FINAL REPORT

Developing conservation strategies for the critically endangered *Acrostira euphorbiae* (Orthoptera: Pamphagidae) facing the alteration of its habitat

Grupo de Investigaciones Entomológicas

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INTRODUCTION

La Palma Stick Grasshopper (*Acrostira euphorbiae*) is only known from the island of La Palma (Canary Islands, Spain), where it has a highly reduced distribution area, mostly included in the protected natural space of Tamanca, in the southwestern part of this island (see Morales *et al.* 2010).

This species is found in dry shrublands dominated by the endemic plant E*uphorbia lamarckii*. Field observations indicate that *Acrostira euphorbiae* strictly depends on its only known host plant (*Euphorbia lamarckii*), the dominant shrub in the highly reduced distribution area of this grasshopper. *Acrostira euphorbiae* is a flightless species of the family Pamphagidae, with a reduced jumping capacity due to its heavy body and weak hind limbs compared to other grasshoppers. It is therefore a species with low dispersal ability, being strongly affected for any threat on its habitat. In the last decades, populations of *Acrostira euphorbiae* have had an important decline mainly due to the alteration of its habitat (wildfire, illegal logging of vegetation, and grazing), that has affected both this grasshopper and its host plant. As a result of this situation, *Acrostira euphorbiae* is included as "Endangered" in both the Spanish National and the Canary Regional official lists of threatened species, this being the maximum category of threat in these catalogues. Furthermore, this species has recently been assessed as Critically Endangered in the IUCN Red List (Jakobs, 2012). The recovery plans for this grasshopper should include captive breeding programs to strengthen populations, in addition to adequate restoration of its degraded habitat.

OBJECTIVES

To clarify the trophic preferences of *Acrostira euphorbiae* and their ecological implications both in altered and non-altered areas are key objectives for correct conservation policies. To accomplish the study we have considered the following objectives:

1. To know the seasonal diet of *Acrostira euphorbiae* by means of microhistological analysis of their faeces, in order to test if this grasshopper is really monophagous or polyphagous.

2. To clarify the trophic preferences of *A. euphorbiae* with experiments of selection, to check whether they depend on the relative abundance or on the nutritional quality of the plant species available in its habitat.
3. To test if the habitat alteration cause negative effects on the populations of *A. euphorbiae.* For such purpose we will check if this grasshopper is capable to feed on the remaining plants in the altered habitat, and if these plants afford them enough nutrients for survival.
4. To design the habitat restoration according these results.

ACTIVITIES CARRIED OUT AND DEGREE OF ACHIEVEMENT OF THE PROPOSED OBJECTIVES

1. Selection of the localities for the study

Sampling areas with altered habitat and others with well preserved habitat were searched, within the distribution range of *Acrostira euphorbiae*, in order to test if the habitat alterations cause negative effects on the populations of this grasshopper. However, it was not possible to find specimens in altered areas, so areas with high densities of *A. euphorbiae* and with the most disparate vegetation among them were finally selected to test if the floristic composition has repercussions on its diet. The two types of areas were i) **Euphorb shrubland,** a spurge shrubland highly dominated by *Euphorbia* species, and ii) **Euphorb shrubland with pine,** a mixed vegetation with *Euphorbia* shrubs and *Pinus canariensis* trees. Since not any **Euphorb shrubland** area was detected with enough grasshopper density to cover the project objectives, the number of sampling areas was increased to four localities within the "Euphorb shrubland" habitat type (Table 1, Figure 1).

Table 1. Localities with populations of *Acrostira euphorbiae* studied during the project development. The code, type of habitat, and location are indicated for each locality.

Code	Habitat	Locality	UTM coordinates	
			X	Y
1	Euphorb shrubland with pine	Pinos-Tamanca	218929	3161594
2	Euphorb shrubland	Acantilado-Tamanca	218511	3161270
3	Euphorb shrubland	Torreón-Tamanca	218322	3162235
4	Euphorb shrubland	Hornito-Tamanca	217954	3163309
5	Euphorb shrubland	Lanzadera	216070	3165561

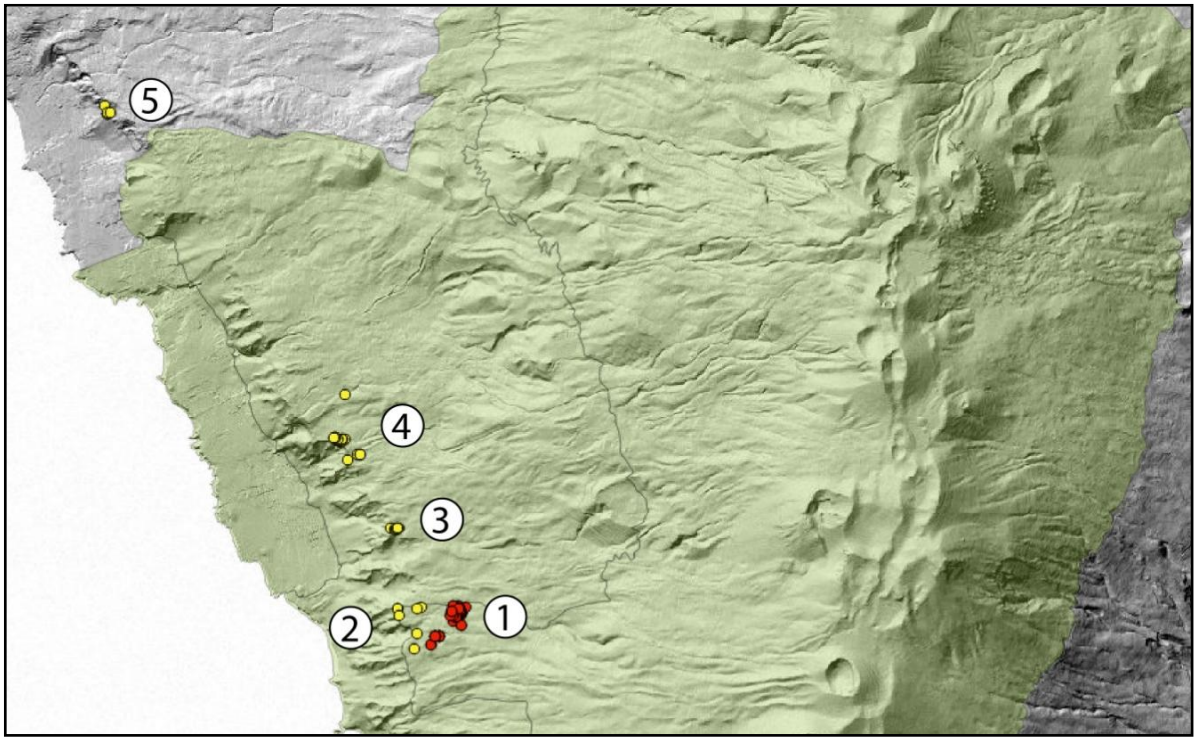

Figure 1. Distribution of the observed / collected specimens of *Acrostira euphorbiae* along the project. The specimens from **Euphorb shrubland** are identified with yellow dots, and those from **Euphorb shrubland with pine** by red dots. Each sampled locality is represented by a numeric code. The protected spaces are highlighted in green, and the unprotected areas in grey.

