PHENOLOGY OF *LAPAROCERUS* SPECIES IN TENERIFE, CANARY ISLANDS (COLEOPTERA, CURCULIONIDAE)

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With 7 figures and 6 tables

ABSTRACT. The weevil genus *Laparocerus* Schönherr, 1834 is restricted to the Macaronesian archipelagos of the Azores, Madeira, Selvagens and Canaries, with a few representatives in the Atlantic region of Morocco. To support the faunal and systematic revision of the genus undertaken by one of the authors, prospection of all islands is required. To be effective in such task, an approximate idea of the phenology of the species is much needed. The *Laparocerus* species (ca. 140) are plant feeding, nocturnal and flightless.

The biggest island, Tenerife, was chosen, with localities situated at progressive altitudes and representing the primary different habitat types. (1) Punta del Hidalgo, 50 m, succulent shrub vegetation, (2) Zapata, 900 m, evergreen laurel forest, (3) Fuente Joco, 1860 m, pine wood understorey, and (4) El Portillo, 2050 m, high mountain scrub formations. In each locality, the same 60 linear metres of vegetation were sampled monthly during one year (October 2002-October 2003). Insects were beaten from vegetation during the night time, counted, and then released back at the same spot. Temperature and relative humidity were measured *in situ* and total monthly rainfall data were taken from neighbouring meteorological stations. A total of 15 species were recorded, with a maximum of 7 in the laurel forest and a minimum of 1 in coastal succulent vegetation. In this latter habitat, the presence of active adults was mostly reduced to a few months (December-April). In the laurel forest there is activity throughout the year, with a winter climax in December and a slight alternation of species. In the pine forest activity is restricted shortly in summer, and, finally, in the upper zone *Laparocerus* are active throughout the year but clearly alternating species. Phenology varies greatly with altitude / habitat type, but a general tendency to winter activity is noticed. Humidity (rainfall) seems to be the key factor influencing this dynamic.

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RESUMO. Os gorgulhos do género *Laparocerus* Schönherr, 1834 estão restritos aos arquipélagos Macaronésicos dos Açores, Madeira, Selvagens e Canárias, com excepção da presença de algumas espécies na região Atlântica de Marrocos. Considera-se necessária uma prospecção em todas as ilhas para apoiar a revisão faunística e sistemática do género que está sendo realizada por um dos autores. Para tal tarefa ser bem sucedida, é necessário haver um conhecimento aproximado da fenologia destas espécies. Estas são cerca de 140, fitófagas, de hábitos nocturnos e não voam.

Foi escolhida a maior ilha, Tenerife, em localidades situadas a altitudes progressivas, representativas dos diferentes tipos de habitats primários. (1) Punta del Hidalgo, 50 m, vegetação predominante de plantas suculentas, (2) Zapata, 900 m, laurissilva, (3) Fuente Joco, 1860 m, vegetação debaixo de floresta de pinheiros, e (4) El Portillo, 2050 m, vegetação de altitude. Em cada localidade amostraram-se os mesmos 60 metros lineares de vegetação, mensalmente, durante um ano (Outubro de 2002 a Outubro de 2003). Os insectos foram colhidos durante a noite, através de batimentos na vegetação, contados e de seguida libertados no mesmo local. A temperatura e a humidade relativa do ar foram medidas *in situ* e dados de precipitação mensal foram obtidas de estações meteorológicas próximas. Foram encontradas um total de 15 espécies, com um máximo de 7 na laurissilva e um mínimo de 1 na vegetação costeira de suculentas. A presença de adultos activos neste último habitat foi reduzida a alguns meses apenas (Dezembro a Abril). Na laurissilva a actividade é constante ao longo do ano, com um clímax de Inverno em Dezembro e uma ligeira alternância de espécies. Na floresta de pinheiros a actividade é restrita no Verão e finalmente, na zona de altitude, os *Laparocerus* são activos durante todo o ano mas com uma clara alternância de espécies. A fenologia varia bastante com a altitude e tipo de habitat, no entanto é patente uma tendência geral para uma actividade de Inverno. A humidade (pluviosidade) parece ser o factor chave que está a influenciar esta dinâmica.

INTRODUCTION

Laparocerus Schönherr, 1834 is a Curculionid genus restricted to the Macaronesian archipelagos of the Azores, Madeira, Selvagens and the Canaries, with a few representatives in the neighbouring Atlantic region of Morocco. The first author is undertaking a systematic and faunal revision of the genus, which implies a prospection of all islands. Unfortunately, the information regarding biology and phenology of this group is very scarce and scattered, mostly derived from occasional sampling.

We know that *Laparocerus* larvae are endogeous and feed on roots of plants. The adults climb on the vegetation to feed on leaves, but are mainly nocturnal, hiding during the day in crevices, under stones, barks, and principally inside the ground. Thus,

an efficient nocturnal sampling method was developed (MACHADO, 2003), but there was still the need to have, at least, a broad idea about the phenology of the species.

The island of Tenerife – in the Canaries – was chosen for being the largest and highest in Macaronesia, offering a good contrast of habitat types at different altitudes, and bearing the greatest number of *Laparocerus* species. In addition, the authors live in that island facilitating the monthly visit of the selected sites. One year was considered enough time-span to obtain a first impression of the dynamics of species. The results speak for themselves.

METHODOLOGY

Four localities at different altitudes in the island of Tenerife were selected (see Table 1 and Fig. 1), representing the principal natural communities of the island: (a) the lower zone succulent shrub vegetation (Punta del Hidalgo), (b) the laurel forest, a moist cloud-forest (Zapata), (c) the Canary pine forest (Fuente Joco), and (d) the upper high mountain scrub vegetation (El Portillo).

TABLE 1 - Transects in Tenerife.

Locality	***Altitude***	***Starting UTM***	***Ending UTM***
Punta del Hidalgo	50 m	28R 371066 3161325	28R 371136 3161232
Zapata	900 m	28R 373253 3157145	28R 373289 3157096
Fuente Joco	1860 m	28R 356545 3138539	28R 356556 3138591
El Portillo	2050 m	28R 346461 3131786	28R 346374 3131798

A fifth low locality on the leeward side (Bco. Bufadero, 60 m UTM 28R 379704 3143746) was unfortunately damaged during the experiment by the civil work of a pipe-line, which destroyed all the vegetation (June 2003). This locality was disregarded.

