

## 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 sustainable<sup>1</sup>. The use of agri-food waste to feed TM larvae increases its sustainability. Indeed, TM degrades many substrates<sup>2</sup> and even plastics due to its highly differentiated microbiota. Furthermore, by feeding on plastic-producing microorganisms, TM can free poly-hydroxyalkanoates (PHA)<sup>3</sup>. 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 nutrients<sup>4</sup> and can indirectly save land and water from plastic and agri-food waste pollution.

**My recent history in European Regulations for food and feed**

Aug 2021: EC Reg 2021/1372

Jun 2021: Authorised as Novel Food, EC Impl Reg 2021/882

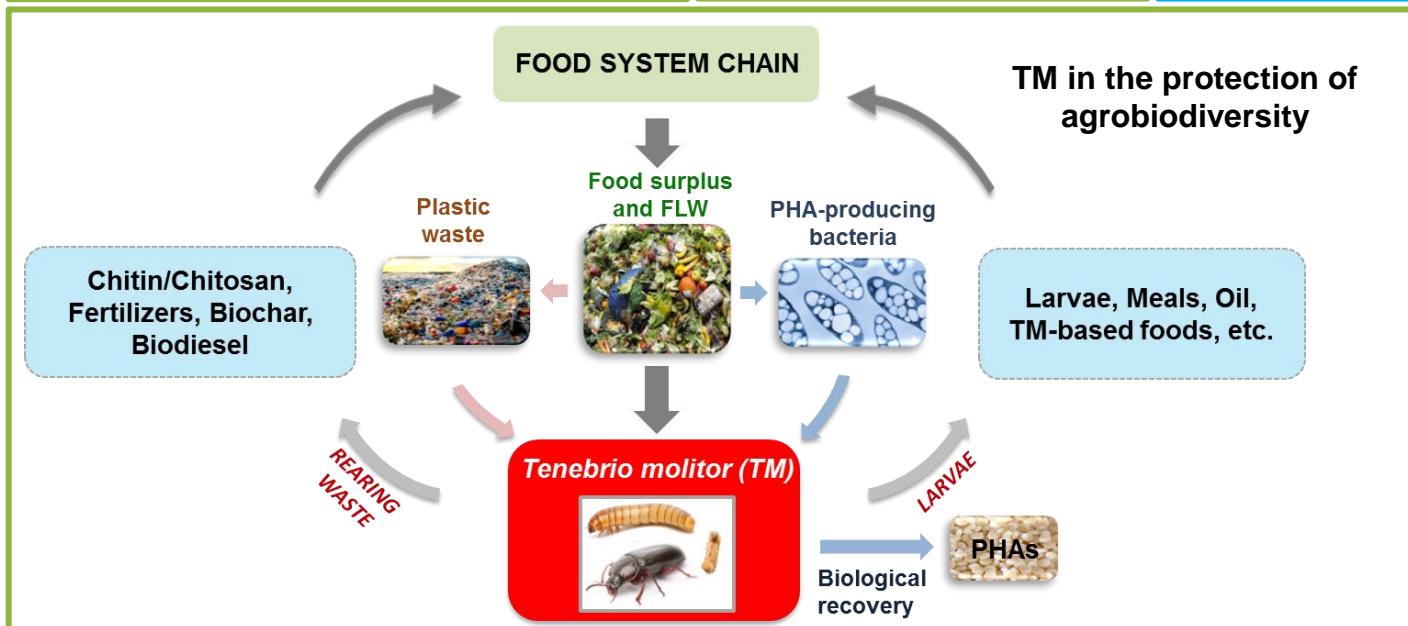
May 2017: EC Reg 2017/893

Nov 2015: TM is regulated under Reg (EU) 2015/2283

Recent EU Regulations about TM use.

GLOBAL MARKET	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<sup>3,4</sup> (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 food<sup>5</sup>. 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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- (4) Errico, S., Spagnoletta, A., Verardi, A., Moliterni, S., Dimatteo, S., Sangiorgio, P. (2021). *Tenebrio molitor* as a source of interesting natural compounds, their recovery processes, biological effects, and safety aspects. Compr Rev Food Sci Food Saf, 1–50. <https://doi.org/10.1111/1541-4337.12863>
- (5) van Huis, A. (2021). Prospects of insects as food and feed. Organic Agriculture 11, 301–308. <https://doi.org/10.1007/s13165-020-00290-7>