Bonn. zool. Beitr.	Jg. 36	H. 3/4	S. 429—470	Bonn, Oktober 1985

New data concerning the Hierro Giant lizard and the Lizard of Salmor (Canary Islands)

by

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Introduction

In March 1984 I was assigned by ICONA (Spain's National Institute for the Conservation of Nature) to prepare the conservation program for *Gallotia simonyi* (Steind. 1889). The species was considered extinct (Klemmer 1976) till the presence of a small population of large lizards was made public in 1975 (see Böhme & Bings 1975, 1977, Böhme et al. 1981). Since being studied by Martínez Rica no further knowledge on its status or biology has been added. Martınez Rica climbed several times and visited the dangerous and almost inaccessible cliff of Gorreta in September, 1975. Valuable information is included in his paper (published in 1982), particularly, considering his brief visits and his not being allowed to collect any specimen.

Further information and an actual view of the population status was needed to prepare a conservation project. I stayed on Hierro the month of August, 1985, concentrating on field studies of feasible areas[1)] for the lizard seeking to find other remnant populations (negative result!) and looking for suitable habitat for future re-introductions. Much of the time was devoted to search, follow-up and confirm stories with the older people, fishermen and goat-herders who knew about the giant lizards in the past (an extensive report is kept at ICONA).

The past habitat and type locality of the species, the outer Rock of Salmor ("Roque Chico"), was studied, too, but only later did I discover that the Giant lizard of Salmor and the Hierro Giant lizard (fig. 1) were not exactly the same.

The latter was studied in situ, on the cliff where I lived in a small recess for seven days. Habitat analysis, behaviour, population and other biological observations were made. Eight specimens were captured, narcotized with ether, studied and liberated thereafter on the same spot.

This paper is simply limited to the presentation of most of the new data obtained on the Hierro Giant lizard, as well as some relevant information regarding the past habitat and museum specimens of *G. simonyi*. In this same issue, a paper is included addressing the past distribution and probable factors causing the decrease of these large lizards, as well as another article outlining the proposed Conservation Plan for the Hierro Giant lizard.

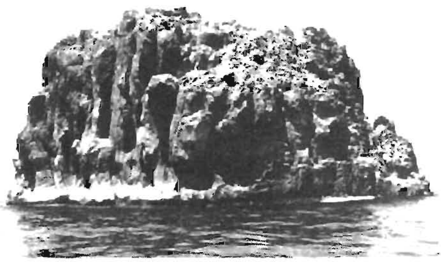
Fig. 1: The Hierro Giant lizard, an extremely endangered reptile which was considered the same as the already extinct Lizard of Salmor (*Gallotia simonyi*). Photo A. Machado.

The Roque Chico of Salmor

Both Roques de Salmor are mentioned as *terra typica* of *G. simonyi* by its author, Steindachner (1889). This seems to be an error if we trust the previous reference of Urusáustegui who stated in 1779 (see footnote 5) that the lizards were living only on the smaller rock (Roque Chico). On August 12 and 13, Mr. Aurelio Martín-Hildago, from the University of La Laguna, and I visited both rocks. He went to study and ring seabirds and kindly helped me to search for signs of lizards (living animals, excrements, bones, etc). As it was the past habitat of *G. simonyi*, I will concentrate only on the description of the Roque Chico.

According to Bravo (1984) the Roques de Salmor belong to a subrecent trachybasaltic and trachytic series that interposed between the normal

Fig. 2: The Roques de Salmor, seen from Punta de Arelmo, N extreme of Valle de El Golfo (El Hierro). The Roque Chico is the outer one. Photo A. Machado



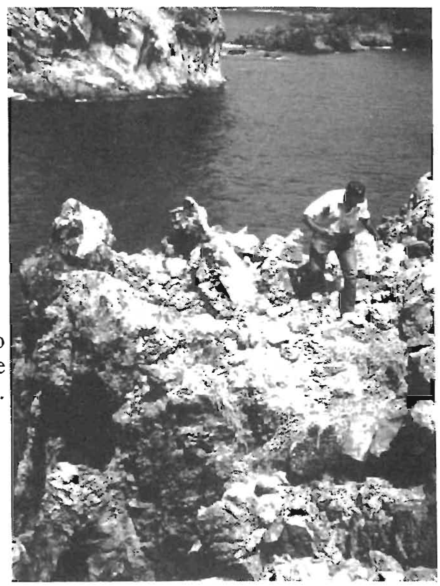


Fig. 3: Left: SE view of the Roque Chico (smaller Rock of Salmor). Right: Baiting in the past habitat of *Gallotia simonyi*. Photo A. Machado.

subhorizontal basaltic formations of El Hierro and the recent series ('tableland formation' of Hausen 1973). The Roque Grande (104 m altitude, surface approx. 2.8 hectares) lies very close (350 m following a chain of small rocks) to Punta de Arelmo (fig. 2), in the extreme NE of the coast of El Golfo. The Roque Chico is isolated, at 830 m from the coast and 340 m from the former, and is much smaller. It is a steep narrow oval rock emerging 37 m directly from the sea, with no shelf[2].

Its top is truncated forming a horizontal platform of some 45 x 25 m, protected on its northern side by an E-W oriented wall, 3—4.5 m high (fig. 3). The north, west and east facing sides are almost vertical, with very few halophytic plants growing in fissures and on ledges (*Astydamia latifoliae* (L. fil) Baill. and *Mesembrianthemum* sp.). On the west face there is an osprey's nest (*Pandion haliaëtus* L.). The south face is a steep and chaotic sequence of broken rocks and small terraces, totally covered by the 'guano' of seabirds — mainly *Larus argentatus atlantis* Dwight — which also breeds on the ledges and on the top. The platform is an uneven surface full of fractured stones and irregular "slates" (15—20 cm diam.), surrounded by groups of loose stones related to the numerous outcrops (everything protruding is covered by bird droppings). The earth (eolic?) is mixed with guano and all kinds of debris (feathers, bones, spines, plastic, etc). A relative dense mantle (30—50 cm high) of dried *Chenopodium* sp. covers the central platform. Other plants, mainly *Chenoloides tomentosa* (Lowe) Botsch.[3] and *Beta* c. f. *maritima*, grow on the northern wall and particularly in the eastern sector, where more earth is accumulated. A few individuals of green *Silene* sp. and *Rubia fruticosa* Ait. were observed, too.

In this eastern sector two long and deep fractures can be considered as an excellent refuge for a large reptile. Moreover, by chance (turning over a stone), we discovered a system of underground galleries (50 cm below) where *Hydrobates pelagicus* (L.) eggs were found. We do not know how extensive this system is. The entrance burrows were inaccessible to us below the rim on the NE side. Nevertheless, Martín Hildago recognized the peculiar smell of *Calonectris diomedia borealis* (Cory) which also breed on the rock, as well as *Columba livia canariensis* Bannerm., in a cavity nearby.

Arthropods were not uncommon on the rock. As winged fauna, I recorded *Macroglossa stellatarum* (Issidae) and many diptera, principally small Muscidae and *Irwiniella frontata* (Becker), a common whitish Therevidae (a group of swifts was continuously sweeping over the platform. In debris and under stones fleas, ticks, silverfishes (abundant), bagworms of female *Amicta cabrerai* Rebel (Psychidae) and a common salticid spider were collected. Extraordinarily abundant were two species of tenebrionid beetles (*Hegeter amaroides* Sol. the most, *Hegeter tristis* Fab. less) and a small lygadeid, *Lamprodema maurum* Fab., which concentrated beneath the plants. *H. amaroides* could easily reach densities of 200 exx/m². *Pimelia* was not found alive, only remnants of specimens.

Large lizard excrements were not seen nor did we obtain results with our baiting and watching (one hour). Any species of lizard seems to be absent from this rock[4], but we counted 7 geckos by turning over stones. Several old fishermen, interviewed, did agree that the large lizards once living there have not been seen since at least the Spanish Civil War.

Human pressure on the Roque Chico has been less than that on the Roque Grande where people used to go more frequently to fish, hunt doves and shearwaters, and particularly to collect salt. In the past, fishermen climbed the

Roque Chico to throw dynamite from the top down on to the shoal of fish (a boat below collected thereafter the dead fish). I was told that prickly pear cacti was planted on top for food and "refreshment", but all were eaten by locusts during a great plague (see Cañizo, 1954) when they were less than 40 cm high.

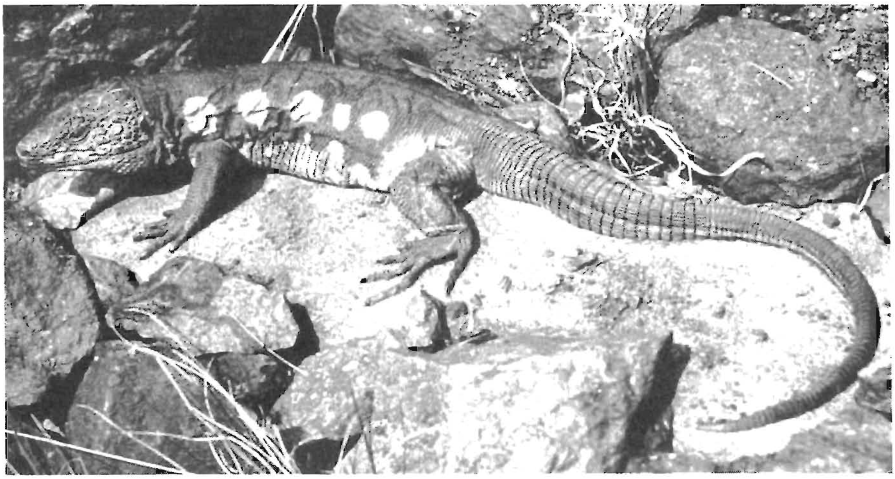


Fig. 4: Photo of a model of the Lizard of Salmor, *G. simonyi*, made by W. Bischoff with sculptor's plaster. Photo W. Bischoff.

The specimens of *Gallotia simonyi*

The first specimens known to science were collected by Oscar Simony, an astronomer and voyager, who visited the Canary Islands several times (1888, 1889 and 1890). His first and only stay in El Hierro was short, two days, but on the second, the 29th of August, 1889, he collected (Simonyi 1892, p. 397) three specimens of the Giant lizard (preserved in the Naturhistorisches Museum Wien: ♂ NMW 16256, ♀ NMW 16255 and ♀ NMW 16254).

One can be almost sure that Oscar Simony knew about the lizards on the Rock as they were mentioned in scientific literature by von Fritsch (1867, 1870) and more precisely on the smaller Rock, by Manrique y Saavedra[5)] (1873) and Viera y Clavijo[6)] (1886) in his Dictionary of Natural History. Simony forwarded those specimens to his Professor of Herpetology, Franz Steindachner, who established the species as *Lacerta Simonyi* (fig. 4). The original description is very short and was published rapidly that same year (19 December 1889). Steindachner gives a more detailed description of *simonyi* in a global work on the herpetological fauna of the Islands (1891), but this description relates mainly to Gran Canarian specimens, which were posteriorly segregated by Schenkel (1901) as *stehlini*. Most old literature references to *simonyi* refer in reality to *stehlini* (i. e. Siebenrock 1894, Wevers 1909, Fejérváry 1914, etc).