In each locality a linear transect of 60 m was marked on the ground enabling us to repeat the transect while keeping the same distance to the vegetation. Except for El Portillo, the transects followed a road or track. Every month from October 2002 through October 2003 the vegetation of only one side of the transect was beaten by the same person using a beating tray of 100 x 80 cm and a stick of 120 cm. Sampling started at least one hour after sunset (stars visible in the sky) with the help of head torches. All specimens were counted and identified *de visu*, being liberated immediately after on the same spot. With this method no single specimen is extracted from the population.

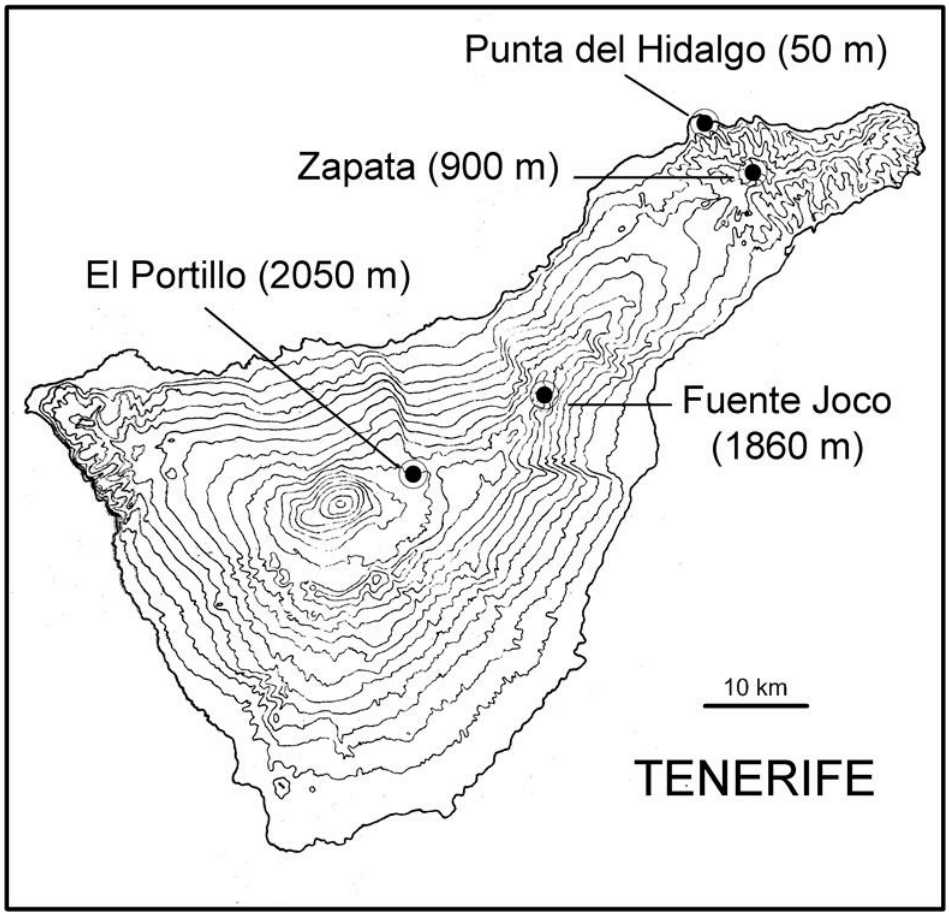


Fig. 1 - Sampling localities in the island of Tenerife.

In Tables 2-5 the species composition of the vegetation of each transect is expressed in accumulated linear meters of coverage independent of the stratum; thus overlapping is possible. A plus sign (+) indicates if *Laparocerus* were present; two pluses (++) for the most abundance.

Weather conditions (wind / clouds / rain), air temperature, and relative humidity were also recorded during sampling as well as notes on the phenology of vegetation and presence of other conspicuous groups (millipeds, hemipterans, etc.). The climatic diagrams in Fig. 2 were elaborated with data of average monthly temperature and monthly rainfall (see ANNEX) provided by the National Metereological Service. The nearest meteorological stations in equivalent conditions were selected and data of pluviometry (P) and temperature (T) were combined from the different stations when the data series were incomplete or missing. For Punta del Hidalgo: T Bajamar (C449R 70 m) and P Punta del Hidalgo (C449S 40 m); for Zaptata T and P Los Rodeos (C474A 617 m); for Fuente Joco, P Gaitero (C453K, 1747 m) and for El Portillo T and P, El Portillo-Centro de Visitantes (C451V 2050 m). Only for the latter locality can the climatic diagram be considered ad-hoc.

