

A new approach for safeguarding agrobiodiversity by using edible insect *Tenebrio molitor*

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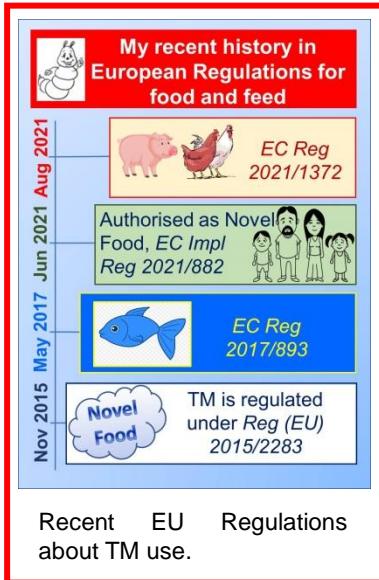
The growing food demand and the world population increase require urgent solutions. *Tenebrio molitor* (TM) is a potential protein source, but its large-scale rearing is not sustainable¹. The use of agri-food waste to feed TM larvae increases its sustainability. Indeed, TM degrades many substrates² and even plastics due to its highly differentiated microbiota. Furthermore, by feeding on plastic-producing microorganisms, TM can free poly-hydroxyalkanoates (PHA)³. Finally, the exploitation of the products deriving from TM rearing waste (chitin, fertilizers, etc.) improves the production cost-effectiveness.

Conventional protein sources

Conventional animal feed (soybean meal and fishmeal) can lead to resources and ecosystems depletion. Moreover, soybean meal involves the no solved question of GMOs. Conventional livestock accounts for 77% of global farming land and contributes to greenhouse gas emissions, water scarcity, and deforestation. Conventional protein sources lead to agrobiodiversity loss.

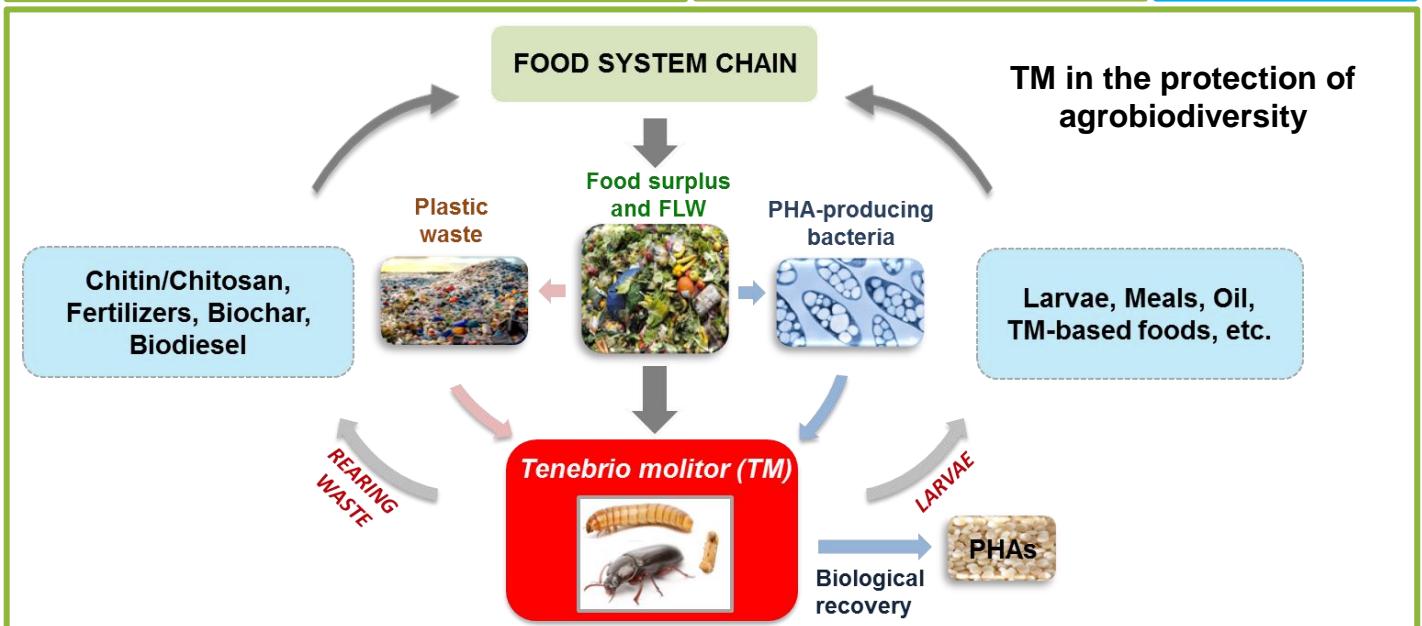
Novel feed & food

Sustainable use of TM can mitigate biodiversity loss, as it provides alternative proteins and nutrients⁴ and can indirectly save land and water from plastic and agri-food waste pollution.



	Global Market 2019 (bn \$)	CAGR 2020-2027 (%)	Global Market by 2027 (bn \$)
Edible insects	0.70	26.5	4.63
Insect Feed	0.69 (a)	12	1.39 (b)
Proteins	0.15	45.7 (c)	1.40 (d)
Oil	83.4 (e)	5.77 (f)	130.3 (g)
Chitin	1.05	11.3	2.48
Chitosan	6.8	24.7	21.4
Organic Fertilizers	4.5	14.1	14.7 (h)
PHA	0.07 (i)	5.3	0.12 (m)

Global Market of insects-based products^{3,4} (bn = billions). Statistics referring to: (a) 2018; (b) 2024; (c) 2019-2025, (d) 2025, (e) 2017, (f) 2017-2024, (g) 2024, (h) 2030; (i) 2018-2028; (l) 2018; (m) 2028.



Research Contributions to the Congress

TM is a valid alternative to conventional protein sources for animal feed and human food⁵. TM rearing based on the use of agri-food waste contributes to biodiversity protection. Indeed, it reduces the land use for crops to feed TM and allows better management of waste. In this context, at the ENEA Trisaia Research Centre (Italy), the PROBIO Laboratory has developed innovative farming methods that use low-value substrates, such as vegetable waste, to produce high-quality bioproducts. TM can also contribute to plastic degradation and releases bioplastics from producing microorganisms. In doing so, TM reduces the long-term negative impact of plastic on biodiversity. In conclusion, TM offers a relevant strategic asset for the protection of agrobiodiversity.

References

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Tenebrio molitor rearing on bran, at ENEA – Trisaia Research Centre