The best description, detailed drawings and magnificent lithography (del. Peter Smit) of *simonyi* are by Boulenger (1891). He studied "the largest of three specimens Hierro, Canary Islands, and presented to the Society (Zoological) by Lord Lilford. . . acquired by the British Museum." An indirect but relevant mention to this capture is found in Meade-Waldo (1890), an ornithologist who visited Hierro in November 1889. "The man that we engaged as guide, and servant also, was anxious to procure for us specimens of the large lizard that inhabits the outer Zalmore Rock . . . After we had arranged to visit this spot, the dark weather and heavy surf prevented any attempt landing on it while we were in Hierro, but Canon Tristam, who came afterwards, was more successful." Two of these specimens are in the British Museum, Natural History (♂ BMNH 91.3.3.1, ♀ BMNH 92.8.31.1) and perhaps the third mentioned by Boulenger is a stuffed one purchased from E. Gerrard (♀? BMNH 1903.9.16.5). In his "Monograph of the Lacertidae" Boulenger (1920) expands his previous description with more data and adds new information about the female.

Salvador (1971) studied one stuffed specimen kept by Mr. L. Diego Cuscoy, director of the Archaelogical Museum in Tenerife, who received it from "Colonel Vallábriga". This specimen is probably the one collected on the rock by a young fisherman, D. Eduardo Rodríguez Morales (interviewed Aug. 23, 1984) in 1928 at the request of Colonel José Angel Rodrigo de Vallábriga. A wine merchant of Valverde, Juan Padilla, acted as middle-man and paid the fisherman 50 pesetas for the lizard. The animal was slow in its movements and was captured with a hat without its brim. Señor Rodríguez measured the total length of the lizard as 75 cms. The stuffed specimen kept in the Museo Insular de Ciencias Naturales, in Santa Cruz de Tenerife (♀ TFMC 32) measures 52 cm but the tail is regenerated (after the 15th whorl). Salvador (1971) estimates a total length of 750 mm. The animal probably lost its tail during the long confinement on the terraced roof of the Colonel's house, from which it fell down and died.

There are many stories circulating, even in the literature, referring to malicious foreigners collecting lizards on the rocks. Most of these seem to be fantastic[7)], including the one of an Englishman poisoning the rock after he took the last specimens. From all the reliable pieces of information I collected, one has to believe that additional lizards have been removed from the Rock (e. g. Mr. R. Morales in 1930, sold one for 12 pesetas) but I have found evidence of only two. They are kept in the British Museum (♀ BMNH 1967.1736 and ♀ BMNH 1967.1737), labelled H. B. Cott/Roques Zalmor. Bannerman (1963) writes: "In the meantime a Cambridge Zoologist Dr. Hugh Cott, had come out to make a survey of all islands and outlying rocks in pursuit of lizards, a rare form which occurs on a rock off Hierro and grows to a very large size." This took place in 1931, the year that on August 15th, Mr. José Padrón Machín, local reporter, was on the Rocks together with an Englishman who captured some specimens, but more were left on the rock. I asked in the Hunterian Museum at the University of Glasgow[8)] and effectively Cott donated material in 1930 and 1940

(M. Reilly, in litt.) but no *simonyi* are there today. In 1956 much of the museum's reptile and amphibian material was given to either the British Museum (Natural History) or the Birmingham City Museum. These specimens have been studied by Wolfgang Bischoff (Museum Alexander Koenig, Bonn) who is preparing a revision of Canarian reptiles, and who generously forwarded me all his unpublished data and photographs.

There is one very well-preserved and large specimen of *Gallotia simonyi* in the recently created Museo Insular de Historia Natural in Santa Cruz de La Palma (♂ PMHN 1105). The animal (fig. 5) came from the interesting natural history collections of the local society "La Cosmológica", whose old registers annotate: Num. 1105, Received: February 1891; Donor: D. Eloy Díaz Casañas; Common name: A lizard of the Roque de Salmor. It had not been previously studied so I include its measurements (in mm), pholidosis and other descriptive details here (see Table I).

The head plates are pitted. Nostril small (1.6 x 2.5 mm). Teeth tricuspid, with the median cusp much higher and more than three times broader than the side cusps; sides subparallel. Gular fold incipient. The specimen's appendages are complete, its tail being regenerated from the 27th whorl. Colouration is gone but a slight indication of two paler spots can be noticed at the height of the fore limb.

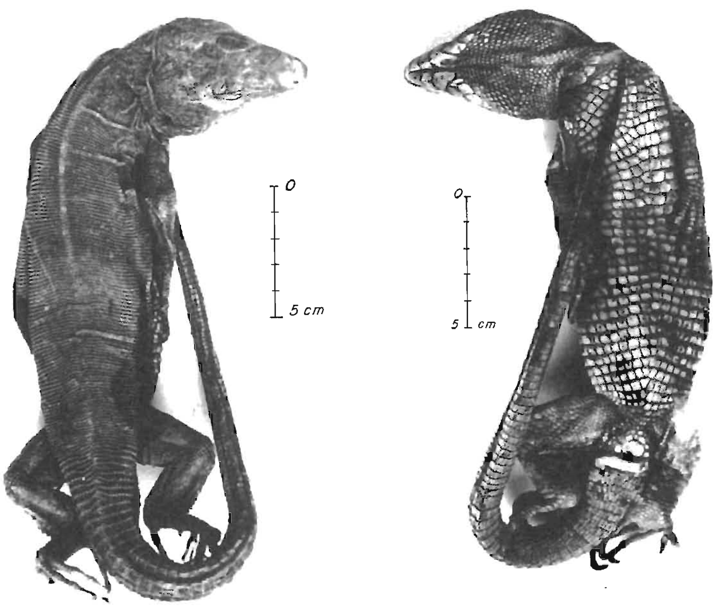


Fig. 5: Dorsal and ventral views of specimen PMHN 1105 of *Gallotia simonyi* from the Museo Insular de Historia Natural of La Palma. Photo A. Machado.

Table I: *Gallotia simonyi*, male, Reg. no. PMHN 1105.

Total length	509	Temporalia	29/33
Snout-vent length	224	Collaria	13
Pileus length	50.4	Gularia	32
Pileus width	22.6	Ventralia long.	18
Head height	27.4	Ventralia trans.	34
Gular max. width	39.4	Dorsalia	> 88
Fore-limb	85	Femoral pores	> 30
Hind-limb	130±3	Sugdig. 4 toe	31/31
Supraciliaria	8/8	Anal plate width	9.15
Suprac. granules	12/14	Anal plate height	5.65
Supralabialia	5/5	Tail whorl num.	109

The habitat of the Hierro Giant lizard

A general view of the Fuga de Gorreta is given in figure 6 and the habitat of the Hierro Giant lizard is marked on a sketch in figure 7. Population distribution limits were established by presence/absence of excrements. Some old excrements found below the habitat, at the base of the cliff, probably were rolled down by the wind[9]. Actually the population is restricted to the northern protruding rocky ridge of the Tibataje cliff face at Gorreta, and concentrated on the very ridge in a band no broader than 10 m (Sector I "Paso del Pino"), ranging from 350 m altitude to 500 m (cliff extends from 100 to 1200 m approx.); see figure 8. Sector II ("Paso de la Calcosa") is a cut on the rim and represents a wider and better biotope (more protected, better insolation, etc); see figure 12. Average slope is greater than 100 %. My habitat size estimation falls therefore in the range of only 1500—2000 m², considerably smaller than that given by Martínez Rica (1982). Effective available terrain, including small platforms and ledges, could be three times the former estimation.

Fig. 6: General view of the Fuga de Gorreta, Valle de El Golfo (El Hierro). Photo A. Machado.

Martínez Rica gives a good geomorphological description of the lizard's biotope. He explains it as a crest, like the arista of a dihedron, that projects forward out from the rock wall. This unstable situation of differentiated desmantlement of the cliff has evolved because of the presence of various dikes (that of Sector II has orientation N 135°E, dip 25° to N) that cut all the subhorizontal layers of lava, tuff (compacted lapilli) or "almagres" (reddish baked tuff or fossil earth). Large subsidences have occurred (on the southern part) and erosion and gravity are still very active (gorge of Gorreta), forming a wide and hugh dejection cone at the base. The dikes are basaltic, with augites but without olivine; they are very consistent. All of the other samples taken from tuff or lava layers correspond to olivinic basalt, but one very dark, granular and more disgregatable broad band in Sector II (Calcosa) is an ankaramitic oceanite (olivine >augite).

The whole of the ridge is very fractured (figs. 8, 10 and 11), consisting of a rough stepping of broken prominences, unstable blocks, small accumulations of boulders, ledges, steep columns and walls. Compared to adjacent zones, numerous refuges for lizards are everywhere available in the form of crevices, cracks, fissures and under stones. Earth is scarce with a high content of gravel and sand from erosion, and is retained irregularly on the small platforms (20 % slopes) or ledges. Bare rock dominates showing varied lichen coverage.

The distribution of lichens reveals some interesting microclimatic zones. Sector II (Calcosa), a cut open to the West and protected from side winds, shows a more thermophylic lichen vegetation dominated by *Xanthoria resendei* Poelt. et Tav., *Caloplaca ferruginea* (Huds.) Th. Fr. and *Caloplaca carphinea* (Fr.) Jatta. On the rim itself (Sector I), conditions are mesothermic with a high coverage of whitish lichens, mostly *Ochrolechia parella* (L.) Massal with some *Parmelia tinctorum* Despr. and *Parmelia* grex. *conspersa.*

South of the rim the terrain falls vertically and is intransitable. The wind sometimes forms a jet stream through the gorge violently hitting this wall where vegetation is extremely scarce and no lizards were seen. North of the rim, the terrain falls more smoothly

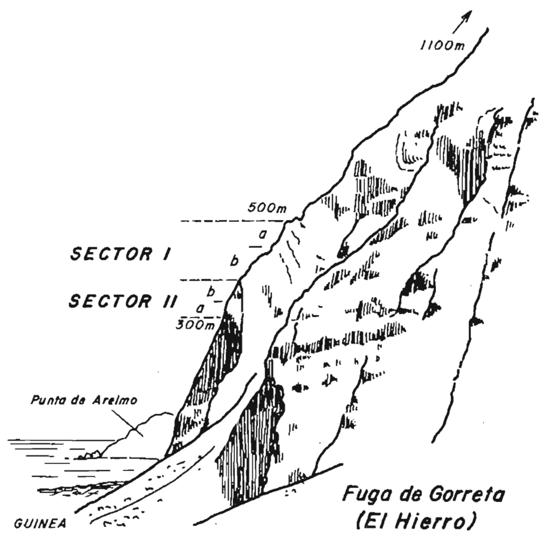


Fig. 7: Sketch of Fuga de Gorreta showing the Hierro Giant Lizard's habitat and sectors (drawn from a photograph).