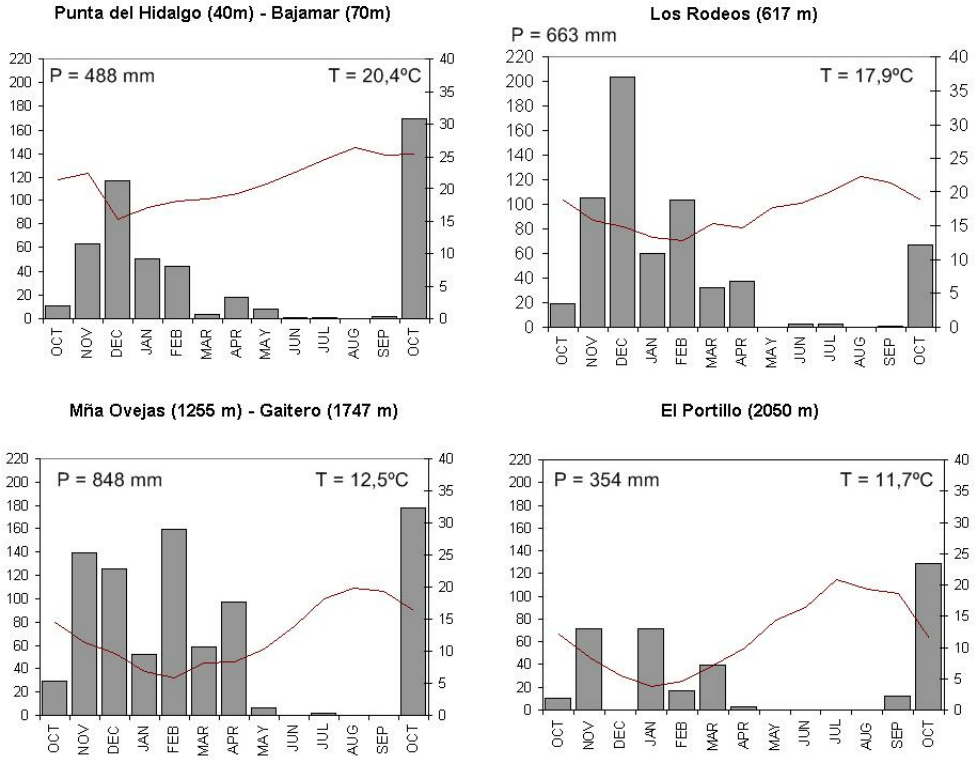


Fig. 2 - Climatic diagrams of neighbouring stations.
Monthly rainfall in mm, left Y-axis. Mean monthly temperature in ºC, right Y-axis.

TABLE 2 - Punta del Hidalgo (50 m). Coastal succulent shrub vegetation. Vegetation sampled; see explanation in the text.

Artemisia thuscula Cav.	+	21 m
Hyparrhenia hirta (L.) Stapf in Prain & *Cenchrus ciliaris* L		17 m
Argyranthemum frutescens (L.) Sch. Bip.	++	11 m
Rumex lunaria L.		8 m
Lavandula canariensis Mill		6 m
Rubia fruticosa Aiton		4 m
Bituminaria bituminosa (L.) C. H. Stirt.		4 m
Pennisetum setaceum (Forssk.) Chiov.		3 m
Euphorbia regis-jubae Webb & Berthel.		2 m
Opuntia dillenii (Ker-Gawl.) Haw.		2 m
Kleinia neriifolia Haw.		1 m
Free of plants		2 m

TABLE 3 - Zapata (900 m). Laurel forest. Vegetation sampled; see explanation in the text.

Viburnum rigidum Vent.	+	32 m
Prunus lusitanica L. subsp. *hixa* (Willd.) Franco	+	14 m
Erica arborea L.	+	12 m
Laurus novocanariensis Rivas-Mart. *et al*.	+	8 m
Diplazium caudatum (Cav.) Jermy		6 m
Rubus ulmifolius Schott	++	4 m
Myrica faya Aiton	+	2 m
Isoplexis canariensis (L.) J. W. Loudon		1 m
Free of plants		1 m

TABLE 4 - Fuente Joco (1860 m). Pine forest. Vegetation sampled; see explanation in the text.

Chamaecytisus proliferus (L. f.) Link	++	37 m
Tinguarra cervariaefolia (DC.) Parl.		4 m
Adenocarpus foliolosus (Aiton) DC.	+	3 m
Rumex maderensis Lowe		2 m
Cistus symphytifolius Lam.	+	1 m
Bystropogon origanifolius L'Hér.	+	1 m
Carlina xeranthemoides L. f.		1 m
Aeonium spathulatum (Hornem.) Praeger		1 m
Sideritis oroteneriffae Negrín & P. Pérez		0.5 m
Descurainia lemsii Bramwell		0.5 m
Free of plants		20 m

TABLE 5 - El Portillo (2050 m). High-mountain scrub vegetation. Vegetation sampled; see explanation in the text.

Pterocephalus lasiospermus Link ex Buch	+	52 m
Spartocytisus supranubius (L. f.) Christ ex G. Kunkel	+	23 m
Adenocarpus viscosus (Willd.) Webb & Berthelot	++	12 m
Descurainia bourgeauana (E. Fourn.) O. E. Schulz		2 m
Free of plants		8 m

To analyse the trend of diversity throughout the year, we used the new index of MARGALEF (1978), k = log (S) / log (N), where S is the number of species present and N the total number of individuals. Data obtained are included in the ANNEX.

TABLE 6 - Summary of *Laparocerus* species by locality.

***Laparocerus* species**	**Pta. Hidalgo, 50 m**	**Zapata, 900 m**	**Fuente Joco, 1860 m**	**El Portillo, 2050 m**
L. bolivari Uyttenboogart, 1937			149	
L. canariensis Boheman, 1842				155
L. crassifrons Wollaston, 1863				161
L. ellipticus Wollaston, 1863		3		
L. excavatus Wollaston, 1863		157		
L. freyi Uyttenboogaart, 1940				180
L. grossepunctatus Wollaston, 1864		534		
L. inaequalis Wollaston, 1863		6		
L. lepidopterus Wollaston, 1864		7		
L. nov. sp. 1		3		
L. nov. sp. 2			1	
L. scapularis Wollaston, 1864				309
L. tenuepunctatus Roudier, 1957			361	
L. tessellatus (Brullé, 1838)		1052	1572	
L. vestitus Wollaston, 1864	331			
Total	331	1762	2083	805

RESULTS

A total number of 4981 specimens of *Laparocerus* belonging to 15 species were found in the thirteen sampling sessions, with a maximum (2083 exx) corresponding to the legume-understorey of the pine forest, and a minimum of 331 in the coastal vegetation.

Species are listed in Table 6. Maximum species richness was obtained in the laurel forest (Zapata), but from the 7 species found, only 3 were constant in showing a normal distribution. On the other hand, it is possible that in Fuente Joco some individuals of *L. crassifrons* have been identified as *L. tenuepunctatus.* Both species are rather similar and difficult to distinguish at night and with the naked eye. The same is valid for *L. freyi* and possible individuals of *L. tessellatus* in El Portillo. This latter species is very common and widespread; in fact, it is the only one clearly present in two different habitats (laurel forest and pine forest). The total number of *Laparocerus* known in Tenerife is above 40 (unpublished).

In general, the weather sampling conditions (fog, breeze, fine drizzle, etc.) seem to have not influenced *Laparocerus* activity. This includes, for instance, special dry weather registered on the 4th of February 2003 in Zapata, with the arrival of dry Sahara air to the island. All dominant species show typical normal distribution curves with little deviations.

