

Determination of microplastics in reared black soldier fly larvae (*Hermetia illucens*) and yellow mealworms (*Tenebrio molitor*) using polarized light optical microscopy

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Introduction

- Novel protein source for food and feed
- Valorisation of waste materials (e.g. former foodstuffs)
- Chemical & physical hazards
- Packaging materials: microplastics



Introduction

- Microplastics: < 5 mm
- Insufficient separation of packaging materials from biomass
- Risks for conventional livestock, but also for insects?
 - Suffocation
 - Transfer
- Presence of MPs in BSFL and YMW



Experimental setup

	Black soldier fly		Yellow mealworm
	Study 1	Study 2	
Plastics	PET, LDPE-300, LDPE-125, LDPE-film		PET, LDPE-300, LDPE-125, BLμP 53-63, BLμP 90-106, GRμP 90-106, PA, PTFE, PS, PP
Exposure	1, 3, 10%	0.15, 3%	1%
Total treatments	12	8	10
Replicates per treatment	3	3	3
Negative control	n=9	n=9	n=9
After harvesting	No washing	Washing	Washing

Experimental setup

Larval survival & growth

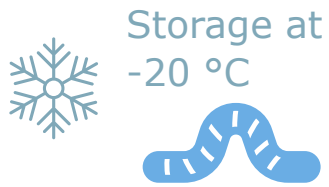
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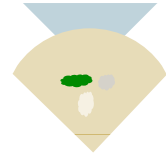
Detection of particles

	Black soldier fly		Yellow mealworm
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Method

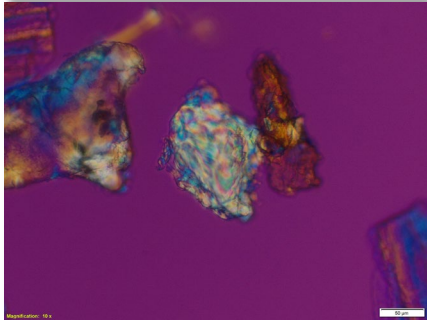


Filtering



Drying

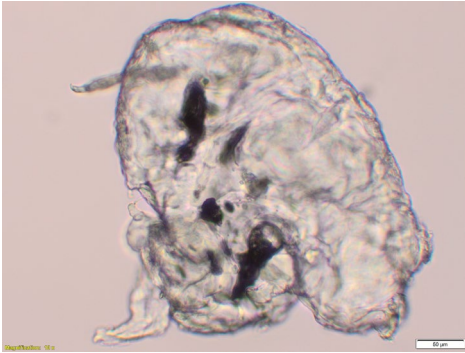
Microscopy with
polarized light



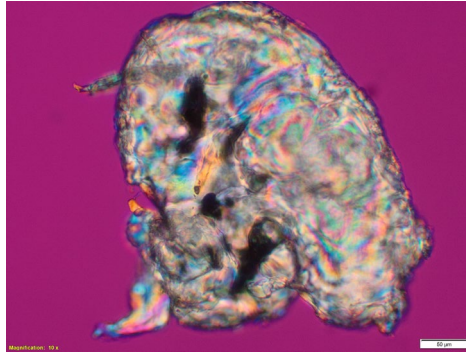
Microscopy: why polarized light?

■ Nile red

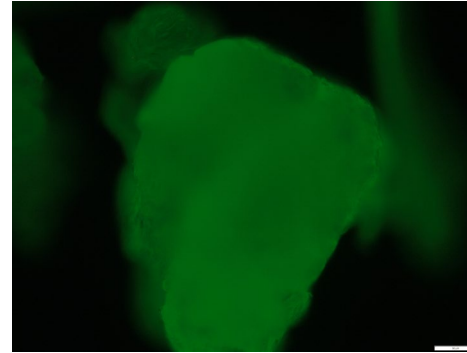
- Fluorescent dye
- Likes everything that is very apolar



Normal light



Polarized light



Stained with Nile Red

LDPE-300

Microscopy: why polarized light?