Pinos-Tamanca was selected as a **Euphorb shrubland with pine** locality (Table 1, Figure 2). This is mostly included in Cumbre Vieja Natural Park, bordering the protected natural space of Tamanca (Figure 1). This locality is located between a pine forest and a **Euphorb shrubland**, reason for which plant species of both vegetal formations are found therein. The dominant species in this plot are *Euphorbia lamarckii*, *Retama rhodorhizoides* and *Pinus canariensis* (Figure 2), although there is a number of other accompanying plants (see Figure 4).

Figure 2. General and close aspects of the most abundant plant species in the study area. A: *Euphorbia lamarckii*, B: *Retama rhodorhizoides* and C: *Pinus canariensis.*

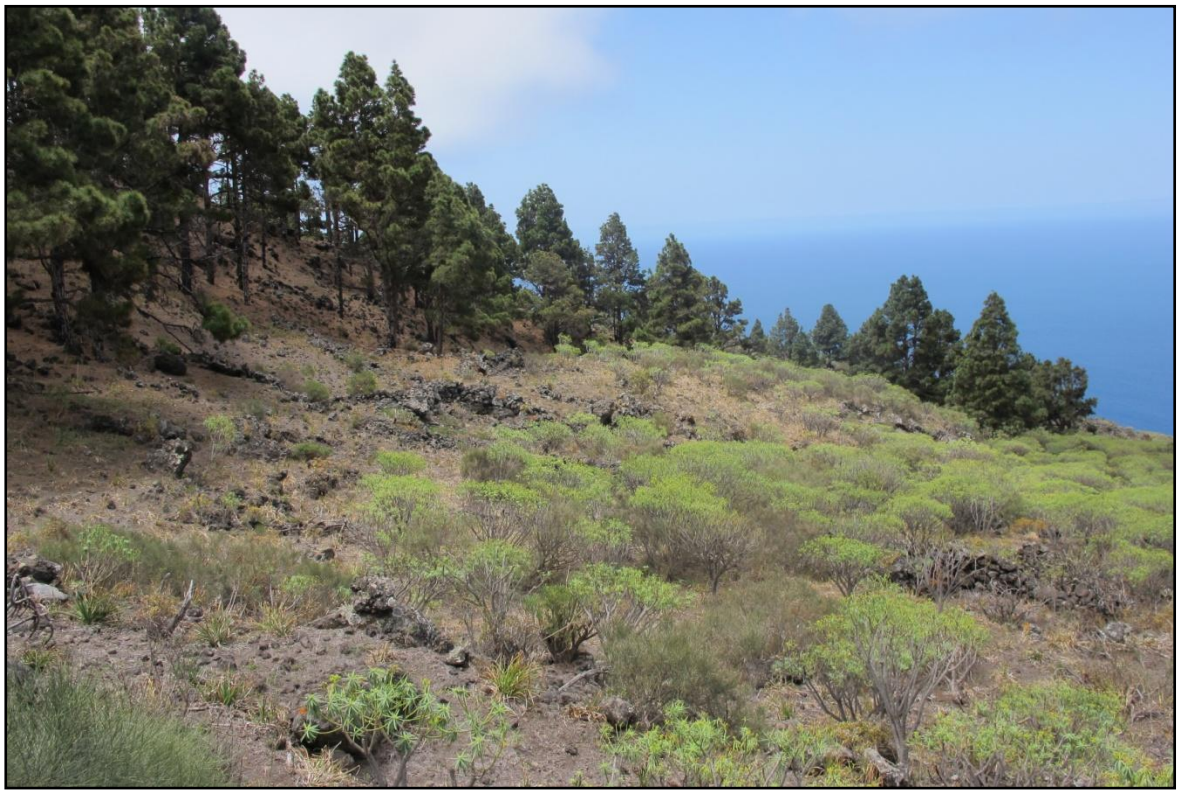

Figure 3. General view of Pinos-Tamanca locality.

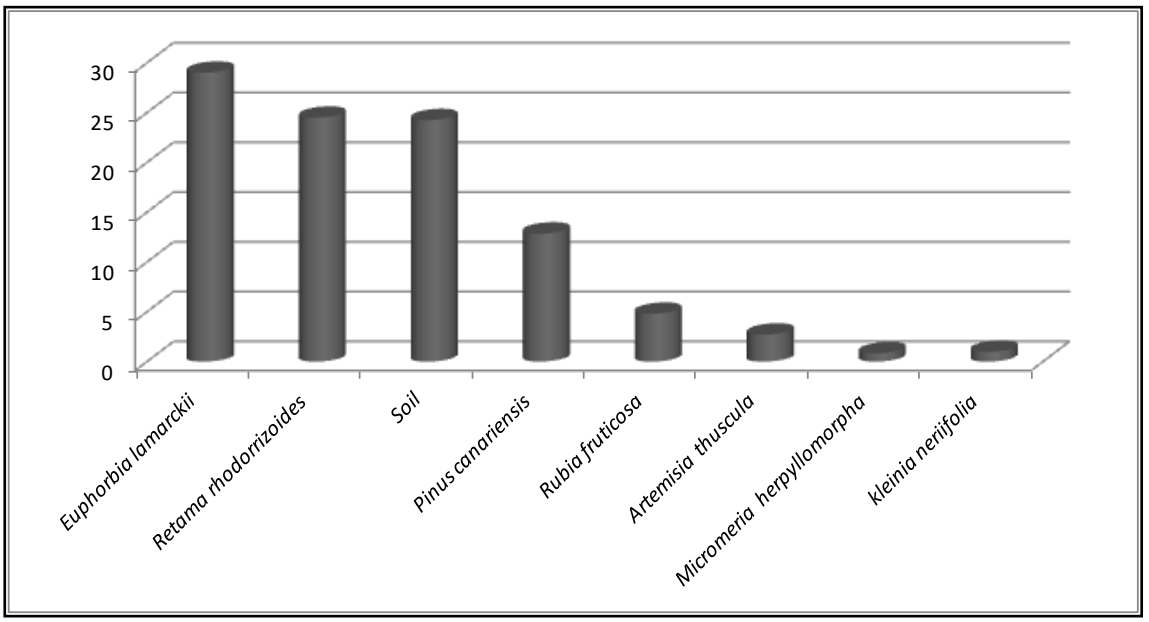

Figure 4. Plant cover, expressed in percentages, in **Euphorb shrubland** with pine.

Regarding the **Euphorb shrubland** areas, localities 2, 3 and 4 are mainly included in the protected natural space of Tamanca. These plots present similar characteristics being dominated by *Euphorbia lamarckii*, *Kleinia neriifolia* and *Retama rhodorhizoides*

(Figure 5-7). In addition, there are other plant species detected in vegetation transects (see Figure 8).

Figure 5. General view of Torreón-Tamanca locality.

Figure 6. General view of Hornito-Tamanca locality.

Figure 7. General view of Acantilado-Tamanca locality.

