BARCELONA ZOO FOUNDATION
PRIC GRANT APPLICATION
(2018)

Mediterranean butterflies meet the lions: An African monitoring network to study and preserve trans-Saharan migrations

Photo: G. Talavera

A Vanessa cardui *butterfly on a lion footprint*

Applicant:

Gerard Talavera
Institut de Biologia Evolutiva (CSIC-UPF)
Pg Marítim de la Barceloneta 37
08003 Barcelona

APPENDIX 1. Project letter of presentation

The signatory requesting a grant or financial aid from the Barcelona Zoo Foundation pursuant to the call for proposals this year with these terms:

1. APPLICANT ENTITY / INSTITUTION

Name (of entity, group, natural person)..INSTITUT DE BIOLOGIA EVOLUTIVA (CSIC – UPF)

NIF / CIF ..Q2818002D..... Section / office ...----.....

Address and PC .Passeig Marítim de la Barceloneta 37-49, 08003.....

City .Barcelona..... Province ..Barcelona.....

Phone number .932309507..... Fax ..----.....

Email ... gerard.talavera@csic.es..... Website ..www.ibe.upf-csic.es.....

Name of legal representative ..Tomàs Marquès Bonet.....

Have you submitted this project to calls for proposals for financial aids or grants to other institutions? NO. If yes, write down which institution.

2. BASIC PROJECT DATA

Name / Title

Mediterranean butterflies meet the lions: An African monitoring network to study and preserve trans-Saharan migrations

Line of research

X 1. Research applied to conservation, both in situ and ex situ, at a global level

X 2. Research applied to animal wellbeing and knowledge of species in their environment

X 3. Research applied to the conservation of Mediterranean biodiversity

Fields of activity: Study and conservation of Mediterranean animals, Development of activities in the scope of local communities close to the conservation areas of species

Conservation project related to animals:

X autochthonous (native)

allochthonous (non-native)

Subject handled and brief description

Monitoring and conservation of the migratory butterfly *Vanessa cardui*, a species that seasonally migrate from/to the sub-Sahara and Europe. The main aims of the project are: 1) Understanding the spatiotemporal dynamics of the species across its Palearctic-African migratory route. 2) Conserving through managing African winter breeding sites (the species displays extreme fluctuations in population size in the Mediterranean, which seem to be related to environmental (in part climatic) conditions in African wintering sites). 3) Disseminating to the society the spectacular phenomenon of the longest butterfly migration known, which will enhance awareness on insect diversity, ecology and the importance of conservation of non-vertebrate organisms.

Site of execution:

AFRICA & EUROPE (Senegal, Benin, Cameroon, Chad, Kenya, Catalonia, Canary Islands, Italy, Israel)

Total project cost: **155,000 Euro**

Total amount requested: **30,000 Euro**

Zoo Barcelona FUNDACIÓ

INSTITUT de BIOLOGIA EVOLUTIVA
CSIC UPF

3.- DECLARACIÓ DE LA PERSONA REPRESENTANT

Nom i cognoms TOMÀS MARQUÈS BONET

DNI / NIF 44014528A

Càrrec que ocupa DIRECTOR IBE

La persona signant declara que totes les dades que consten en aquesta sol·licitud i als documents que l'acompanyen són certes. Que compleix i accepta la normativa general vigent reguladora de les beques que atorga el Zoo de Barcelona i tots els requisits exigits a les bases de la convocatòria per sol·licitar i atorgar aquestes beques i ajuts. Que està assabentada que la manca de justificació documental de les beques rebudes del Zoo de Barcelona no solament comporta l'anul·lació de la beca i l'exigència de responsabilitats als preceptors, sinó que, a més a més, com a conseqüència d'això, no es tramitarà aquesta sol·licitud ni sol·licituds posteriors.

EL DIRECTOR

Barcelona, 1 de JUNY de 2018

TOMÀS MARQUÈS BONET

Segell de l'entitat/institució/grup Signatura del sol·licitant o representant autoritzat/da

En compliment de la Llei orgànica 15/1999, de 13 de desembre, de Protecció de dades de caràcter personal (LOPD), s'informa que les seves dades de caràcter personal passaran a formar part d'un fitxer el titular i responsable del qual és Barcelona de Serveis Municipals, SA, (d'ara en endavant BSM). Consent l'ús de les seves dades amb la finalitat d'inscripció i informació relacionada amb l'activitat o servei per al qual les està facilitant. També consent l'enviament d'informació comercial d'altres promocions o serveis de BSM i Parc d'Atraccions Tibidabo, SAU. En el cas de ser menor de 14 anys és imprescindible que el consentiment sigui dels pares, tutors o representants legals. Pot exercir els seus drets d'accés, rectificació, cancel·lació i oposició mitjançant una sol·licitud per escrit amb la referència "Tutela Drets LOPD" i dirigida a Barcelona de Serveis Municipals, c/Calàbria,66 – (08015- Barcelona).

APPENDIX 2. Project submission sheet

APPLICANT NAME AND SURNAME(S):

GERARD TALAVERA MOR

EMAIL: gerard.talavera@csic.es **PHONE NUMBER:** +34 605205287

ADDRESS: Pg. Maragall 252 entresol, 08031 Barcelona

DNI: 43518141W **NATIONALITY:** Spanish **PASSPORT NO.:**

DEGREE / PERSONAL QUALIFICATION:

PhD on Biology

INSTITUTION YOU WORK FOR, where applicable

INSTITUT DE BIOLOGIA EVOLUTIVA (CSIC – UPF), BARCELONA

PROJECT TITLE:

Mediterranean butterflies meet the lions: An African monitoring network to study and preserve trans-Saharan migrations

LINE OF RESEARCH (mark with X)

X Research applied to conservation, both in situ and ex situ, at a global level

X Research applied to animal wellbeing and knowledge of species in their environment

X Research and investigation projects shall be prioritised on the effects of climate change on animals

Research applied to the protection of biodiversity in the city of Barcelona

X Research applied to animals native to the Mediterranean region

RELATED CONSERVATION PROJECT (mark with an X)

X Conservation project related to autochthonous (native) animals

Conservation project related to allochthonous (non-native) animals

HEAD RESEARCHER (if this party is an applicant):

Gerard Talavera

SUPERVISOR (if applicable):

BRIEF PROJECT DESCRIPTION (including objectives, materials, methods and an explanation of how the research results will contribute to improving the conservation, wellbeing and management of the zoos' animal populations):

The Painted Lady butterfly, *Vanessa cardui*, is a virtually cosmopolitan species adapted to seasonally exploit a wide range of habitats. It has been recently discovered that this species undertakes migrations between the Palearctic and the Afrotropics similar to those of migratory brids. Most populations undergo yearly long-distance latitudinal migrations in a circuit between Tropical Africa (September to February) and the temperate zone (February to September) (Talavera & Vila, 2016) (Fig. 1a)

Objectives
The main aims of the project are: 1) Understanding the spatiotemporal dynamics of the butterfly *Vanessa cardui* across its Palearctic-African migratory route. 2) Conserving this species through managing and preserving African winter breeding sites. This butterfly displays extreme fluctuations in population size in the Mediterranean, which seem to be related to environmental (in part climatic) conditions in African wintering sites. 3) Disseminating to the society the spectacular phenomenon of the longest butterfly migration known, which will enhance awareness on insect diversity, ecology and the importance of conservation of non-vertebrate organisms.

Specific objectives of the PRIC grant
1) Establish three long-term monitoring stations autonomously functioning in key areas in Senegal, Cameroon and Chad.

2) Obtain systematic data on *V. cardui* arrivals and breeding densities during a two-year period

3) Communicate the Painted Lady migratory phenomenon through citizen science across Africa and Europe and gather a strong network of volunteering observers to report data complementary to the monitoring stations.

Materials & methods

1) Monitoring scheme

We will conduct exhaustive surveys to delineate a comprehensive map of *V. cardui* breeding hotspots along the circum-Saharan region. Next we will establish the methodological basis and infrastructure for a long-term monitoring scheme. Hotspots will be monitored through periodic visits every two weeks along the year. Immature and adult abundance will be estimated by performing systematic counts.

2) Citizen science, education and outreach

We will launch an educational and citizen science program to communicate the Painted lady migratory phenomenon both in Africa and Europe (e.g. organization of workshops). The program will also engage citizen scientists to report breeding sites across Africa. Reporting immatures is a novelty for citizen science and migratory species

Additional methodology employed in the full Project (funds not requested to PRIC)

A multidisciplinary approach will be used to analyse *V. cardui* temporal series of collected samples to study population dynamics, using DNA phylogeography, pollen metabarcoding, stable isotope analyses and ecological niche modelling.

How the research results will contribute to improving the conservation, wellbeing and management of the zoos' animal populations

Vanessa cardui is an autochthonous species that is common in spring and summer in Barcelona and in the Zoo in particular. This beautiful species is thus part of the natural environment in the Zoo and contributes to provide a natural environment to both the rest of animals as well as the visitors. However, *V. cardui* is suffering still not completely understood extreme fluctuations in the populations.

The study of *V. cardui* is an opportunity to increase our knowledge on how protecting autochthonous fauna through understanding the impact of environment outside our region. Obtaining sustained data on the population dynamics on its African wintering latitudes will help with an appropriate management to protect this species.

It is also an ideal model system to disseminate the insect migration phenomenon among the general public, including the Zoo. For example, a breeding site could be easily simulated in the Zoo, showing the main larval hostplants (likely hosting immatures naturally half of the year), along with a dedicated informative panel explaining its special biology, the migratory routes and the link between Sub-Saharan African and the Mediterranean.

EXPLAIN IN DETAIL IF THE METHODOLOGY APPLIED COULD HAVE ANY NEGATIVE IMPACT ON THE ANIMALS OR VISITORS TO THE ZOO:

Vanessa cardui do no present a risk of any sort to other animals in the zoo, visitors of staff. Because of its cosmopolitan condition, *V. cardui* live naturally together with many of the animals present in the Zoo, and this is particularly true with those occurring in the African savannah.

