

- **Response to Tagliabue et al, on treatment of GM crops in 'Ten policies for pollinators'**

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Tagliabue et al. (2016) suggest that our Policy Forum article on policies for pollinators (Dicks et al. 2016) and related work (Potts et al. 2016, IPBES 2016a,b) are “theoretically and factually wrong and therefore seriously misleading” in their treatment of Genetically Modified (GM) crops. We refute this and believe it stems from a misunderstanding or misreading of our text on three key issues.

First, we do not assume that all GM-crops are herbicide-tolerant, nor that all herbicide-tolerant crops are GM. The IPBES pollinators report we cited (IPBES 2016a,b) and our recent review paper (Potts et al. 2016) clearly present herbicide-tolerance as one of many traits engineered into GM-crops.

Second, the concerns we raise about GM-crops for pollinators are not about the DNA recombinant technology itself. Instead we highlight potential risks to pollinators from specific insect-resistant and herbicide-tolerant technologies (Potts et al. 2016, IPBES 2016a,b, Dicks et al. 2016), as these are by far the most widely grown GM-crops around the world (James 2014) and the most relevant to the IPBES assessment.

Third, we do not overlook the potential impacts on pollinators of herbicides used on non-GM-crops. We suggest raising regulatory standards for all pesticides (this includes herbicides) as a priority, including assessing their indirect and sublethal effects on pollinators.

For both pesticides and GM-crops, we suggest indirect effects should be considered during risk assessment, for instance by examining what changes to agricultural management arise from use of these products.

Tagliabue et al. point out that “any risk from sublethal [or indirect] effects of an herbicide [on pollinators] should be part of the risk assessment done on the herbicide itself” (square-bracketed text added for clarity). We agree with this. Indeed, it is already included in our ten policy suggestions (suggestion 1: Raise pesticide regulatory standards). The misunderstanding perhaps comes about because the generally accepted definition of pesticide includes herbicides; this is not made explicit in our text, but is very clear in the cited references (IPBES 2016b; Goulson et al. 2015 and FAO/WHO 2014).

Our policy suggestion relating to GM-crops (suggestion 3: Include indirect and sublethal effects in GM-crop risk assessments) was included because there is a current opportunity for countries to amend or develop risk assessment protocols for GM-crops, in response to new guidance on risk assessment issued under the Cartagena Protocol (CBD 2016). This guidance clearly indicates that indirect effects caused by changes in use or management should be considered among the adverse environmental effects of ‘Living Modified Organisms*’.

GM herbicide-tolerant crops were used in Dicks et al. (2016) to illustrate potential adverse effects of changes to farm management – in this case increased herbicide use – on pollinators as a result of growing such GM-crops. This is an additional impact to that arising from herbicides applied on other crops, and only occurs if herbicide quantities are higher, weed densities consequently lower, in GM herbicide-tolerant crop fields compared to equivalent non-GM-crops. The few available studies on this indicate that herbicide-tolerant GM-crops can lead to a reduction of pollinators in the fields, linked to lower flowering weed densities, as shown for beet and oilseed rape (e.g., Abrol 2012; Bohan et al. 2005; Haughton et al. 2003).

Indirect effects are likely to differ among crops and contexts, which is why we argue they should be taken into account during case-by-case risk assessment of GM-crops. For instance, the indirect effects of insect-resistant Bt-GM-crops on pollinators could be positive (Kovács-Hostyánszki, A. et al. 2016, Potts et al. 2016). There is evidence of lower insecticide use in such fields (Klumper and Qaim 2014; Brookes and Barfoot 2013), and some studies showed that insect communities on Bt-crops can be more diverse than those on insecticide-treated non-Bt-crops (for example, Marvier et al. 2007). These effects must be balanced against potential direct (including sublethal) effects of GM insect-resistant crops on pollinators, an area where more research is needed (Kovács-Hostyánszki, A. et al. 2016, IPBES 2016a).