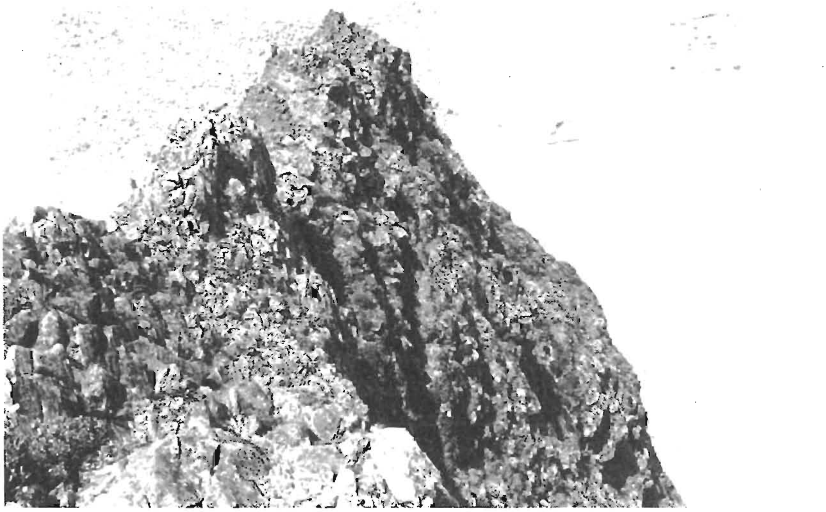


Fig. 8: General view of Sector I of the habitat seen from Paso del Pino. Photo A. Machado.

in a stepwise fashion (more earth accumulated) but still very steep (>100 %). This face is open to humid northerly wind arriving from the sea, an effect shown by the presence of some epilythic bryophytes and the more hygrophylic lichens which dominate there: *Ramalina bourgeana* Nyl. *Rocella fusiformis* (L.) DC. and *Rocella tuberculata* Vain.[10]

Major vegetation in the lizard's habitat corresponds to a reduced version of the cliff's flora, due to a lesser soil availability, abundance of rocks and crevices and a warmer and more xeric microclimate. Dominance is achieved by xerophytic succulents like *Kleinia neriifolia* Haw. and *Euphorbia obtusifolia regis-jubae* (Webb. & Berth.), and woody shrubs: *Echium hierrense* Webb ex Bolle, *Lavandula canariensis* Mill. and *Artemisia thuscula* Cav. *Micromeria* sp. chaemophytes are very inconspicuous, but rather common throughout. Crevices are mostly occupied by *Carlina salicifolia* (L. fil.) Cav., browsed *Psoralea bituminosa* L., *Aeonium hierrense* (Murr.) Pit. et Pr., *Aeonium longythirsum* (Burch.) Svent and *Phyllis viscosa* Webb ex Christ. Less common are *Globularia salicina* Lam., *Rumex lunaria* L., *Schizogyne sericea* (L. fil) DC., *Paronychia canariensis* (L. fil) Juss., *Periploca laevigata* Ait., *Rubia fruticosa* Ait. and *Erica arborea* L.

Attached to rocks and in small gaps I frequently saw dried *Wahlenbergia l. lobelioides* (L. fil.) A. DC. and some individuals of *Cheilantes catanensis* (Cos.) H. P. Fuchs, *Lobularia* sp. and *Polycapaea* cf. *divaricata* (Ait.) Poir, but the majority of the smaller plants belong to the gramineae. Most abundant throughout were *Trachynia distachya* (Hasselq. ex. L.), *Vulpia* sp., *Hyparrhenia hirta* (L.) Stapf. and *Brachypodium* cf. *arbuscula*, which is the only grass that remains green in summer.

Therophytic vegetation which should start to develop in September with the arrival of the rains, is composed of a vast number of annuals and biannuals. I found remains of *Bidens pilosa* L. (should be very common), *Papaver*, several *Trifolium*, *Ononis*, *Plantago*, *Silene*, *Vicia*, etc.

In El Hierro, shepherds distinguish two seasons in the year: from June to October the pasture is dry, then, from October to June everything is green (Lorenzo Perera, 1980).




Fig. 9: Lizard's watchmen J.P. Pérez Machin, in the accesspass to the Hierro Giant lizard's habitat. Fig. 10: Detail of habitat in Sector I. On top, Paso del Pino, normal observing position of author. Fig. 11: Aspect of the rim. Note the abundance of crevices and brocken blocks. The North, left of the picture. Fig. 12: General view of Sector II of the habitat (Paso de la Calcosa). White cloth shows the entrance to the author's refuge-laboratory. Photos A. Machado.

This general concept is perhaps the best approach to a phenology related to rainfall. Pluviometric information from Hierro is scarce and incomplete. Nevertheless, one could accept the SPA-15 isoyeths map in which the lizard's habitat falls in the band of 300—400 mm. Mean annual temperature should be a few degrees higher than 19.4° C (Village of Valverde). These values seem reasonable to me.

The influence of man has been important on all the cliff of Tibataje. Goat-herding was very active in the past (up to a thousand goats in the fifties, J. Machín pers. comm.) till prohibited recently and now reduced to only a few uncontrolled animals. The rest of the cliff is dominated in its lower and median sectors by a substitution community of cistus break (*Micromerio-cistetum monspeliensi* A. Santos 1976), very rich in therophytes and hemicryptophytes (*Asphodelus*, etc). *Psoralea bituminosa* is a common plant throughout the cliff but heavily attacked by goats which clearly prefer it as fodder. A few trees belonging to the transitional community of the potential vegetation can still be found: *Olea europaea cerasiformis (*Webb et Berth.), *Sideroxylon marmulano* Banks ex Lowe and *Juniperus phoenicea* L.

I have seen slides of the habitat taken by Mr. C. Silva[11)] in 1975 and 1976 and some changes in the vegetation can be observed since then. *Euphorbia* and *Kleinia* are almost the same (they must grow very slowly), but a number of new bushes of *Echium* and *Artemisia* stand out, as well as more grass attached to the stones. One can relate this change to a reduction of goat grazing pressure.

The upper distributional limit of the lizard population appears not to be related to the substrate, which extends further up virtually the same kind. At this altitude (500—550 m) a slight change in the vegetation occurs, notable by the progressive appearance of small plants of *Erica arborea*, an advance of the subhumid bush formation of the upper parts of the cliff. This change, associated with a humidity increase, could be due to the cloud layer of the NE trade winds which are more constant and lower, particularly in summer. An increase of humidity conditions is also valid to explain the limits of habitat towards the North. *Roccella* lichens and a dense increase of *Aeonium* show the effect of the humid wind touching that side. The lack of appropriate refuges (no crevices, few holes) could be a reasonable or additional explanation, too.

There are few breeding vertebrates in the lizard's habitat. Two small groups, no more than 12 pairs in total, of *Columba livia canariensis* Bann. are placed deep in the rocks. *Gallotia galloti caesaris* (Lehrs) is very abundant and *Tarentola boettgeri hierrensis* Joger & Bischoff is present, too. On the northern side of the Cliff, at 375 m altitude, I saw one skink (probably *Chalcides viridanus* (Grav.)) but none in the range of the giant lizards. The same occurs with rabbits, whose excrements were found only in the cistus breaks. Signs of mice (*Mus* sp.), excrements and gnawings on *Rumex* and *Carlina*, were present. There were not many and I could not catch any specimens. *Rattus rattus* excrements and burrows can be seen in the cliff, not far from the lizard's habitat.

The number of vertebrates whose range covers the lizard's habitat is much greater than those permanently living or breeding there. My records include: *Falco tinnunculus canariensis* Koenig, the most common bird of prey, always in the vicinity, with five nests in Gorreta (250—300 m); *Falco* sp., a pair was active hunting rock doves during the whole month of my stay; *Buteo buteo insularum* Floericke, three buzzards were always at the top of the cliff but they do not seem to come lower (confirmed with herders); *Tyto alba* (Scop.), a nest was discovered just at the base of the cliff, below the lizard's habitat[12)]; *Corvus corax tingitanus* Irby breeds along the cliff with nests in the lower part every 800—1200 m, that of Gorreta raised 3 young and all 5 ravens could be seen every day while flying to and from the cultivated fields; *Phylloscopus* sp. (probably *collybita*), two observations in Sector II, feeding and preening; *Upupa epops* L., a single short sighting and *Apus u. unicolor* (L.), a stable group of about 15 to 20. At dusk, some bats (*Pipistrellus* size) hunted near my refuge (bats have been very abundant this year in Hierro).

According to various goat-herders — A. Armas, J. Brito, L. Febles, J. Machín, E. Padrón, J. P. Pérez — who formerly walked and know the cliff well, feral cats are not uncommon. The latter observed one in Sector II in 1978. Kestrels, on the young lizards, and feral cats, in general, ought to be considered as one of the principal potential predators of the actual cantonized lizard population. Despite the prohibition mentioned above, a few goats are still present. Recent droppings were found in the lizard's area, especially in Sector II which is the "best" pass for goats between the northern and southern sectors. One has to infer that there is a certain degree of negative impact on plant fodder availability.

August is not the best month to study the invertebrate fauna which, because of the dryness, has entered the "bottle-neck" phase, and one can only detect a reduced representation of the whole. However, I collected some species in five pit-fall traps (plastic jars of 100 ml with turquin's liquid, operating 4 nights) and took some field observations directly. To these, one must add those other species recognizable in the lizard excrements and listed on Table IV.

Most common insects were ants[13)] (typical for a summer situation), particularly the big *Camponotus rufoglaucus feai* Emery which wander individually everywhere; they also climb on *Euphorbia* to look for nectar. *Leptothorax risi* Forel can be abundant below plants (*Rumex*, *Echium*). *Monomorium pharaonis* (L.) and *M. medinae* Forel were present, too, but less common.

The major part of other ground-dwellers found, generally very few, were coleoptera like *Dapsa* sp., *Alloxantha ochracea* Seidl., *Hegeter tristis* and *H. amaroides*, *Anthicus* cf. *guttifer*, *Laparocerus* ssp.. The environmental conditions were very dry, indeed, but I did not see the common hemiptera and ground spiders (only a few juvenile Gnaphosidae). The epiedaphic fauna was very restricted. From the traps one can add some springtails, silverfish and mites. From plant detritus, I collected some diptera pupae, a few heterocera caterpillars and coleoptera larvae, remnants of Iulidae and snail shells of *Napaeus* sp., *Hemicycla* sp. and *Canariella* sp..

Planticole animal life observed was not abundant either. A few Anthocoridae, Thomisidae, and among coleoptera: *Chrysolina gypsophilae grossepunctata* (Har. Lind.), *Apion radiolus chalybeipenne* Woll., *Attagenus* sp. (floricole) and *Scobicia* sp. (wooddweller). Dead *Lavandula* were affected by *Stenidea* sp. and Isoptera (See Table IV for more species).

Grashoppers are common in summer in El Hierro and are an important food supply for many other animals. In the lizard's habitat very few were observed (4 exx of *Aiolopus* sp.) and common species like *Dociostaurus maroccanus* (Thunb.) were absent. Perhaps the rough topography and strong winds are reasons for this. Nevertheless, the lizard's excrements contained some additional species of this group: crickets, earwings and a small cockroach.

Martínez Rica (1982) emphasizes the abundance of spiders which he relates to the air coming up the cliff bringing wind-borne insects. In fact, an *Araneus* is very abundant, especially in the cistus break and the antlion-traps he observed related to this phenomenon, belong to *Uroleon* sp.. Down of *Periploca laevigata* continuously passing upwards at different velocities (15—40 Km/h). This daily regime of thermals must have an outstanding importance — one of the ecological key factors — in the energy income of the cliff communities, which somehow must be adapted (increase of small detritivors and predators) to exploit this regular "manna". I did not take glue-traps to collect this "manna" so it is difficult to distinguish between the local winged insect fauna and that which is wind drifted.

Flies like several little Muscidae, *Sarcophaga* sp., *Lucilia sericata* Meig. and *Irwiniella frontata* (Becker) were common (also present *Drosophila* spp., *Promachus* sp., Syrphidae, Bombilidae and Tachinidae). Hymenoptera were practically not observed (*Halictus* sp. and a few solitary wasps) whereas *Bombus canariensis* Pérez seems to be available for the lizards, perhaps being eaten just after emerging from their ground nests. I did not see any in flight. Some diurnal butterflies (*Vanessa* and *Colias*) crossed the area (drifted) but the repeated appearance of *Hipparchia wyssii bacchus* Higgins makes me think that it can be breeding in *Brachypodium* sp. (its food-plant is still unknown). *Macroglossa stellatarum* L. was flying at sunset and *Celerio Euphorbiae tithymali* B. was seen on *Euphorbia* nearby (they can eat a considerable amount of leaves and flowers!). Apart from *Pionea* sp. I found no moths, probably because of the time of the year.