PROJECT LENGTH:

2 years

OTHER INSTITUTIONS INVOLVED:

- **African Parks** (https://www.african-parks.org/): Managing 13 National Parks in Africa

- **Mpala Research Center and Wildlife Foundation** (http://www.mpala.org/), Kenya

- **Congo Basin Institute** (https://www.cbi.ucla.edu/), Cameroon

- **CENAGREF** (http://www.cenagref.net/), Benin

- **Asociation Zerynthia** (http://www.asociacion-zerynthia.org/), Spain

- **Israeli Lepidoterist's Society** (LINK), Israel

BUDGETARY FRAMEWORK

SUMMARY OF EXPENSES

- Monitoring Stations: 6,000 euros
- 1-year contract biologist for educational and citizen science programs: 21,000 euros
- Logistics and basic supplies for organizing Educational Workshops: 3,000 euros

SUMMARY OF REVENUES

- 125,000 euros will be provided by the National Geographic Society (covering expenses for trip expeditions, laboratory costs, monitoring stations and equipment)

PROPOSED GRANT OR FINANCIAL AID BEING REQUESTED OF THE BARCELONA ZOO ALONG WITH THIS SHEET AND THE PROJECT LETTER OF PRESENTATION (appendices 1 and 2 of these rules), YOU MUST SUBMIT A PROJECT WITH THE DETAILED REPORT OF THE SCHEDULE BEING SUBMITTED WITH THE APPLICATION FOR THE GRANT OR AID:

- PLAN OR PROGRAMME

This project aims at supporting the initiation of a monitoring network scheme in Africa for a long-term assessment of the migratory butterfly *Vanessa cardui*. This species performs long-range trans-Saharan migrations between the Mediterranean zone and the Afrotropics every year during the spring and fall seasons. Fluctuations of the population sizes are extreme in this species, ranging from massive arrivals of billions of individuals to Catalonia (e.g. in 2009), to years when only a few individuals are recorded. Importantly, the cause for these fluctuations is not understood, but preliminary ecological niche modelling analyses point to a critical role of the winter breeding sites in tropical Africa, notably the Sahel and Savannah habitats, which are under a very strong impact of climate change effects.

In order to understand the population dynamics and key factors for the conservation of this migratory butterfly, we will establish a monitoring station in Senegal, Cameroon and Chad. These will run over two years (ideally establishing for longer) and will be visited once every two weeks by specifically trained local people to account for population abundance dynamics both for immatures and adults, as well as for the collection of representative samples.

The support from a PRIC grant will allow establishing these three monitoring stations. These will fit within a larger initiative funded by the National Geographic Society, having already two core stations in Africa (Benin and Kenya) and funding to support laboratory analyses of time-series of samples. The chosen locations will highly improve the network with multiple points in five countries from West to East Africa.

Importantly, educational and dissemination activities have great potential on this system, involving key and attractive elements like long-range migration on insects and the link between the fauna in tropical Africa and in the Mediterranean. This will be addressed through intense citizen science programmes both in Africa and Europe. These are expected to be transformative in Africa through engaging communities, wildlife managers and local academics. Support from the PRIC grant will be dedicated to personnel to develop an educational programme and a strong initiative on citizen science to communicate the system, the progress of the conducted research and promote participation. This member of the team will help at situating *Vanessa cardui* as a flagship species for invertebrate conservation. The account of such an epic journey by an apparently fragile butterfly serves as a powerful image to increase public awareness on this "smaller majority" of migrating organisms, as well as to demonstrate the interconnectedness and our shared responsibilities in a global world.

- SCIENTIFIC JUSTIFICATION OF PROJECT

Conservation efforts of migrating insect species, and the natural phenomena they create, are hampered by a relative lack of scientific knowledge compared to that of migratory vertebrates, as well as a lack of awareness of this "smaller majority" of organisms. In these unfavourable circumstances, a few taxa can act as flagship species, such as the Monarch butterfly *(Danaus plexippus)* in North America (Oberhauser et al 2015).

The Painted lady butterfly (*Vanessa cardui*) constitutes an outstanding example of migrating insect. It is the most cosmopolitan of all butterflies and it exhibits what is potentially the widest distributional range of any animal performing large-scale migratory movements. The destination of south-bound fall European migrants and their overwintering sites were, until recently, a central unsolved question. The applicants made long-term expeditions across multiple sub-Saharan countries in search of the overwintering sites of this species . These expeditions led to the discovery that European autumn migrants travel into Africa, crossing the Sahara Desert by the tens of thousands and breed in the African savannah (Talavera &

Vila 2016; Stefanescu et al 2016). These migrations entail distances >4000 km in single flights and a migration range twice the size previously reported. Later, the applicants show that these populations establishing in the Afrotropics undertake return migrations to the Mediterranean in the following spring, therefore closing a circuit that remained a mystery until now (Talavera et al 2018, Suchan et al 2018). Thus, in a most remarkable journey for a butterfly, most populations of *V. cardui* undertake a long-distance annual migration between the Palearctic and Tropical regions in Africa similar to those of some birds.

Thus, the annual cycle of this butterfly has two critical stages and areas of influence that are mutually dependent, one in the temperate zone from March to September (Europe and Mediterranean Africa) and one in the Tropical Zone (sub-Saharan Africa) from October to February. The discovery that the overwintering sanctuaries are located in tropical Africa represents a change of paradigm: *Vanessa cardui* becomes the species of butterfly with the longest migratory flights and facing the hardest geographical obstacles (the Mediterranean Sea, the Sahara desert), and it shows that this species breeds massively in a highly sensitive habitat that depends on seasonal rainfall. In fact, our preliminary ecological niche modelling analyses suggest that the conservation of *V. cardui* may depend on climatic oscillations in the African Sahel and Savannah.

Our main goals in this research are to obtain statistically significant data on the population dynamics and, thus, the movement patterns of Painted Lady migrations in the Tropical African Savannah. We will develop new tools to track long-range insect migrations, will establish long-term monitoring systems for *V. cardui*, and will design specific citizen science and protection plans for the breeding sanctuaries discovered in the Savannah.

SPECIFIC OBJECTIVES TO THE PRIC GRANT:

1) Establish three long-term monitoring stations autonomously functioning in key areas in Senegal, Cameroon and Chad.

2) Obtain systematic data on *V. cardui* arrivals and breeding densities during a two-year period

3) Communicate the Painted Lady migratory phenomenon through citizen science across Africa and Europe and gather a strong network of volunteering observers to report data complementary to the monitoring stations.

ADDITIONAL SPECIFIC OBJECTIVES OF THE FULL PROJECT (not requested to PRIC)

4) Establish two core monitoring stations in protected areas in Benin and Kenya: this two sites will function as a regular stations to obtain data, as a field experimental laboratory to design, test and optimize automatic trap systems for continuous monitoring. With these, there will be 5 stations in total for Africa (Figure 2B)

5) Establish four monitoring stations in the circum-Mediterranean region: these will provide data on migrations from/to the sub-Sahara in spring/summer. The stations will be set up in the Canary Islands (Tenerife), Catalonia (delta del Llobregat), Calabria (Italy) and Israel. (Figure 2B). These sites have been selected because flocks of *V. cardui* have been repeatedly observed arriving there from across the sea. Capturing northward flying migrants in spring will work as an indicator of overwintering population viabilities in Africa. Both hand monitoring and trap systems will be used to obtain abundance data.

6) Develop novel methods to trace geographical origins and paths of migrating insects: Stable Isotopes, DNA pollen metabarcoding and DNA phylogeography

Using time-series of samples collecting at the multiple monitoring sites, we will use multiple techniques to trace the dynamics of colonisations across time. We will isolate carrying pollen grains attached to the insect bodies after feeding on plants. Applying pollen DNA metabarcoding [Suchan et al 2018] to identify endemic pollen typical of regions other than where insects are collected can provide information regarding distant origins of the migrating individuals

Stable isotope data on δ^2H has proven useful to test long-distance migrations (Talavera et al 2018). We propose implementing -strontium ($^{87}Sr/^{86}Sr$) as a marker for tracing migrating insects, which incorporates information from geological bedrock sources, and has the potential to narrow the inferred areas to smaller, local scales.

4) Design a conservation plan for breeding sanctuaries: surveys, monitoring and modelling

The tropical African Savannah is threatened by two main phenomena: climate change and human land-use overexploitation (Beale et al, 2015). Most conservation plans in Africa focus on protecting large mammals, given their interest for tourism. These plans often include controlled fires as a land-clearing tool, but these might be unfavorable for many insects depending on timing and certain host plants. We propose using data from surveys, monitoring and modelling to identify high-priority conservation spots for *V. cardui* breeding and work in coordination with our African partner institutions, to delineate conservation actions appealing to insects. The monitoring sites will benefit from a stronger surveillance and will be properly managed: when adequate, they will be excluded from controlled fires plans and fenced to avoid destruction by herbivorous animals or large mammals.

METHODOLOGY:

3) Monitoring scheme

We will conduct exhaustive surveys to delineate a comprehensive map of *V. cardui* breeding hotspots in the three different countries. Next we will establish the methodological basis and infrastructure for a long-term monitoring scheme. Hotspots will be monitored through periodic visits every two weeks along the year. Immature abundance will be estimated by performing systematic counts. Surveys and monitoring will be done in three countries (The Bassari Country - Senegal, the Bamenda highlands – Cameroon and the Mongo mountains and Zakouma - Chad) and neighbouring zones. Local academics will be engaged to continue the monitoring scheme beyond the end of the grant, incorporating the system in their research and educational activities. Our African team partners: The Congo Basin Institute (Cameroon), Khadim Kebe (Senegal), African Parks (Chad, Benin) and the Mpala Research Center (Kenya), will be key at building a robust community network in Africa. Our partners in the north side of the Sahara will play a similar role in the Mediterranean region. All institutions, team members and monitoring volunteers will be permanently in touch to share experiences and jointly resolve potential issues.

4) Citizen science, education and outreach

We will launch a citizen science program to communicate the Painted lady migratory phenomenon. The project will be customized in the online platform Natusfera (www.natusfera.org) and iNaturalist (www.inaturalist.org) (Figure 3c). The program will engage to report breeding sites across Africa, thus obtaining valuable data from a wide area. Reporting immatures is a novelty for citizen science and migratory species, where efforts focus on observations of adults. Besides disseminating the program through regular internet channels we aim to reach some communities personally. We will approach organizations and communities in other regions in Africa to offer workshops on *V. cardui* biology, including how to identify immature stages and how to report them through online platforms. We aim to visit

schools, universities, national parks, game reserves and conservation NGOs. We propose to recruit a biologist who will be fully dedicated to this part of the project during a year period.

Additional methodology employed in the full Project (funds not requested to PRIC)

1) **DNA phylogeography and pollen metabarcoding**

Tissue from the butterfly samples of monitoring site's temporal series will be used to track genetic diversity along time. RADseq protocols will be used for genome-reduced marker sampling and coalescent-based phylogeography for genealogical inference. Pollen grains will be isolated by vortexing and centrifugation, DNA will be extracted and we will amplify the ITS2 region for plants (pollen) (Suchan, Talavera et al, 2018). Amplicons will be sequenced on Illumina MiSequsing 500-cycle MiSeq Reagent Kit v2. The resulting paired-end reads will be merged using PEAR. Sequences will be filtered and clustered using USEARCH and classified into species using SINTAX.

2) **Stable isotope analyses**

Stable –hydrogen (δ^2H) and -strontium ($^{87}Sr/^{86}Sr$) isotope analyses of wing chitin will be jointly modeled into isoscape maps to estimate natal geographic origins of collected specimens (Talavera et al 2018). About 500 specimens will be analysed for δ^2H and $^{87}Sr/^{86}Sr$. Tissue samples will be analysed using continuous-flow isotope-ratio mass spectrometry

3) **Niche modelling**

Ecological niche modelling techniques will be specifically developed in the light of the migration problem. Usually, modelling inferences are based on static data, but we are developing novel methods based on temporal-series of climatic, ecological and land use data. This will allow modelling monthly population shifts at two geographical scales: 1) Small-scale modelling within the expedition zones to understand local preferences at fine-scale. 2) Large-scale modelling to identify other potentially suitable breeding areas in Tropical Africa in different months.