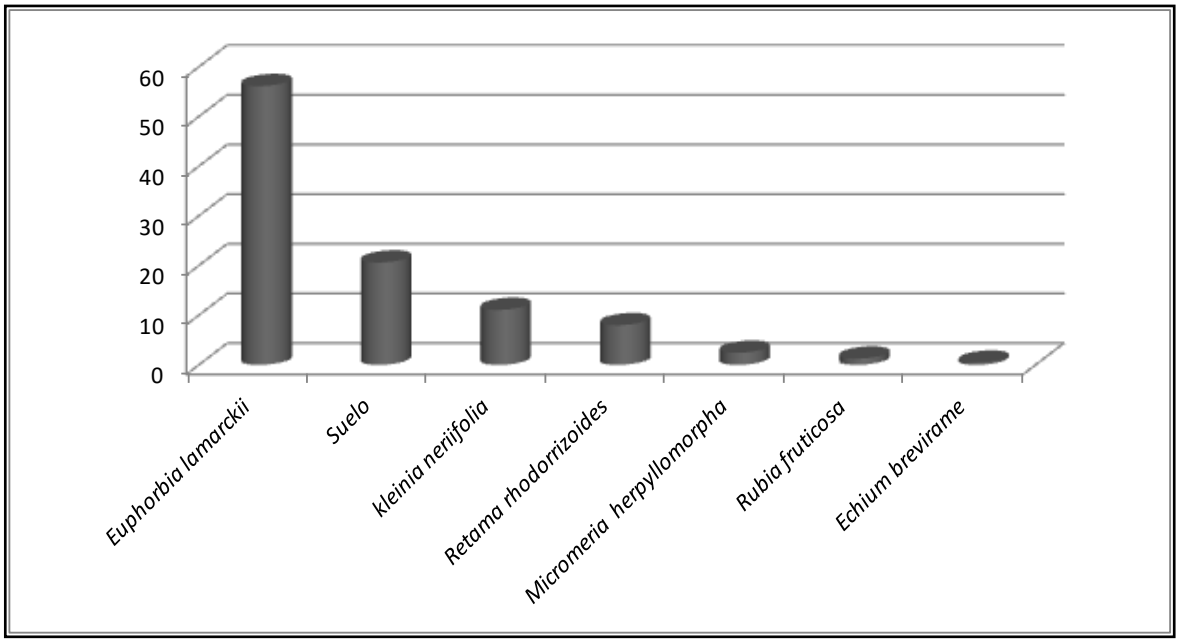

Figure 8. Plant cover, expressed in percentages, in the **Euphorb shrubland** localities 2-4.

The number of specimens was not enough to achieve the proposed objectives, and then a new **Euphorb shrubland** locality -La Lanzadera- was selected, being located northwards and outside protected natural areas (Table 1, Figure 1). This plot has a

greater slope and a lower plant cover, and it harbors slightly different plant species typical from more humid environments, (Figure 9).

Figure 9. General view of Lanzadera locality.

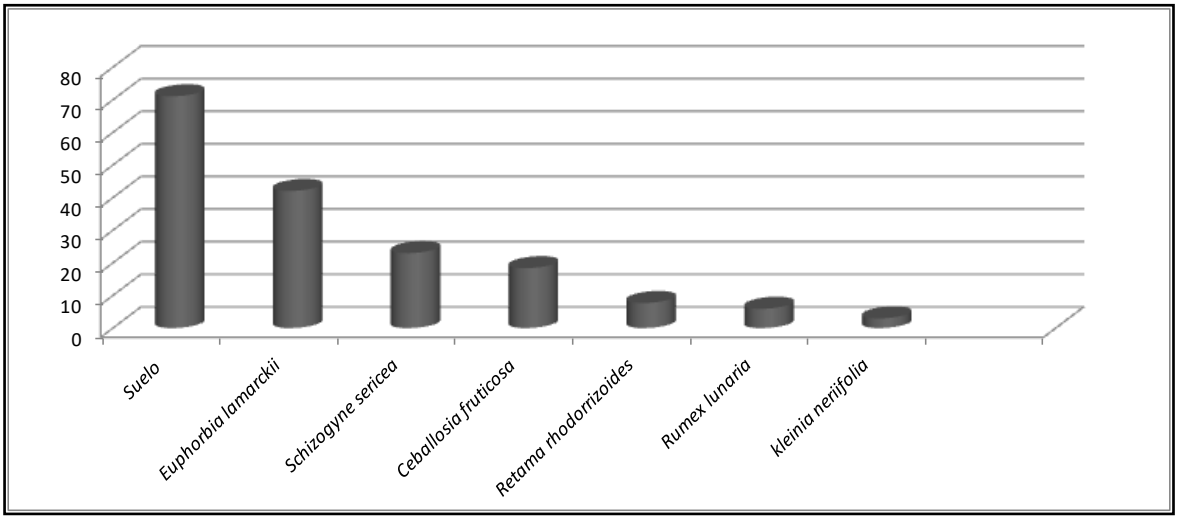

Figure 10. Plant cover, expressed in percentages, in the **Euphorb shrubland** locality 5.

2. Searching specimens of *Acrostira euphorbiae*

Like the rest of Canarian pamphagids, this species mimics extraordinarily and moves very slowly, for which it is difficult to detect its movements. Also characteristic of its behavior is to rotate around the branch on which it stands when it perceives some near activity, interposing the branch between itself and the subject of the movement; In this way it hides from the sight of any stranger, making very difficult its localisation (Figures 11-13). In order to increase the success detecting *A. euphorbiae* specimens, the used sampling technique was with two observers per plant at the same time, which allows detecting the individuals that move hiding of one of the observers (Figure 14). According to our previous experience with this species and with the rest of Canarian pamphagids we chose to search mainly on the plant species susceptible to harbor the grasshoppers, namely *Euphorbia lamarckii*, *Retama rhodorhizoides*, *Pinus canariensis*, *Kleinia neriifolia*, *Adenocarpus* spp., and *Echium brevirame.*

Figure 11. Female of *Acrostira euphorbiae* hiding behind a spurge branch.

Figure 12. Male of *Acrostira euphorbiae* on a *Euphorbia lamarckii* stem.

Figure 13. *Acrostira euphorbiae* nymph camouflaged on a trunk of *Euphorbia lamarcki*.

Figura 14. Searching specimens of *Acrostira euphorbiae.* Two observers looking for specimens from opposite sides of a plant at the same time, which allows detecting the individuals that move hiding of one of the observers.

A total of 107 specimens were observed, 41 from **Euphorb shrubland** and 66 from **Euphorb shrubland with pine** (Figure 15).