The IPBES global assessment on pollinators and pollination identifies impacts of GM-crops on pollinators as a knowledge gap (IPBES 2016b). We consider it a pressing need, since currently cultivated GM-varieties represent around 12% of the world's arable land, an equivalent of 181.5 million ha (Kovács-Hostyánszki, A. et al. 2016; James 2014; Li et al. 2014). The most widely commercialized GM-crops are maize, cotton, canola (oilseed rape) and soybean, all of which are potential food sources for pollinators.

This clarifies our reasons for suggesting that GM-crop risk assessments are expanded to include sublethal and indirect effects, to avoid unexpected adverse effects on pollinators.

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*FOOTNOTE: This term is synonymous with GM, and specifically refers to organisms whose genetic material has been modified with 'modern biotechnology', not techniques used in traditional breeding and selection.

Competing Interests: None declared.

- **RE: A mistake about "GMO(s)", HT crops, herbicides**

- [Giovanni Tagliabue](#), Independent researcher (epistemologist), N/A

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This interesting and valuable article on an important ecological problem, in one single point, is theoretically and factually wrong, therefore seriously misleading. The authors, as happens too often to many outstanding scientists in diverse fields, are caught in a semantic trap: "GMO(s)". (The same mistake is evident in another paper on the same subject, just published in Nature:

www.nature.com/nature/journal/vaop/ncurrent/full/nature20588.html and in the Summary for policymakers of the assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on pollinators, pollination, and food production, www.ipbes.net/publication/thematic-assessment-pollinators-pollination-an...)

Let's consider this statement from the article: "Genetically modified (GM) crops pose potential risks to pollinators through poorly understood sublethal and indirect effects. For example, GM herbicide-tolerant crops lead to increased herbicide use".

There's a triple confusion here: 1. Herbicide-tolerant (HT) crops are not equal to "GMOs": HT is just one trait among MANY very different others; various traits that can be infused in several crops have nothing to do with HT and pollinators (virus-immunized papayas, bio-fortified Golden rice, insect-resistant cotton, starch-rebalanced potato, etc.). 2. Many "non-GMO" crops are herbicide-tolerant. There is no reason to single out recombinant DNA over other methods to warn about the use of herbicides. 3. Since the late 1940s, herbicides are widely used without being coupled with HT crops ("GMO" or otherwise).

Case in point, in Europe, where all HT "GMO" crops are forbidden, herbicide use is massive. Thus, if you stick to the "GMO" misunderstanding, you end up invoking the control of HT "GMOs" where they are not present and let "non-GMO" huge areas (many millions of hectares) escape the supervision of herbicides.

At the end of the day, any risk from sublethal effects of an herbicide should be part of the risk assessment done on the herbicide itself, whether the herbicide is intended for use on "GMO" or "non-GMO" crops. That would be rightly targeted and coherent.

Consequently, we suggest to change your "pollinator policies" at point 3 from "Include indirect and sublethal effects in GM crop risk assessments" into "Ensure that the risk assessment done on herbicides includes the rates that would be used on any crops."

Furthermore, in view of the upcoming meeting of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) in Cancun (<https://www.cbd.int/side-events/2304>), we warmly invite you to make clear to your audience that, whatever role HT crops ("GM" or otherwise) may have on the ecologic dynamics involving pollinators, that has nothing to do with the use of recombinant DNA agri-food biotechnology at large. We understand that in Cancun the Conference of the Parties of the Convention is expected to adopt a decision on pollinators and pollination: we hope that, having corrected a partially wrong perspective on the concept of HT crops, you will help issuing a balanced and coherent statement.

We share scientists' and public's concern for the destiny of pollinators worldwide. While a rational discussion regarding the HT-pollinators issue is welcome, any groundless enlargement to the alleged harmfulness of a class of biotech methods in its entirety must be rejected. As fellow researchers, we hope that you will avoid being exploited by those who are cunningly pushing their biotechnophobic agenda.

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