21/12/2017

Dear Dr. Marina Wolowski and reviewers,

On behalf of authors, I am pleased to resubmit the revised version of the Manuscript entitled “El rol de los volátiles florales en las interacciones mutualistas y antagonistas”. We appreciate the constructive comments and suggestions of the reviewers. The suggestions have substantially improved the manuscript. The way we have addressed each of their comments and suggestions are presented below.

Please do not hesitate to contact us for any further question or concerns.

We thank you for your kind attention.

Sincerely yours,

PD: The title was changed to “Compuestos orgánicos volátiles: comentarios sobre su efecto en las interacciones planta-visitantes florales” in order to represent better the content of the review.

Because of the modifications in the manuscript, the number of the lines with the suggestions has changed, therefore, the new line number with the corrections is written in parenthesis. The additions suggested are in red colored text.

**Reviewer A:**

**1) A revisão aborda tema central a partir de perspectiva histórica ou apresenta contexto teórico adequadamente?: Não**

We included information about the theoretical context (lines 68-73, 259-265).

**2) O texto está completo, apresentando contribuições científicas relevantes?: Observar no item "Considerações Finais".**

The corrections were made according to the suggestions in “Considerações Finais”.

**3) O título é suficientemente conciso e reflete com precisão o conteúdo do artigo?: Não. O título levanta uma proposta, que não corresponde inteiramente com o texto apresentado. Detalho: O título propõe um tratamento integrado de interações mutualísticas e antagonistas, mas o texto é um tratamento quase exclusivo de COVs florais como atributos envolvidos na polinização. O único antagonismo que é abordado em mais detalhe é a polinização por engodo. Portanto acho que o título é inapropriado para o texto apresentado.**

Another example of antagonism was added (230-233) and it was clarified in the table that the majority of interactions cited were about antagonist interactions although the text was more extended in the mutualism interactions.

**4) O Resumo contêm a proposta do trabalho e seus objetivos de acordo com um artigo de revisão? Apresenta, com clareza e concisão, os principais pontos abordados pelo artigo (incluindo resultados e conclusões, quando pertinente)?: Não. O resumo está genérico e vago.**

The abstract was rewritten to present adequately all the topics in the manuscript.

**5) As palavras-chave são pertinentes e diferentes daquelas apresentadas no título?: Duas repetem palavras que já estão no título**

The repeated words “mutualistas” and “antagonistas” were erased from the key words.

**6) A introdução apresenta com clareza o contexto teórico/empírico em que se insere o assunto da revisão? O número e a natureza das citações são adequados?: Ver considerações finais. Sinto que falta cobertura bibliográfica**

We added some pertinent citations colored in red in the text.

**Questions 7 and 8 with positive answers, no corrections suggested.**

**9) Todas as tabelas e figuras estão referidas no texto? As discussões condizem com o exposto nas figuras e tabelas?: Sim. Mas a tabela está incompleta e precisa ser repensada**

Some examples were added to the table, and the division between mutualist and antagonist interactions was made to establish a suitable link with the text.

**10) O material bibliográfico é pertinente e atual? O número de referências é adequado para uma revisão? Falta alguma referência importante sobre o assunto?: A pesar de ter referências relevantes, assuntos inteiros não foram abordados (ver considerações finais) e falta cobertura bibliográfica. Chama muito a atenção a falta de qualquer citação ao Armbruster, que seria extremamente importante para o artigo. Também senti falta do artigo Kessler D, Diezel C, Baldwin IT (2010) Changing pollinators as a means of escaping herbivores. Current Biology 20:237-242 porque eles tocam no assunto de "timing" da emissão dos COVs**

The paper of Kessler was a very interesting suggestion and was added as an example of floral volatile change under herbivory. Nonetheless, it could only be found one paper of Armbruster related to floral volatiles and was cited next to a topic that was already considered in the text.