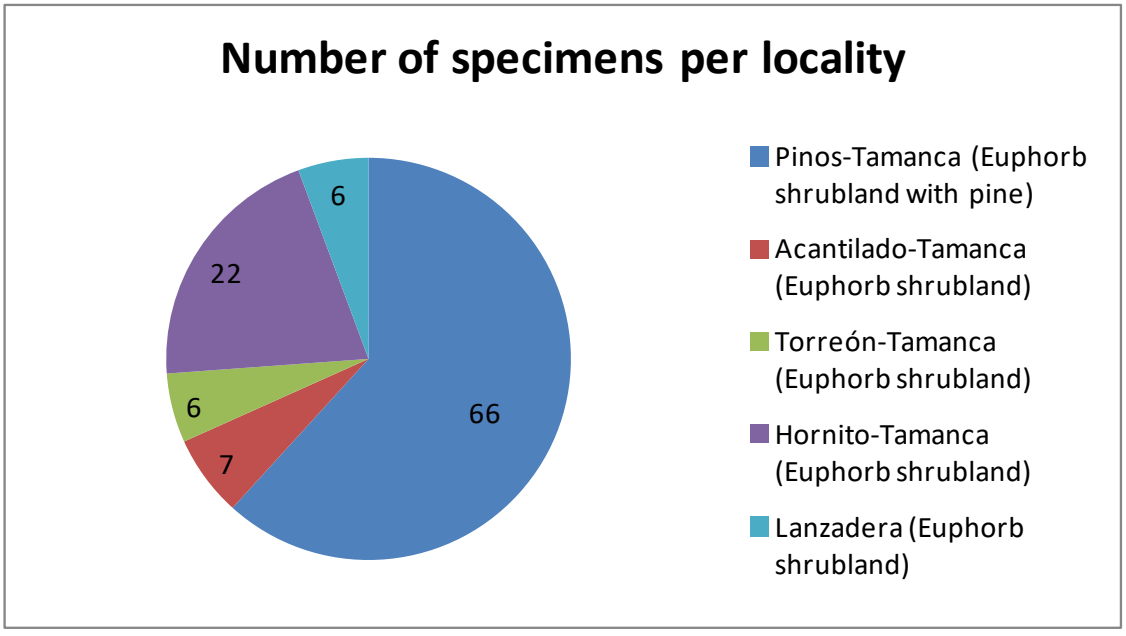

Figure 15. Number of specimens of *Acrostira euphorbiae* observed in each locality.

The distribution area of the grasshopper *A. euphorbiae*, mainly the Tamanca area, has undergone ecological alterations in the last years due to illegal logging of *E. lamarckii*, grazing by goats, and some wildfires like that in 2009. Moreover, again in 2016 a new wildfire has reached several locations where previously populations of this grasshopper had been detected. Despite our attempts, it was impossible to establish study plots in areas with the mentioned conditions. On one hand, the presence of this grasshopper was not detected in areas with illegal logging, making impossible to compare with a **Euphorb shrubland** without affections. On the other hand, in **Euphorb shrubland with pine** it was not possible to establish plots without fire affection, since all localities of this habitat had been disturbed by the 2009 fire. Therefore, we decided to differentiate only between **Euphorb shrubland** and **Euphorb shrubland with pine** localities. All these inconveniences are also a consequence of the reduced distributional area of this species.

With respect to its potential nutrient plants, the presence of this grasshopper has been observed on three plant species in these localities during the study. As we expected, specimens were detected on *Euphorbia lamarcki* (Figure 16), a plant on which it had previously been observed and that is presumably its main host-plant. Moreover, grasshoppers were found for the first time on *Retama rhodorhizoides* and *Pinus canariensis* (Figures 17 and 18), which would expand the list of possible nutrient plants.

Figure 16. Adult female of *Acrostira euphorbiae* detected on *Euphorbia lamarcki.*

Figure 17. Adult female of *Acrostira euphorbiae* detected on *Pinus canariensis.*

Figure 18. Adult female of *Acrostira euphorbiae* detected on *Retama rhodorhizoides.*

Figure 19. Nymph of *Acrostira euphorbiae* feeding on *Euphorbia lamarckii* in Tamanca. A gnawed leaf is clearly observed at right.

During the present study, in addition to its detection on these three plant species already mentioned, it was confirmed that *Acrostira euphorbiae* feeds in the wild, at least, on *Euphorbia lamarckii* (Figure 19).

The captured specimens were always released on their corresponding plot, either after 24 hours in captivity to collect the excrements of their last intake in the nature, or after longer periods for the experiments of trophic preferences. In addition, the eggs layed by females in captivity were buried in suitable areas within the same plot where their progenitors were previously captured (Figure 20).

Figure 20. Egg pods of *Acrostira euphorbiae* layed by females kept in captivity, ready to be buried in the study plots at the end of the lab experiments.

Consequently, the level of achievement of this activity was very high, since all planned actions were successfully accomplished, except finding affected localities (either by illegal logging or by fires) with a sufficient density of grasshoppers.

3. Diet study by microhistological analysis of the excrements

A total of 59 from **Euphorb shrubland** and 40 excrements were analyzed from **Euphorb shrubland with pine** (Figure 21).

Figure 21. The *Acrostira euphorbiae* specimens after feeding in the natural environment (A) remove excrement in pellets (B). The striking sexual dimorphism of this species is also evident in their pellets, much larger in females than in males (C).

The results shown that *Euphorbia lamarcki* was the most consumed plant species in *Acrostira euphorbiae* natural area (76.1%), but also the presence of *Retama rhodorhizoides* and *Pinus canariensis* was detected in the faeces, although in a lesser amount (19.6% and 4.3%, respectively, Figure 22). The results of the microhistological analysis indicate that these endemic grasshoppers are not monophagous as previously believed. They do not consume exclusively *E. lamarckii*, their only host plant considered hitherto, but they also feed on two other plant species present in their habitat.

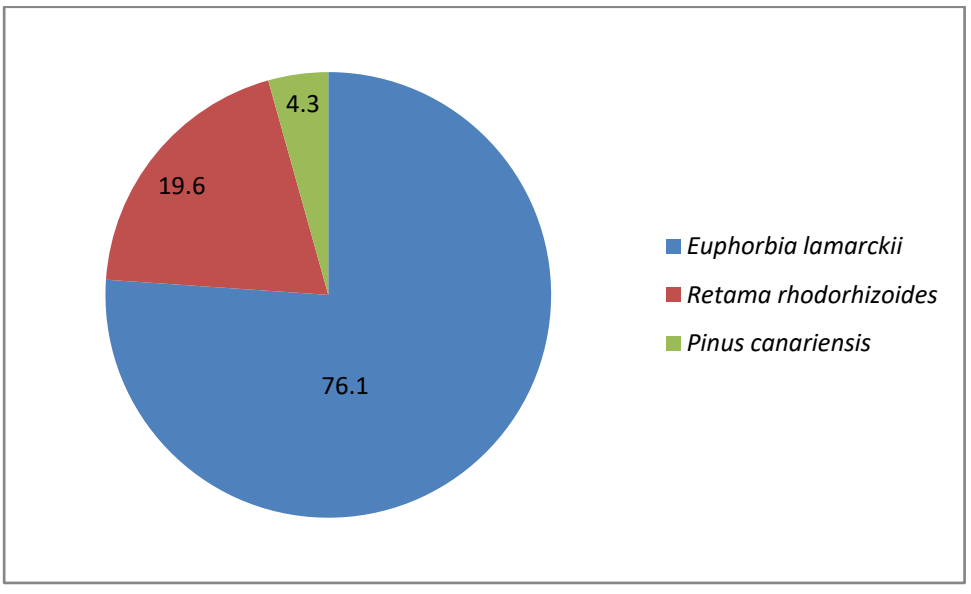

Figure 22. Percentages of different plant species found in the diet of *Acrostira euphorbiae*.

According to each habitat, we could observe that in **Euphorb shrubland** localities they feed mainly on *Euphorbia* (88.9%) and to a lesser extent on *Retama* (Figure 23).