Coastal vegetation

The population dynamic of *Laparocerus* at the Punta del Hidalgo transect is shown in Fig. 3. Activity is almost restricted to the winter, with a clear peak in January. This is the period when vegetal biomass production is highest. Plant species like *Senecio* or *Euphorbia* loose their leaves in the summer. The rest of plants are dried and very little insect life can be observed after May. The emergence of adult *L. vestitus* coincides with the sprouting of new shoots of *Argyranthemum* and the greening of *Artemisia*. Other species of *Laparocerus* known to be in the area were not sampled: *L. tibialis* (WOLLASTON, 1864), which feeds on *Kleinia* or *Rumex*, and *L. obscurus* Wollaston, 1864 common in *Rubia*, *Artemisia*, etc.

Laurel forest

The activity of *Laparocerus* in the laurel forest runs throughout the year. The two most abundant species, *L. tessellatus* and *L. grossepunctatus* are clearly winter animals with peaks in December and January, respectively (see Fig. 4), but they can be found as well in summer, even in large numbers as is the case of *tessellatus* (a secondary peak?). Immature specimens of *L. grossepunctatus* were registered from October to December, and April; copulating pairs almost every month.

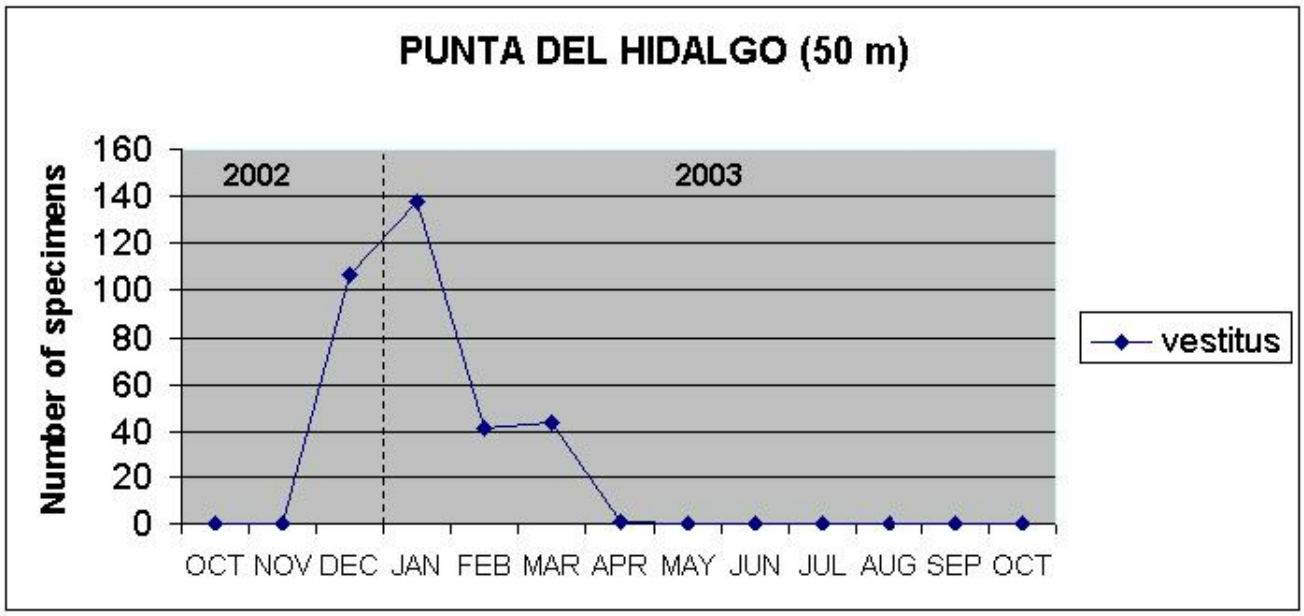


Fig. 3 - Monthly variation of *Laparocerus* in coastal succulent vegetation.

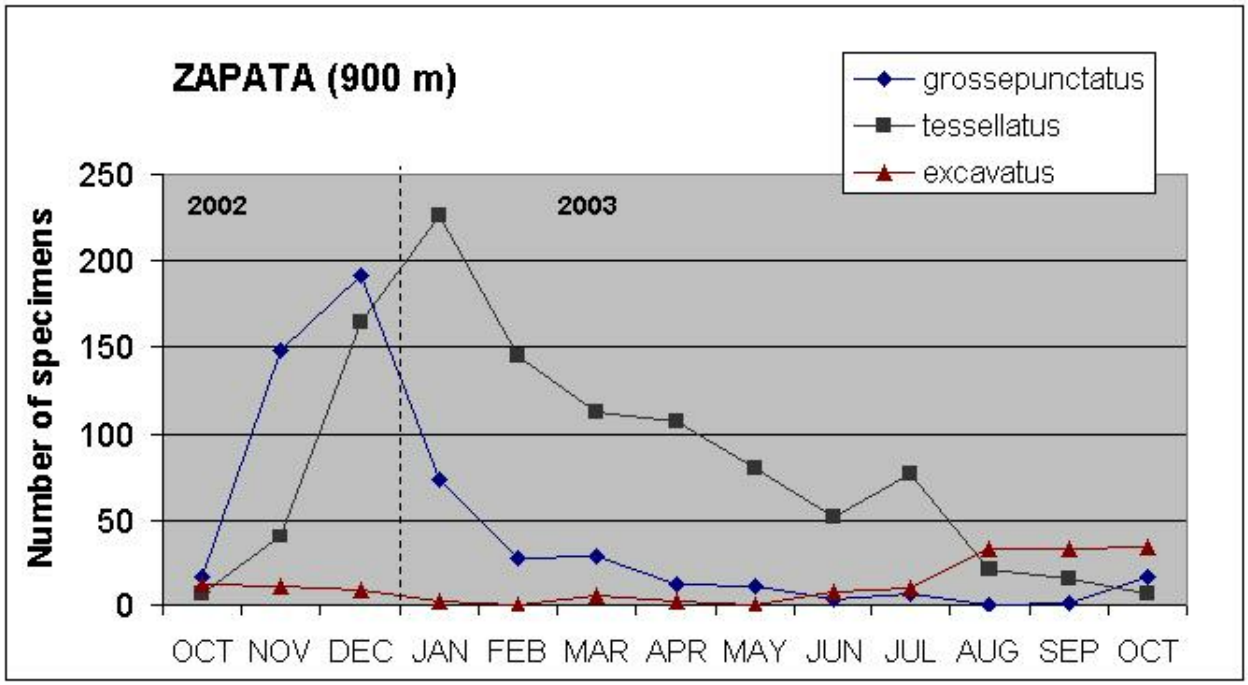


Fig. 4 - Monthly variation of *Laparocerus* in the laurel forest.