**11) O texto é conciso, claro e objetivo? b) Termos técnicos relativos ao assunto da revisão foram usados corretamente e definidos de forma a esclarecer o leitor leigo? c) Termos técnicos concebidos em outras línguas foram bem traduzidos?: Não, várias definições estão mal formuladas e algumas ideias estão mal compreendidas/apresentadas**

The corrections to the technical terms and translations were made according with the suggestions.

**12) Considerações finais: The manuscript “EL ROL DE LOS VOLÁTILES FLORALES EN LAS INTERACCIONES MUTUALISTAS Y ANTAGONISTAS” has a very interesting and novel proposal of integrating the understanding of the role of floral VOCs in different animal-flower interactions. Understanding the combined effects of herbivores and pollinators on the evolution of floral traits, and in particular floral VOCs, is a major challenge in plant-insect interactions, and a shift in the way the field has been focussed over the past 50 years. This proposal is worth a detailed analysis, and would be worthy of publication.**

**However, despite this interesting proposal in the title, the manuscript, almost in its entirety, reverts to the classic plant-pollinator approach that dominated pollination ecology in the 20th century. The word “antagonists” is used in the title, but the text has very few discussions of antagonist-mediated selective pressures (with the exception of deceptive pollination systems), and even less in relation to integrating mutualisms and antagonisms as selective pressures in shaping the evolution and ecology of floral VOCs. The text almost exclusively discusses pollinator-mediated selection as the primary driving force in the evolution of floral VOCs, and the most important ecological interaction mediated by floral VOCs. It goes as far as suggesting the herbivory can be irrelevant as a selective pressure compared to pollination.**

This unbalanced consideration about the antagonist interaction in the text was balanced with some discussions about both types on interactions along the text.

**I therefore cannot recommend publication of the manuscript as it stands, and suggest the authors elaborate on the manuscript or change the focus. In my opinion there are two solutions for this manuscript: 1) the authors change the title and present a more classic treatise on the evolution of floral VOCs as traits involved in plant-pollinator interactions (which is the way the manuscript stands at the moment) and 2) the authors re-work the manuscript to reflect the proposal in the title, incorporating an approach that truly integrates herbivory and pollination, and proposes ways forward to address floral VOCs as floral traits involved in a multitude of ecological interactions. This second option is, of course, the much more interesting (and difficult) one, but it will result in a much more profound and relevant paper.**

We tried to keep our original idea (second option) and therefore we added more information about the antagonistic interactions trying to avoid the original misestimation and also we changed the tittle to “Compuestos orgánicos volátiles: comentarios sobre su efecto en las interacciones planta-visitantes florales”.

**There is no discussion in the manuscript on the very active field of context dependence of interactions. It is well known that the same interaction can occur on a spectrum, being antagonistic and mutualistic, depending on the ecological context. This is at the heart of the authors’ proposal and is not mentioned at all in the text, and discussing this in relation to floral VOCs would be very interesting.**

Some ideas about this topic were added in different parts of the text (lines 172-176, 183-190).

**The discussions on selective pressures involved in the origins of floral chemistry are very underdeveloped. What is the consensus on the origin of plant chemistry involved in floral signalling? This is an excellent area for discussing the evolutionary links between pollination and herbivory, but is not explored at all in the manuscript.**

This idea was discussed in lines 256-265.

**What do the authors mean when they refer to “herbivory”? This is a very important issue, and is at the very core of the discussion the authors are trying to establish, but they do not elaborate this at all. Is a floral visitor that consumes pollen or nectar not a herbivore? When is such a pollinator a mutualist and when is it an antagonist? What is the role of floral traits, in particular floral VOCs, in modulating this balance between offering resources for mutual gain and being exploited? The title implies this kind of question will be addressed, but the text ignores these issues.**

The antagonistic interactions considered in this review, as well as in many papers consulted, are referred to the ones related with herbivores that are not involved in the pollination of the flowers, or with flowers that have dishonest attraction signals, being in both cases one of the interactors harmful. So, the word “herbivore” do not include the pollinators because even though they also eat some parts of the flower, they provide a benefit to the flower.