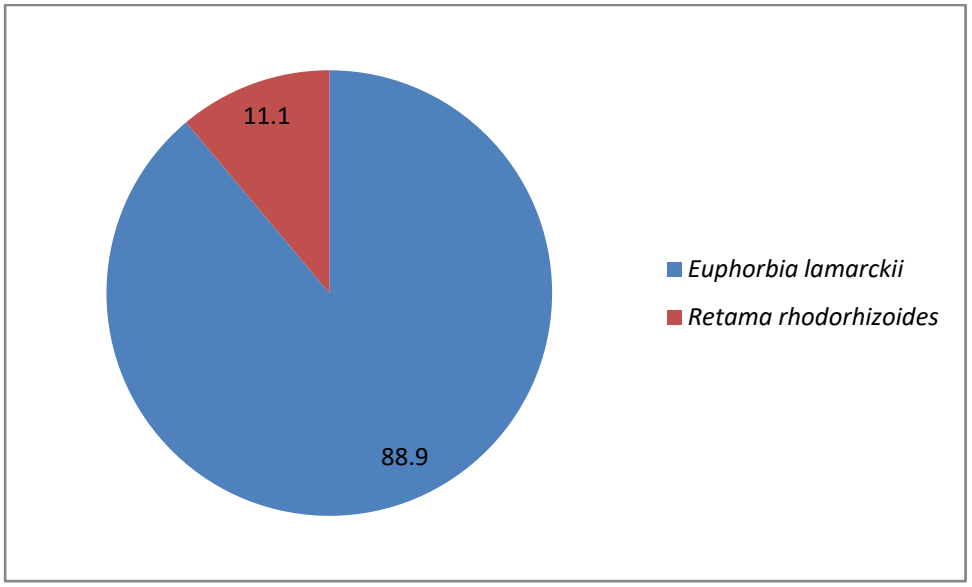

Figure 23. Percentages of the different plant species in the diet of *Acrostira euphorbiae* in **Euphorb shrubland**.

However, in **Euphorb shrubland with pine** localities they present a more varied diet: although *E. lamarckii* was also the most consumed (67.8%), *Retama* has been detected in 25% of the excrements and *Pinus* in a 7.2 % (Figure 24).

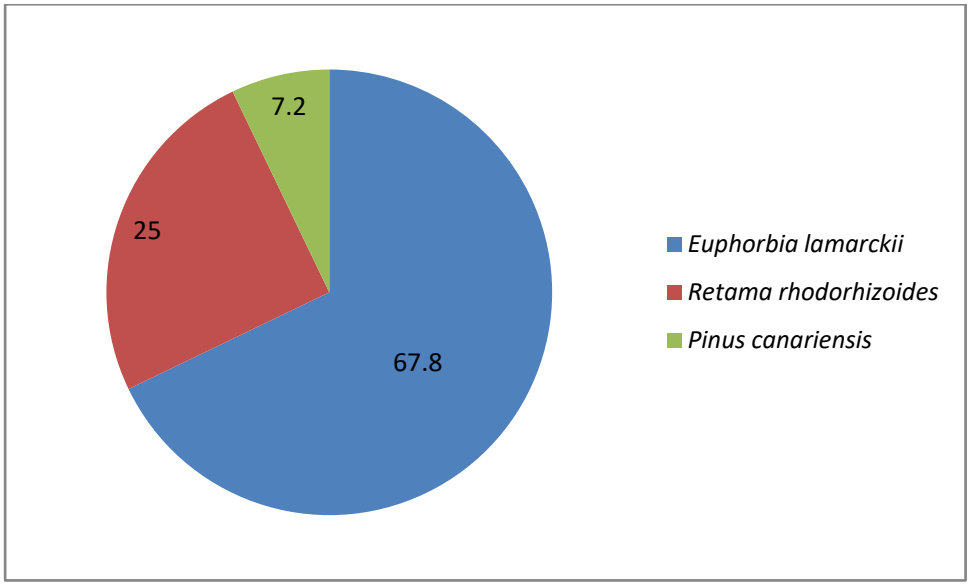

Figure 24. Percentages of the different plant species in the diet of *Acrostira euphorbiae* in **Euphorb shrubland with pine**.

The degree of accomplishment of this activity has been of 100%, since all the proposed objectives were completed.

4. Experiments of trophic preferences

Once the composition of the diet of *Acrostira euphorbiae* was known in each selected habitat (Euphorb shrubland with and without pine), a series of trophic preference experiments were carried out. In these experiments we used only females, which were kept in captivity for this period. In order to check if their trophic preferences varied in each habitat, after a starvation period of the grasshoppers the three plant species found in their diet were supplied in equal proportion (3 grams). In addition, three other experiments were carried out by supplying these plants in varying proportions (3 g *vs* 1 g *vs* 1 g, Figure 25) in order to detect if their trophic preferences were correlated with the available biomass of each plant,.

Figure 25. View of the interior of a terrarium during an experiment of trophic preference. The three plant species previously detected in their diet can be observed, supplied in different proportions.

All experiments lasted for a period of seven days. At each treatment (day) fresh plants were afforded in the afternoon, they were fed on during the night, and in the morning the unconsumed remains were removed for analytical processing. Fresh plants were collected daily, weighed, and after the experiments of preference they were dried at 80 °C in an oven for two days, and then reweighed to obtain their dry weight (Figure 26).

Figure 26. Weighing of the plant remains used during the experiments, after drying in the oven.

The trophic preferences were calculated from the dry weight amount consumed of each plant. During the experiments it was possible to verify that in captivity they were also able to feed on these three plant species (Figures 27-29).

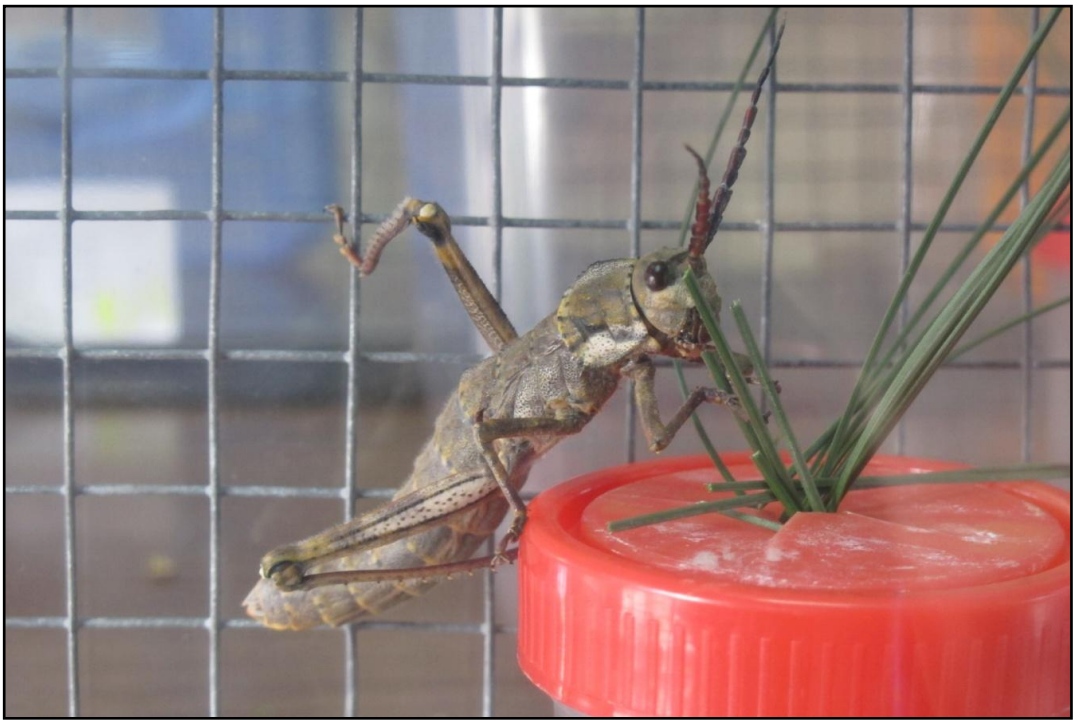

Figure 27. A specimen of *Acrostira euphorbiae* feeding on pine needles in captivity.