- PRESENTATION OF TECHNICIANS, RESEARCHERS AND PARTICIPATING INSTITUTIONS (as applicable)

INSTITUTIONS

1) **INSTITUT DE BIOLOGIA EVOLUTIVA (CSIC-UPF)** https://www.ibe.upf-csic.es/

The researchers at IBE will lead the research, coordinate the monitoring network and the citizen science activities

2) **African Parks** (https://www.african-parks.org/)

African Parks is a non-profit conservation organization that takes on direct responsability for the rehabilitation and long-term management of protected areas in partnership with governments and local communities. Currently, AP manages 13 National Parks in Africa.

3) **Mpala Research Center and Wildlife Foundation** (http://www.mpala.org/), Kenya

Mpala is the larger and most international Research facilities in Kenya, uniquely positioned in a natural reserve in Laikipia. The institution defines itself as "A Living Laboratory"

4) **Congo Basin Institute** (https://www.cbi.ucla.edu/), Cameroon

The CBI is a joint institution between University of California los Angeles and the Institute of Tropical Agriculture that facilitates environmental research in Cameroon.

5) **CENAGREF** (http://www.cenagref.net/), Benin

CENAGREF is the governmental division of Beninese government that manages Natural Protected Areas, including National Parks, cynegetics zones and fauna reservations.

6) **Asociación ZERYNTHIA** (http://www.asociacion-zerynthia.org/)

ZERYNTHIA is a non-profit organization aimed at studying, disseminating and conserving butterflies and their habitats in Spain

7) **Israeli Lepidopterist's Society**

The ILS aims at learning, studying and monitoring the butterflies of Israel and their habitats.

PEOPLE

Gerard Talavera (IBE, CSIC, Barcelona)
Roger Vila (IBE, CSIC, Barcelona)
Cecília Corbella (IBE, CSIC, Barcelona)
Mattia Menchetti (IBE, CSIC, Barcelona)
Martial Kiki (CENAGREF, Benin)
Khadim Kebe (Senegal)
Dino Martins (Director Mpala Research Centre, Kenya)
Tomasz Suchan (Polish Academy of Sciences, Poland)
Clement Bataille (University of Ottawa, Canada)
Jaume Piera (Institut de Ciències del Mar, CSIC)

- COST ESTIMATE

We request funds to support three concepts:

1) Assistant stipends for Monitoring Stations

   20 euros x day of work x 50 weeks (2 years) = 1000 euros x 3 stations x 2 people = 6000

2) Educational workshops: 3,000

   Local transportation for participants, meeting space, basic material and meals. 10-15 workshops of 1 or 2 days long will be run at National Parks, Local Colleges, Conservation NGOs and schools in the regions where monitoring activities are done

3) Personnel: 1-year contract

   A biologist will be hired to develop educational and dissemination activities in Africa and Europe, and to coordination assistants at monitoring stations during the starting phase of the monitoring network. 1 year contract = 21000 euro

Note: costs involving travelling of the research team to the monitoring sites (4 trips in two years) will be covered by other funds (NatGeo). All African countries will visited consecutively in the same expedition

Detailed budget:

Concept	Total Amount	NatGeo	PRIC ZOO	Observations
Personnel	21,000	-	21,000	Contract for CiSci manager / coordinator (1 year)
Monitoring Assistants (Senegal, Cameroon, Chad)	6,000	-	6,000	50 weeks x 2 years x 3 stations x 2 people
Monitoring Assistants (Benin, Kenya)	8,000	8,000		50 weeks x 2 years x 4 stations (2 per country) x 2 people + Management of traps
Educational Workshops	3,000	-	3,000	
Airfares	25,000	25,000	-	4 trips (Africa) x 4 people
Vehicle Rental	16,000	16,000	-	40 days x 4 trips (Africa) (5 countries)
Vehicle Gas & Maintenance	4,000	4,000	-	40 days x 4 trips (Africa) (5 countries)
Lodging	6,000	6,000	-	40 days x 4 trips x 4 people
Food	9,000	9,000	-	40 days x 4 trips x 4 people
Equipment and Supplies	4,000	4,000	-	Traps, nets, tubes, ethanol, glassine envelopes.
Laboratory Analyses	30,000	30,000	-	DNA reagents, stable isotopes, sequencing fees
Communications	1,500	1,500	-	Postage supplies and samples, SIM Cards cell phones
Miscellaneous	2,750	2,750	-	Incidental expenses, publication fees
Institutional overheads	18,750	18,750	-	
TOTAL	**155,000**	**125,000**	**30,000**	

- DETAILED PLANNING

Activity	Year 1												Year 2											
Month No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Exploration for Hotspots																								
First expedition to establish sites																								
Site monitoring																								
Second expedition for sites control and exporting samples																								
Third expedition for sites control and exporting samples																								
Fourth expedition for sites control and exporting samples																								
Educational workshops																								
Managing sampling collection																								
Laboratory analyses (isotopes, DNA)																								
MS preparation																								

- LIST OF MATERIALS

  - Laboratory facilities: Molecular work will be done at the Institute of Evolutionary Biology (IBE). Stable Isotope Analyses will be done at the University of Ottawa. (Canada). The facilities include fullly-equipped laboratories for the planned activitites.
  - Entomological instrumentation for field expeditions and monitoring stations: nets, tubes, ethanol, glassine envelopes
  - Malaise traps: some of the monitoring stations will include entomological malaise traps for continuous captures of flying insects.

- POSSIBLE PUBLICATIONS

There are no precedents for the proposed monitoring scheme in Africa and the systematic data on migrating insects that will generate the project will represent an important novelty. For this reason, and because of the emergence of *V. cardui* as a model on ecological research, we expect an outcome with high-impact publications.

Two type of scientific publications are envisaged:

1) Population abundance dynamics: The monitored results from two years along the 5 different stations in Africa, revealing peaks of major/minor breeding abundances and migratory waves.
2) Geographical origin dynamics: Laboratory analyses showing the spatiotemporal dynamics of natal origins and genetic affinity from different migratory waves along time: using stable isotopes, pollen metabarcoding and DNA phylogeography techniques.

- SPECIFIC PLAN FOR COMMUNICATION AND DISSEMINATION OF RESULTS

  - Stimulating citizen science in African countries: training workshops, use of social networks and open CitSci platforms

  - Panel exhibit and mini-rearing lab in the Zoo

  - Outreach and research talks for both workers and general public at the Zoo

  - Presentations at Congresses, Meetings and Seminar Series.

- REQUIREMENTS REQUESTED FROM ZOO

The funding requested to the Zoo will be critical to accomplish and even increase the project of understanding, protecting and disseminating the migratory butterfly *Vanessa cardui*. In addition, we request the following to the Zoo:

- A dedicated space where to exhibit an informative panel about the project and the system. In additions this could be complemented with a simulated breeding site with a sample of the different larval hostplants.
- The opportunity to give periodic outreach talks at Zoo's facilities, to the general public and to the Zoo's staff.
- To be granted to mention the support of the Zoo to the project to our African partner institutions and along the dissemination activities.

References

Beale, CM, Rensberg, SV, Bond, WJ, Coughenour, M, Fynn, R, Gaylard, A, Grant, R, Harris, B, Jones, T, Mduma, S, Owen-Smith, N & Sinclair, ARE 2013, 'Ten lessons for the conservation of African savannah ecosystems' *Biological Conservation*, vol 167, pp. 224-232.

Oberhauser, K.S., Nail, K.R., Altizer, S. (2015). *Monarchs in a Changing World: Biology and Conservation of an Iconic Butterfly.* Cornell University Press: Ithaca.

Stefanescu, C., Soto, DX., **Talavera, G., Vila, R**. & Hobson, KA. (2016). Long-distance autumn migration across the Sahara by painted lady butterflies: exploiting resource pulses in the tropical savannah**. Biology Letters** 12: 20160561.

Suchan T*, Talavera G*, Sáez L, Ronikier M, Vila R (2018). *Pollen metabarcoding as a tool for tracking long-distance insect migration*. bioRxiv. DOI: https://doi.org/10.1101/312363

Talavera G*, Bataille C*, Benyamini D, Gascoigne-Pees M, Vila R (2018). *Round-trip across the Sahara: Afrotropical Painted Lady butterflies recolonize the Mediterranean in early spring*. Biology Letters. In press

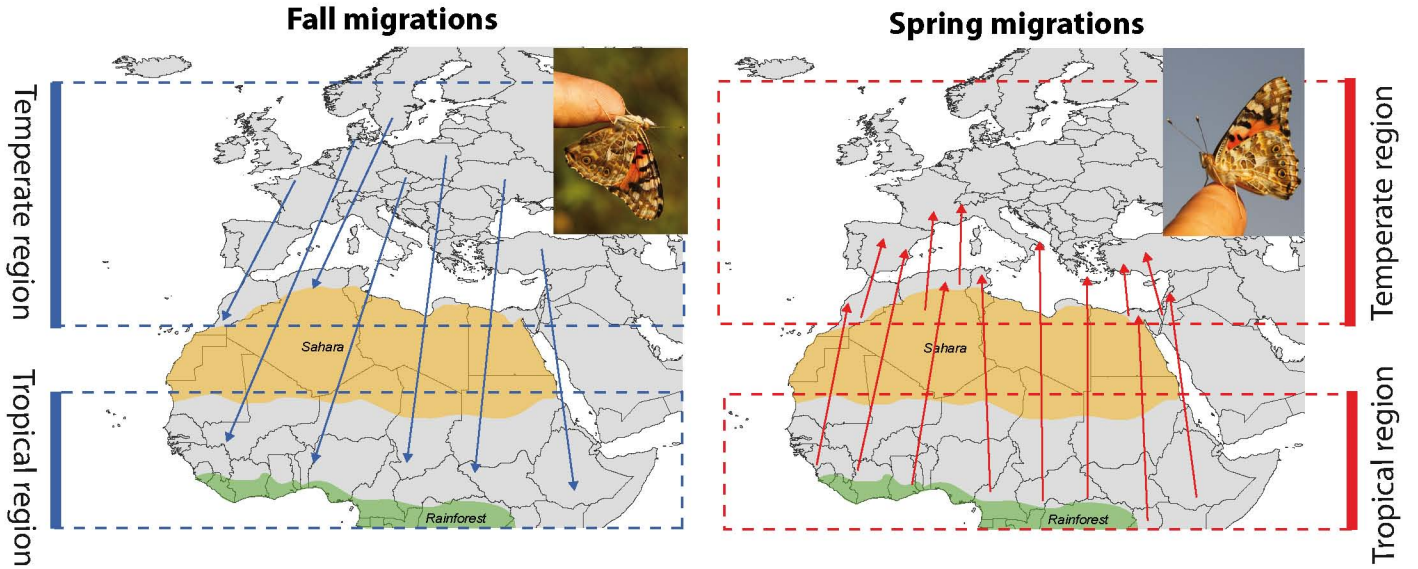
Talavera, G. and Vila, R. (2016). Discovery of mass migration and breeding of the painted lady butterfly *Vanessa cardui* in the Sub-Sahara: the Europe–Africa migration revisited. Biological Journal of the Linnean Society. DOI: 10.1111/bij.12873.