L. excavatus is less abundant but also permanently present, showing an increase in numbers at the end of summer and autumn, and mostly reduced numbers during the winter. The rest of the species (*L. inaequalis*, *L. ellipticus*, *L. lepidopterus* and

Laparocerus n. sp. 1) were sampled in too few specimens to be able to judge about their dynamics. The transect chosen seems to be not the optimum habitat for them. Nonetheless, *L. ellipticus* could be also a summer species as is *L. excavatus.* It is important to note that the vegetation never dries out in this moist evergreen cloud forest. Thus, several insect groups are particularly abundant in the summer nights *Cardiophorus*, *Acalles*, *Lebiinae*, etc. With the exception of *Isoplexis canariensis*, all other plants species in the transect had *Laparocerus*. Despite its little development (dwarf plants), *Rubus ulmifolius* was always attacked and harboured 6 of the 7 species present.

Pine forest

We prospected the understorey of a Canary pine forest, composed mainly by *Chamaeocytisis proliferus* (see Table 4), a legume tree that can grow up to 3-4 m and which harboured the bulk of *Laparocerus* as well as other insects (*Sitona, Coccinella*, *Hemiptera*, etc.). Three species were sampled in numbers showing a clear peak in winter (December-January) followed by a smooth decrease towards July. Thereafter there are no more *Laparocerus* (included *L. tessellatus)* when the climate turns dry and warm, with no influence of trade wind clouds.

One single specimen of a new species (*Laparocerus* n. sp. 2) was captured in July. A further prospection of the area in August enabled us to find the species in numbers some 150 m away from the transect, on a volcanic-ash hill covered with *Adenocarpus viscosus*. This latter species is clearly a summer animal, but we are not able to confirm any relation to the pine forest habitat. Other *Laparocerus* species known to be present in the area are *L. tenellus* Woll., 1864 and, occasionally, *L. canariensis* and *L. crassifrons*. They did not appear.

High mountain shrub

Four species were sampled in the leguminous shrub vegetation at El Portillo. Two of them (*L. scapularis, L. crassifrons*) are late winter animals (peaks in February), being absent from June to October. Similarly, this occurs with *L. freyi* but its peak shifts towards April. Finally, *L. canariensis,* which is present almost all year, is a spring-summer animal, with a minimum population in January-February. A slight alternation of species is observed (Fig. 6).

Frequent frost and even snow in winter does not stop *Laparocerus* activity. The record numbers of 152 specimens of *L. scapularis* were sampled at 2.6º C in February, the coldest month, and *L. crassifrons* was seen copulating at 7.7º C. Except for *Descourainia* (a Cruciferae), the other plant species had *Laparocerus*. *L. canariensis* was almost exclusively in *Pterocephalus*; *L. crassifrons* showed preference for *Spartocytisus*, while *L. scapularis* and *L. freyi* were abundant on *Adenocarpus*. Woody leguminose plants are well accepted by *Laparocerus*.

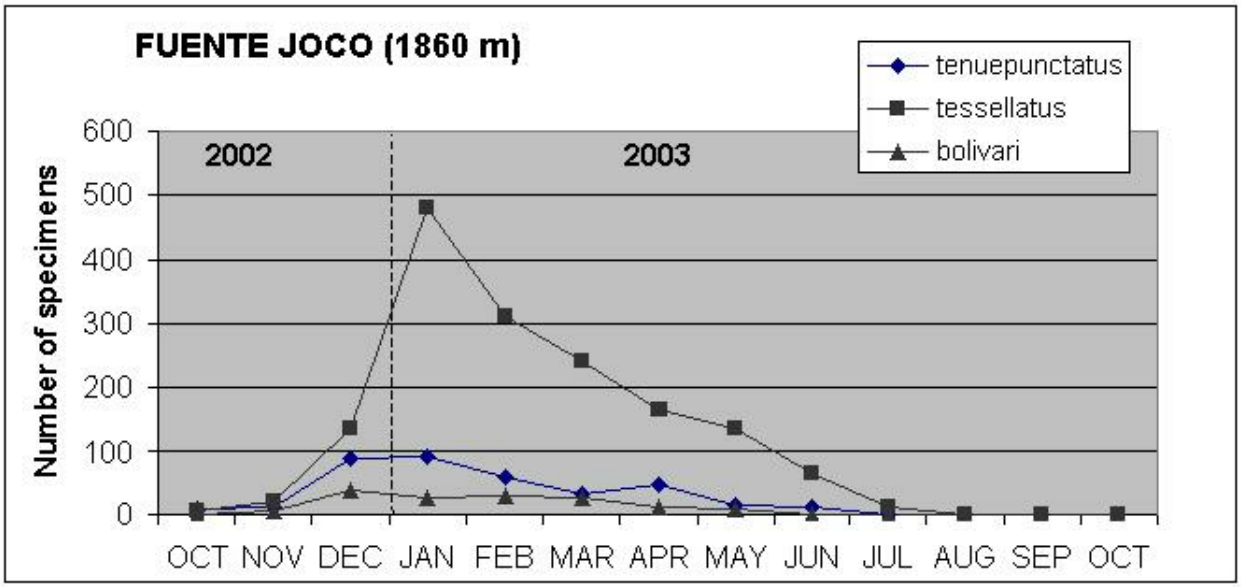


Fig. 5 - Monthly variation of *Laparocerus* in the pine forest.