Figure 28. A specimen of *Acrostira euphorbiae* feeding on *E. lamarckii* in captivity.

Figure 29. A specimen of *Acrostira euphorbiae* feeding on *R. rhodorhizoides* in captivity.

The results of the trophic preference experiments showed that when the three plants are supplied in equal proportion, this grasshopper usually prefers *Euphorbia lamarckii*, then *Retama rhodorhizoides* and finally *Pinus canariensis*, with almost no difference between specimens from the two habitats. When the proportion of each plant is varied, these grasshoppers continue to prefer *E. lamarckii*, although when *Retama* is in greater proportion they prefer it, with consumptions close to those of *Euphorbia* (Table 2).

Therefore, it seems that their preference for *Euhorbia lamarckii* is innate, since specimens from both habitats selected it without influencing the presence or absence of the other two plants in the original habitat of each individual.

Table 2. Trophic preferences of *Acrostira euphorbiae* in each of the treatments according to the original habitats. In boldface the highest values of each treatment (i.e. the preferred plant) are marked.

Euphorb shrubland	***Pinus canariensis***	***Retama rhodorhizoides***	***Euphorbia lamarckii***
3P-3R-3E	0.9373	5.8245	**6.2793**
1P-1R-3E	0.5859	0.9999	**5.3108**
3P-1R-1E	2.4406	2.3067	**6.6718**
1P-3R-1E	0.6965	**4.4909**	4.0935
Euphorb shrubland with pine	***Pinus canariensis***	***Retama rhodorhizoides***	***Euphorbia lamarckii***
3P-3R-3E	0.3797	7.5878	**8.2735**
1P-1R-3E	0.2259	0.5979	**4.7263**
3P-1R-1E	1.1365	2.5958	**5.3200**
1P-3R-1E	1.6752	**6.1781**	4.7499

The degree of accomplishment of this activity has been of 100%, since all the proposed objectives were completed.

5. Assimilation experiments

An experiment about the degree of assimilation of the three plants found in the diet was carried out, with a group of captive females individually isolated. To do this, each plant was daily supplied and along one week at a given weight (3 grams) to the grasshoppers, and replaced the next day (Figure 30).

As with trophic preference experiments, the dry and fresh plant weight values were calculated to minimize errors by hydration or desiccation of the samples (Figure 31).

Figure 30. Interior of a terrarium during an assimilation experiment, in which only a species of plant is supplied.

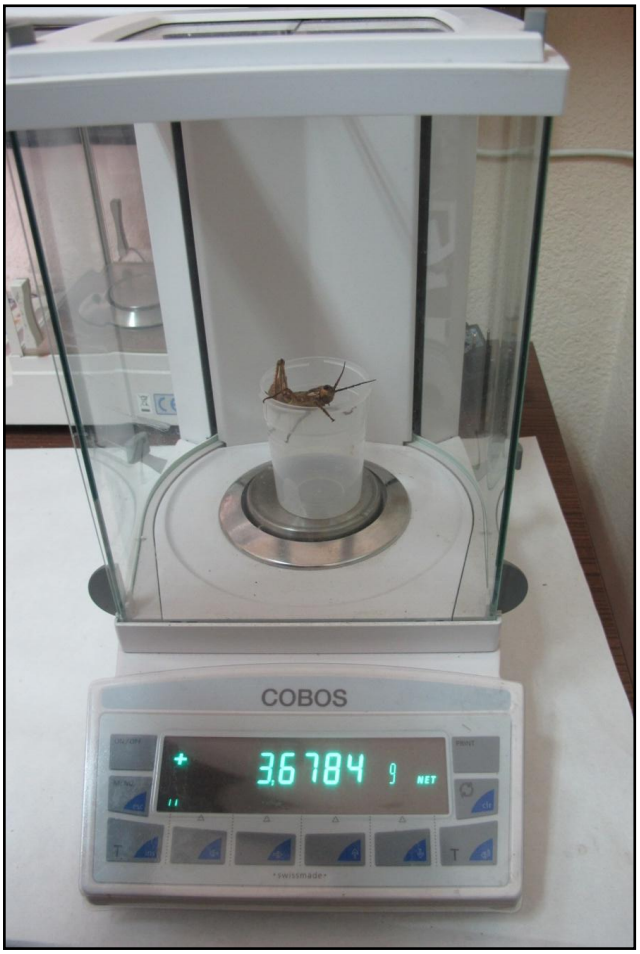

Figure 31. Weighing of the specimens used in the experiments, necessary to evaluate their growth when they fed with the different plants.

The approximate assimilation of each plant species was evaluated by calculating the weight of the excreta deposited each day with respect to the weight of the food provided. In addition, it was possible to evaluate the efficiency with which the digested food is converted into body substances considering the above parameters, and taking the weight of the grasshoppers before providing the food and after removing it.

Table 3. Summary table of the assimilation experiments, which shows the consumption, assimilation and growth of specimens of each habitat after feeding, separately, with each of the three plant species that previously appeared in their diet in the wild.

Plant species	**Habitat**	**Consumption**	**Assimilation**	**Growth**
E. lamarckii	Shrubland with pine	**0.4998**	**0.1014**	**0.3682**
	Euphorb shrubland	**0.3289**	**0.0537**	**0.2721**
R. rhodorhizoides	Shrubland with pine	0.2851	0.0928	-0.3132
	Euphorb shrubland	0.2104	0.0663	-0.0556
P. canariensis	Shrubland with pine	0.2415	-0.0157	-0.0915
	Euphorb shrubland	0.1870	-0.0760	-0.0941

The results of assimilation showed that in general *Acrostira euphorbiae* consumes, assimilates and grows better when feeding on *Euphorbia lamarckii* than when they do with the other species offered. In fact, feeding only on *Retama* or *Pinus* does not have an adequate consumption and assimilation, leading to weight loss and therefore negative growth (Table 3). This shows that *Euphorbia* is basic for the proper development and maintenance of this species, and that it probably consumes the other two species of plants to supplement its diet.

The degree of accomplishment of this activity has been of 100%, since all the proposed objectives were completed.

6. Analysis of macronutrients

In order to know if the trophic preferences of *Acrostira euphorbiae* are conditioned by the proportion of macronutrients of the main plant species consumed in its natural habitat, the following analyses were carried out: i) nutritional analyses of samples of the plant species appeared in the diet on their natural environment; ii) nutritional analyses of samples of the particular specimens of plant species used to feed the grasshoppers during the trophic preference experiments. For this purpose, about 500 grams of each plant species from its natural habitat in La Palma (LP) and those used for feeding in captivity from Tenerife (TF) were collected.