ADDITIONAL INFORMATION

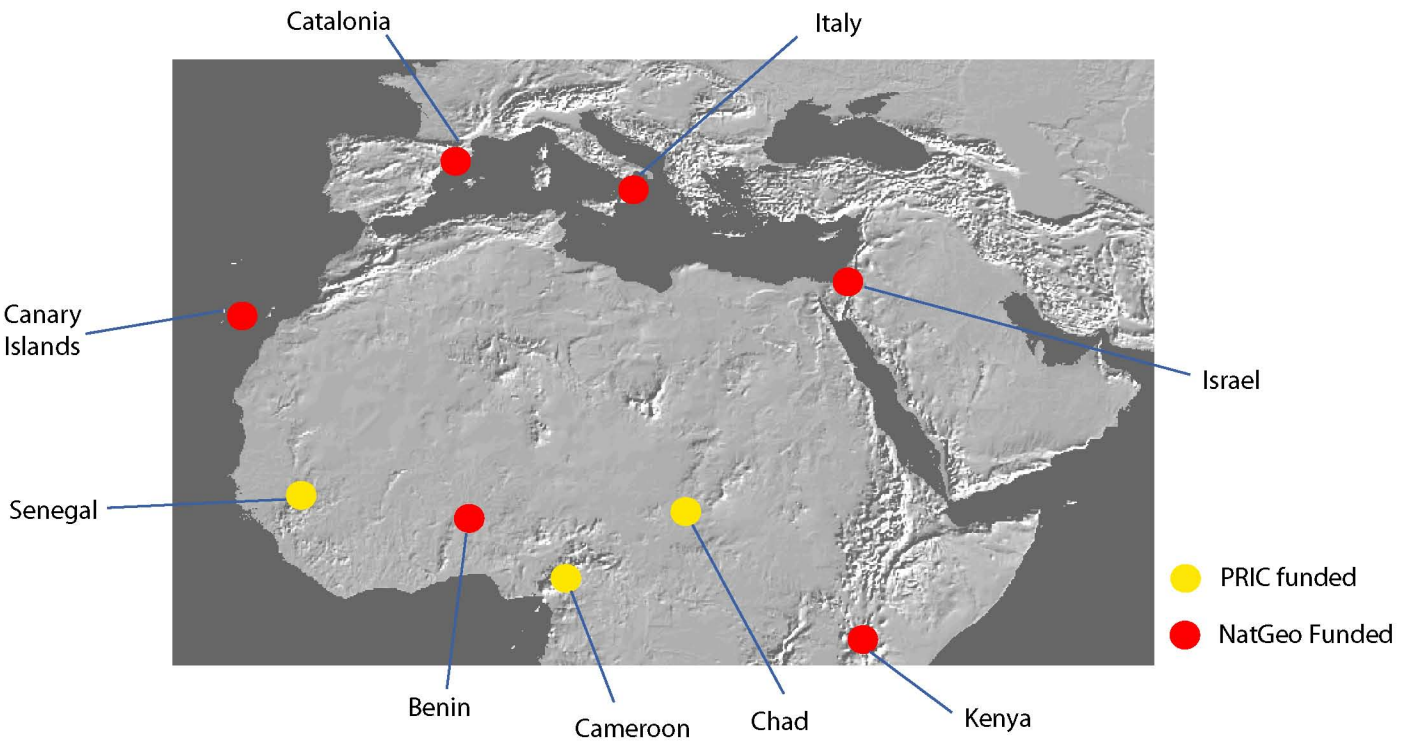
- Figure 1. A) Schematic fall and spring *V. cardui* trans-Saharan migrations. B) Proposed monitoring scheme. C) Citizen Science banner on open iNaturalist project
- Award letter National Geographic Society
- Letter of Support from African Parks in Pendjari (Benin)
- Research Permit for Kenya
- Research Permit for Cameroon
- Research Permit for Catalonia
- Research Permit for Tenerife
- CV of the head researcher

Other letters of support and permits are hold by local collaborators or currently in process.

A) Palearctic-African migratory system for *V. cardui*



B) *V. cardui* monitoring network



C) Citizen Science project on open platform

NATIONAL GEOGRAPHIC

Committee for Research
& Exploration

January 24, 2018

GRANT #WW1-300R-18
Dr Gerard Talavera
Institut de Biologia Evolutiva (CSIC-UPF)
Animal Diversity and Evolution
Pg Marítim de la Barceloneta 37
Barcelona, MA 08006
Spain

Dear Dr Talavera:

I am pleased to advise that the Committee for Research and Exploration of the National Geographic Society has authorized a grant of $143,000.00 in support of your proposed project "The longest butterfly migration: monitoring and conservation of the Painted Lady butterfly breeding sanctuaries in tropical Africa."

The number of this grant is WW1-300R-18. This number must be used in all correspondence, reports, and payment requests.

As a condition of our grants, we require the following:

1. AGREEMENT FORMS

We require that all participants in projects sponsored by the Society execute our standard agreement forms, which are enclosed for signature. The **GRANT AGREEMENT** must be completed and signed by the principal investigator. The **PROJECT MEMBER AGREEMENT** (final page of the grant agreement) is to be completed and submitted by all other project participants with a significant role in the project.

These agreement forms insure that the Society will have first rights for popular publication, in its official journal, of projects which it supports. It is the dues of our members that make these research grants possible. Therefore, it is appropriate that publication(s) about research supported by these grants--and through member dues--appear first in NATIONAL GEOGRAPHIC magazine.

By signing these forms and accepting this grant, the grant recipient(s) and/or principal investigator(s) and investigative team agree(s) to provide the Society with rights of first refusal for popular publication, filming, and other vehicles for popular audiences, of the research results and/or dissemination of news briefs or releases on the research or the research site. This does not apply to publication in scholarly scientific or educational journals, which is permissible when

support by the National Geographic Society is properly acknowledged in writing. We request that you notify our Communications office and CRE program officer upon submission of an article for publication in *Science* or *Nature* (see contact list).

In addition, abstracted material on your project (and results thereafter), may also be provided through the Society's Web site. On select projects, grant recipients will be contacted with regard to the possibility of providing interactive access to your ongoing scientific research and/or exploration endeavors.

2. PUBLICATION AND PUBLICITY - NATIONAL GEOGRAPHIC SOCIETY

The Society offers many outlets for your research results.

- **NATIONAL GEOGRAPHIC Magazine**
  Each month several columns highlight interesting scientific finds and personal anecdotes of interest to the Society's 9 million members (including foreign language editions). Please refer to recent issues for these features. Full-length features are the result of many years of research and months of professional photography.

- **Press Releases, Press Conferences**
  Any other publicity on your project (TV interviews, university press releases, etc.) should be coordinated with the Society's Communications division. That office reaches an international audience with news releases on especially significant scientific results from the work of grantees and holds major news conferences.

- **Lectures**
  Throughout the year, the Society sponsors hour-long illustrated lectures in the auditorium at our Washington headquarters and in select cities around the country. We occasionally invite research grantees to lecture there.

3. LIABILITY

The Society has no legal liability for the safety or welfare of expedition members. It is advisable to point out that hazards often result from any type of research--especially field-oriented research. Therefore, we recommend that project personnel take out protection in the form of personal insurance, if they so desire.

4. GRANT PAYMENT REQUESTS

Grant payments are made by either ACH/direct deposit (required for US payments) or Wire (non-US payments only). Either the ACH request form and a voided check or the Wire request form must be used when requesting payment. Grant payments will be issued in one full payment. Payments may take up to 6 weeks for processing, assuming all payment information is correct. Please plan accordingly when requesting payment of your grant.

Issuance of payment for grants must be requested within 18 months of the date of the award. Project extensions will be considered - and may be authorized - under extenuating

circumstances. Funds not requested after 18 months will be returned to the overall grants program budget.

THE SIGNED GRANT AGREEMENT, PAYMENT REQUEST FORM, APPROPRIATE TAX FORM and PHOTO MUST BE SUBMITTED THROUGH THE ONLINE PORTAL *BEFORE* WE CAN PROCEED WITH ISSUING PAYMENT OF THE GRANT.

In order to assist you in your record keeping and tax reporting, we want to inform you that the Society may provide you with a Form 1099-MISC or Form 1042-S, as may be applicable, early next year. We recommend that you consult with your tax advisor if you have any questions regarding your filing obligations or tax liability.

5. REPORTS

We ask that you note on the grant agreement the date you expect to submit your report and financial accounting. We generally expect a final report and full financial accounting within six months of the end of your fieldwork. It is your responsibility to comply with due dates for all reports or to call to our attention any necessary due date revisions. **All grant recipients must submit these items**.

Any funds that remain unexpended upon completion of your grant project are to be returned to the National Geographic Society.

Sincerely,

Peter H. Raven

Peter H. Raven
Chairman
Committee for Research and Exploration

BENINREVELE

Complexe Pendjari
African Parks, Benin

Parc National de la
Pendjari
Benin

Tanguiéta, le 26. Septeber 2017

N° 057 APN/TAN/2017

LETTER OF SUPPORT

To Whom It May Concern:

This letter is to show our support for the research proposal entitled "**The longest butterfly migration: monitoring and conservation of the Painted Lady butterfly breeding sanctuaries in tropical Africa**", with Gerard Talavera (Institute of Evolutionary Biology, CSIC-UPF) as the Principal Investigator, to be carried out in agreement with African Parks.

African Parks, Benin is a non-profit conservation organization that takes on direct responsibility for the rehabilitation and long-term management of protected areas in partnership with governments and local communities. At this moment we manage 11 Parks in 8 African countries. Pendjari National Park Complex is managed by African Parks since August 2017.

Dr. Talavera is studying the unusual migratory phenomenon of "Painted Lady" butterflies, *Vanessa cardui*, in Sub-Saharan Africa, and the ecological importance of the tropical savannah for the viability of this species' populations and part of their migratory cycle. His research is highly complementary to the general conservation goals of our organization and we will allow the research within Pendjari NP Complex, at places and periods that are convenient to both parties.

Yours sincerely

James TERJANIAN
Directeur du Complexe Pendjari,
African Parks, Benin

African Parks Benin
Complexe du PN Pendjari, Tanguéta
Tel : +229/0954 118 18

Numéro de registre :
2017/N°045/MISP/DC/SGM/DAIC/SAAP-ASSOC/SA
Identifiant Fiscal Unique : 6201710002477
Cotonou, Benin

NATIONAL COMMISSION FORSCIENCE, TECHNOLOGY ANDINNOVATION

Telephone:+254-20-2213471, 2241349,3310571,2219420
Fax: +254-20-318245,318249
Email: dg@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/18/36721/19561** Date: **25th January, 2018**

Dr. Gerard Talavera Mor
Evolutionary Biology Institut
SPAIN.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Ecology and long-range movements of butterflies with dispersal abilities or migratory behavior"*** I am pleased to inform you that you have been authorized to undertake research in **All Counties** for the period ending **25th January, 2019.**

You are advised to report to **the County Commissioners and the County Directors of Education, All Counties** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

GP Kalerwa
GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioners
All Counties.