**There are some fundamental misunderstandings in the discussion of VOCs. One such misunderstanding is that secondary metabolism is only activated after “environmental changes” (line 58). Plants have a constitutive chemical phenotype, expressed independent of environmental cues. This phenotype is, of course, highly plastic and can change, but the constitutive phenotype does exist.**

This observation is true, it was erased from the text.

**Another misunderstanding is illustrated in lines 129-132. Here it is stated that repellent compounds are only emitted after heavy herbivory. First of all, repellent to whom? This is essential, and goes to the heart of some of the vagueness of the manuscript. Second, there are many well known constitutively produced compounds that are repellent to some or many herbivores of that plant. Third, why can’t floral and vegetative VOCs be repellent to many insects? There are some well known cases that are, and there are good reasons for it. At the same time, those compounds can be attractive to other insects. This is an idea I expected to see discussed in the manuscript.**

We added information related to this topic and rewrite the paragraph (lines 125-129, 172-176, 187-190).

**Minor points:**

**• Line 8: this definition is very incomplete.**

A more detailed information is given in the “Producción y emisión de COV por plantas” section of the text (lines 66-75).

**• Line 11: Is it proven that VOCs act at a greater distance than visual cues?**

Some studies found this result (Dobson, 1994; Gu et al. 2016; Goyret & Yuan 2015), but usually related with entomophily and/or nocturnal pollinators.

**• Line 13. This is the only sentence in the abstract that mentions antagonisms, and is very vague and uninformative**

This was corrected by the improved connection of both interactions.

**• Line 18: Do not use words in the title as keywords**

The repeated words used in the title and the key words were erased.

**• Please standardise “bencenoides” or “benzoides”**

It was standardized to “bencenoides”.

**• Lines 52-59: It would be useful to state some of the other ecological roles of floral VOCs here.**

We added the antimicrobial or antifungal activity for protection (lines 41-42).

**• Lines 63-65. This definition is incomplete and does not define VOCs. All that is stated is that they vary, so y the definition provided, any compound could be a VOC.**

We tried to explain this definition in the section *Producción y emisión de COV por plantas*

**• Line 72: in Spanish it should be “chiquimato”**

The correct translation was siquimato and was changed in the text (line 86).

**• Lines 79-80: Isn’t the idea of “pollination syndrome” contrary to the proposal of the paper? The idea of a syndrome is that floral traits evolved almost uniquely in response to selection pressure from pollinators. The idea of the paper of incorporating antagonists should be to challenge (or at least expand) this idea.**

In agreement with this observation, the idea was erased from the text because it changed the focus of the paper.

**• Lines 68-80: In this section there could be a more detailed description of the structures involved in floral VOC synthesis. This is essential when analysing the ecological role of floral VOCs**

This information is written between lines 68 and 73.

**• Lines 112-113: This is a vast generalization, and again demonstrates the pollinator-centric approach taken. It could very well be the case that the timing of floral VOC emission are as dependent on herbivores as on pollinators. Kessler et al 2010 demonstrated shifts in timing and quantity of VOC emissions due to herbivore presence.**

The paper suggested was added.

**• Line 116: I believe “aromáticos” here is used in the colloquial sense of “fragrant” compounds. I suggest avoiding the term in order to avoid confusion with the chemical meaning of “aromatic”.**

The term was erased when it meant fragrant but was maintained when it was referred to chemical aromatic compound.

**• Lines 137-138: Is pollinator attraction always more important? How can be sure? I don’t think this is the case. Also, this ignores the evidence on the interconnectedness of plant metabolic processes, showing that defence against herbivores can alter floral VOCs.**

This idea was changed to meet the suggestion (lines 123-138).

**• Line 168: Bats are mammals as well, what s the difference here?**

It was clarified that we mean non-flying mammals (lines 269).

**• Lines 174-178: This is confusing. Rephrase**

It was rephrased (218-222).

**• Line 202: confusing. Rephrase**

It was rephrased (line 243).

**• Line 202-212: this whole paragraph is very confusing, and does not hold up. Please analyse and try to state more clearly what you mean here.**

The paragraph was rewritten in a clearly way and more information was added for a better understanding (lines 243-255).