The analyses were performed by Innoagral laboratories (http://www.innoagral.com/), and consisted on the detection and calculation of the main chemical compounds: moisture, ash, crude protein, crude fat, total carbohydrates, acid detergent (ADF) which represents the lignin and cellulose fractions of the plant material, and neutral detergent fiber (NDF) which contains the fibers in ADF plus hemicellulose. The percentage corresponding to each compound was estimated by the following methodologies: Kjeldahl method for proteins, Soxhlet extraction with hexane for lipids, gravimetric digestion with acid detergent solution for ADF, and neutral detergent digestion for NDF. The ash was measured by drying the samples at 550 °C for 3 hours

Table 4. Nutritional composition of the main food plants for *Acrostira euphorbiae*. Values expressed in percentages. Abbreviations: TF, Tenerife; LP, La Palma; ADF, acid detergent fiber; NDF, Neutral detergent fiber.

Plant species	**Ash**	**Fat**	**Carbohydrates**	**Protein**	**Fibre**	
					ADF	**NDF**
***Euphorbia lamarckii* TF**	**9.11**	1.33	74.40	15.20	30.00	56.00
***Euphorbia lamarckii* LP**	**10.50**	1.53	67.70	20.20	37.70	62.70
***Retama rhodorhizoides* TF**	3.78	**1.59**	**79.00**	15.60	38.90	49.60
***Retama rhodorhizoides* LP**	5.78	**1.46**	**76.50**	16.30	38.20	52.90
***Pinus canariensis* TF**	3.34	1.48	**81.30**	13.90	35.40	51.10
***Pinus canariensis* LP**	2.99	1.31	**79.10**	16.60	36.10	46.90

Nutrient contents may be the key to understand the trophic preferences of the endangered *Acrostira euphorbiae*. As in other species of the genus, its ancestral food plant is probably *Euphorbia lamarckii*, which is the most consumed species in both habitats in La Palma, and it seems to provide everything necessary for the development of these grasshoppers (Table 4). However, probably they also consume *Retama* and *Pinus,* in less proportion, to supplement some deficiency, or in order to increase the intake of some nutrients present in greater proportion in these plants.

The degree of accomplishment of this activity has been of 100%, since all the proposed objectives were completed.

7. Design conservation strategies for *Acrostira euphorbiae*

During the present study, the continuity of most of the affections previously detected in the protected natural area of Tamanca has been verified, which directly stress the populations of the grasshopper *Acrostira euphorbiae*.

- *Wildfires:* Besides the evidences of damage caused by wildfires in recent years in this natural area, a new fire partially burned some of the main locations of this study in the summer of 2016 (Figures 32 and 33). This event probably produced a decrease in the population of this grasshopper in the affected localities, although not its local extinction since adult females were found during our surveys after the fire.

Figure 32. Affected area by successive wildfires. Detail of the effects of the 2016 wildfire.

Figure 33. Area affected by successive wildfires. Detail of the effects of the 2016 summer fire.

- *Illegal logging:* illegal and massive shrub logging in order to expand grazing areas is still visible today (Figure 34). **Euphorb shrubland** probably have not recovered due to continuous grazing by cattle. During the present study, no specimens have been observed in the areas affected by logging.

Figure 34. Area with illegal logging to encourage grazing.

- *Livestock*: it is an expanding activity throughout Tamanca. Groups, mainly of goats, have been detected in all the studied localities in Tamanca (Figure 35). This activity is transforming the floristic composition of the **Euphorb shrubland** due to the intensive grazing of certain plant species and the overdispersion of others by means of excrements. This fact, together with logging, significantly damages the **Euphorb shrubland**, decreasing the quantity and the good state of conservation of the potential host plants of *Acrostira*.

Figure 35. Goat cattle in the protected natural area of Tamanca.

Therefore, we consider that the first actions to be undertaken for the conservation of *Acrostira euphorbiae* should be those aimed at conserving their habitat, that is those which minimize the conditions we have detailed above. Although most of the populations are in protected natural areas (Tamanca Protected Landscape, Cumbre Vieja Natural Park and El Remo Protected Landscape) the grasshopper populations are not free of the aforementioned conditions, so the uses of these protected areas should be reviewed and the most harmful ones limited. It would be of great importance for the viability of this grasshopper that the livestock decreased in these protected areas, and especially that logging would not occur again in this protected area. The damage caused to the populations of *Acrostira* is far higher than the poor benefit of making clearances of *Euphorbia* spurges to improve pastures. We have observed that the areas where illegal loggings were carried out have not recovered the log, probably due to the continuous grazing, and the populations of *Acrostira* have been lost or displaced. Therefore, it is advisable to plant in these altered areas the species that were previously felled down, mainly *Euphorbia lamarckii* and *Retama rhodorhizoides*. And regarding again to plant repopulations, Protected Landscape of El Remo should be another place to take into account for this purpose, given the presence of this grasshopper (in fact, it is the typical locality from where the species was described), which has been greatly altered in recent

years, changing its vegetation at this time. Recovering of previous vegetation in El Remo, including the host plants of *Acrostira euphorbiae* (i.e. *E. lamarckii* and *R. rhodorhizoides*), could help to improve the populations of the grasshopper in this highly disturbed small area.

With the data obtained during the present study, a series of articles will be developed for publishing in impact scientific journals, but an extract of them will also be included in reports for regional spreading journals, since the social diffusion of the situation of this endangered species is extremely important for its conservation.

The degree of achievement of this activity is expected to be high, taking into account that it will occur after the submission of the present report when the data will be submitted to the competent administrations concerned with the future recovery plan of the species. In addition, research articles and information will also be published after submission of the report.

EXPENSES

Expense Particular	Amount (in EUROS)	Amount (in DOLLARS)*
To know the diet of *Acrostira euphorbiae*	4.592,85 €	5.245,95
To clarify the trophic preferences of *A. euphorbiae*	4.349,91 €	4.949,76
To know the effects of habitat alteration on *A. euphorbiae*	2.341,84 €	2.674,85
To design the habitat restoration	936,44 €	1.065,07
Total (€):	**12.221,04 €**	**13958.87**

*The amounts were converted from euros to dollars on June 29, 2017, so they are approximate values.