Population size and structure

The population size of the Hierro Giant lizard was deduced by first establishing two different habitat types: sector I and II. Both sectors were subdivided in A (= visible) and B (= extrapolable) because of observation coverage. In each visible sector 4 specimens were captured and marked (only two marked in sector II) with washable colour-paint on the top of the head. On coming days, counts were undertaken obtaining the proportion of marked/unmarked specimens to estimate total population of the sector including animals that do not emerge or are hidden from the observers' eye by the roughness of the terrain. Then, the relative density obtained (total number of specimens calculated / proportional size of subsector) was extrapolated to the other habitat's homologous subsectors, corrected by their own proportional size. Global population size is finally obtained by adding values of sector I and sector II.

In subsection I-A nine specimens were seen, one marked; and in subsection II-A two of eight, but all lizards probably living there — nine — were observed (and known) during the stay, including the 4 captured there. A/B proportions are 1.3 : 2.4 in sector I and 1 : 2 in sector II, as measured from a photograph of the side-view of the ridge. This gives a total population estimate of 102 + 16 = 118.

By exercising moderation, one could restrict the visual area of sector I-A to one third of the whole sector, by which the number of specimens actually seen in it falls to 7. In sector II direct counts gave 9 + 3 = 12 specimens. A conservative estimate would be a stock of 82 + 12 = 96.

It is reasonable to speak of a hundred specimens. This number is acceptable to me from a subjective perception of the natural circumstances involved. Thus, the population density would be between 15—20 m^2 per animal (500/ha), a high density for average land conditions, but perhaps not so much for a fractured, steep and rough ridge. The sympatric and more abundant *Gallotia galloti caesaris* was very common, with extremely higher densities when compared to surrounding areas.

It is difficult to give the precise number of different individual lizards observed on the cliff during the stay. According to my notes, an approximate figure of 28 ± 5 emerges. Broad segregation into three size classes (small, medium and big) gives a proportion of 2 : 8 : 6 by direct observation and a sex ratio of 1 : 1. The only two "small" lizards seen are considered as young of the previous year (one of them measured gave snout-vent = 114 mm). Young lizards from the present year were not seen. "Big" refers to sizes around a total length of 45—50 cm (Snout-vent = approx. 180—190 mm). The head of an older and what appeared to be a much larger specimen was seen at a long distance (ca. 30 m

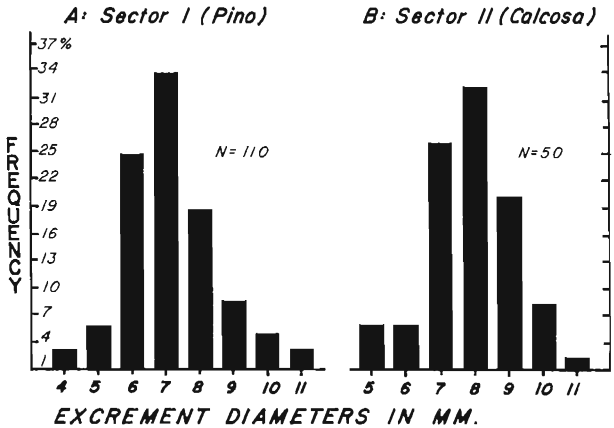


Fig. 13: Bar-chart showing frequency of excrement diameter classes in Hierro Giant lizard on (A) Sector I and (B) Sector II of habitat.

with binoculars of 20 x 80). Martínez Rica (1982) measured indirectly two old males (62 ±2 cm and 71 ±5 cm) with a greyish pileus because of age. If we accept a "very big" category for the head I observed, and another for the unseen young of the year, proportions would be 0 : 2 : 8 : 5 : 1.

An indirect approach was also taken to estimate population structure. The excrement diameter of a given lizard should be approximately constant if diet does not change much, varying principally in length depending on the amout of food ingested. Thus, a frequency analysis of excrement diameter classes could give us an inferred view of the whole population structure. All excrements (perhaps deposited in a period of 2—2½ months), that were not old (disintegrated, bleached by sun, etc) were sampled and measured with a calibrator: 110 in sector I and 50 in sector II. Figures 13 A and 13 B show the respective size frequency distribution obtained.

The proportion of young from this exercise gives 7.5 %, less than observed in the field (1 : 8). Even so, both cases indicate that we are probably dealing with a collapsing population. The Hierro Giant lizard has to be considered in extreme danger of extinction.

Reproduction

Some female lizards observed and photographed (600 mm Novoflex telephotolens) in the field were clearly identified to be pregnant, but doubts arise in other cases. Therefore, I only trust the proportion obtained from the four females collected, of which three were pregnant. The bulges on the flanks could be easily observed and counted (figs. 15 and 28 B). Eight appears to be the minimum number of eggs, but some additional ones could well exist situated in the middle, between the two rows of four. This estimate is reasonable to experts like W. Bings, W. Bischoff, H. K. Nettmann and S. Rykena (all pers. comm., November, 1984), who have seen close-up black and white photographs taken from the above mentioned specimens. The Gran Canarian Giant lizard, *Gallotia stehlini* (Schenkel) is known to have 7—11 (Bischoff, 1974), 8—11 (Rogner, 1981) and 10—14 (Heselhaus, 1981) eggs.

On one shelf of sector II, near a deep crevice in the basalt wall, I found 3 old dried-out egg skins near each other, between pebbles and vegetal remains (borne by water from the inside?). These egg skins (Fig. 14) look similar to those of *G. stehlini* and show normal hatching breakages. Only three successful eggs from 11—12 mean a very high clutch failure (75 %). Their measurements in mm are 23 x 17, 24 x 19 and 24 x 17 (the figures may be inaccurate due to shrinkage).

In spite of having carefully searched in the few suitable sites of the study area in sector II, no fresh eggs of *G. simonyi* were found , but two of *Tarentola boettgeri hierensis* Joger & Bischoff, being studied by S. Rykena, revealed embryos with a development difference of 4—6 weeks.

The Hierro Giant lizard's egg-laying appears to take place around the month of September, involving most of the fertile females (75 %). Pregnant specimen V-6 with 147 mm snout to vent (91.5 g body weight) tends to indicate that female fertility arises at the end of the second year. According to Klemmer (1976: 448) the young of the heavier *Gallotia stehlini* are adult within their fourth year of live. However, Böhme & Bischoff (1976: 110) refer to the young obtained by Bischoff (1974: 99) from a second clutch laid in a terrarium, which emerged in January 1974 after two months incubation and became fertile during late autumn of 1975.

An earlier clutch could be laid in April as in other Canarian lizards (see Molina et al. 1980), but this cannot be affirmed with the actual data at hand, in spite of the fact that no young of the year were seen. A very low natality and/or a great young mortality seems to be involved in the actual population dynamics. It is known (Bellairs 1975) that reptiles under environmental stress conditions reduce reproduction, and may even not breed each year. The Hierro Giant lizard could only perfectly breed once late in the year.

There are very few sites in the present lizard's range where enough stable soil is available to lay eggs. Depth of the earth[14)] rarely exceeds a few centimeters (4—10 cm) and is very exposed to the sun and wind, thus humidity is low. Orography may be the cause of why I did not register dewfall occurring in the valley a little away from the cliff. Eggs ought to be laid in the crevices and holes near the surface, where sand is accumulated. Humidity[15)] is better preserved there and usually higher (for instance, 54 % at 30 cm in a hole between rocks, 58 % at 50 cm in a crack in tuff and 66 % at 24 cm in a tube formed by a burnt fallen trunk during the eruption; air humidity was 48 %). Enough transferred heat is available depending on the conductivity of materials (30°C, 25°C and 24°C respectively; air temp. 25°C), high in rocks, low in volcanic tuff. Scurried

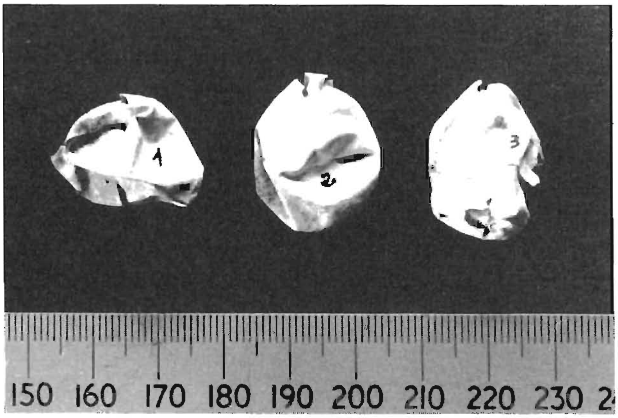


Fig. 14: Egg skins of Hierro Giant lizard found in Paso de La Calcosa, Gorreta (Sector II). Photo A. Machado.

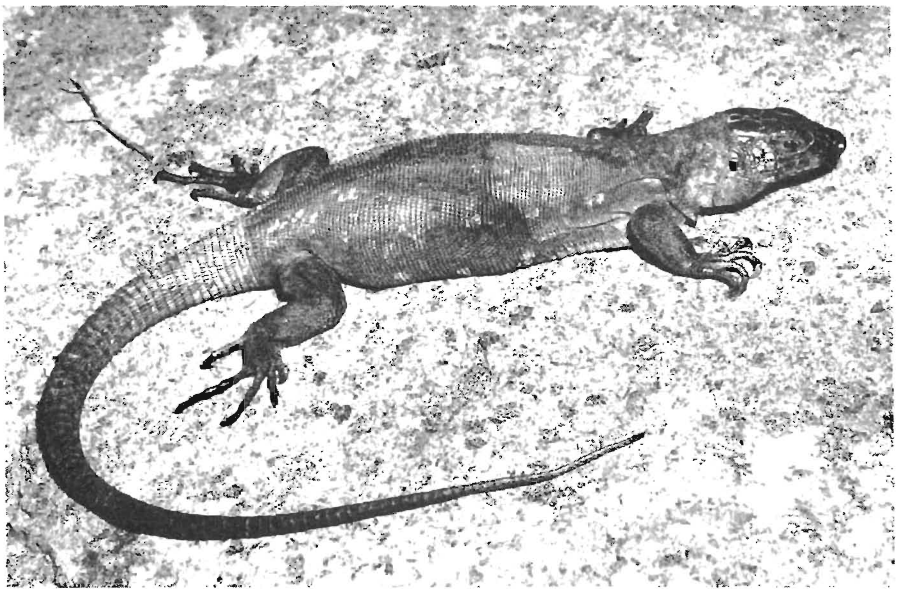
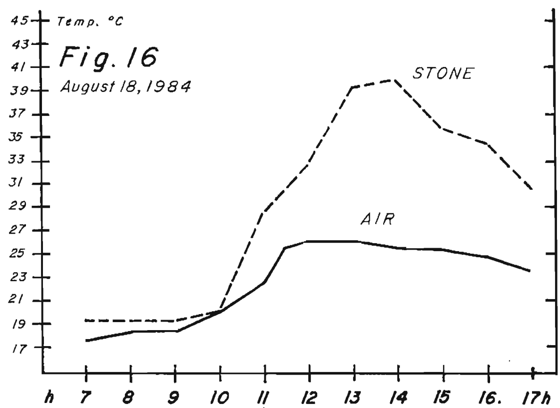


Fig. 15: Pregnant female of Hierro Giant lizard, total length 448 mm (specimen V-4). Photo A. Machado.

rain-water may create the appropriate humidity conditions in these chambers for egg development. This supposition could explain a late breeding season in the population, adjusted to the first rains that normally appear in September. After I left the cliff, a little rain fell (25th August), being registered by ICONA 16 l/m² at the nearby village of Frontera.