**• Table 1: This table is very incomplete. I believe a more complete description here would be interesting and useful. Again, the table highlights the pollination-centric approach. For example, when a florivore uses floral VOCs, is that not an interaction between floral volatiles and floral visitors?**

The table was divides for the mutualist and antagonist interactions to avoid confusions and a couple of examples were added.

**Reviewer B:**

**Questions 1-4 with positive answers, no corrections suggested.**

**5) As palavras-chave são pertinentes e diferentes daquelas apresentadas no título?: no**

We already corrected this mistake noticed by the reviewer A too.

**Questions 6-10 with positive answers, no corrections suggested.**

**11) O texto é conciso, claro e objetivo? b) Termos técnicos relativos ao assunto da revisão foram usados corretamente e definidos de forma a esclarecer o leitor leigo? c) Termos técnicos concebidos em outras línguas foram bem traduzidos?: a) en general si, pero ver comentarios en el ms b) en general si, pero ver comentarios en el ms c) a veces, no.**

The words in english were translated into Spanish and the technic terms were changed or explained.

**12) Considerações finais.: Los autores hacen un valiente esfuerzo por exponer distintos aspectos de las relaciones planta-insecto mediadas por compuestos volátiles florales. La información está bien organizada, en consistencia con artículos clásicos en el tema. Sin embargo, el artículo se limita principalmente a enumerar casos, sin profundizar sobre ellos ni aportar con una visión crítica, profunda o con sugerencias de nuevas avenidas de investigación. La exposición de algunos temas es muy confusa, lo que hace difícil la comprensión del contenido. Devuelvo el ms con numerosos cambios y comentarios. Los autores no deben tomarlos como una crítica exhaustiva sino como una base de partida para la modificación sustancial del ms. Se justifica que lo hagan porque pueden transformarlo en una contribución útil y atractiva.**

All the additions and eliminations to the manuscript were accepted. The suggestions about the use of another word or expression and the rewriting of some paragraphs was done. The additions suggested are in red colored text.

**Minor points**

**L8-17:**

Changes accepted (L8-16)

**L15: Mal adjetivo: ambiguo**

Thank you for the suggestion. Text changed (L13)

**L21-31:**

The abstract was reformulated considering the suggestions.

**L39: Traducir “and” en las citas**

The references were modified and adapted in accordance with the norms of the journal.

**L48: Explicar cómo**

Thank you for pointing that out. We added some explanation now (L50-51).

**L61-82: Esta seccion debe ser re-escrita pues contiene mucha información trivial y mucha información vaga, imprecisa.**

This session was rewritten so that the information became clearer and more accurate. New information has also been added between paragraphs (L66-91).

**L62: ¿sólo como respuestas a cambios?**

Changes were made and paragraph rewritten.

**L65: ¿en qué sentido? ¿baja masa molecular?/**

Information withdrawn and sentence modified.

**L66-68: información incompleta**

We've added more information (L68-73).

**L69-70: Explicar. Valorar importancia del dato**

Thanks for the sugestion. We believe it does not apply to the work to explain the differences between the anabolic and catabolic processes. For this, we complement the paragraph saying that regardless of the type of process, the diversity of the compounds is by enzymatic derivations (L80-81).

**L73: Grande es mal adjetivo. ¿variada? ¿prolífica?**

We modify the adjective (L85).

**L74: No. Una vez emitidos POR la flora se distribuyen alrededor de ella.**

We made the change (L86).

**L80: ¿Por qué se particulariza este caso?**

We mention this example only to exemplify and highlight the transfer potential (amplitude) of VOCs. However, this information has been withdrawn.

**L86: ¿por quién?**

We modified the phrase and the ambiguity was removed (L93).

**L87: ¿sólo la cantidad?**

Thank you for your consideration. Not only quantity, but also identity (L94).

**L88: Sería interesante comentar el hecho que las flores polinizadas por el viento también producen aromas**

We've added the suggested information (L96-98).