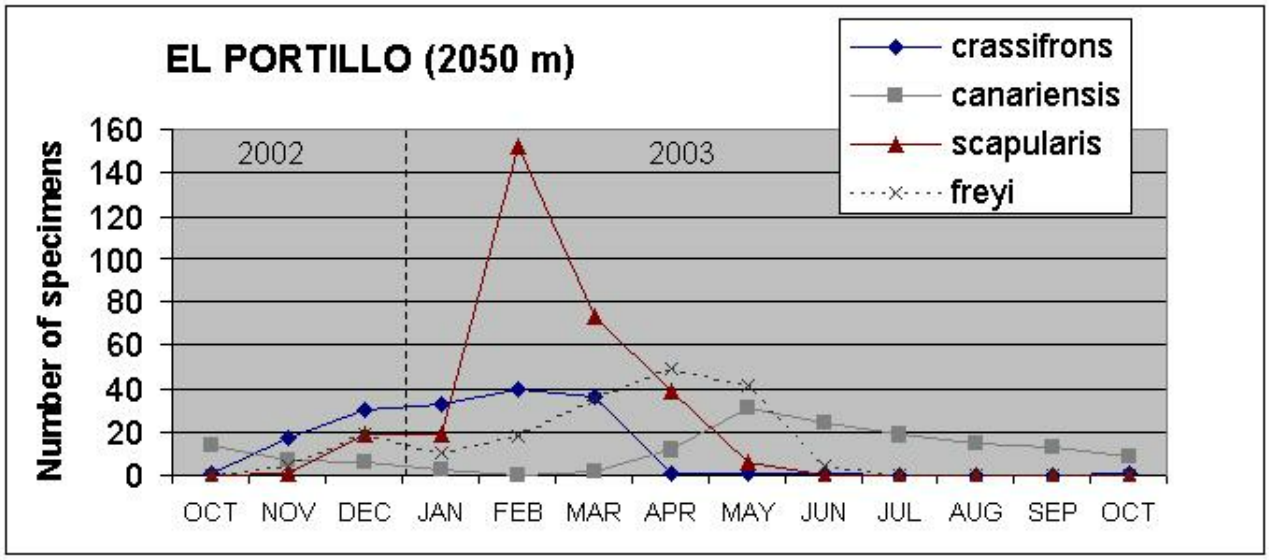


Fig. 6 - Monthly variation of *Laparocerus* in the high-mountain shrub vegetation.

In the laurel forest locality, Zapata, diversity fluctuates (maximum 0.33, minimum 0.13) regularly but the tendency is to maintain a steady value of 0.25 throughout the year. In the pine forest (Fuente Joco) and in the high mountain region (El Portillo), the trend of diversity is to decrease from winter to summer (zero value), with peaks of 0.30 and 0.41 in November, and in July (0.28) and June (0.33), respectively. The collapse in summer is very abrupt. Diversity at Punta del Hidalgo is zero; only one species was present.

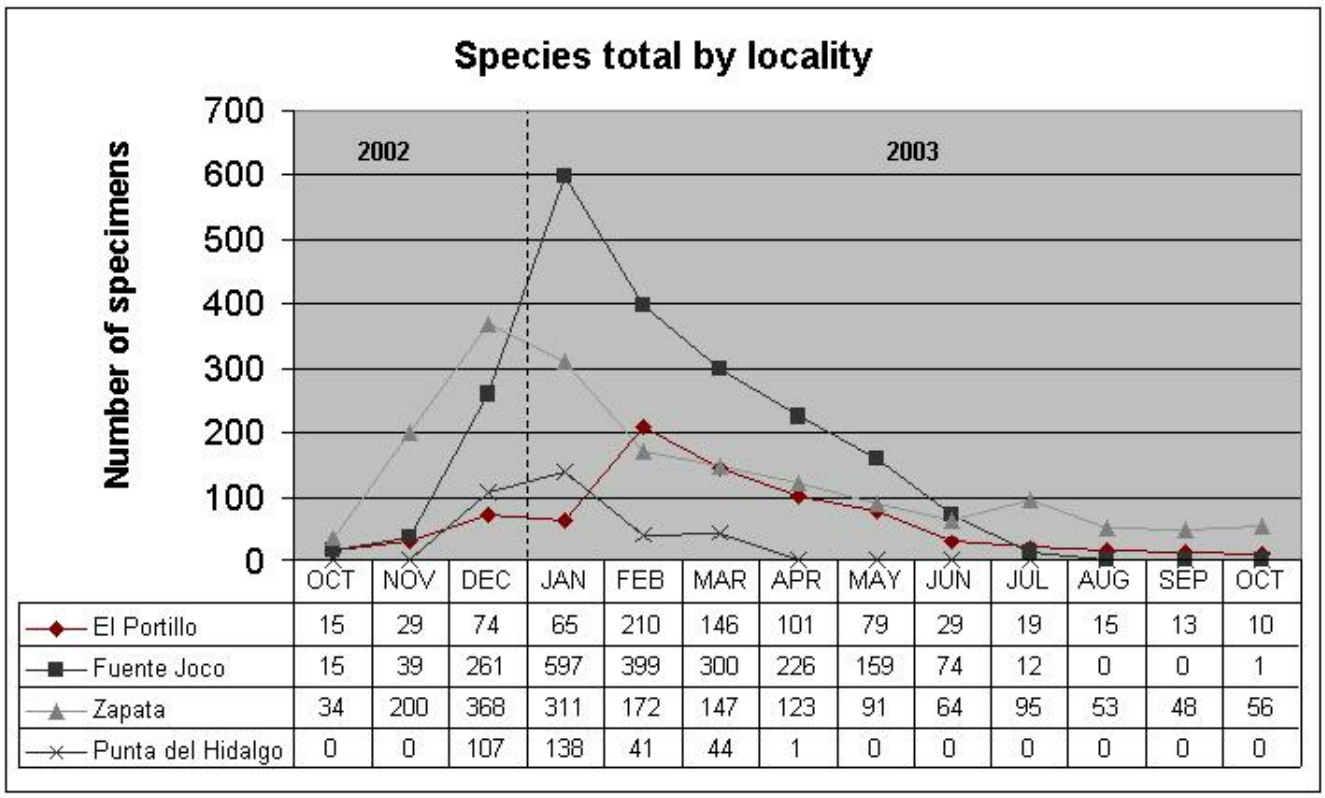
DISCUSSION

In the temperate regions of Europe, leaf-feeding weevils tend to overwinter as diapaused eggs and larvae, or as invernating adults (v. SCHERF, 1964; MORRIS 1997). Winter low temperatures seem to have a prominent role in this pattern. In the island of Tenerife, adult *Laparocerus* main activity concentrates in winter months with a slight shift from early winter to spring while gaining altitude (see Fig. 7). In the lower and intermediate regions humidity (rainfall / cloud presence) seems to play an important role in the dynamics of this group. Activity restriction is highest (7 months) during the dry season in the coastal habitat, and much shorter in the pine forest (2 months). In the moist laurel forest and in the high mountain region, populations decrease in summertime but are still present. Apparently, there are a few species whose maximum numbers shift to spring or early summer. This tendency is clearer in the high mountain environment, where low temperatures could be a more limiting factor, at least for their food-plants.