Activity

The weather conditions during my stay on the cliff were good, normally sunny and without wind. Because of the north-south orientation of the cliff of Tibataje, open to the west, the sun reaches its face only late in the morning. It is very noteworthy that the first portion touched by the sun rays coincides exactly with the very rim of the ridge where the lizards live. On August 17th this happened at 10 h 31 min; sunrise was at 6 h 38 min and sunset at 19 h 42 min. In figure 16 the thermometric regime measured in the air and on rock-surfaces is shown. A sharp increase occurs with the arrival of the sun. Lizards were seen active outside shortly after this moment, usually some individuals of *Gallotia galloti*



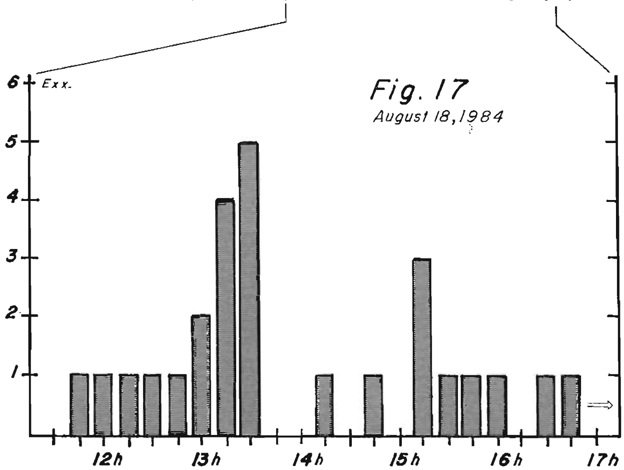


Fig. 16: Thermometric regime of the air and stone surfaces on August 18, 1984 at Gorreta (Hierro).

Fig. 17: Activity pattern of the Hierro Giant lizard on August 18, 1984 at Gorreta (Hierro).

caesaris, before those of the Giant lizard, which are very cautious and shy. Before they emerge[16] they may lie for a long time (ca. 20—30 mins) near the entrance of their refuge or just poke their head. Thereafter, different basking and „head up low" attending patterns follow previous to any exploratory behaviour. This contrasts markedly with the much more "careless" conduct of the smaller *caesaris*, which gives the impression of fearing nothing.

Activity pattern was followed on one warm day (August 18th, max. temp. 26.0°C, average 22.2°C) in a defined area in sector I (ca 150—200 m²), observing from above counting the number of lizards seen every 15 minutes. The pattern obtained and presented in figure 17 shows an increase in the number of active lizards before maximum temperatures at noon; thereafter a retreat from the surface occurs (perhaps still active in crevices and holes) to be followed by a second, more extended but less intensive, active period in the afternoon. Several times I observed the Giant lizards basking and moving about till very late (max. at 19 h 32 mins; air temp. 23.8°C / stone temp. 31.6°C). The whole habitat is exposed to afternoon sunshine, till sunset. No nocturnal activity was detected. The same pattern is seen in *Gallotia galloti caesaris*, though starting earlier in the morning.

Body temperature was measured at the vent with a digital thermometer (Electrotherm M-99), just after the lizards were captured. Specimen V-6 was removed some minutes later, the temperature having risen to 39.5°C. Four measurements are valid: 35.1°C, 35.8°C, 33.1°C and 30.9°C. Thus, following Bellairs (1975), ecrictic temperature can be considered around 33.2°C. Mean body temperature in active *caesaris* gives a similar value: 32.1°C (n = 5; T. min. 26.7°C, T. max. 36.9°C).

Feeding

The number of direct field observations of lizards actively feeding was unfortunately low, as follows.

— A "big" specimen helped itself with the fore-limb to maintain a dry grass (*Bromus* sp.) while devouring it with snipping bites. It used the right fore-limb also to clean remains from around the mouth when finished.

— A "big" specimen ate completely one fresh flower of *Kleinia neriifolia* (long and tubular) that was lying on the ground.

— A "medium" sized specimen interrupted basking shortly to eat capsules of *Wahlenbergia lobelioides* which were close by.

— A "medium" specimen dedicated considerable time to eating a few dry leaves of *Lavandula* lying under a bush. This same individual sniffed at a cigarette end without any further consequence. Tobacco is a strong poison for lizards (I cleared all the area of stub ends; there were many!).

— A "small" specimen climbed down from an *Echium hierrense* which had many sprouting leaf buds on the lower parts, probably a consequence of the browsing of goats. Close inspection revealed that some of the buds had been partly eaten.

Fig. 18: Young Hierro Giant lizard (Specimen V-8) on *Kleinia neriifolia*, a succulent plant which is starting to bloom. Photo A. Machado.

— Another "small" specimen agilely climbed a leafless medium sized *Euphorbia obtusifolia regis-jubae* (6 branches, 1.20 m high). It stretched out its neck but failed on the first attempt. When better placed, it turned its head and tore off with a side bite a complete flower-head together with a piece of twig[17]. After ingesting this by chewing, it moved further up and pulled off with a strong tug an unripe fruit (3-celled capsule), which it maintained between the jaws and, after indecision, descended quickly and disappeared out of sight.

Salvador (1971) believed that a commensalism existed between the lizard of Salmor and the seabirds, whose droppings should have been exploited by the reptile. I dedicated some time observing if the lizards went to the spot where pigeon droppings were accumulated. They did not seem to have any preference for excrements nor did they show any interest when crossing the area. Only a young specimen when wandering about, stopped briefly to smell (?) a dropping of a bird of prey (seen from a distance). Worthy of mention is my observation of a *caesaris* halting at a fresh excrement of a congener and licking it twice.

This latter species was much more active and on many occasions, I saw the "nervous" animal snapping at flies or ants that alighted or passed nearby. This behaviour was not observed with the large species. Sometimes, the quick *Camponotus* ants even ran over the lizard's body and head. However, ants form part of the diet of the species.

As an indirect approach to the study of feeding biology, I concentrated on the analysis of excrements, which turned out to be of great value. Nonetheless, it may be of interest to first give a description of the excrement.

The excrements of *Gallotia* aff. *simonyi* (fig. 19) are long and cylindrical, with many irregularities. They commonly present a smooth curve that can form a sinuosity or a complete twist, in some cases, but rarely a strong angle. The first

Fig. 19: Series of excrements of the Hierro Giant lizard. Renal excreta is missing. Photo A. Machado.

appearing end is blunt with almost the same thickness as the middle part. On the contrary, the other extreme shows a more or less acute point that ends in a filamentary fibrous prolongation of variable size and form (straight and hairlike, arched, looped, mucronated, etc). This "filament" is always shorter than the main body. The length varies from 2 to 6 or even 9 (maximum) cm (average medium size is 3—4 cm) and its diameter from 5.4 to 12 mm (average 8.1 mm). Weights are given in table II.

Table II: Excrement size class weights (in grams).

Category	Sector I		Sector II		Total	
Size	Number	Weight	Number	Weight	Number	Weight
Small	17	0.32	13	0.14	30	0.24
Medium	21	0.59	29	0.50	50	0.54
Big	10	1.15	10	0.83	20	0.99
Total	48	0.61	52	0.47	100	0.54

(Maximum weight = 1.2 gr)

Because of the fibrous constitution, they are moderately resistant. Their texture is thus rough and of dull aspect when fresh, varying from dark brown to blackish brown. One can easily distinguish vegetable fibres or poorly digested leaves on the surface, but only in few cases remains of insects are visible. Excrements of *Gallotia galloti caesaris* are, on the other hand, "earthy" and composed almost entirely of insect remains, being much smaller and lighter: 10—15 mm length, 3—5 mm diameter, and a weight of some 0.075 g (average of 32). Moreover, both ends are equally blunt.

The renal excreta is usually placed on the distal end of the excrement, in a lateral position. It consists of a mineral plaster that easily seperates off. When fresh this plaster is formed of two well delimitated portions, one of a bright white colour and the other of a vivid yellow. There are considerable mineral differences[18] between these portions and I do not know their significance. It may be related to the lizard's biology: a herbivorous animal living under xerophytic conditions and not drinking water directly. Werner Bings (pers. comm.) told me that *Uromastix* has a similar double-coloured renal excreta.

Sixteen percent of the excrements collected were infected by a small ptinid coleoptera, which is endemic to El Hierro: *Casapus subcalvus* (Woll.). The exit holes can easily be recognized (1.7 mm diam.). The larvae and pupae are parasitized by white mites and by a small chalcid (Eurytomidae).

A group of one hundred excrements were selected and boiled in water to loosen them and then studied individually in clean water and glycerine under 10—80 X magnification. Small samples of most plant species were brought from the field to facilitate recognition. A card was made for each excrement content, taking note of the different materials but without quantifying them. Individual items' rests were simply marked "most, medium, or few", regarding their broad quantity in the content.

The data that resulted from the analysis are resumed in Table III in the form of a frequency table. That is to say, giving the percentage of the whole group (see Table II for excrement number of each class and sector) in which a specific item appears in an excrement (all values are rounded to an integer). This does not indicate how much of the item was in it. For instance, an excrement contained a flower of *Psoralea bituminosa*, while another large one had 205 folioles, or the record of six bumblebees. Thus, it is obvious that table III has little significance from an energetic point of view. However these qualitative figures allow us to gain a good idea of the lizards' preferences in relation to food availability at this season of the year.

In figure 20 data from both sectors of habitat have been united giving a better view of the frequencies relating to excrement classes. Animal material has been separated from vegetal, as in table III, and equally presented in descending order of the item's total frequency value. In this case, only the first five items have been included in the graph, the remainder in the "Others" category.

To give a broad quantitative vision of the materials encountered, I have given 100 points for items that constitute "most" of the excrement and 50 points for "medium". The spectrum obtained this way (fig. 21) has to be handled with great reservations, so far as it is based on excrement content proportions. One will find low values (few remains) for materials with a high digestability, which, on the other hand, constitute a significant income in the lizard's energy budget. *Euphorbia*, *Kleinia*, grasses and arthropods were very digested and may thus have a major role in the feeding biology of the lizard.

At this season of the year, the Hierro Giant lizard shows a definite preference for *Psoralea bituminosa* (= "tedera"), the folioles, buds and seeds which represent the majority (42 cases) in most excrements or a considerable (24 cases)

Table III: Frequency analysis (in %) of content of 100 lizard excrements (class sample size in brackets; see Table II). Values rounded to integers.

A.-Vegetal

Excrement class	Small (30)		Medium (50)		Big (20)		Total
Habitat sector	I	II	I	II	I	II	%
Psoralea bitumin.	88	77	95	90	100	88	89
Echium hierrense	18	77	52	41	70	60	49
Undet. seed + flow.	24	31	52	31	30	30	34
Gramineae	12	8	52	31	20	40	29
Euphorbia obtus.	53	23	38	14	30	10	28
Rumex fruits	12	23	33	14	30	30	22
Phyllis viscosa	6	15	10	38	20	20	20
Carlina salicif.	12	15	10	24	20	20	17
Kleinia neriifo.	—	15	5	28	10	10	13
Arthemisia thus.	12	15	10	10	—	20	11
Lavandula canar.	—	8	5	14	—	—	6
Trifolium sp.	—	23	—	10	—	—	6
Rubia fruticosa	—	23	—	—	—	—	6
Muscii	6	—	5	—	10	10	4
Paronychia canar.	6	8	—	3	—	10	4
Micromeria sp.	6	8	—	3	—	—	3
Globularia salic.	6	—	5	3	—	—	3
Lichens	6	—	—	—	10	—	2

B.-Animal

Excrement class	Small		Medium		Big		Total
Habitat sector	I	II	I	II	I	II	%
Ants.	71	31	33	31	20	30	37
Coleoptera	35	8	19	28	—	10	20
Other insects	18	23	10	14	30	—	15
Bombus canar.	6	8	29	10	10	20	14
Orthopteroids	18	—	10	7	20	20	11
Other hymenop.	—	15	10	7	10	—	7
Reptiles remn.	18	—	—	14	—	—	7
Diptera	—	15	10	7	—	—	6
Spiders	6	8	5	7	—	—	5
Feathers	6	8	5	—	10	—	4
Arthrop. (global)	94	54	76	59	50	50	66

part of the content. The easily recognizable folioles and hairy buds were in many cases poorly digested, but this could well be related to the "strength" of the fodder[19], which is also actively sought for by other herbivores (goats, sheep, etc).

