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Review of the scientific achievements of Dr Gema Trigos Peral

Preliminary remarks

This review has been prepared in connection with the habilitation proceedings conducted at the Museum and Institute of Zoology of the Polish Academy of Sciences. The opinions contained herein are based on the documentation provided to me, namely:

- the self-report,
- two groups of publications indicated as two separate scientific achievements,
- the list of scientific achievements (I also verified the current citations according to the Scopus and ISI databases).

The evaluation has been prepared in accordance with the applicable legal regulations governing habilitation proceedings, i.e. the Act of 20 July 2018 – Law on Higher Education and Science (Articles 218–226). According to this Act, the degree of doktor habilitowany may be awarded to a person who:

- holds a doctoral degree;
- has scientific or artistic achievements constituting a significant contribution to the development of a given discipline, including at least:
 - a) one scientific monograph published by a publisher included in the official list,
 - b) a thematically coherent series of scientific articles published in indexed journals or peer-reviewed international conference proceedings,
 - c) one original scientific, technological, engineering, or artistic achievement;
- demonstrates significant scientific or artistic activity carried out in more than one academic or scientific institution, in particular abroad.

Basic information about the Candidate

Dr Gema Trigos Peral has been employed (since 30 June 2015, i.e. before obtaining her doctoral degree) at the Laboratory of Social and Myrmecophilous Insects of the Museum and Institute of Zoology of the Polish Academy of Sciences. She started as a specialist and has held the position of assistant professor since 2018. During her studies at the University of Córdoba (MSc in Biology, 2008), postgraduate and doctoral studies (PhD in Biology, 20 October 2015, also at the University of Córdoba), she was highly active, undertaking internships, obtaining scholarships, and collaborating with numerous research institutions. In 2015, she was awarded by the Iberian Association of Myrmecology for her 10-year research summarized in her doctoral dissertation. To my knowledge, Dr Trigos Peral has not previously applied for habilitation.

Evaluation of scientific achievements

1. Main achievement forming the basis for the habilitation application entitled:

“Urban areas: Biotic and abiotic stressors shape ant communities in anthropogenic environments”, consisting of four scientific publications.

1.1 Journal quality and author contribution

The publications were published in high-ranking journals: *Urban Ecosystems*, *Biological Invasions*, *Science of The Total Environment* and *Myrmecological News*. Their impact factors ranged from 3.005 to 8.200, with three belonging to the first quartile and one to the second quartile. In all four articles, the Candidate is the first author, which clearly demonstrates her leading role in both the research and the preparation of the publications. Publications, it is worth emphasizing, published in demanding journals with a high position among periodicals on environmental biology.

1.2 Evaluation of publications

The papers included in this achievement constitute a thematically diverse, yet coherent, and highly interesting body of work. They address various aspects of ant ecology, from a description of the impact of urban environments on the distribution and diversity of ant species communities, through an analysis of the competitive behavior of species potentially competing with each other in urban environments, then an analysis of

typical urban stressors (light, heat stress) on foraging behavior, and finally an analysis of the impact of an 'urban' diet on selected elements of ant physiology. This topic forms a very interesting research process, evolving from classical descriptions of ant communities to studies of ant behavior and physiology. I also appreciated the wide variety of research methods, especially the inventive experiments – both field and laboratory.

All publications demonstrate a keen attention to accuracy and the ability to replicate such research in the future. The Habilitation Candidate's careful planning of the research, the selection of methods, and the way of communicating and presenting the results undoubtedly contributed to the publication of the articles in high-ranked journals. In my opinion, all four publications demonstrate a very high level of attention to these aspects.

Due to my current role (including working on the editorial board of *Advances in Clinical and Experimental Medicine*, where I have already evaluated hundreds of articles in terms of methodology and statistical analysis), I read the methods chapters in all four articles with great appreciation. Dr. Trigoso Peral regularly uses the R environment, including advanced models like GLMM and ZIP (Zero-Inflated Poisson regression). This is a very valuable skill, and it's safe to say that having such a high level of proficiency in R tools guarantees the ability to use other models and statistical analysis tools in the future as they develop. Both the data collection section and the analysis section raised almost no objections. The presentation of the results is also, in my opinion, very good, and I have almost no reservations about it.

Why did I use the phrase "almost flawless" twice above? Almost, because in these publications, the Authors omitted checking the assumptions of individual models or tests. For example, the t-test requires normal distributions of data when comparing their means, but also a check for homogeneity of variance to decide whether or not to apply the Welch correction. On the other hand, the t-test performed in the R environment applies the Welch correction by default, so this was probably the case in these publications, but this was not clearly explained. Similarly, when using the t-test to compare paired data, the key assumption is a normal distribution of differences between the two compared measurements, which was also not verified. Also, the use of a given model should be justified by demonstrating its compliance with the assumptions, and in the case of generalized models, by explaining the principles for selecting a given model variant.

Furthermore, it is helpful to present certain measures of model performance (such as residual analysis). Finally, one more note regarding the language of statistics. In the publications discussed, statistical significance (e.g., very high, i.e., at $p < 0.001$) sometimes replaces the assessment of the magnitude of the effect (or the magnitude of the difference), and these are not synonyms. With a large sample, even small impact values can be statistically significant, while with a small sample, the opposite is true.