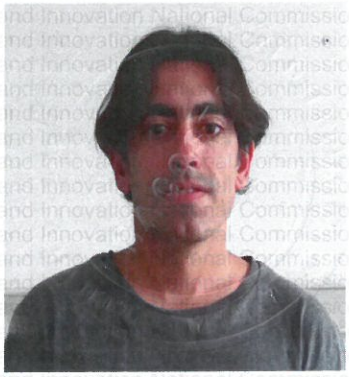
The County Directors of Education
All Counties.

THIS IS TO CERTIFY THAT:
DR. GERARD TALAVERA MOR
of EVOLUTIONARY BIOLOGY INSTITUT (CSIC-UPF), Edifici CMIMA, Passeig Marítim 37-49-08003 Barcelona,has been permitted to conduct research in
All Counties County

on the topic: ***ECOLOGY AND LONG-RANGE MOVEMENTS OF BUTTERFLIES WITH DISPERSAL ABILITIES OR MIGRATORY BEHAVIOR.***

for the period ending:
25th January,2019

Permit No : NACOSTI/P/18/36721/19561
Date Of Issue : 25th January,2018
Fee Recieved :USD 500



.....
Applicant's Signature

G P Kalerwa
.....
Director General
National Commission for Science, Technology & Innovation

ORIGINAL

AC: 22644

OFFICIAL RECEIPT

Station Nairobi Date 11/1/18

RECEIVED from Gerard Talavera Mor

~~Shillings~~ USD Five Hundred only

cents

on account of Research permit fee

Vote Head R43

NACOSTI

Item A.I.A

Cash Cheque No. Direct Deposit

USD	500/-
Kshs	
AC No.	

Signature of Officer receiving remittance

REPUBLIQUE DU CAMERO
Paix-Travail-Patrie

MINISTERE DE LA RECHERCHE SCI
L'INNOVATION

SECRETARIAT GENER

DIVISION DES POLITIQUES SCIENTI
PLANIFICATION

CELLULE DE LA PROGRAMMATION ET DE LA PLANIFICATION

B.P : 1457 Yaoundé – Cameroun
Tél : (237) 22 22 13 34 ou 22 22 52 02

REPUBLIC OF CAMEROON
Peace-Work-Fatherland

MINISTRY OF SCIENTIFIC RESEARCH AND INNOVATION

GENERAL SECRETARIAT

DIVISION OF SCIENTIFIC POLICY AND PLANNING

PROGRAMMING AND PLANNING UNIT

PO Box 1457 Yaoundé- Cameroon
Tél : (237) 22 22 13 34 or 22 22 52 02

RRICI-POINT-T PJ-YAOUNDE 232117 15 1B34 07/09/17 10:17 MINISTERE DES FINANCES DIRECTION GENERALE DES IMPOTS FCFA 0010000 TIMBRE FISCAL-FISCAL STAMP CMR10199

00000020

N° _____/MINRESI/B00/C00/C10/C14 Yaoundé, le 11 SEPT 2017

AUTORISATION DE RECHERCHE

RESEARCH PERMIT

Vu la Constitution ;
Mindful constitution ;
Vu le décret n°2011/408 du 09 décembre 2011 portant organisation du Gouvernement ;
Mindful of decree n°2011/408 of 09 December 2011 organizing the Government;
Vu le décret n°2011/410 du 09 décembre 2011 portant formation du Gouvernement ;
Mindful of decree n°2011/410 of 09 December 2011 appointing the members of the Government;
Vu le décret n°2005/091 du 29 mars 2005 portant organisation du Ministère de la Recherche Scientifique et de l'Innovation ;
Mindful of decree n°2005/091 of 29 March 2005 organizing the Ministry of Scientific Research And Innovation;
Vu la demande de l'intéressé .
Considering the Applicant's request.

Noms et prénoms/*Names :* **TALAVERA MOR GERARD**

Addresses Permanentes/ Permanent *address*: **Edifici CHIMA,Passing Maritim de la Barcelona, 37-49 08003 Barcelona(Spain). E-mail : gerardtalavera@csic.es**

Addresse au Cameroun/*Address in Cameroon*: **s/c Pr. NGAMENI TCHAMADEU Norbert University of Dschang p.o Box 67 Dschang;E-mail : Tchamaznn@yahoo.fr**

Nationalité /*Nationality :* **SPAIN**

Est autorisé (e) à effectuer des travaux de recherche en République du Cameroun dans la ou les Région(s) de: *Is hereby authorized to carry out scientific or technical research in the Republic of Cameroon in the Region of*: **North-West,Center,Adamawa,North,East,West.**

Pour une période de / F*or a period of* **04 Months** du/from : **01/11/2017** au/to **29/02/2018**

En collaboration avec / I*n collaboration with:* **Pr. NGAMENI TCHAMADEU Norbert University of Dschang p.o Box 67 Dschang;E-mail : Tchamaznn@yahoo.fr**

Objet de la Recherche/*Research Title:* **Ecology and long-range movements of the species Vanessa cardui..**

Cette autorisation de recherche n'est valable que pendant la période de recherche indiquée ci-dessus, et peut être renouvelable.
This research permit is valid only for the research period indicated above and it can renewed.

AMPLIATION:
- CAB/MINRESI
- SGPRC
- SGPM
- MINDEF
- DGSN
- DGRE
- CRRI – **North-west,Center,Adamawa,North,West and East .**
- SG/MINRESI
- IG/MINRESI
- C/DPSP
- Chrono/Archives

Pour le Ministre de la Recherche Scientifique et de l'Innovation et par Délégation
Le Secrétaire Général

Mme Ebelle Etamè Rebecca Madeleine

Generalitat de Catalunya
www.gencat.cat

GENERALITAT DE CATALUNYA

Generalitat de Catalunya
Departament de Territori i Sostenibilitat

Autorització especial per a la captura científica, de gestió o educativa

Referència SF/0205 **ANY 2018**

Persona Autoritzada TALAVERA MOR, GERARD **Avalador** ROGER VILA

DNI 43518141W **Telèfon** **E-mail**

Entitat

Espècie/s Ropalòcers: totes les espècies.

Quantitat Màxim 6 exemplars per espècie i municipi.

Zona Tot Catalunya (excepte Vall d'Aran).

Finalitat Recerca.

Mètode Captura Mànega entomològica.

CONDICIONS:
1.En cas d'accedir a un Parc Nacional, Parc Natural, Paratge Natural d'Interès Nacional o altre espai amb òrgan rector o direcció tècnica, es necessitarà autorització de l'espai.
2. Quan l'exemplar a capturar sigui un ocell amb el niu situat dins d'un espai protegit, caldrà l'autorització complementària del director/a del mateix encara que es capturi fora de l'espai.
3. Un cop finalitzat el període de vigència de l'autorització, s'enviarà informe detallat sobre el resultat de les captures realitzades. En el cas de les autoritzacions de captura científica que es donin per a espècies amenaçades, no només caldrà donar la memòria dels resultats sinó que el Departament podrà demanar totes les dades obtingudes que deriven d'aquesta autorització, les quals seran utilitzades per a la conservació / gestió de l'espècie. Aquestes dades seran emprades amb tota confidencialitat.
4. Les dades dels exemplars capturats o observats hauran de ser introduïdes a la base ORNITHO (www.ornitho.cat).
5. El titular d'aquesta autorització serà el responsable dels danys que es puguin causar a tercers, com a conseqüència del desenvolupament de les actuacions relacionades amb aquesta autorització.
6. Aquesta autorització és a títol personal i intransferible. No faculta l'ús d'armes de foc, ni d'altres mètodes que els expressament autoritzats, ni a capturar altres espècies. Si es comprovés la utilització abusiva o de lucre del permís, s'anul.larà l'autorització i s'adoptaran les mesures pertinents contra l'interessat.
7. Per a les captures de peixos en Zones de Pesca Controlada (ZPC) s'haurà de comunicar prèviament a les societats gestores de cada ZPC.
8. Quan l'autorització afecti la manipulació d'espècies catalogades legalment com a amenaçades, caldrà avisar el Cos d'Agents Rurals (tel. 93 561 70 00) per comunicar els dies i llocs exactes de les actuacions, tot deixant un telèfon de contacte, per tal de poder supervisar l'actuació en cas que es consideri oportú.

Condicions particulars

Només es sacrificaran 6 ex. per espècie i localitat amb finalitats científiques de determinacions citològiques i genètiques (és imprescindible informe posterior especificant nombre d'ex. i sps. dels resultats, signat pels avaladors de l'estudi).

FONAMENTS DEL DRET:
Llei 42/2007, de 13 de desembre, del Patrimoni natural i de la biodiversitat: art 58. Decret Legislatiu 2/2008, de 15 d'abril, pel qual s'aprova el Text refós de la Llei de protecció dels animals: art 34 (Captura científica d'espècies protegides); art 31 (Reserves Naturals de Fauna Salvatge). Decret 148/1992, de 9 de juny, pel qual es regulen les activitats fotogràfiques, científiques i esportives que poden afectar les espècies de la fauna salvatge: art 4 i 7. Llei 1/1970, de Caça: Art. 26 (Caça científica). Decret 506/1971, del reglament de Caça: art. 28 (Caça científica). Resolució MAH/2172/2007, d'espècies objecte de d'aprofitament cinegètic. Llei 22/2009, del 23 de desembre, d'ordenació sostenible de la pesca en aigües continentals: art. 27 (Pesca científica). Resolució anual per la qual es fixen les espècies pescables, els períodes hàbils de pesca i les aigües en què es pot dur a terme l'activitat de la pesca a les aigües continentals de Catalunya. Llei 12/1985, de 13 de juny, d'Espais Naturals: art 21 (Espais Naturals de Protecció Especial). Llei 5/1995, de 21 de juny, de protecció dels animals utilitzats per a experimentació i per a altres finalitats científiques: art 4.

VISTOS els articles esmentats,
AUTORITZO al titular a CAPTURAR les espècies esmentades, amb la finalitat i arts que s'indiquen.