The abundance of *Psoralea* in the lizard's excrement does not correlate with the visual abundance of the leguminous species in its habitat. Nonetheless, I believe that due to grazing pressure exercised by goats, *Psoralea* is growing more frequently between cracks and holes that are inaccessible to goats and similarly to me, but not for the lizards. They must search the plant selectively, perhaps

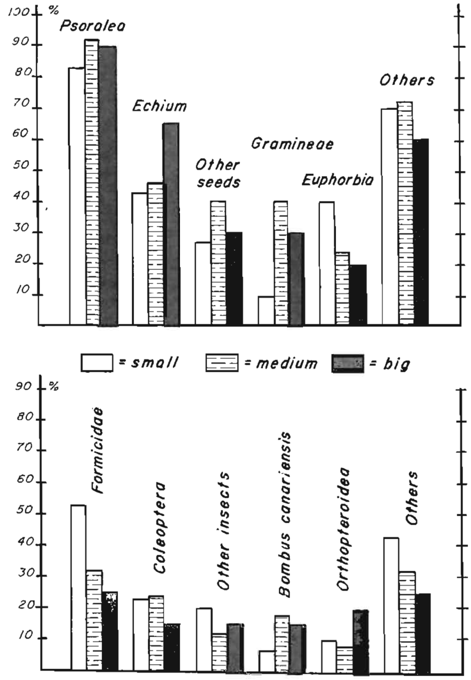


Fig. 20: Frequency analysis of 100 excrements of the Hierro Giant lizard (August 1984). Items shown in frequencies (%) of appearance. Blank = "small"; striped = "medium" and black = "big" excrements.

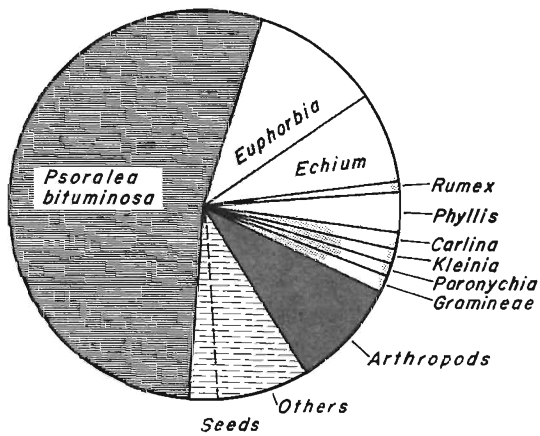


Fig. 21: Content spectrum of 100 excrements of the Hierro Giant lizard. Explanation in text.

as a result of its nutritional richness. Although, to me, food availability appeared not to be a limiting factor, other plant species may have low nutritious values, particularly *Euphorbia*, *Kleinia* and dry grasses. Excluding the young, most specimens observed were somehow meager, showing a characteristic fold on their flanks. Fat was also apparently missing from their tails.

From figure 20 one can deduce that *Echium* constitutes another good fodder-plant for the Hierro Giant lizard. It is a woody bush with lanceolate hairy leaves, very drought resistant and regularly available in the habitat. Furthermore, younger lizards seem to eat less seeds and dry grasses (poor in water), showing preference for succulent *Euphorbia*, which they can climb more easily than older specimens. The other dendroid succulent, *Kleinia* — which has no latex — may have an important role as a water supply when its leaves are in bloom[20]. Both *Euphorbia* and *Kleinia* are summer deciduous. The latter was leafless with most flowers starting to open (already in bloom at lower altitudes), while the former was in all phenological stages: with leaves, most without leaves, with flowers, with green fruits and with dry fruits "shooting out" their seeds with the typical "tick" of the mechanism. One third to one half of the small flower bearing stems were missing (probably having been decapitated by young lizards in the way I had observed).

Rubia fruticosa ("tasaigo") is another plant favoured by goats (nutritious!) and possibly also by the phytophagus lizard, despite its spiny bordered leaves. However, almost all the individuals I saw were totally dry, which is uncommon and related to the severe drought and heat experienced at the beginning of the summer (many vineyards were similarly affected).

Martínez Rica (1982) cites the absence of insects in the diet of the lizard but does not mention how many excrements were studied. I found 66 % containing arthropod remains forming a complement to the plant material. According to fig. 14, younger specimens (= "small" excrement class) are much more entomophagous than larger specimens. However, a slight prey differentiation can be deduced. The latter prefer larger insects like bumblebees and various big orthopteroids (*Gryllus bimaculatus* De G., *Sphingonothus* sp., *Guanchia* sp.), while the former shows a clear preference for ants (mostly *Leptothorax* and *Monomorium*)[21]. Other insects found are listed in column A of table IV.

Worthy of mention are the few remains of vertebrate species encountered. Bird feathers (whole body-feathers or pieces of feathers) appeared in 4 % of excrements, and in one case, a piece of egg shell was included (in "small" excrement). Bellairs (1975) mentions a giant subspecies of the tiger snake (*Notechis ater serventyi*) that inhabits small islets off Tasmania, feeding on young chicks of *Puffinus tenuirostris* during their short breeding period. The snakes develop large fat reserves for the rest of the year, when food is scarce. I thought about this possibility for the Lizard of Salmor which could combine this source with a few plants and seabird food remains, etc., but unfortunately this can no longer be investigated. A certain degree of omnivory is shown by the Hierro Giant lizard, so it is not illogical that they may eat a broken or fresh bird egg and other occasional animal material.

Remains of *Tarentola* (including bones) were found in one "small"excrement. In a "medium" one, the presence of skin (incl. ventral scales) and bone remains and the four feet of a *Gallotia galloti caesaris* confirm a single case of possible

Table IV. Insects found in excrements of (A) Hierro Giant lizard (*Gallotia* aff. *simonyi*) and of (B) Hierro Common lizard, (*Gallotia galloti caesaris*).

Group	A	B
ORTHOPTEROIDS		
Sphingonothus sp.		X
Undet. locustid		X
Gryllus bimaculatus	X	
Guanchia sp.	X	X
Phyllodromica sp.	X	
HEMIPTERA		
Nezara viridula		X
Anthocorids		X
Other hemiptera	X	
LEPIDOPTERA		
Undet. microlep.	X	
Undet. Larvae	X	
DIPTERA		
Cecydomids		X
Tripetids	X	X
Lucilia sp.	X	
Other diptera		X
HYMENOPTERA		
Undet. chalcids		X
Undet. sphecid	X	X
Halictus sp.		X
Bombus caraniensis	X	
Formicidae	X	X
Other hymen.		X
COLEOPTERA		
Harpalus sp.	X	
Undet. histerid	X	
Undet. staphylinids	X	X
Attagenus sp.	X	
Undet. melyrid		X
Thanasimus paivae		X
Dapsa sp.	X	X
Coccinella algirica		X
Chilocorus renipustulatus		X
Scobicia sp.	X	
Hegeter sp.	X	X
Stenidea sp.	X	X
Lepromoris gibba	X	
Chrysolina grossopunctata	X	X
Cryptocephalus sp.	X	X
Dicladispa occator		X
Apion radiolus	X	X
Laparocerus sp.	X	X

predation (perhaps it was found dead). Tail vertebrae and whorl scales were more frequent (5 %). It is generally accepted (Bellairs 1975) that the proportion of tail regeneration in a lizard population is related to predation. However, I believe that the lizards do on occasions snap at their congener's tail when involved in persecute chases during the mating season. This could also explain the regeneration of the mid and end parts of tail observed in 25 % of the specimens captured (in other Canarian lizards this proportion is even much higher). In general, 7 % of excrements had reptile material.

Hierro Common lizard (*G. galloti caesaris*) excrements were studied too (32 exx), to see whether food competition could be deduced from their analysis. Considered as a whole, plant material forms a minor part though in some individual excrements it constituted the majority of the material. Leaves of *Rubia*, *Psoralea*, *Artemisia* and Gramineae were recognized (more triturated than in the Giant lizard) but fruits/seeds are much more frequent. However, insects should be the fundamental diet if one considers the amount of remains in the excrements. In table IV a list of the insects recognized is given (column B).

On comparing the spectra of both species one can observe that they do coincide to a certain extent. This implies a degree of competition primarily between *caesaris* and young Giant lizard. However, if one considers the ecology of the different insect groups and species listed, *caesaris* is seen to predate more on winged fauna and on planticole life. This type of trophic niche separation arises from the size difference and the greater agility of the smaller species (6.5 times lighter[22)]).

Behaviour

In a week of varied field work it is difficult to concentrate on behavioural observations. However, I would like to present some comments that may be of interest in the light of what is known from other reptiles.

As mentioned before, the Hierro Giant lizards were not particularly active. Most of the time, especially in the older specimens, is devoted to basking. This takes place on rocks near the entrance of their refuges, when not at the very entrance itself (morning). The sites selected are normally protruding with a dominating view around (see fig. 22). The range of the individuals was not determined, but in subsector IIb they wandered through most of it, though turning back to their specific refuges. Large size specimens were more sedentary.

It seemed to me as if the area was fairly divided up, each adult having its own refuge. Retreat was quick and always to the same place (or hole), even if they had to move when I was approaching. This does not apply to the smaller Hierro Common lizard.

They are almost always alert and detect and react very easily to new elements in their environment (a kestrel rapidly born up by the thermals provoked a instant turn of the head of a medium sized lizard that turned situated below). Only

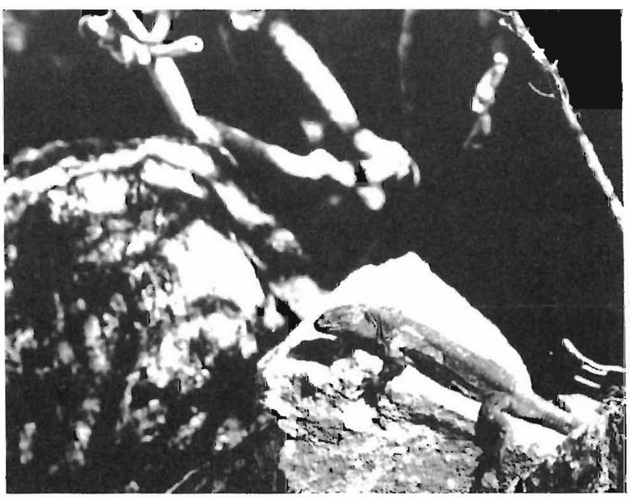


Fig. 22: Large sized Hierro Giant lizard basking on a stone with good overlook in Sector II (Calcosa, Gorreta). Photo A. Machado.