**L90: ¿las aves no poseen aroma? ¿Qué se quiere decir?**

We meant the flowers that attract birds are scentless, but because this topic is controversial, we removed it from the text.

**L90: Explicar si se trata de un individuo sometido a condiciones distintas o a distintos individuos sometidos a condiciones diferentes.**

It is an individual under different conditions. We rewrite the sentence. Thank you for your consideration (L99).

**L94: Tipos de compuestos no mutamente excluyentes**

Modified (103-104).

**L96: Evitar dos “mientras” en una misma frase**

Suggestion accepted.

**L99: Buen adverbio. Las descripciones anteriores de este parrafo son muy taxativas.**

Thanks for the placement regarding the adverb used.

**L100: Si es género, usar cursivas**

Correction made. Thank you (L113).

**L103: ¿en sentido químico u organoléptico?**

Modified sentence (L116).

**L106: ¿uno solo?**

No. Modified information (L119).

**L112: ¿“et al” con cursiva?**

According to the norms of the magazine "*et al*." should be used in italics.

**L113:**

In this session, we add new examples and try to contextualize with those already presented.

**L122: ¿agaónido?**

Yes, we meant agaónido, the vernacular name (L153).

**L133: traducir**

We translate (L174).

**L134: ¿no se considera que los compuestos que atraen polinizadores pueden ser distintos de los que repelen herbívoros y por lo tanto no ser emisiones “in compatibles”?**

We took this information out because it was really conflictive. Thank you for your consideration.

**L137: No se entiende que el benzoato de metilo atraiga herbívoros y tenga un efecto negativo hacia ellos. Explicar mejor.**

We rewrite the paragraph trying to explain it more clearly and objectively. In addition, we contextualize the paragraph better and cite more examples. Thank you for your consideration (L172 - 175).

**L138: ¿a qué se refiere?**

We rewrote the sentence so that the reading became clearer (L174-175).

**L142: Parece un argumento tautológico. Explicar mejor.**

The phrase was reformulated (L193-194).

**L143: Parece traducción literal de “call for help”. Traducir mejor: ¿Pida ayuda?**

Suggestion accepted. Thank you (L194).

**L147: Esta sección está muy confusa. Sugiero definir los dos tipos de señales, discutir costos y beneficios, dar ejemplos.**

Suggestions accepted and session restructured. Thank you.

**L149: ¿constantes?**

Word erased.

**L150: ¡NUNCA usar la palabra”para”; las plantas no tienen intenciones.**

Modified.

**L151: ¿constantes?**

The word has been erased.

**L172: ¿periódicamente?**

Term withdrawn.

**L176: Sugiero no calificar a la orquídea**

Suggestion accepted (L218).

**L180: ¿todas?**

Some species. We made the change (L222).

**L182: Sugiero eiminar esta información secundaria. Distrae**

Information withdrawn.

**L 187: Esta explicación está un tanto confusa. Reescribir.**

Explanation changed (L226-229).

**L201: Evitar esta expresión**

We removed the expression.

**L192: No esta clara la relación causa-efecto. Más aún, esta cnclusión se asemeja a uno de los antecedentes. Rescribir el párrafo.**

The paragraph has been rewritten. Thank you for your consideration.

**L198: No se ha hablado sobre esto**

The paragraph has been modified and new information has been added (L259-265).

**L209: Este párrafo esta MUY confuso. Reescribir.**

The paragraph has been rewritten (L270-280).

**L221: ¿A qué se refiere?**

We refer to diversities of VOCs. This paragraph attempts to explain the different causes for such diversity (L271-282).

**L232: No usar este tiempo verbal**

Modified.

**L233: Es un adjetvo ambiguo: ¿a qué se refiere?**

The adjective was removed in order to avoid ambiguity. Thank you.

**L236: ¿temperatura de qué?**

All information on Macrozmia species in the text has been withdrawn. Therefore, do not consider the other corrections on this topic, they have been withdrawn. Thank you.

**L243: ¿poco conocidos o escasos? Citas más recientes**

They are little known. More recent work has been added (L294-296).

**L250: traducir**

Modified. Obrigado.