The detailed expenses are as follows:

Date	Expense Particular	Objective	Amount (in EUROS)
06/04/2016	Transport	To know the diet of *Acrostira euphorbiae*	378.78
07/04/2016	Transport	To know the diet of *Acrostira euphorbiae*	25.5
22/04/2016	Personnel costs	To know the diet of *Acrostira euphorbiae*	800
04/05/2016	Transport	To know the diet of *Acrostira euphorbiae*	78.11
06/05/2016	Personnel costs	To know the diet of *Acrostira euphorbiae*	1000
11/05/2016	Materials	To know the diet of *Acrostira euphorbiae*	18
15/05/2016	Transport	To know the diet of *Acrostira euphorbiae*	105
16/05/2016	Subsistence	To know the diet of *Acrostira euphorbiae*	10.2
16/05/2016	Transport	To know the diet of *Acrostira euphorbiae*	26.01
16/05/2016	Materials	To know the diet of *Acrostira euphorbiae*	2.35
16/05/2016	Subsistence	To know the diet of *Acrostira euphorbiae*	10.55
16/05/2016	Subsistence	To know the diet of *Acrostira euphorbiae*	4.71
18/05/2016	Subsistence	To know the diet of *Acrostira euphorbiae*	61.64
19/05/2016	Subsistence	To know the effects of habitat alteration on *A. euphorbiae*	9.4
19/05/2016	Transport	To know the effects of habitat alteration on *A. euphorbiae*	10
20/05/2016	Subsistence	To know the effects of habitat alteration on *A. euphorbiae*	12.4
20/05/2016	Subsistence	To know the effects of habitat alteration on *A. euphorbiae*	35
20/05/2016	Transport	To know the effects of habitat alteration on *A. euphorbiae*	65.9
20/05/2016	Transport	To know the effects of habitat alteration on *A. euphorbiae*	53.2
21/05/2016	Subsistence	To know the effects of habitat alteration on *A. euphorbiae*	9.4
22/05/2016	Subsistence	To know the effects of habitat alteration on *A. euphorbiae*	9.4
23/05/2016	Subsistence	To know the effects of habitat alteration on *A. euphorbiae*	47.51
23/05/2016	Subsistence	To know the effects of habitat alteration on *A. euphorbiae*	6.43
23/05/2016	Subsistence	To know the effects of habitat alteration on *A. euphorbiae*	9.4
23/05/2016	Transport	To know the effects of habitat alteration on *A. euphorbiae*	27.2
01/06/2016	Personnel costs	To know the effects of habitat alteration on *A. euphorbiae*	1000
15/06/2016	Materials	To clarify the trophic preferences of *A. euphorbiae*	30.03
01/07/2016	Personnel costs	To clarify the trophic preferences of *A. euphorbiae*	1000
29/07/2016	Materials	To clarify the trophic preferences of *A. euphorbiae*	30.03
30/07/2016	Materials	To clarify the trophic preferences of *A. euphorbiae*	92.5
01/08/2016	Transport	To clarify the trophic preferences of *A. euphorbiae*	1.42
01/08/2016	Personnel costs	To clarify the trophic preferences of *A. euphorbiae*	1000
05/08/2016	Materials	To clarify the trophic preferences of *A. euphorbiae*	4.95
01/09/2016	Personnel costs	To clarify the trophic preferences of *A. euphorbiae*	1000
01/09/2016	Materials	To clarify the trophic preferences of *A. euphorbiae*	36.15
19/09/2016	Materials	To know the diet of Acrostira euphorbiae	30
04/10/2016	Personnel costs	To know the effects of habitat alteration on *A. euphorbiae*	1000
01/11/2016	Personnel costs	To know the diet of Acrostira euphorbiae	1000
16/11/2016	Materials	To know the diet of Acrostira euphorbiae	30
01/12/2016	Personnel costs	To know the diet of Acrostira euphorbiae	1000
03/12/2016	Materials	To clarify the trophic preferences of *A. euphorbiae*	111
05/12/2016	Materials	To clarify the trophic preferences of *A. euphorbiae*	10.02
07/12/2016	Materials	To know the effects of habitat alteration on *A. euphorbiae*	4.95

PERSONNEL

Six members of our association have participated in the different activities carried out during the development of this project. Their participation in different activities is detailed as follows:

Activity 1 (fieldwork), which consisted on searching specimens of *Acrostira euphorbiae*, performing vegetation transects, and collecting excrements and other data, was carried out by 3 members: David Hernández (DH), Javier García (JG) and Rafael García (RG).

Activity 2 (Diet study by microhistological analyses of excrements) was performed mainly by DH.

Activities 3 and 4 (Experiments of trophic preferences and assimilation) were directed and advisored by Nuria Macías (NM) and Heriberto López (HL), and developed mainly by DH with the help of JG.

The part of activity 5 (Macronutrient Analysis) not performed by the Innoagral laboratories, was carried out by DH and HL.

The design of conservation strategies for A*crostira euphorbiae* was jointly developed by all participant members.

The supervision of the project was led by Pedro Oromí (PO) and HL, and the drafting of the report by DH, HL, and PO.

DISSEMINATION

The present project has been disseminated by different regional media with the aims of informing: a) the situation of *Acrostira euphorbiae*, b) the importance of this project for the conservation of this endangered species, and c) the sponsors that have made it possible.

Newspapers

- *La Palma Ahora* (http://www.eldiario.es/lapalmaahora/):

In this digital newspaper, an article was published at the beginning of the project (05/20/2016) entitled in Spanish "Estudian la dieta y el hábitat del saltamontes de Tamanca para evitar su desaparición" (They study the diet and the habitat of the grasshopper of Tamanca to avoid its disappearance). It emphasized that "a scientific GIET team is in the Island investigating the habits of this endemic insect in danger of extinction. The work is funded by **The Mohamed bin Zayed Species Conservation Fund** and the CajaCanarias Foundation.

The full article can be read at:

http://www.eldiario.es/lapalmaahora/sociedad/Estudian-habitat-saltamontes-Tamanca-desaparicion_0_517948486.html

In addition, coinciding with the completion of the project, this journal published a new article with the main results of the project (19/02/2017), entitled in Spanish "Unos 2.000 ejemplares más del saltamontes amenazado podrían nacer esta primavera en Tamanca" (Some 2,000 specimens more of the threatened grasshopper could be born this spring in Tamanca".

The full article can be read at:

http://www.eldiario.es/lapalmaahora/sociedad/nacimiento-saltamontes-amenazado-Tamanca_0_612789676.html

- *Diario de Avisos* (http://diariodeavisos.elespanol.com/):

This newspaper focused its article (published 10/01/2017) on the release of the grasshoppers (*Acrostira euphorbiae*) that took place in Tamanca after the end of the experiments in captivity.

It can be found at the following link: (http://diariodeavisos.elespanol.com/2017/01/jeque-arabe-financia-estudio-saltamontes-remo/) and begins with the following paragraphs: "At the end of last December, the release of the specimens of El Remo Grasshopper (*Acrostira euphorbiae*), which had been collected for study in the framework of the research project on the feeding and habitat of this endemic species from La Palma, classified in danger of extinction, and carried out by the Group of Entomological Investigations of Tenerife (GIET). "

"This project, which is supervised by researchers Pedro Oromí (University of La Laguna) and Heriberto López (CSIC), is funded by CajaCanarias Foundation and **Mohamed bin Zayed Foundation for the Conservation of Species**"

Television

- *Antena3Canarias* (http://www.antena3.com/canarias/)

This TV chain made a brief report on the project that is pending broadcast.

Radio

- *El Espejo Canario* (http://www.elespejocanario.es/)

On January 13th, 2017, an interview was conducted from this radio station with a member of the team about the El Remo Grasshopper project.

The program can be heard at the following link: http://www.elespejocanario.es/audios/ampliar/4249

OTHER COMMENTS

In addition to the planned activities, after the completion of the project the layings obtained from the females maintained in captivity were buried in the same locality where they were previously captured. Each of the 100 obtained layings had an average of 28 eggs inside. This action can be of great relevance for the conservation of the species, since, after its outbreak, the populations of this threatened grasshopper are likely to increase.

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