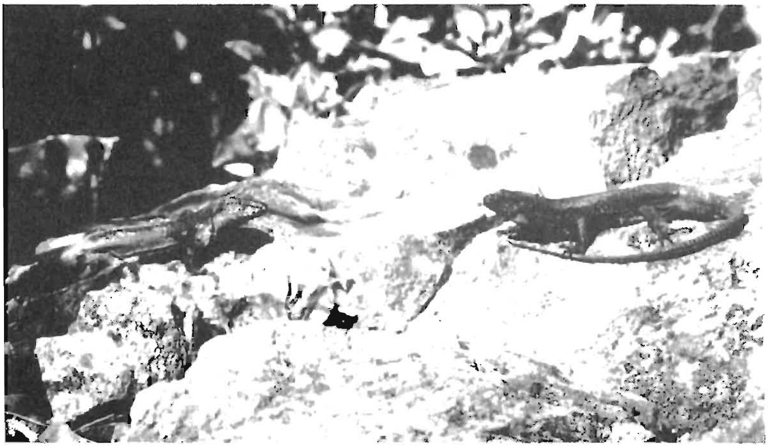


Fig. 23: Pair of Hierro Giant lizards before approach. Female left, male right. White design on body is due to skin moult. Photo A. Machado.

during the last days of my stay were my "neighbors" (those medium sized) less shy and more tolerant to my presence, approaching to a distance of three meters. The Hierro Giant lizard shows a general (young to a lesser degree) cautious conduct, even when eating. My impression is that the animal "fears" a predator, which could be a kestrel (for young specimens) or feral cats.

Almost all the animals seen were in different stages of skin moult (the two young were not!). During this process the remains of loose skin form irregular patterns on the animal (see fig. 1), which acquires an extraordinary cryptic capacity on mosaic lichen-covered stones, when observed from above.

Molina et al. (1980: 13) cite briefly an aggressive interaction seen at Gorreta[23)] between a Common (*caesaris*) and a young Giant lizard. The former species is much more abundant than the latter and their ranges overlap completely. So far as I saw, the small *caesaris* avoid their large congener by locating them and maintaining a "prudent" distance. On one occasion a hunting *caesaris*, climbing a rock, suddenly came face to face with a medium sized Giant lizard, 25—30 cm away. The instant reaction of *caesaris* was a backwards lateral jump and a short run to a stone nearby, creating a distance of 60—70 cm. Thereafter, it continued as normal. The Giant lizard dit not move, neither did *caesaris* produce its protective "peeps" (Bischoff 1974). These very audible "peeps" were heard frequently throughout all the week when *caesaris* were performing persecution chases.

One month earlier, on Gran Canaria, I recorded a short and rapid direct frontal run by a big *Gallotia stehlini* towards another male that was crossing 1.5 m in front of the hole were it was. No persecution took place. The aggressor stopped with extended head and fore-limb, its orange-tint gular region inflated; thereafter — being alone — it opened its mouth widely for a few seconds before retiring (seen from distance with binoculars).

During my stay in Gorreta, I did not observe any aggressive-defense territorial behaviour between specimens of the Giant lizard. The individuals I handled showed no aggression either, but simply struggled to try and escape[24]. Adult males of *stehlini* open their jaw showing the reddish interior, and if intimidated, produce a strong and prolonged guttural "hkjkjkjkjkj . . ."

Regarding sexual behaviour, I only recorded two observations when — after visual contact — a male approached a female (from 1—0.5 m). In the first case (see fig. 23) a touch of snouts took place and immediately the male disappeared followed by the female. In the other, the male touched the female's tail with its feet. The latter then climbed up and entered a crevice, reappearing one meter higher up on a ledge of the basalt wall. The male which was facing downward, began to bob the snout up and down on the spot where the female's tail had been (tongue was not put out), turned, and on repeating the head movements, followed the same path as the hidden female. When on the ledge top, he suddenly grasped transversally in his jaws a 4—5 cm twig(?) and moved out of sight (observed from 17 m below).

The four females captured were inspected for mating-bite scars on the neck region without results. Böhme & Bischoff (1976) consider the side neck-bite as an important ethological character of *Gallotia.*

To confront Bischoff's terrarium observation on the absence of ectoparasites (1974: 97) on Canarian lacertids, I can state the presence of mites on the Hierro Giant lizard, but I cannot confirm if they are the same as those frequently found, for instance, on wild *Gallotia galloti.* On the other hand, the use of the fore-limb he describes (Bischoff 1973) for *Gallotia stehlini* is confirmed in Hierro Giant lizard by the one observation described in the chapter on feeding. *G. galloti caesaris* scratched the neck with the hind-limb; two observations!

Colouration

The maximum sizes registered for the Hierro Giant lizard are total length around half a meter (470—509 mm) and from snout to vent 182—187 mm. This size should be taken as normal, but as in other lizard species, the very old individuals may grow to larger sizes.

The smallest specimen I studied is a young male from the last brood — I think —, measuring 357 mm total length (114 mm snout to vent). I have seen slides of individuals, apparently smaller, taken by C. Silva. They are very distinctively coloured, compared to adult specimens.

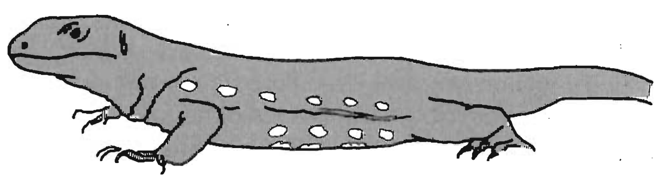


Fig. 24: Colouration pattern in adult Hierro Giant lizard.

The head is the most contrasting coloured part. Its upper parts are of a clear yellowish brown colour with an irregular black design. The large scales around the mouth and eye are bi-coloured, bright creamy-white variedly suffused with black, making a very striking pattern (fig. 25A). The smaller scales of the temporalia and gular region are similarly coloured, but on the latter a greenisch tint is present as well as a peculiar and notable design. This consists of two convergent lateral white stripes on each side (fig. 25B). The folds behind the collar bear some yellowish granules on their flanks. A similar yellowish scale prickling can be present on the other ventral parts, which are of a uniform light dirty-gray.

The body is brown with a greenish tint, darker in the middle of the back. A fairly dark narrow middle line (width = 4 scales) is present, being more conspicuous on the neck (fig. 25D). On the sides (fig. 25C) the lighter supraocular line gradually breaks up, diminishing, to finally disappear around the middle of body or even before[25]. Between this diffuse stripe and the middle of the flanks, a broad darker band (starting from the tympanus) gives contrast to the series of 7—9 lighter spots which acquire a yellow colour towards the head. Two further series of light, more or less irregular blotches (= 6 scales), are placed above, between the diffuse stripe and the middle line. These blotches lack the dark tint and run along the body passing on to the tail. They show no peculiar colour. However, the blotch and spot series may lie close to one another and the blotches almost join up. Seen from above, this gives the impression of irregular light-coloured transverse bands. On the lower flanks, close to the darker lateral band, two more series of similar blotches are present, though less conspicuous due to the background being lighter. Furthermore, there is another series of 4 wider yellow spots close to the outer ventralia. Some of these may be divided into an upper and lower portion, the latter extending normally on the outer ventral scales (2—3). The anal region bears a carrot-orange tint and some scales of that colour extent onto the inner and posterior flanks of the hind-limbs, which may bear also orange blotches if the orange tint extends through all the ventral parts. The underside of the feet is lightly coloured.

The pattern of light blotches extends onto the limbs, too, endowering the young with a generally spotted appearance. Only the yellow spots (1—2—3) above the fore-limb axilla stand out.

On older medium sized animals one can recognize remnants of this spotted pattern (i. e. the light neck stripe), particularly in the females where it seems to persist for a longer period than in males. Another juvenile colour character that can be found on older specimens is a reddish tint on the ventral parts, particularly in the anal region, feet, hind limb flanks, but also on the ventralia and gular scales. Bi-coloured mouth and temporal scales may persist too.

The adult colouration is dull and simple. Animals are of a more or less dark gray-brown (sometimes like basalt), fairly blackish (this probably related to the moult). On the flanks the series of yellow spots are the only ones present,

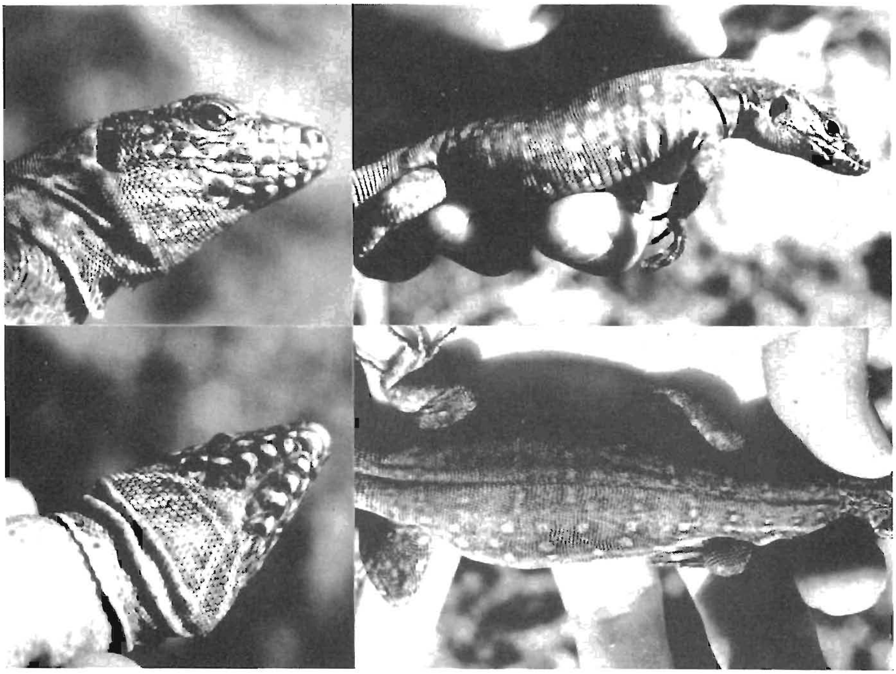


Fig. 25: Colouration details of young Hierro Giant lizard, snout to vent 114 mm (specimen V-8). A) Head, lateral view. B) Head, ventral view. C) Lateral view of body. D) Dorsal view of body. Photo A. Machado.

originally numbering 5 to 6, but frequently the posterior ones are faded or missing. At least the first — the "scapulary" spot — was always present or recognizable. It is usually yellower and bigger than the others and slightly oval (= 8 x 5 scales). Some specimens have two differentiated scapulary spots.

The ventrolateral spots (= 3—4 x 2—4 scales) are paler but more persistent, usually divided and extending onto a few ventral scales (2—3). Belly is gray with/without the reddish tint or individually coloured scales. The palm of the feet is darker and bordered with black; toes are ventrally black.

The colour pattern of the adult Hierro Giant lizard (see fig. 24) is similar to that described for the Lizard of Salmor (see fig. 4). The gular region has no distinctive colouration in either sex and the series of lateral spots are equivalent, whereas those of the latter are much more enlarged and, according to Steindachner, of yellowish green or brownish yellow colour (1889: 261) and dirty-yellow or dull bluish green (1891: 292); according to Boulenger (1891: 125) light yellow.

The ecdysis seems to be very prolonged in the Hierro Giant lizard, thus one can observe many different patterns and whitish designs as the skin is separating.

Table V. Measurements and pholidosis taken from eight living specimens of the Hierro Giant lizard.