1.3 Summary of the opinion on the achievement

Based on the above arguments, I believe that the achievement under review represents a significant contribution to the development of environmental biology, both in the field of myrmecology and, more generally, the ecology of anthropogenic areas (cities). Since I am not a myrmecologist, I necessarily read the publications in a more general context, treating ants as a "model" group used to demonstrate fascinating mechanisms that play an important role in the insect world. And I am fully convinced of the significant value of these studies and publications.

2. Additional achievement: studies of ant personality at the individual and colony levels.

This additional achievement represents another aspect of ant research within the Candidate's broad field of interest, namely, individual and interindividual differences in ant behavior. These publications are also of very high quality in terms of their preparation, and one of them was published in a journal with a relatively high IF (>3) in the second quartile (*Behavioral Ecology*). My assessment of the quality of these articles is as positive as the articles from the main achievement.

3. Bibliometric characteristics and number of publications

- a. Total IF: 106.285; total points (MEiN): 2370;
- b. Citations (WoS): 166 (135 without self-citations);
- c. Citations (Scopus): 172 (147 without self-citations);
- d. H-index: 8;
- e. Number of publications:
 - Articles in international indexed journals – 27 (but this is unclear because Appendix II does not include the Cell publications), all after the doctorate.
 - Articles in local journals – 2 before, 9 after the doctorate.

- Chapters in monographs – 2 (after the doctorate).

Considering the largely field-based nature of Dr. Trigos Peral's research, which require spending many hours to gather sufficiently large samples, I believe the number and quality of publications are certainly commendable. The number of publications in journals with an IF in the consecutive years 2016-2025 was 2, 1, 2, 3, 2, 7, 1, 2, 5, and 3, which, in my opinion, demonstrates a very high and consistent level of commitment to the planning and conduct of research and publishing its results. It is also worth noting that a large portion of the articles were published in high-ranking journals, i.e., in Q1 (9/27, or 33%) or Q2 (13/27, or almost 50%). This means that approximately 80% of the publications appeared in journals in the upper half of the journal ranking in a given topic. Additionally, Dr. Trigos Peral was the first author of eight publications from Q1 and Q2. The aforementioned publication records demonstrate the Candidate's leading role in these studies and publications. I also checked current scientometric indicators. The number of citations in the Web of Science has increased relatively significantly – to 204, or almost 25%. This is a significant increase.

Taking into account the above opinions and assessment of scientific achievements, I believe that Dr. Trigos Peral meets the criterion of demonstrating significant scientific activity.

Teaching, organizational and outreach activity

1. Research projects, obtaining external grants

Dr. Gema Trigos Peral has secured grants from the National Science Centre (NCN) – "FUGA" (2015), "Miniatura" (2019), and the Polish National Agency for Academic Exchange (NAWA) – for research in cooperation with Poland and Germany (2020). She has also participated in seven different research projects (NCN – 5, Biodiversa – 1, Ministry of Economy and Competitiveness of Spain – 1). In most of these projects, she conducted field research, performed behavioral tests on ants, etc. Additionally, she conducted research on ants in the Biebrza Valley (in the context of a large-scale fire there) in collaboration with the Forest Research Institute.

2. Conference Organization and Participation

From 2019 to 2021, Dr. Trigos Peral was as a member of the organizing committee of two international myrmecology conferences and as the main organizer of one (Taxomara Virtual 2021), which was held online (due to the pandemic) on December 11-12, 2021 (with 103 participants from 15 countries in Europe, Africa, and the America).

Dr. Trigos Peral presented her contributions (oral presentations, posters) at 29 national and international conferences (in 9 European countries, 1 African country, and 2 South American countries). The topics covered at these conferences are characterized by a wide range.

3. Editorial work on scientific journals

In 2024, Dr. Trigos Peral assumed the position of editor-in-chief of the journal *Insectes Sociaux* and, also this year, joined the editorial board of the journal *Fragmenta Faunistica*.

4. Participation in committees

The Candidate served on three committees evaluating doctoral dissertations (in Spain and Italy) and on one committee evaluating research grants (National Fund for Scientific Research, Brussels, Belgium).

5. Teaching activities

Although teaching activities are generally very limited at Polish Academy of Sciences institutes, Dr. Trigos Peral was very active in this area as well. She supervised 13 students studying in various countries, including supervising their bachelor's and master's theses.

6. Science popularization

a) Between 2019 and 2025, Dr. Trigos Peral presented papers at 11 seminars in Poland, Spain, and the USA.

b) Citizen science activities – conducting workshops on ants and online entomology courses.

c) Media Interviews – Dr. Trigos Peral gave 8 interviews to various media outlets.

Summary and Final Conclusion

Based on the materials provided to me, and summarizing my own opinions regarding specific aspects of Dr. Gema Trigos Peral's work presented above, I believe that both the achievements listed as the basis for applying for the habilitation degree and the remaining scientific achievements meet the requirements for admission to the next stages of the habilitation process.

Dr. Trigos Peral demonstrates significant scientific activity on an international scale, and I consider her contribution to the development of knowledge about ants and the ecology of anthropogenic areas to be universal and significant. The Candidate's activities to date have been very comprehensive and intense – from conducting numerous interesting studies and publishing their results, through obtaining grants, frequently engaging in various collaborations, learning new research methods, participating in and organizing conferences, serving on expert committees, and finally, educational activities and promoting scientific achievements. Dr. Gema Trigos Peral's comprehensive commitment to the various activities that constitute her scientific work deserves full recognition.



Signed by /
Podpisano przez:

Krzysztof Kujawa

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