	Nile Red	Polarized light
Pros	Fluorescence easily visible against dark background	No staining procedure necessary Unique pattern observed for certain microplastics
Cons	Possible co-staining of matrix Possible autofluorescence of matrix	Specific microscopic skills necessary

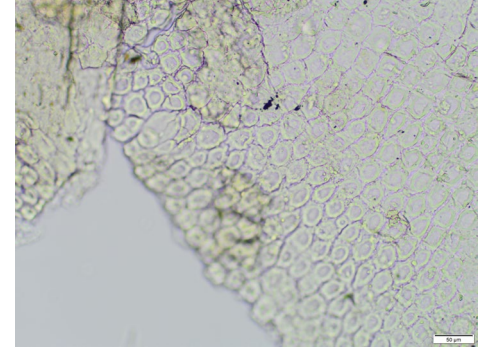
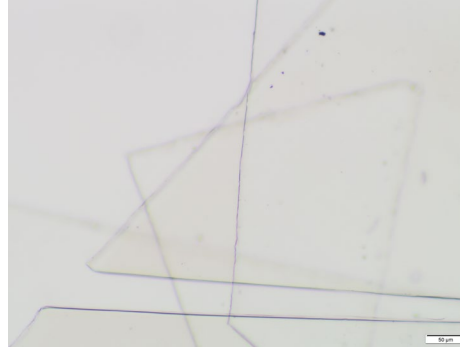
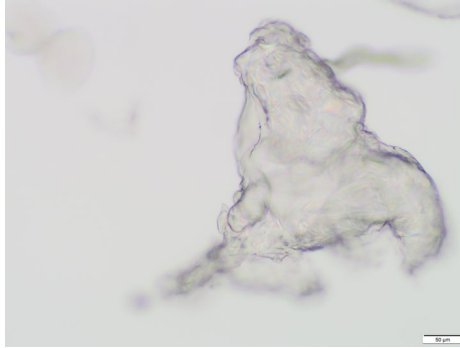
Microscopy: why polarized light?

LDPE-300

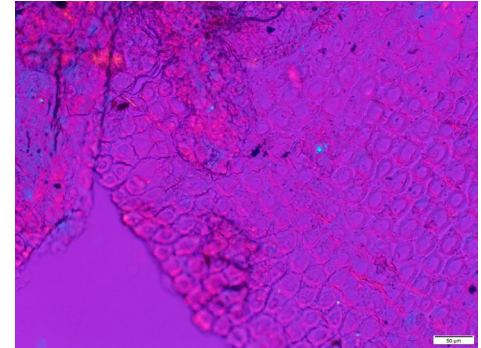
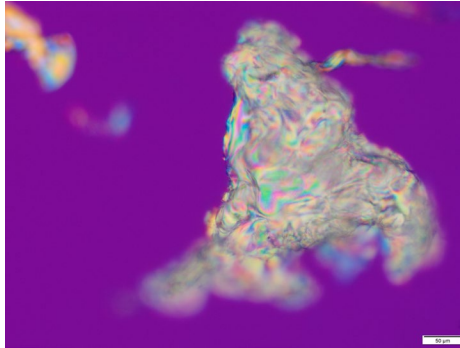
LDPE-film

Cuticle

Normal light



Polarized light



Results: survival & yield

- No significant difference between groups
- Tested plastics have no influence on survival and growth

BSF study 1
YMW



Results: particles found

	Black soldier fly					
	Study 1			Study 2		
	1%	3%	10%	0.15%		3%
PET	-	-	-	± 10% of all particles, plastic	> 50% of all particles, plastic	
LDPE-300	-	-	-	Not present	Trace	
LDPE-125	-	-	-	Not present	Trace	
LDPE-film	-	-	-	Not present	Trace	

Not washing = no
particle detection!

Discussion

Black soldier fly

- More plastic particles found in PET treatment compared to LDPE treatment (Both 300 μm size & powder)
- At 3%, more plastic particles than at 0.15%
 - Ingestion of MPs depends on initial particle load (Lievens *et al.* 2023)
- Possibly chemical structure plays a role



Results: particles found

Yellow mealworm

Significantly different

PET, LDPE-300, GR μ P 90-106

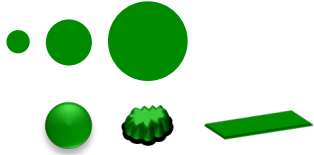
Not significantly different

LDPE-125, BL μ P 53-63, BL μ P 90-106,
PA, PTFE, PS, PP

Discussion

Yellow mealworm

- Significantly more plastic particles in: PET, LDPE-300, GR μ P 90-106
 - PET & LDPE-300 both 300 μ m size
- Many factors could play a role for consumption
 - Size
 - Shape
 - Chemical structure
 - Density



Conclusions & further steps

- Presence of microplastics in insect feed did **not affect survival & growth** of YMW and BSFL
- **BSFL**: **More plastic particles** were found in substrate spiked with **PET**, with more particles present at a higher concentration – substrate spiked with **LDPE** showed **no** or **trace amounts** of plastic particles
- **YMW**: **significantly more plastic particles** found in substrate spiked with **PET**, **LDPE-300** and **GR μ P 90-106**
- Future research to focus on more **types** of plastics, **shapes**, **densities**, **sizes**

Acknowledgements

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