced the complete mitochondrial genome for the four species using Next-Generation Sequencing. The sequences are being used for phylogenetic reconstruction of the family Tingidae to determine the phylogenetic position of the four species within the family. We also DNA-barcoded a total of 70 specimens across the four olive lace bug species for confirmation of morphological identification. This study is the first research chapter in the MSc student's thesis. A and was published in a peer-reviewed journal, with the MSc student as first author (see Vaylen Hlaka, Éric Guilbert, Samuel Jacobus Smit, Simon van Noort, Elleunorah Allsopp, Jethro Langley and Barbara van Asch 2021 Species Diversity and Phylogenetic Relationships of Olive Lace Bugs (Hemiptera: Tingidae) Found in South Africa *Insects* 2021, 12, 830. <https://doi.org/10.3390/insects12090830>).

OLIVE FLEA BEETLES

Three species of olive flea beetles have been reported in the Western Cape (*Argopistes sexvitattus*, *Argopistes capensis* and *Argopistes oleae*). However, we only found *A. sexvitattus* and *A. capensis*, and only two specimens of the latter. We sequenced the complete mitochondrial genome for *A. sexvitattus* and *A. olea* using Next-Generation Sequencing. We also DNA-barcoded a total of 50 specimens for confirmation of morphological identification. This study is the second research chapter in the MSc student's thesis. A manuscript reporting the results is currently under review in the journal *Genes*. We predict that it will be published before the end of the year.

OLIVE SEED WEEVILS

A preliminary survey of olive seed weevils was performed during the extension of the project. We found only one species (*Anchonocranus oleae*), both in wild and cultivated olives. We sequenced the complete mitochondrial genome for *A. oleae* using Next-Generation Sequencing, and DNA-barcoded a total of 30 specimens for confirmation of morphological identification. The genetic data generated is useful for monitoring and identifying this and closely related species. This study was published in July 2022: Smit SJ, Allsopp E, Nethavhani Z, Caleca V, Oberprieler RG, van Asch B. Mitogenomics of the Olive Seed Weevil, *Anchonocranus oleae* Marshall and implications for its phylogenetic position in Curculionidae. *Insects*, 2022, 13, 607. <https://doi.org/10.3390/insects13070607>.

OLIVE PSYLLIDS

The genetic survey of olive psyllids collected in the Western Cape is almost completed but data analyses are writeup are still underway. We will share the results and publications associated with this part of the work as soon as we finalize this section of the project.

CONCLUSION

We conducted surveys of wild and cultivated olives in the Western Cape for assessing the species diversity of four groups of insects known to be present in the region.

(1) The species diversity of olive lace bugs is higher than previously known, with four species present instead of one. *Plerochila australis* is by far the most frequently found species.

(2) The species diversity of olive flea beetles is lower than previously known, with only two species present, of which *Argopistes sexvitattus* dominates at almost 100% in all sites visited.

(3) The species diversity of olive seed weevils is restricted to one species (*Anchonocranus oleae*) in all sites visited.

(4) The species diversity of olive psyllids seems to be concordant with a single species but data analyses in still underway.

Our results represent a significant update on the diversity of these pests. We already published most of the results in scientific journals, but we propose that it would be useful to prepare a leaflet for olive growers showing images and damages provoked by these insects for reference in the field. We offer to do so, time allowing and SA Olive agreeing to disseminate it.

FINAL REPORT

1. Problem identification and objectives

AIM

To generate new information on species diversity of olive lace bugs and olive flea beetles and their distribution in the Western Cape of South Africa, using DNA-based methods.

OBJECTIVES 2020

1. To determine distribution of lace bugs and flea beetles in olive growing areas.
2. To identify lace bug and flea beetle species using DNA and morphological data.

OBJECTIVES 2021

1. To assess the distribution of the identified species across olive farms.
2. To assess the intraspecific diversity for the most frequently found / relevant species.

2. Amended workplan (materials & methods) and SOP

We do not anticipate major changes at this point.

3. Accumulated outputs

Technology developed

None

Human resources developed/trained

One MSc student graduated in December 2021.

Patents

None

Publications (popular, press releases, semi-scientific, scientific)

One conference paper was published in July 2021: Hlaka V, van Asch B. DNA Barcoding of Olive Lace Bugs (Hemiptera: Tingidae) Reveals Previously Unknown Species Diversity in South Africa, in Proceedings of the 1st International Electronic Conference on Entomology, 1–15 July 2021, MDPI: Basel, Switzerland, doi:10.3390/IECE-10610.

One full research paper was published in September 2021: Hlaka V, Guilbert E, Smit SJ, van Noort S, Allsopp E, Langley J, van Asch B 2021 Species Diversity and Phylogenetic Relationships of Olive Lace Bugs (Hemiptera: Tingidae) Found in South Africa *Insects* 2021, 12, 830. <https://doi.org/10.3390/insects12090830>.

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One full research paper is currently under review: Hlaka V, Biondi M, Allsopp E, van Asch B. *Argopistes capensis* and *Argopistes sexvittatus* (Chrysomelidae: Alticini): mitogenomics and phylogeny of two flea beetles affecting olive trees.

Presentations/papers delivered

The MSc student presented a poster communication at ESSA Conference 28 Jun- 1 July 2021.

5. Budget for the following year: 1 April 2021 to 31 December 2021 (YEAR 2)

	WCDA	Other*					TOTAL
FUNDING REQUIRED FOR FOLLOWING YEAR: TOTAL							
Personnel costs (NOTE: MSc bursary)	40000						40000
Running costs	44250						44250
Equipment (capital items*) [List capital items HERE]	0						0
Other	0						0

* Specify other sources

6. Total estimated budget for project (insert actual cost when available)

	Year	WCDA	Other				TOTAL
Total cost in real terms for year 1	2020	141250					141250
Total cost in real terms for year 2	2021	84250					84250
Total cost in real terms for year 3	-						
Total cost in real terms for year 4	-						
Total cost in real terms for year 5	-						
TOTAL		225500					225500

EVALUATION BY ALTERNATIVE CROPS FUND STEERING COMMITTEE

This section is for office use only

Comments on project:

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**Recommendation by
Alternative Crops Fund Steering
Committee**

Designation	Designation
Signature	Signature
Date:	Date: