

LARVAE COMPOST

Länsiharju primary school - Lahti - Finland

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The target group

Primary school, children ages of 9-12 and their teachers. The indirect target group is childrens' parents and sisters.

The purpose of the best practice

The aim is to investigate the operation of a black soldier fly larva powered composter - a bioconverter - and related systems in and out of the classroom. The larvae composter is thus a research laboratory.

The idea of larvae compost was to research larvae of Black Soldier Fly (BSF) ability to recycle biomaterial created by school centeen, the behavior of larvae, composting, nutrient cycle, and importance of soil in agriculture.



Relationship to the curriculum

The best practice has a relationship and an impact on the below-mentioned subject. It's possible to integrate the larvae compost themes on many topics because of its multidisciplinary nature.

The team of the best practice was international (Finland - Italy), partly outside of the school world and operated over the internet both for COVID-19 reasons but also because of the international co-operation. The team composition gave also a unique flavor to the best practice.

- Major subjects: Natural Sciences, Biology, Environmental Science
- Related subjects: Computer Science, Health Studies and Mother Tongue

Implementation of the larvae compost

Larvae compost experiment was done during autumn 2020 in Länsiharju elementary school in Lahti Finland with 4th grade students (about 10 years old) and their teacher.

Below we explain the needed accessories and the practical procedure to execute the best practice.

Accessories for larvae compost

- 10,000 black soldier larvae
- Plastic box with high edge and lid, size approx. 40 cm * 40 cm (eg IKEA)
- Terrarium heater mat under the compost bin for optimal temperature

- Peat-based mold on the bottom of the composter 3-5 l
- School canteen waste food approx. 3-5 dl / day
- Water to maintain even humidity
- Temperature meter and humidity meter
- Laptop, camera and software for streaming
- Research protocol and research diary (eg OneNote)
- Camera
- Work instructions for larval composter care
- Peer support and outside help may be needed

Experiment phasing and indicative durations

- Purchase of supplies: a few weeks
- Starting the larval composter incl. stroke: 1-2 h
- The larvae are fed, monitored and treated for at least 2-3 weeks: 15-60 min / day
- Linking the experiment to different subjects such as Health Education and Nutrition, Mother Tongue, Computer Science, etc.
- When the larval stage is nearing the end, 10,000 larvae are divided into the following fractions, for example:
 - About 4950 plump larvae are fed to fish from a nearby lake
 - About 4950 plump larvae are fed to chickens or pigs on a nearby farm
 - about 100 larvae are taken to the next stage of their life cycle, ie they are allowed to form black wing flies (2-3 weeks)
 - The larvae of the larval composter will be utilized as a strong biofertilizer in the mother spring day flower growing project next spring.
- Final review and assignment 1-2 hours

Assessment in your best practice

The best practice applied simple but efficient Plan-Do-Check-Act methodology. The team put a lot of effort to assess and learn from the experiment. We applied following main assessment practices.

- a) After each main step, the team assesses the implementation. For example, after the PLAN phase, the team gathered to assess what was the purpose of the PLAN phase, what was the actual results of the PLAN phase, and what did the team learn from the process. Also in the end of the project, the final assessment was conducted.
- b) The children kept the diary in One-Note (see ANNEX A). The diary was direct feedback on how children thought about the experiment.
- c) The children kept a monitoring matrix to assess the conditions and performance of larvae compost
- d) The team assessed continuously the progress in everyday co-operation during the implementation period (4 weeks). The team had a common chat channel and it was in vivid use.
- e) The Lahti European Green Capital project 2021 provided funding to execute this experiment. They requested an assessment that was focused on inclusion, communication, and dissemination activities. The team used streaming at Youtube and postings on Twitter, LinkedIn, and Facebook to tell about the experiment. We estimated, that we reached out directly to about 120 people and 1500 in social media.

The main results regarding the feasibility and impact are:

The project shows that the larval composter can be maintained with instructions and a little guidance from children as well as those who were not previously aware of it.

Finally, according to the teacher, the experiment was a success, and it was an interesting and memorable experience for the students of the LUMA class in Länsiharju.

ANNEX A: The blog of Larvae Compost at Länsiharju school 4th class

Oppilaat kirjoittavat havaintoja One-Note alustalle koulupäivien aikana. Toukkakompostorin toiminnasta mitataan ja seurataan annetujen ruuan määrä, sen laatua, toukkien toimintaa ja kasvua, sekä kompostorin lämpätilaa, kosteutta ja hajua.

22.9.2020 1. päivä

Meidän luokka sai toukkakompostorin. Olemme odottaneet ja ajatelleet sitä kovasti ja tänään se vihdoin toteutui. Laitoimme takapöydät yhteen ja saimme ison alustan kompostorille.

Luokkaan tuotiin 10 000 kappaletta mustasotilaskärpäsen toukkia. Ne asuvat valkoisessa muovilaatikossa.

Ne tuntuvat limaisilta ja liikkuvilta spageteiltä. Melkein kaikki uskaltavat koskea niihin. Meidän koko luokka oli yllättyneitä kuinka pieniä ne ovatkaan.

Ne tuottavat multaa ja syövät paljon.

Tänään toukilla oli ruokana jauhelihakeittoa ilman lientä ja tomaattiviipaleita. Annamme myös ruisleipää kuivikkeeksi.

Toukille piti laittaa turve-este, koska ne yrittivät kiivetä pois.

23.9.2020 2. päivä

Viime yönä toukat olivat ihan pimeässä, mutta yritetään saada valoa niille.

Eilisistä ruoista oli jäljellä ruisleipäpalasia ja tomaatteja. Toukat olivat syöneet ensin pehmeät perunat ja porkkanat.

Toukilla on liian kylmä ja ne liikkuvat hitaasti, joten yksi tämän kokeilun järjestäjistä tulee tuomaan toukille oman lämpöpeiton. Kompostorissa pitää olla tasainen lämpö, 25 astetta.

Tänään toukat saivat ruokana Tipalanpastaa eli makaronia, nyhtökaura ja porkkanaa.

24.9.2020 3. päivä

Toukat saivat lämpöpeiton ja voivat taas hyvin.

Toukat ovat tänään vilkaita.

Tiistain tomaateista on otettu vain neste muu on jäenty syömättä.

Toukilla on tänään noin 24-25 astetta lämpöä.

Tänään toukilla on ruokana lihakastiketta ilman lientä, perunaa ja porkkana- ja kaaliraastetta.

25.9.2020 4. päivä

Kompostori haisi hirveälle koska keskiviikon pastassa oli kermaa.

Tänään ruokana oli keltaista broilerikeittoa ja sämpylää.

Lämpö on pysynyt tasaisena, turpeen kosteus on n. 57.

Tiistain tomaatit ovat homeisia riekaleita.

Eiliset perunkuoret olivat jäätneet pohjalle ja perunat kadonnut.

Syöminen on nopeutunut tiistaista, ruoka häviää todella nopeasti. Myös toukat ovat nopeampia eikä enää samassa kassassa. Lämpöpeitto toimii hyvin.

28.9.2020 7. päivä

Tänään toukat haisivat kamalalle mutta haju meni nopeasti pois jokainen kerta kun tuliin luokkaan.

Toukat söivät kasvispihvejä, perunaa ja salaattia. Ruokajätettä laitettiin 308g.

Kuivat tomaattien kuoret ja perunan kuoret otettiin pois, koska ne eivät tykänneet niistä.

Turpeen kosteus oli 39. Huoneen lämpötila oli liian kuuma noin 29'c.

Toukat olivat nopeita. Toukkien määrä on noin 10 000.

Toukkien kunto on hyvä.

Toukat ovat kasvaneet runsaasti.



29.9.2020 8. päivä päivä

Tänään toukilla oli ruokana nakkikeittoa, ruisleipää ja kokonainen banaani kuorineen. Toukat tappelivat ruoasta. Toukat olivat aktiivisia ruoan suhteen. Huoneen lämpötila on +25c. Turpeen kosteus on 46%.

Luokkaamme tuli sitruunoita peittämään kompostorin pahaa hajua. Hajun syytä ei vieläkään tiedetä. Myös toukat ovat kasvaneet.





30.9.20 9. päivä

Tänään toukat saivat ruuaksi nakkiteittoa, kaksi näkkäriä ja kokonaisen omenan. Eilinen banaani meni nopeasti toukkien suuhun. Aamulla toukat olivat todella nopeita ja kompostorin lämpö oli 35,5c ja se oli liikaa. Otimme lämpömaton johdon pois pistorasiasta lämmön ylhäisyyden takia. Toukille ei maistu kuoret paitsi banaanin kuoret maittoivat. Turpeen kosteus oli 51%. Annetun ruokajätteen määrä oli tänään 550g.



1.10.2020 10. päivä

Toukat voivat hyvin ja ovat aktiivisia.

Eilen laitettuun omenaan ei ole vielä koskettu.

Tänään toukat saivat kolme pinaattilättyä, neljä näkkäriä ja porkkanaraastetta.

Pinaattilätyn kimpussa on paljon toukkia pari on jopa päällä.

2.10.2020 11. päivä

Omenaan oli tehty pieniä viiltoja ja tänään se oli syöty.

Tänään ruokana oli spaghetti, jauhelihakastiketta, salaattia (retiisiä, paprikaa ja salaatinlehtiä) ja ruisleipää.

Turvetta oli laitettu lisää että haju hälvenee.

Lämpötila on pysynyt tasaisena.

Useat toukat ovat kokoontuneet keskelle muoviastiaa.

Turpeen kosteus on n. 40%.

Toukat ovat erittäin suuria verrattuna alkuun. Jos toukat alkavat näyttää ruskeelta, ovat kärpäset pian syntymässä!

Black Soldier Fly Larvae Compost

Lahti - Finland



10 000 larvae in the food waste compost



Larvae compost experiment was done during autumn 2020 in Länsiharju elementary school with 4th grade students (about 10 years old) and their teacher.



The idea of larvae compost was to research larvae of Black Soldier Fly (BSF) ability to recycle biomaterial created by school canteen, the behavior of larvae, composting, nutrient cycle, and importance of soil in agriculture.



Larvae compost was operational for about 4 weeks. During this time larvae grew 4 times their original size and they ate multiple kilos of biomaterial which was school kitchen waste food.

How project advanced, first week



- Tuesday 22.9.2020 we delivered necessary materials and 10 000 larvae to Länsiharju school.
- We created project environment, plastic container with high walls with nutrient rich soil at bottom of the container and our streaming setup.
- For first day we informed teacher and students about project and we added larvae to aforementioned project environment.



Toukkakompostorin hoito-ohjeet

- Toukat ruokitaan suunnilleen samaan aikaan päivästä, n. klo 12.00.
- Muistetaan antaa tarpeeksi ruokaa, mutta ei liian paljon.
- Ei liikaa nestettää.
- Ruoka annetaan varovasti osissa. Älä laita ruokaa toukkien päälle.
- Jos kosteusprosentti on liian suuri, lisätään turvetta.
- Lämpötilan pitäisi olla n. 25 astetta.
- Aina voidaan pyytää apua Tuulalta tai Kallelta.
- Palauta toukat kompostoriin, jos ne ovat karkuteillä.
- Älä altista toukkia kemikaaleille esim. käsidesille.
- Puhu toukille mukavia ja iloisia asioita.
- Älä ahdistele toukkia sorkkimalla niitä.

Toukkakompostori

LAHTI – EUROPEAN GREEN CAPITAL 2021



Päivämäärä	Vilkkopälvä	Turpeen kosteus > 80 %	Huoneen lämpötila > 20 C	Annetun ruokajätteen määrä (g)	Ruokajätteen laatu*1)	Toukkien määrä	Toukkien kunto*2)	Toukkien painonrousus *3)	Toukkien kyky prosessoida ruokajäte (h) - *4)	Prosessoidun ruokajätteen määrä (kg) - *5)
22.9.2020	tiistai	50	19		proteiini / Kasvis hiilihydraatti	10 000	hyvä			
23.9.2020	keskiviikko	54	18.4		hiilihydraatti proteiin	10 000	hitaata			
24.9.2020	+ Onstai	53	20.9	380 g	hiilihydraatti proteiini	10 000	nopeita			
25.9.2020	Periantergi	52	23.1		-	10 000	NOPEITA			
27.9.2020	sunnuntai	44	26	3021	-	10 000	nopeita			
28.9.2020	maanantai	39	29.2	308 g	krisipirnien laatu	10 000	hisaat (+ 200ml vettä)			
29.9.2020	torstai	48	25.9	540 g	perunat, röstit	10 000	hopetta + Bananit + riisi/citra			
30.9.2020	keskiviikko	53	23.0	550 g	hiilihydraatti proteiini	9 999	hopaita			
1.10.2020	torstai	39	27.0	362 g	piipuista ja sokerista	10 000	aktiivisia			
2.10.2020	perjantai	40	27.0	231 g	piipuista ja sokerista	10 000	Normaali			

Larvae compost in operation



- The next weeks went according to plan and without problems
- Larvae feeding turned out to be very simple, though our larvae expert biologist Saverio Danubio from Italy was worried about moisture dropping too low in the container where larvae were
- While feeding larvae we came to conclusion that larvae could easily consume multiple litres of food a day after first week and sometimes teacher and students even underestimated hunger of larvae
- Most important observation was environment required by larvae to keep up their appetite. Experiment environment could not be too cold or too moist, otherwise larvae would lose their appetite and stop moving
- Observing environment and ensuring that environment was suitable for larvae was easy for the children, because if environment were up to standard, children could observe massively more movement by larvae
- If two needs of the larvae were taken care off, not too cold or too moist, larvae would feed with unmatched appetite regardless of how hight temperature was in container

Repeating the larvae composting experiment

- As stated in slide before taking care of the larvae was surprisingly easy as long as larvae environment was warm and not too moist
- Recreating experiment can be effortless as long temperature is not issue
- Larvae eat anything as long its not too dry and too hard. For example, bone is too hard and uncooked pasta is too dry
- Ensuring that larvae has enough to eat is important as well
- Having students write diary and report how much food is given to larvae everyday is great way to include students to experiment



RECYCLE
LARVAE
COMPOST
RESOURCES:
4 STORIES

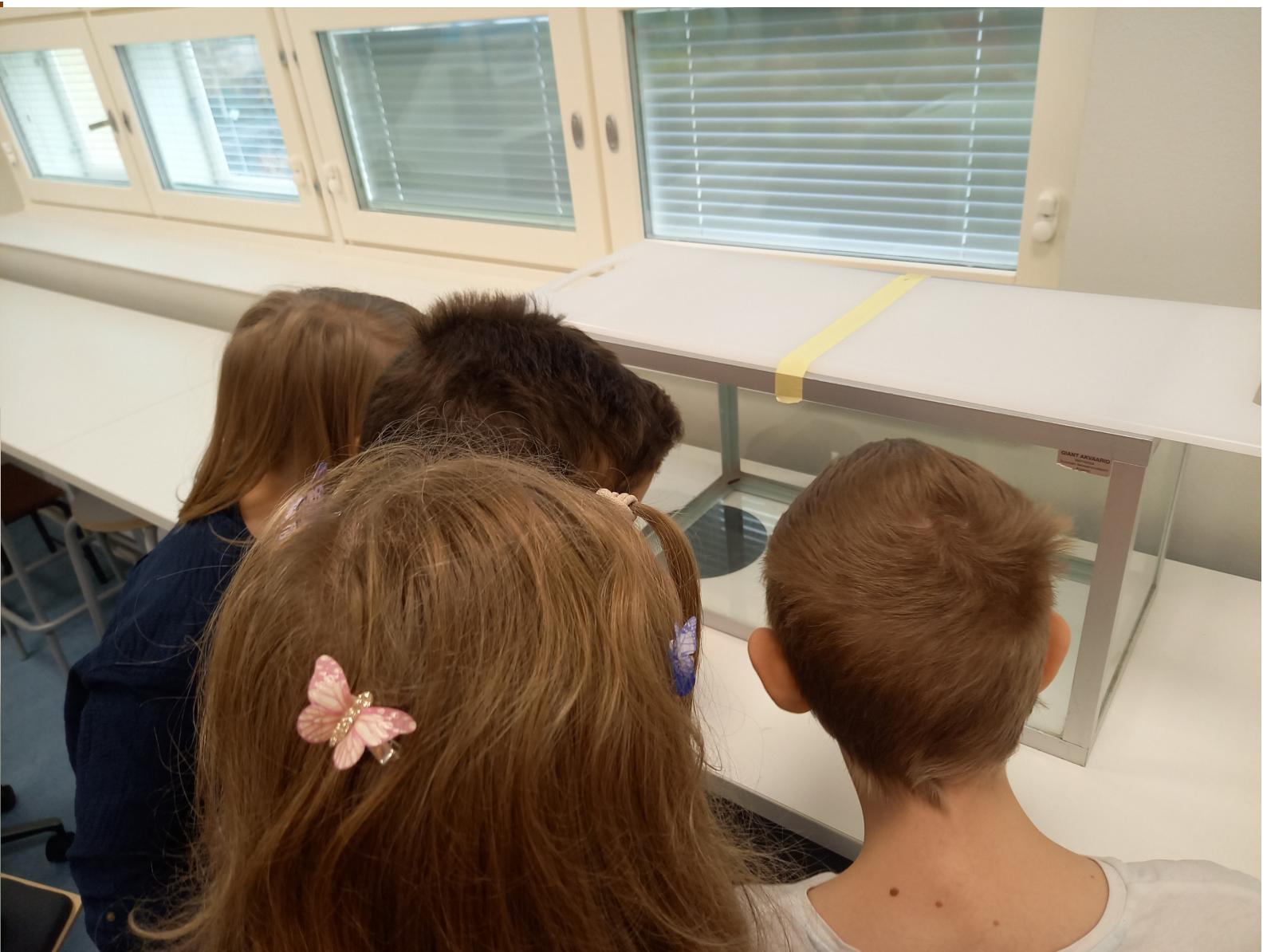




1. story: 4950 larvae for hens



2. Story: 4950 larvae for fish



3. Story: about 100 larvae transformed to black soldier flies



4. Story: the compost output is a perfect organic fertilizer for Mothers' Day flowers which are to be cultivated at the school greenhouse

Learning experience and environment



Larvae compost improved learning environment and offered new ways for students to study school subjects.



Main subjects

Natural science
Biology
Environmental studies



Other subjects

IT
Social studies
Health education



Learning environment



Project creates interest for students in biology and natural sciences and it allows students to directly observe growth of insects.



Teacher who was part of our larvae experiment stated that “project provided experience, what kids will never forget”



If students have preexistent interest towards biology, larvae compost might be experiment what raises interest to next level

Required material for larvae compost

Black soldier fly larvae

Plastic container with at least
40x40 cm size

Heater below plastic
container to create warm
environment in container.

Soil, at least 3 to 5 dl

Biomaterial, in our
experiment we used food
waste from school cafeteria.
3 to 1 litre a day depending
on size of larvae.

Water to upkeep moisture in
container

Moisture and heat measurer

For streaming laptop,
camera, and software for
streaming. In our case we
used OBS studio and YouTube

Research diary

Ability to take photos

Clear guidelines written down
to help students.

Experiment steps and estimated duration of each step



Acquisition of material and getting everything started: 1 – 2 weeks.



Starting up larvae compost : 1 – 2 hours.



Feeding, observing, and taking care of larvae every day: 15 to 60 minutes



Tying larvae compost with other subjects such as biology, languages, and natural sciences



Before larvae hatches, deciding what to do with larvae, for example feeding half of the larvae to farm animal and other half to fish.



Utilizing soil created by larvae in other projects at school, for example growing up flowers or creating small farm.



Last observations and dismantling container: 1 hour

The team of a best practice

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