Barcelona, 05/03/2018

EL CAP DEL SERVEI DE FAUNA I FLORA
Ricard Casanovas Urgell

Període de validesa 31 de desembre de 2018

Doc.original signat per:
CPISR-1 C Ricard Casanovas Urgell
07/03/2018

Document electrònic garantit amb signatura electrònica. Podeu verificar la integritat d'aquest document a l'adreça web csv.gencat.cat

Original electrònic / Còpia autèntica

CODI SEGUR DE VERIFICACIÓ

0AQT1MH5COC8FK4K45GI3T73CJZZM0OB

Data creació còpia:
08/03/2018
Data caducitat còpia:
08/03/2021

Área de Sostenibilidad, Medio Ambiente y Seguridad
Servicio Administrativo de Medio Ambiente
Unidad de Coordinación

Fecha: 10/04/2018 **Fax:** 922 23 91 94
Ref.: YMG/cpa **Tfno:** 922 84 34 99

Asunto: Autorización de actividades con fauna

Roger Vila Ujaldon

Expte: **AFF 62/18**
Nº Sigma: **2018-00972**

Autorización de prospección de fauna

Peticionario	Roger Vila Ujaldon
DNI /CIF	52162824C
Promotor	CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS
Actuación proyectada	Captura de ejemplares de la superfamilia papilionoidea en el Paque Natural de Corona Forestal y fuera de los Espacios Naturales Protegidos
Objetivo	Proyecto "Genómica de la especiación en organismos no-modelo: Explorando el continuo de diversificación en las mariposas europeas".
E.N.P.	P.N. Corona Forestal

1. ACTIVIDAD QUE SE AUTORIZA:

Especie/s y número/s: Captura de ejemplares de la super familia papilionoidea (mariposas diurnas) no catalogados en el Parque Natural de Corona Forestal y fuera de los Espacios Naturales Protegidos.

2. CONDICIONES:

Se autoriza la actividad con sujeción a las siguientes condiciones:

1. **Medios, sistemas o métodos y personal cualificado:**

- La captura se realizará mediante manga entomológica.
- Recogida de estadios inmaduros para cría en cautividad.
- La captura se hará con criterios de no dañar a las poblaciones naturales. A tal fin se recolectará material de distintas poblaciones.
- El peticionario viene avalado por Consejo Superior de Investigaciones Científicas.
- Los trabajos se realizarán en colaboración con:
  - Cecilia Corbella Felip con DNI 46629544B
  - Ruth Escobés Jiménez con DNI 16609975L
  - Enrique García-Barros Saura con DNI 50297983L
  - Juan Hernández Roldán con DNI 51385118J
  - Joan Carles Hinojosa Galisteo con DNI 78100706C
  - Miguel López Munguira con DNI 51341557Z

- Yeray Monasterio León con DNI 16617351W
- Martín Rodney Gascoigne-Pees con DNI 507331531
- Helena Romo Benito con DNI 07244945Z
- Gerard Talavera Mor con DNI 43518141W
- Juan Carlos Vicente Arranz con DNI 9332070G

2. **Condiciones de riesgo y circunstancias de tiempo y lugar:**

- La ejecución de la actividad se llevará a cabo **bajo la exclusiva responsabilidad del interesado**. Se le advierte que el desarrollo de cualquier actividad en el medio natural puede entrañar riesgos, debido a desniveles de terreno, posibilidad de desprendimientos, fenómenos meteorológicos adversos, incendios forestales, etc... Por favor, esté atento a la información meteorológica y para cualquier consulta o aclaración puede ponerse en contacto con el Centro de Servicios al Ciudadano en el teléfono 901501901.
- En el caso que en el desarrollo de los trabajos apareciera un taxón no descrito para la Isla, se depositará, al menos un ejemplar, en el Museo de Ciencias Naturales del Cabildo de Tenerife.

3. **Controles:**

- El autorizado deberá llevar consigo en todo momento este documento, y mostrarlo a los Agentes de Medio Ambiente cuando lo soliciten.
- Cualquier tipo de marcas o etiquetas necesarias que se realice sobre el espécimen deberá contener el número de expediente de esta autorización.
- Los investigadores se comprometerán a mantener informada a la administración gestora de sobre la ejecución del proyecto.
- Asimismo, una vez concluido el estudio se entregará una memoria que contenga los resultados obtenidos en la investigación con el compromiso de este órgano de no utilizar los datos sin el conocimiento de los investigadores y de no utilizar los mismos sin citar la fuente, así mismo se entregará una copia de los trabajos que se publiquen. En las publicaciones siempre se deberá indicar que los datos de campo se han obtenido previa autorización del Cabildo Insular de Tenerife.
- Ante cualquier contingencia se deberá contactar con el **teléfono 922239156**, de lunes a viernes, en horario de 08.00 a 14.00, ó a través del correo medionatural@tenerife.es.

4. **Plazo**:

Esta autorización es **válida hasta el 1 de abril de 2019**. Podrá ser revocada si se advierten circunstancias que afecten a la diversidad biológica insular o que vulneraran su contenido, y no exime de la obligación de obtener las autorizaciones que corresponda emitir a otros organismos o particulares.

3. CONSIDERACIONES:

Esta autorización se concede teniendo en cuenta la siguiente excepción a las prohibiciones del Capítulo I Título III de la Ley 42/2007:

- Cuando sea necesario por razón de investigación, educación, repoblación o reintroducción, o cuando se precise para la cría en cautividad orientada a dichos fines.

4. NORMATIVA APLICABLE:

En la resolución de este procedimiento se han tenido en cuenta las siguientes disposiciones específicas: 1) Ley 42/2007, de 13 de diciembre, del Patrimonio Natural y de la Biodiversidad. 2) ·Orden de 20 de febrero de 1991, sobre Protección de Especies de la Flora Vascular Silvestre de la Comunidad Autónoma de Canarias; 3) Decreto 151/2001, de 23 de julio, por el que se crea el Catálogo de especies amenazadas de Canarias. 4) Instrumentos de planeamiento de los Espacios Naturales Protegidos 5) Ley 4/2010, de 4 de junio, del Catálogo Canario de Especies Protegidas. 6) Real Decreto 139/2011, de 4 de febrero, para el desarrollo del Listado de Especies Silvestres en Régimen de Protección Especial y del Catálogo Español de Especies Amenazadas.

5. RECURSOS:

Esta resolución se emite por delegación del Consejero Insular del Área de Sostenibilidad, Medio Ambiente y Seguridad, y no agota la vía administrativa. En caso de disconformidad, los interesados podrán interponer RECURSO DE ALZADA ante el Presidente del Cabildo de Tenerife en el plazo de UN MES a contar desde el día siguiente al de recepción de este documento.

Documento firmado electrónicamente:

El Jefe del Servicio Técnico de Gestión Ambiental
Cristóbal Rodríguez Piñero

Gerard Talavera
http://www.gerardtalavera.com

e-mail: gerard.talavera@csic.es
Phone: (+34) 605205287

CURRICULUM VITAE

Personal data

Name:	Gerard Talavera
Address:	Institut de Biologia Evolutiva (IBE, CSIC-UPF) Pg Marítim de la Barceloneta 37-49 08003 Barcelona, Spain
Date of birth:	04-Aug-1980
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Domains of research

Phylogenetics, Biogeography, Biodiversity, Entomology, Taxonomy, Ecology, Evolution, Animal migration, Population Genetics, Phylogeography, Systematics, Diversification, Speciation, Macroevolution, Comparative methods, Genomics, Behavior, Butterflies, Lepidoptera, Ants, Formicidae.

Education

2012 – Ph.D. in Biology, Universitat Autònoma de Barcelona (UAB), Catalonia, Spain; Advisor: Dr. Roger Vila; Thesis: *Phylogenetic inference at different insect taxonomic levels*. (Maximum mark: Cum Laude; Award with Special Distinction for best Ph.D. thesis in the Department of Genetics and Microbiology)

2007 – M.Sc. in Genetics, Universitat Autònoma de Barcelona (UAB), Catalonia, Spain. Advisor: Dr. José Castresana; Thesis: *Alignments quality and their impact in phylogenetic analysis* (Maximum mark: 10/10)

2004 – Graduate in Biology, Universitat Autònoma de Barcelona (UAB), Catalonia, Spain.

Fellowships and Appointments

2018 - 2020: Institut de Biologia Evolutiva (IBE, CSIC-UPF), Barcelona, Spain
Butterfly Diversity and Evolution Lab
Juan de la Cierva (Incorporación) Fellowship

2015 - 2018: Institut de Biologia Evolutiva (IBE, CSIC-UPF), Barcelona, Spain
Butterfly Diversity and Evolution Lab
IOF Marie Curie Fellowship

2014 - 2017: Museum of Comparative Zoology (MCZ) & Department of Organismic and Evolutionary Biology (OEB), Harvard University, MA, USA. (laboratory of Prof. Naomi Pierce). IOF Marie Curie Fellowship

2014 - 2015: Museum of Comparative Zoology (MCZ) & Department of Organismic and Evolutionary Biology (OEB), Harvard University, MA, USA. (laboratory of Prof. Naomi Pierce). Beatriu de Pinós Postodoctoral Fellowship

2013 - 2014: Department of Entomology, Faculty of Biology & Soil Science
St Petersburg State University, Russia (laboratory of Prof. Vladimir Lukhtanov)
Postdoctoral Fellow.

2009 - 2012: Museum of Comparative Zoology (MCZ) & Department of Organismic and Evolutionary Biology (OEB), Harvard University, MA, USA. (laboratory of Prof. Naomi Pierce). Visiting PhD Student Fellowship. Awarded by the Spanish Ministry of Science.

2008 - 2012: Institute of Evolutionary Biology (CSIC-UPF), Barcelona, Spain & Department of Genetics and Microbiology Universitat Autònoma de Barcelona (UAB), Spain
PhD Student. Awarded by the Spanish Ministry of Science.

2004 - 2007: Institute of Molecular Biology (CSIC), Barcelona, Catalonia, Spain.
Group of Phylogeny and Computational Evolutionary Biology
Postgraduate Fellowship and MSc Student. Awarded by the CSIC I3P postgraduate program (Spanish Ministry of Science) and the BBVA foundation.

Participation in Research Projects and Grants

1. *In review*: **The genetics of migratory behaviour in butterflies.** *Swedish Research Council FORMAS*. Researchers: Niclas Backström, Gerard Talavera and Roger Vila.

2. *In review*: **Monitoring long-range insect dispersal on high seas: on-board automated trap prototypes for a future VOS global network.** *Spanish Ministerio de Economía y Competitividad (Plan Nacional I+D+I*. EXPLORA). PI: Gerard Talavera.

3. 2018 – 2020: **The longest butterfly migration: monitoring and conservation of the Painted Lady butterfly breeding sanctuaries in tropical Africa.** *National Geographic Society* (Committee for Research and Exploration) (WW1-300R-18). $143,000. PI: Gerard Talavera.

4. 2018 – 2020: **Discovering an adaptive radiation: uncharted butterfly-ant-plant ecological networks in the great South American Plata Basin.** *National Geographic Society* (Committee for Research and Exploration) (WW+224R-17). PI: Lucas Kaminski. $38,315.

5. 2017 – 2018: **The Palaearctic-African butterfly migration system: stable isotope evidence for spring colonization of Europe from the Sub-Sahara by *Vanessa cardui*.** *BES Large Research Grant (British Ecological Society)*. PI: Gerard Talavera. 23,000 €.