To interpret correctly the data obtained, it would be necessary to know the biology of the species sampled. Unfortunately, there are no such studies available. In any case, it should not be assumed that every species has a single generation a year or that adults live less than one year. Our inference from field collecting is that, at least, species of the subgenus *Amynthas* (not present in this experiment) live apparently more than one year. But this is probably the exception.

CAMPOS *et al*. (1986) realised a phenological study of surface beetle populations in the high mountain region of Tenerife. Their methodology is not fully comparable with ours as they used pit-falls, which remove specimens from the population. Nonetheless, it is worth comparing their results as they include the same species of *Laparocerus,* except for *L. tessellatus* (Brullé, 1838), which they record instead of *L. freyi*. As these species can be mixed or confused, we assume *freyi* / *tessellatus* as one single taxon. Their data are rather consistent with ours: a summer stop for *freyi* / *tessellatus* and an increase of *canariensis* in the same period, with an extraordinary peak of 548 specimens (from a total of 718) collected in September.

PERAZA *et al*. (1986) conducted the same type of study in two pine forest localities of Tenerife, at 1400 m altitude (windward) and at 1700 m (leeward). They collected 17 specimens of *L. crassifrons* in spring (leeward locality), and a longer series of *L. tessellatus* distributed all over the year (144 exx), with the exception of October and September, and showing two peaks, one in January (15 exx) and another in July (59 exx). For this latter species, data of both localities were integrated and, as it is explained, the locality in the windward side of the island is very humid with understorey of *Myrica faya* and *Erica arborea*, which are common trees in the laurel forest. Indeed, most of the other insect species collected are typical from the laurel forest. Thus, this locality in the north (Montaña de los Organos) is to be considered as a mixed pine / laurel forest habitat.



	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
El Portillo	15	29	74	65	210	146	101	79	29	19	15	13	10
Fuente Joco	15	39	261	597	399	300	226	159	74	12	0	0	1
Zapata	34	200	368	311	172	147	123	91	64	95	53	48	56
Punta del Hidalgo	0	0	107	138	41	44	1	0	0	0	0	0	0

Fig. 7 - Aggregated monthly variation of *Lapacerus* in four localities of Tenerife.

The few phenological patterns known in other insect groups vary considerably. For instance, BÁEZ & ORTEGA (1982) did a phenological study of Drosophilidae in Tenerife, which included habitats equivalent to ours, except for the high mountain region. In the lower zone succulent vegetation populations increase in winter and are absent in the summer, while in the laurel forest they are almost exclusively present in the summer. The pine forest has Drosphilidae all year around. Another study on butterflies (ARANGUREN & BÁEZ, 1984) shows very fluctuating numbers, which are probably more linked to the weather conditions at the day of capture (flying individuals) than to real population changes. It is of little value to compare phenology patterns between groups that have different biology or have been studied using different methods. *Laparocerus* are non-flying weevils, and we consider it basic for phenological studies to not extract specimens from the target population.

The climatic diagrams in Fig. 2, reflect only the variation of temperature and rainfall. However, these values do not fully reflect the environmental conditions in localities exposed to the trade wind cloud layer. The frequent presence of fog helps to reduce evapotranspiration and to maintain more humid conditions in the forest than otherwise. Additional hidden fog precipitations may add 50% or even duplicate the amount of direct rainfall (KÄMMER, 1974; ABOAL *et al*., 2000). This phenomenon is

crucial for the persistence of the laurel cloud forest, particularly in the summer, when the trade winds are more stable. Above the laurel forest, no influence of the clouds during the summer provides for much dryer conditions (relative humidity less than 50%), which only allows the dwelling of a pine forest community. The prolonged humidity conditions in the laurel forest explain the presence of winter-species, like *L. tesselatus*, throughout the year, while they disappear in the summer at Fuente Joco.

CONCLUSION

In conclusion, humidity, more than temperature, seems to determine the general pattern of adult winter activity of *Laparocerus* in the Canaries. This pattern contrasts with the situation in Madeira and the Azores, which have a more oceanic climate. There are no proper phenological studies from these archipelagos, but data taken from the literature (f. i. WOLLASTON, 1854, 1865; BORGES, 1999) and from our collecting in these islands (unpublished) reflects that most *Laparocerus* species are active in summer and only a few dwell mainly in winter (i. e. *L. clavatus* Wollaston, 1854, *L. undulatus* Wollaston, 1854*).* In this respect, Madeira and the Azores reflect a more "continental" pattern, probably more related to the much more humid conditions of the summer than to the harsher winter temperatures. In the Canaries, "summer species" are the exception, not the rule. Nonetheless, most laurel forest "winter species" are still active during summer, but not at their optimum level. This generalisation should be confirmed by further studies involving the other species present in the island.