6. 2017 – 2019: **Speciation genomics in non-model organisms: exploring the diversification continuum in European butterflies (RADMAR).** (CGL2016-76322-P). *Spanish Ministerio de Economía y Competitividad (Plan Nacional I+D+I)*. Insitute of Evolutionary Biology (IBE), Barcelona, Catalonia, Spain. PI: Roger Vila. 179,080 €.

7. 2017 – 2019: **Chromosome rearrangements in the evolution of moths and butterflies (Lepidoptera)**. *Czech Science Foundation*. Czech Republic. PI: Petr Nguyen. 235,000 €.

8. 2016 – 2017: **Phylogenetic and computational analysis of social brain evolution.** *Boston University, USA*. PI: Sara Arganda. 4,750 €.

9. 2016: **Putnam Expedition Grant.** *Museum of Comparative Zoology, Harvard University*. PI: Gerard Talavera. 8,000 €.

10. 2016 – 2019: **ButterflyNet— an integrative framework for comparative biology** (Award 1541557). *National Science Foundation – GoLife Program (NSF – Division of Environmental Biology)* . The City College of New York, USA. PI: David Lohman. 2,500,000 €

11. 2015 – 2018: **Population dynamics and altitudinal distribution of the butterfly Agalis urticae in a latitudinal gradient: implications from a climate change perspective** (CGL2014-57784-P). *Spanish Ministerio de Economía y Competitividad (Plan Nacional I+D+I)*. Universidad Rey Juan Carlos, Spain. PI: David Gutierrrez Garcia. 150,000 €.

12. 2015 – 2017: **Holarctic Ant Species: Recent dispersal or intercontinental convergent evolution?** *Swiss National Science Foundation*. Switzerland. PI: Sami Schär.

13. 2015: **Putnam Expedition Grant.** *Museum of Comparative Zoology, Harvard University*. PI: Gerard Talavera. 9,500 €.

14. 2015 – 2017: **Eco-PhyloGeo— Linking phylogeography to ecology: extracting rules for butterfly biodiversity at large spatial scale** (H2020-MSCA-IF-2014-EF_658844). *Marie Curie Actions—European Fellowships (EF)*. Scientist in Charge/Coordinator: Roger Vila. Research Fellow: Leonardo Dapporto. 170,122 €.

15. 2014 – 2017: **Dynamics of Mediterranean butterflies in a phylogeographic framework: mapping genetic diversity across time and space (DynaGen)** (CGL2013-48277-P). *Spanish Ministerio de Economía y Competitividad (Plan Nacional I+D+I)*. Institut de Biología Evolutiva (CSIC-UPF), Spain. PI: Roger Vila. 181,500 €.

16. 2014 – 2015: **Deep Africa project: The mystery of the European butterflies vanishing into the Sahara** (9528-1). Committee for Research & Exploration. National Geographic Society. PI: Roger Vila. 20,000 €.

17. 2014 – 2017: **MIGRATION— The most cosmopolitan animal migration: phylogeography and population genomics of the butterfly Vanessa cardui** (FP7-PEOPLE-2013-IOF_622716). Marie Curie Actions— International Outgoing Fellowships (IOF). Scientist in Charge/Coordinator: Roger Vila. Research Fellow: Gerard Talavera. 214,558 €.

18. 2011 – 2013: **Faunal genetic comparison to infer big-scale biogeographical patterns: the colonization of Western Mediterranean islands by butterflies**. (CGL2010-21226/BOS). *Spanish Ministerio de Economía y Competitividad (Plan Nacional I+D+I)*. PI: Roger Vila. 193,600 €.

19. 2010: **Mating Behaviour, Dispersal History and Chromosome Evolution of *Lysandra coridon* (Lepidoptera, Lycaenidae)**. *MBB grants, Harvard University*. PI: Lukas Rieppel. 4,500 €.

20. 2007 – 2009: **Combining morphological, cytological and molecular data to study the taxonomy of the Iberian Rophalocera (Lepidoptera: Hesperioidea + Papilionoidea)**. *Spanish Ministry of Science (Plan Nacional I+D+I)*. PI: Roger Vila. 140,360 €.

21. 2005 – 2008: **Big scale phylogenetic analyses of mammals and birds to study their diversification patterns and rates**. *Spanish Ministry of Science (Plan Nacional I+D+I)*. PI: José Castresana. 40,000 €.

22. 2004 – 2006: **Phylogenomics: the quality of sequence alignments**. *BBVA Foundation*. PI: José Castresana. 40,000 €.

Courses, Meetings, Seminars and Presentations at Congresses

2018 – 8th International Conference on the Biology of Butterflies. Bangalore (India)
Accepted abstracts:

- Oral presentation: *Investigating the worldwide migration of the Painted Lady butterfly (Vanessa cardui) through integrative research*. Gerard Talavera.
- Poster presentation: *A global citizen science project for the worldwide Painted Lady butterfly migration*. Gerard Talavera, Mattia Menchetti, Roger Vila
- Oral presentation: *Genome instability in the blue butterflies (Lycaenidae)*. Nguyen P, Dalíková M, Kreklová M, Koutecký P, Hladová I , Petřvalská K, Vila R, Talavera G

2018 – 3th International Congress – Butterflies of the Middle East. Tel Aviv (Israel)
Invited talk: *Unraveling the worldwide migrations of the Painted Lady butterfly (Vanessa cardui) through integrative research*

2017 – 7th International Barcode of Life conference (iBOL). Kruger National Park (South Africa)
Oral presentation: *Can DNA barcodes helps improve higher-level systematics? Simulations and the Polyommatus blue butterflies (Lepidoptera, Lycaenidae) provide an answer*.

2017 – V Jornadas Nacionales de Lepidopterología. Peguerinos (Ávila), Spain.
Invited talk: *De viaje con Vanessa cardui*

2016 – Ecology, Behaviour and Evolution (EBE) Seminar Series. Boston University
Invited talk: *Palaearctic-African seasonal movements of the most cosmopolitan insect migration: the painted lady butterfly* Vanessa cardui

2016 – North American Butterfly Association Biennial Meeting / Texas Butterfly Festival
Keynote speaker. November 2016, Mission, TX, USA

2016 – Workshop on Population and Speciation Genomics 2016
Cesky Krumlov, Czech Republic

2015 – V Encuentro de Lepidoptera Neotropicales (ELEN)
Tucuman, Argentina
Oral Presentation: *Barren in the Promised land: The biogeographic history of the relict Brazilian butterfly Elkalyce cogina (Lycaenidae)*
Poster Presentation: *Ancient Neotropical origin and recent recolonisation: Phylogeny, biogeography and diversification of the Riodinidae (Lepidoptera: Papilionoidea).*

2015 - Butterfly Weekend - Boston Museum of Science
Guest Research Presentation: *A marvelous migration*

2014 - 7th International Conference on the Biology of Butterflies.
Turku University, Finland
Poster presentation: *Making phylogenetically comprehensible the hyperdiverse Polyommatina butterflies*
Poster presentation: *DNA barcoding of Iberian butterflies enables a continental-scale assessment of potential cryptic diversity*

2014 - 1st Congress of Insects in Qatar. Doha, Qatar
Invited talk: *Exploring insect diversity through molecular systematics: phylogenetic and spatial biodiversity surveys of butterfly fauna*

2014 - Workshop on Landscape Genetics
Göttingen, Germany (Awarded by the Volkswagen Foundation)

2014 - Workshop on Genomics 2014
Cesky Krumlov, Czech Republic

2013 - Thematic School on Advanced methods in Neotropical Biogeography
Kourou, French Guiana. (Awarded by CEBA - Centre d'étude de la biodiversité amazonienne)

2013 - II Iberian Congress of Biological Systematics. Barcelona, Catalonia, Spain
Oral presentation: *Improving the knowledge of root, branches and leaves of the hyperdiverse Lycaenidae + Riodinidae tree*

2013 - 5th Central European Workshop of Myrmecology.
University of Innsbruck, Austria.
Oral Presentation: *Discovered just before extinction? The first endemic ant from the Balearic Islands endangered by climate change.*

2013- XIII Jornada de Biologia Evolutiva
Societat Catalana de Biologia Evolutiva, Barcelona, Spain
Oral Presentation: *Descoberta just abans de l'extinció? La primera formiga endèmica de les Illes Balears amenaçada pel canvi climàtic.*

2012 - First Joint Congress on Evolutionary Biology
Ottawa, Ontario, Canada
Poster presentation: *Exploring ecological causes behind the Palaeartic radiation of the Polyommatus blues*.

2012 - Biodiversity Informatics Training Workshop (BITW) (VertNet)
University of Colorado (USA) *(Awarded by the Vertnet project)*

2011 - CEE Symposium on "Integrating Ecology into Macroevolutionary Research"
Zoological Society of London
Poster presentation: *Exploring ecological causes behind the Palaeartic radiation of the Polyommatus blues*. Talavera, G., Lukhtanov, VA., Pierce, NE., Vila, R.

2010 - 6th International Conference on the Biology of Butterflies
Universidad de Alberta, Canada
Poster presentation: *How common are dot-like distribution ranges? Taxonomical oversplitting in Western European Agrodiaetus (Lepidoptera, Lycaenidae) revealed by chromosomal and molecular markers*.

2010 - Workshop on Molecular Evolution 2010
23th July to 12th of August of 2010. MBL - Woods Hole, MA (USA)

2009 - Mutualism (5th Annual Harvard Plant Biology Symposium)
Harvard University

Mentoring:

Supervision of students

- Joan Carles Hinojosa (PhD Student – Co-supervisor): "Speciation genomics in non-model organisms: exploring the diversification continuum in European butterflies. University of Barcelona. (2018-present)
- Nina Sokolov (Intern Student): Next-Gen Sequencing. Harvard University. 4 months (2016)
- Sarah Guth (Intern Student): Animal behavior. Harvard University. 4 months (2015)
- Patricia Gimenez (Final year project): "Testing hybridization events in the alpine Erebia butterflies". University of Barcelona. 2016.
- Jignasha Rana (Pre-Grad School Research project): "Exploring cryptic diversity in North American ants using molecular-based methods". Harvard University. 2015
- Monica Navarro (Minor thesis): "A new cryptic species of butterfly in the European mountains". University of Barcelona. 2013.

Fieldwork

- 2018: Butterfly diversity and tracking migrants in Cameroon
- 2018: Butterfly diversity and tracking migrants in Ghana
- 2017: Butterfly diversity and tracking migrants in Uganda
- 2017: Butterfly diversity and tracking migrants in Kenya
- 2017: Butterfly diversity and tracking migrants in South Africa
- 2017: Butterfly diversity and tracking migrants in Morocco
- 2016: Butterfly diversity and tracking migrants in Crete (Greece)
- 2016: Butterfly diversity and tracking migrants in SE Asia, China and Japan
- 2016: Butterfly diversity and tracking migrants in Hawaii
- 2015: Ant-Butterfly interactions in Argentina
- 2015: Butterfly diversity and tracking migrants in Northern and Central Mexico
- 2015: Butterfly diversity and tracking migrants in Dominican Republic
- 2015: Butterfly diversity and tracking migrants in Northern, Central US and Canada
- 2015: Butterfly diversity and tracking migrants in Namibia

- 2015: Butterfly diversity and tracking migrants in California and Arizona
- 2014: Butterfly and Ant diversity of S Ethiopia
- 2014: Butterfly and Ant diversity of Senegal
- 2014: Butterfly and Ant diversity of Benin
- 2014: Butterfly and Ant diversity of Chad
- 2014: Butterfly and Ant diversity of N Ethiopia
- 2014: Butterfly and Ant diversity of Qatar
- 2013: Butterfly and Ant diversity of French Guiana
- 2013: Butterfly and Ant diversity of NE USA
- 2013: Butterfly and Ant diversity of Oman
- 2012: Ant diversity of the Balearic Islands
- 2011: Butterfly population tracking in Germany
- 2011: Butterfly diversity of NE Kazakhstan and Altai Mountains
- 2010: Butterfly diversity of W Canada
- 2009: Butterfly and Ant diversity of the Balearic Islands

Others:

Reviewer for: Commitee for Research and Exploration Reviewer Circle (National Geographic Society) National Science Foundation (NSF, USA), Scientific Reports, Gene, Journal of Biogeography, BMC Evolutionary Biology, Methods in Ecology and Evolution, Plos ONE, Ecological Research, Molecular Phylogenetics and Evolution, Genome, Biological Journal of the Linnean Society, Zoological Journal of the Linnean Society, Comparative Cytogenetics, Journal of Insect Conservation, Organisms Diversity and Evolution, European Journal of Entomology.

Scientific Affiliations: Commitee for Research and Exploration (National Geographic Society), European Society for Evolutionary Biology (ESEB), British Ecological Society, The Systematics Association, Cambridge Entomological Club, Spanish Society for Evolutionary Biology (SESBE), Asociación Ibérica de Mirmecología.

Outreach and public impact: My research has been regularly highlighted in the media by renowned publishers as National Geographic, BBC Earth, ScienceNews and The Guardian, as well as by numerous other papers, both in press and online from multiple countries and in multiple languages (see www.gerardtalavera.com/outreach.html). I have also been interviewed on radio programs and I am regularly invited to give public outreach talks. I am committed to the outreach programs and strategies of the institutions that I belong, being an active contributor. I am also active at social media and currently leading a global citizen science project (www.butterflymigration.org).

Languages: Catalan (native), Spanish (native), English (fluent), French (basic), Portuguese (basic).

Publication List

28) **Talavera G***, Bataille C*, Benyamini D, Gascoigne-Pees M, Vila R **(2018)**. *Round-trip across the Sahara: Afrotropical Painted Lady butterflies recolonize the Mediterranean in early spring*. **Biology Letters.** *Accepted* (*co-first authors)

27) Suchan T*, **Talavera G***, Sáez L, Ronikier M, Vila R **(2018)**. *Pollen metabarcoding as a tool for tracking long-distance insect migration*. **bioRxiv.** DOI**:** https://doi.org/10.1101/312363 (*co-first authors). *Submitted to* **Molecular Ecology Resources**

26) Schar S*, **Talavera G***, Espadaler X, Rana JD, Andersen A, Cover SP, Vila R. *Do Holarctic ant species exist? Trans-Beringian dispersal and homoplasy in the Formicidae*. **(2018) Journal of Biogeography**. *In Press*

25) Schar S, Eastwood R, Arnaldi K, **Talavera G**, Boyle J, Espeland M, Nash D, Vila R, Pierce N. *Ecological specialization drives diversification in the ant-associated butterfly family Lycaenidae*. **Proceedings of the Royal Society B**. *In review*

24) Espeland M, Breinholt J, Willmott KR, Warren AD, Vila R, Toussaint EFA, Maunsell SC, Aduse-Poku K, **Talavera G**, Eastwood R, Jarzyna MA, Ries L, Guralnick R, Lohman DJ, Pierce NE, Kawahara AY. **(2018)** *Comprehensive higher-level phylogeny of butterflies (Papilionoidea) inferred from genomic data*. **Current Biology** 28(5):770-778.

23) Gilbert KJ, Nitta JH, **Talavera G**, Pierce N. **(2018)** *Ecological correlates of the evolution of pitcher traits in the genus* Nepenthes *(Caryophyllales)*. **Biological Journal of the Linnean Society** 123(2): 321-337

22) Dincă V, **Talavera G**, Vila R. **(2017)** *First record of Euchloe tagis (Hübner, 1804) in the province of Tarragona (Catalonia, Spain) based on morphology and DNA data (Lepidoptera: Pieridae)*. **Butlletí de la Societat Catalana de Lepidopterologia**, 107: 7-15.

21) Stefanescu C, Soto DX, **Talavera G**, Vila R, Hobson K **(2016)**. *Long-distance autumn migration across the Sahara by painted lady butterflies: exploiting resource pulses in the tropical savannah.* **Biology Letters**. DOI: 10.1098/rsbl.2016.0561

20) **Talavera G**, Vila R. **(2016)**. *Discovery mass migration and breeding of the painted lady butterfly* Vanessa cardui *in the Sub-Sahara: the Europe-Africa migration revisited*. **Biological Journal of the Linnean Society**. DOI: 10.1111/bij.12873

19) Hernández-Roldán J, Dapporto L, Dincă V, Vicente JC, Hornett EA, Šíchová J, Lukhtanov V, **Talavera G**, Vila R **(2015)** *Integrative analyses unveil speciation linked to host plant shift in* Spialia *butterflies*. **Molecular Ecology** 25: 4267-4284.

18) **Talavera G**, Kaminski LA, Freitas AVL, Vila R. **(2015)** *One note samba: The biogeographical history of the relict Brazilian butterfly,* Elkalyce cogina. **Journal of Biogeography** 43: 727-737.

17) Dincă V, Montagud S, **Talavera G**, Hernández-Roldán J, Munguira M, García-Barros E, Hebert P, Vila R. (2015) *DNA barcode reference for Iberian butterflies enables a continental scale preview of potential cryptic diversity*. **Scientific Reports** 5, 12395.

16) Espeland M, Hall JP, DeVries PJ, Lees DC, Cornwall M, Hsu YF, Campbell DL, **Talavera G**, Vila R, Salzman S, Ruehr S, Lohman DJ, Pierce NE **(2015)**. *Ancient Neotropical origin and recent recolonisation: Phylogeny, biogeography and diversification of the Riodinidae (Lepidoptera: Papilionoidea)*. **Molecular Phylogenetics and Evolution** 93:296-306

15) Dinca V, Backström N, Dapporto L, Friberg M, García-Barros E, Hebert PDN, Hernández-Roldán J, Hornett E, Lukhtanov V, Marec F, Montagud S, Munguira ML, Olofsson M, Sichova J, Talavera G, Vicente-Arranz V, Vila R, Wiklund C **(2015)**. *DNA barcodes highlight unique research models in European butterflies*. **Genome** 58:391.

14) Kaliszewska ZA, Lohman DJ, Sommer K, Adelson G, Rand DB, Mathew J, **Talavera G**, Pierce NE **(2015)** *When caterpillars attack: biogeography and life history evolution of the Miletinae (Lepidoptera, Lycaenidae)*. **Evolution** 69: 571-588.

13) **Talavera G**, Espadaler X, Vila R **(2014)**. *Discovered just before extinction? The first endemic ant species from the Balearic islands* (Lasius balearicus) *endangered by climate change*. **Journal of Biogeography** 42: 589-601.

12) **Talavera G**, Lukthanov VA, Rieppel L, Pierce NE, Vila R **(2013)**. *In the shadow of phylogenetic uncertainty: the recent diversification of the Lysandra butterflies through chromosomal change*. **Molecular Phylogenetics and Evolution** 69(3):469-478.

11) **Talavera G**, Dinca V, Vila R **(2013)**. *Factors affecting species delimitations with the GMYC model: insights from a butterfly survey*. **Methods in Ecology and Evolution** 4(12):1101-1110.

10) Dapporto L, Ramazzotti M, Fattorini S, **Talavera G**, Vila R, Dennis RLH **(2013)**. *recluster: an unbiased clustering procedure for beta-diversity turnover*. **Ecography** 36(10):1070-1075.

9) Sañudo-Restrepo CP, Dinca V, **Talavera G**, Vila R **(2013)**. *Biogeography and systematics of Aricia butterflies (Lepidoptera, Lycaenidae).* **Molecular Phylogenetics and Evolution** 66:369-379.

8) **Talavera G**, Lukthanov VA, Pierce NE, Vila R. **(2013)**. *Establishing criteria for higher level taxonomic classification using molecular data: the systematics of Polyommatus blue butterflies (Lepidoptera,Lycaenidae)*. **Cladistics** 29:166-192.

7) **Talavera G**, Vila R. **(2011)**. *What is the phylogenetic signal limit from mitogenomes? The reconciliation between mitochondrial and nuclear data in the Insecta Class phylogeny*. **BMC Evolutionary Biology** 11:315. #HighlyAccessed

6) Hernandez-Roldán JL, Múrria C, Romo H, **Talavera G**, Zakharov E, Hebert PDN, Vila R. **(2011)**. *Tracing the origin of disjunct distributions: a case of biogeographical convergence in Pyrgus butterflies*. **Journal of Biogeography** 30(10): 2006-2020.

5) Dinca V, Lukhtanov VA, **Talavera G**, Vila R. **(2011)**. *Unexpected layers of cryptic diversity in wood white Leptidea butterflies*. **Nature Communications** 2:324.

4) Lukhtanov VA, Dinca V, **Talavera G**, Vila R. **(2011)**. *Unprecedented within-species chromosome number cline in the Wood White butterfly, Leptidea sinapis, and its significance for karyotype evolution and speciation*. **BMC Evolutionary Biology** 11:109. #HighlyAccessed

3) Vila R, Lukhtanov VA, **Talavera G**, Gil-T F, Pierce NE. **(2010)**. *How common are dot-like distribution ranges? Taxonomical oversplitting in Western European Agrodiaetus (Lepidoptera, Lycaenidae) revealed by chromosomal and molecular markers.* **Biological Journal of Linnean Society** 101:1(130-154).

2) Soria-Carrasco V, **Talavera G**, Igea J, Castresana J. **(2007)**. *The K tree score: quantification of differences in the relative branch length and topology of phylogenetic trees*. **Bioinformatics** 23, 2954-2956.

1) **Talavera G**, Castresana J. **(2007)**. *Improvement of phylogenies after removing divergent and ambiguously aligned blocks from protein sequence alignments*. **Systematic Biology** 56, 564-577.

Other Publications (Non-ISI)

Sáez L, **Talavera, G.** 2010. *Redescubrimiento de* Woodsia pulchella *en el macizo de Pedraforca: la compleja evaluación de la escalada clásica sobre la población de una especie amenazada.* **Conservación Vegetal,** 14: 21-23.

Talavera, G. 2012. *Phylogenetic inference at different insect taxonomic levels.* Doctoral thesis, Universitat Autònoma de Barcelona, 365 pp.