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ANNEX

1. PUNTA DEL HIDALGO (50 m). Coastal succulent vegetation

Month	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
Sampling day	-10-02	-11-02	-12-02	-10-03	4-2-03	7-2-03	2-4-03	9-4-03	2-6-03	9-6-03	2-8-03	2-9-03	-10-03
Start hour	21:30	22:35	21:40	21:30	21:30	22:00	23:30	22:00	21:55	22:25	12:30	21:50	23:35
Temperature	21,7	22,4	18,6	16,8	18	18,3	17,9	20	20,7	21,4	22,5	24,6	22,5
Relative humidiy	85%	86%	75%	73%	83%	76%	93%	78%	77%	91%	74%	80%	87%
Weather condit.	drizzle	breeze	breeze	clear	windy	clear	breeze	clear	clear	windy	clear	breeze	clear
Laparocerus	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
vestitus	0	0	107	138	41	44	1	0	0	0	0	0	0
T o t a l	0	0	107	138	41	44	1	0	0	0	0	0	0
Diversity	0	0	0	0	0	0	0	0	0	0	0	0	0
Bajamar (70 m) /Punta del Hidalgo (40 m)													
Mean temperatu	21,4	22,5	15,2	17,1	18,1	18,4	19,2	20,8	22,6	24,6	26,4	25,3	25,4
Rainfall (mm)	11,2	62,8	116,8	50,9	44,0	3,7	17,7	8,5	0,5	1,0	0,0	1,4	169,7

2. ZAPATA (900 m). Laurel forest

Month	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
Sampling day	-10-02	-11-02	-12-02	-10-03	4-2-03	7-2-03	2-4-03	9-4-03	2-6-03	9-6-03	2-8-03	2-9-03	-10-03
Start hour	22:15	20:30	20:10	19:45	20:30	20:45	21:30	12:00	23:20	22:55	23:20	23:15	21:35
Temperature	17,3	16,9	13,2	16,3	11	13,3	13,7	17,2	14	14,6	20,1	19	20
Relative humidi	92%	93%	86%	53%	80%	85%	92%	72%	91%	93%	57%	77%	73%
Weather condit	foggy	breeze	wet	dlear	clear	dlear	dlear	dlear	foggy	clear	clear	clear	clear
Laparocerus	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
grossepunctatu	16	148	192	74	27	28	12	11	3	6	0	1	16
tessellatus	6	40	164	226	145	113	107	80	52	77	21	15	6
excavatus	12	11	9	2	0	5	2	0	8	10	32	32	34
lepidopterus	0	1	1	5	0	0	0	0	0	0	0	0	0
spec. 1	0	0	2	0	0	1	0	0	0	0	0	0	0
ellipticus	0	0	0	0	0	0	0	0	1	2	0	0	0
inaequalis	0	0	0	4	0	0	2	0	0	0	0	0	0
T o t a l	34	200	368	311	172	147	123	91	64	95	53	48	56
Diversity	0,31	0,26	0,27	0,28	0,13	0,28	0,29	0,15	0,33	0,30	0,17	0,28	0,27
Los Rodeos (617 m)													
Mean temperat	18,7	15,8	14,8	13,3	12,7	15,2	14,7	17,6	18,2	20	22,4	21,4	18,7
Rainfall (mm)	19,3	104,6	203,2	59,4	103,1	31,7	37,4	0,4	3	2,8	0,3	1,2	67

3. FUENTE JOCO (1860 m). Pine forest

Month	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
Sampling day	-10-02	-11-02	-12-02	1-1-03	3-2-03	8-2-03	1-4-03	0-4-03	3-6-03	0-6-03	1-8-03	1-9-03	-10-03
Start hour	23:20	23:45	22:45	21:30	20:00	20:45	23:30	22:15	23:50	23:50	23:20	23:25	21:15
Temperature	16,6	11	10	13,4	4,8	13,3	9,3	8,8	11	17,4	21	20,3	17.2
Relative humidi	51%	68%	72%	35%	55%	40%	88%	89%	61%	37%	24%	32%	63%
Weather condit	clear	clear	clear	clear	clear	clear	clear	fog	clear	clear	clear	clear	clear
Laparocerus	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
tenuepunctatus	9	13	87	90	57	33	47	14	11	0	0	0	0
tessellatus	6	20	137	480	312	241	166	136	63	11	0	0	0
bolivari	0	6	37	27	30	26	13	9	0	0	0	0	1
spec. 2	0	0	0	0	0	0	0	0	0	1	0	0	0
T o t a l	15	39	261	597	399	300	226	159	74	12	0	0	1
Diversity	0,26	0,30	0,20	0,17	0,18	0,19	0,20	0,22	0,26	0,28	0,00	0,00	0,00
Gaitero (1747 m) / Montaña Ovejas (1255 m)													
Mean temperat	14,5	11,4	9,6	6,9	5,9	8,2	8,4	10,3	13,9	18,2	19,8	19,4	16,4
Rainfall (mm)	29,1	139,2	125,3	52,3	159,1	59	97	6,1	0	2,1	0,4	0,4	178

4. EL PORTILLO (2050 m) High mountain shrub vegetation

Month	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
Sampling day	-10-02	-11-02	-12-02	1-1-03	3-2-03	8-2-03	1-4-03	0-4-03	3-6-03	0-6-03	1-8-03	1-9-03	-10-03
Start hour	21:45	21:30	20:50	20:00	9:30	22:05	21:30	21:45	22:15	22:40	22:20	21:45	21:50
Temperature	12,3	7,7	6,4	13,2	2,6	9,2	8,9	4,1	10,8	14,9	18,5	17,3	13,1
Relative humidiy	53%	51%	69%	33%	55%	39%	79%	79%	51%	45%	24%	39%	49%
Weather condit.	clear	clear	wet	clear	windy	clear	clear	clear	clear	clear	clear	clear	clear
Mean temperatu	12,2	8,4	5,5	3,7	4,6	7,2	10	14,4	16,4	20,8	19,4	18,6	11,4
Rainfall (mm)	10,2	71	0	71,2	17,2	39,6	3	0	0	0	0	12,5	128,8
Laparocerus													
crassifrons	1	17	30	33	40	36	1	1	1	0	0	0	1
canariensis	14	7	6	3	0	2	12	31	24	19	15	13	9
scapularis	0	1	19	19	152	73	39	6	0	0	0	0	0
freyi	0	4	19	10	18	35	49	41	4	0	0	0	0
T o t a l	15	29	74	65	210	146	101	79	29	19	15	13	10
Diversity	0,26	0,41	0,32	0,33	0,21	0,28	0,30	0,32	0,33	0,00	0,00	0,00	0,30

Date received: 11-10-2004.