Speciemen	V-8	V-6	V-2	V-1	V-4	V-3	V-7	V-5
Sex	male	female	female	female	female	male	male	male
Weight (g)	—	91.5	123	121.5	158.4	160	185.4	195.5
Total length (mm)	357	400	360	420	448	444	509	470
Snout-vent length (mm)	114	147	156	159	174	181	182	187
Pileus length (mm)	26.2	30.0	32.8	35.2	35.0	40.9	42.0	43.2
Head width [26] (mm)	12.8	13.9	15.1	15.0	15.5	17.5	17.7	17.9
Snout to tympanus (mm)	25.4	30.0	32.0	32.0	33.2	40.0	41.1	41.3
Gular max. width (mm)	19.3	20.5	25.2	25.0	24.3	33.8	35.0	36.0
Distance bet. legs (mm)	56	75	78	90	92	90	90	87.5
Supracil. granules n°	9/9	12/12	10/10	9/10	9/9	7/8	10/12	10/12
Supracil scales n°	7	7/8	6	5	6	6	6	6
Temporalia n°	66	62	56/57	54	54	57	62	58
Collaria n°	15	15	13	16	17	15	15	15
Gularia n°	34	30	32	29	29	33	29	30
Ventralia longitud. n°	19	21	19—20	19	17—18	19—20	18—19	18—20
Ventralia transver. n°	34	35	35	34	35	34	35	34
Dorsalia n°	—	92	88—92	85	93	98	96	91
Anal height	2.2	3.5	2.5	2.75	3.45	3.15	—	3.5
Anal width	2.8	3.9	5.5	6.05	7.55	4.55	—	3.9
Femoral pores n°	26/28	24/26	27/27	29/29	25/25	30/28	24/27	26/27
Lamelles 4the toe n°	32	32	30	30	28/29	32	32	32
Tail whorls n°	128	114	61 +	107	104	118	114	97
Tail status	complete	complete	reg.>61	complete	complete	reg.>27	complete	complete
Serrated collar	little	little	smooth	smooth	very	very	yes	very
Gular fold	incip.	yes (18)	incip.	v. little	incip.	nothing	nothing	nothing
Reproduction devel.	—	pregnant	pregnant	—	pregnant	—	—	—

Specimen data and remarks

Eight specimens were captured with traps, large plastic bags and rigid opaque polyvinyl tubes (70 cm long and 7 cm diameter) baited with tomatoes, cheese and grapes, and placed vertically in the vicinity of the lizards' refuges. On various occasions, several *caesaris* fell into the traps prior to the Giant lizards, which were much more reluctant to enter. After taking the vent temperature, the lizards were placed in the tubes. These were then sealed with sticking plaster and used to transport and keep the specimens individually at the cave-laboratory, the only place with shade.

To permit accurate weighing, counting, measurements and close up photography, the following procedure was used (tested before with *Gallotia stehlini* from Gran Canaria). The specimen is transferred to a wide one gallon glass jar (mouth 10 cm and base 16 cm diameter) where a small tube with cotton-wool has 2.5 ml of ether. It takes 10—20 minutes till they become torpid. Having lost part of its strength, the lizard is grasped with one hand and, with the other, a smaller plastic bottle (150 ml, 3 cm opening and 5 cm diameter base) containing an additional 2.5 ml of ether is put over his head like a helmet. Narcosis comes quickly after some resistance from the lizard. When eyes are kept closed for a while the specimen is usually ready for some minutes of manipulation. Then another dosis is applied, and so on, always avoiding a full narcosis. This can be continued several times (5—8) without danger or damage. Specimens recover completely within 30 to 45 minutes. If total narcosis occurs, no damage should be expected (*stehlini* at least is very resistant to ether dosis), though the vision of the animal be hampered.

Specimen data are included in table V and some of the photographs taken shown in figure 28.

One of the questions pending when I was instructed to prepare the Conservation Plan was to state whether the lizard population inhabiting the cliff belonged to *Gallotia simonyi*, a taxon that was established on specimens collected on the outer Rock of Salmor as mentioned before. Böhme & Bings (1977) announced that they were the same on the basis of comparing the magnificent lithography in Boulenger's article (1891) with a photograph (taken in 1975 in a room, by the local photographer of Valverde) of one of the two living specimens brought down from the cliff by herder Juan Machín and his nephew, and replaced a few days later by order of the Spanish authorities. This belief has always been generally accepted even before the population of Gorreta was discovered.

Thanks to the information provided by Mr. Wolfgang Bischoff during my stay in Bonn (on the occasion of the Herpetologia Canariensis Symposium, November 1984) and to the well preserved specimen of the Lizard of Salmor kept in the Museum of La Palma, I was able to state that this animal was different from that living today in Gorreta which, most probably, is the same one that existed in the past on the lower parts of El Hierro (see von Fritsch 1870, Böhme et al. 1976, Urusáustegui 1983). It is not my intention to describe any taxon on the latter animal, nor could I so far as a type is needed. Taxonomy and taxonomists should wait till the population is in better shape.

I will limit myself to exposing those main differences that I have detected and my general impression. The Lizard of Salmor and the Gran Canarian Giant lizard[27)] are broader and heavier animals, what should be confirmed by skeleton studies some day. The heads of these two animals have a triangular and acute shape, with pileus lateral margins straight convergent to the snout (subparallel). In the Hierro Giant lizard the pileus shape is more oval, with curved sides. The median supraocular plates (2—3) are much broader and, thus, a little protruding, giving the animal's eyes a slight "frog"-like profile. Head of *simonyi* is flat, as in *stehlini*. See figure 26A.

The configuration of the snout in the Hierro Giant lizard differs, too (fig. 26B). Besides being more rounded, what first attracts the attention is the size of the nostril. It is very conspicuous, completely circular and much larger, with its diameter as long as the distance from its border to the mouth rim.

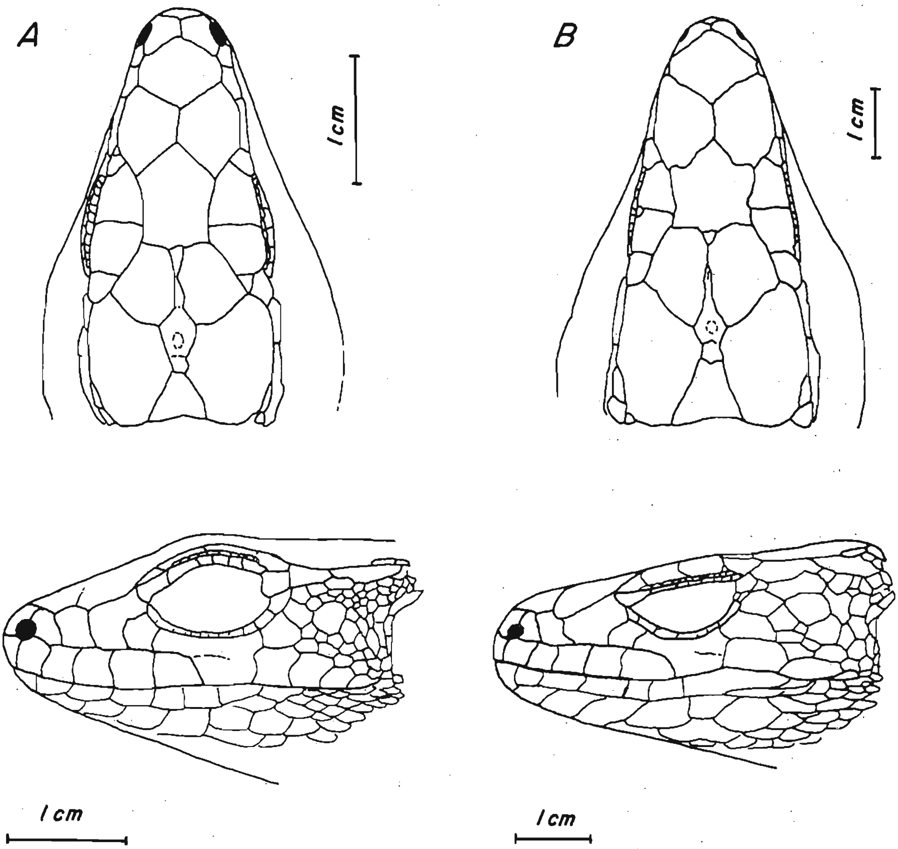


Fig. 26: Sketch of head of (a) Hierro Giant lizard and (b) Lizard of Salmor. Lateral and dorsal views.

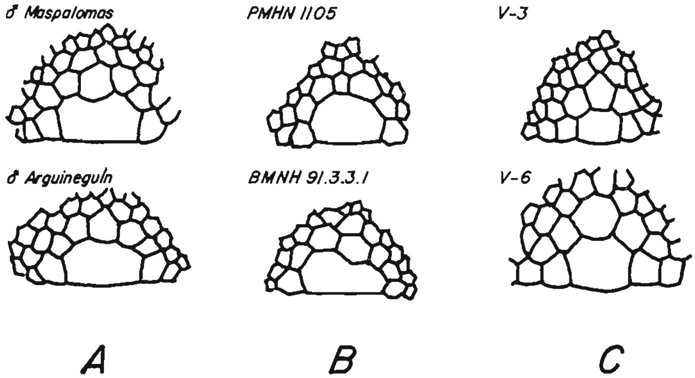


Fig. 27: Anal region of (a) *Gallotia stehlini* (b) *Gallotia simonyi* and (c) *Gallotia* aff. *simonyi*.

The temporal region in the Lizard of Salmor has few but large plates, an average number of 28.9 (min. 33 and max. 39) while the Hierro Giant lizard shows a clearly differentiated large massetericum (+1) and many smaller plates, an average number of 58.4 (min. 54 and max. 66). According to Boulenger (1920) *stehlini* temporal scutellation varies between 75 and 110.

In the former, the preanal plate is bordered by the three semicircles of small scales, the first of which has 7 (one BMNH specimen has only six, but still small). The preanal region of the latter is different (see fig. 27), showing larger and fewer plates. The preanal is not so differentiated in size from the other plates, of which only 5 are in touch with the preanal in the six specimens studied. In 33 individuals of *Gallotia stehlini* inspected by Mr. López Jurado, the average number is 6.4, varying between 6 and 7, as in *simonyi*. Peters (1961) gives a high taxonomical value to the anal region and Arnold (1973) says that there is some tendency for the larger species and those from arid regions to have higher numbers of scales.

When I first saw the Hierro Giant lizard in nature, I thought immediately of a different animal, a separate species from the Gran Canaria Giant lizard. Taxonomists were still discussing two independent lines, or a single polytypic species: *Gallotia simonyi simonyi* and *Gallotia simonyi stehlini*. Only now, I realize that my first impressions were probably right, but with different consequences. In the four papers I have prepared simultaneously for this occasion, I have preferably used the following common names that avoid misunderstanding: the Gran Canaria Giant lizard, the Lizard of Salmor, and the Hierro Giant lizard[28)], and when using Latin names, I conventionally applied *Gallotia stehlini*, *Gallotia simonyi* and *Gallotia* aff. *simonyi* respectively. The term "giant" may not be very appropriate for lizards of 50—80 cm length, but as such it is already introduced in the literature and legislation.

There are enough differences between these animals to make one think of separate though related species. Disregarding taxonomic status, I feel that there are more relevant relations between the Lizard of Salmor and the Gran Canaria Giant lizard (body structure, anal region, etc) than between the former and the Hierro Giant lizard, despite their geographical vicinity and common characteristics (colouration, tricuspid teeth, etc). On the other hand, the latter and its congener from Gran Canaria are less related. Therefore I have used the name *Gallotia* aff. *simonyi.*

However, if one would accept and introduce these relations into nomenclature, then we may come to the old concept of *Gallotia simonyi* being polytypic (*simonyi* = Salmor, *stehlini* = Gran Canaria) and an independent undescribed species on El Hierro. Whereas this sounds shocking, it can be more confusing if we consider that according to Joger & Bischoff (1983), geckos collected on the "Roques del Salmor" are *Tarentola delalandii* (Dum. et Bibron), a species endemic to Tenerife and La Palma, instead of *Tarentola boettgeri hierrensis* Joger & Bischoff[29], which inhabits El Hierro. The striking side of science is that there always is a next question.

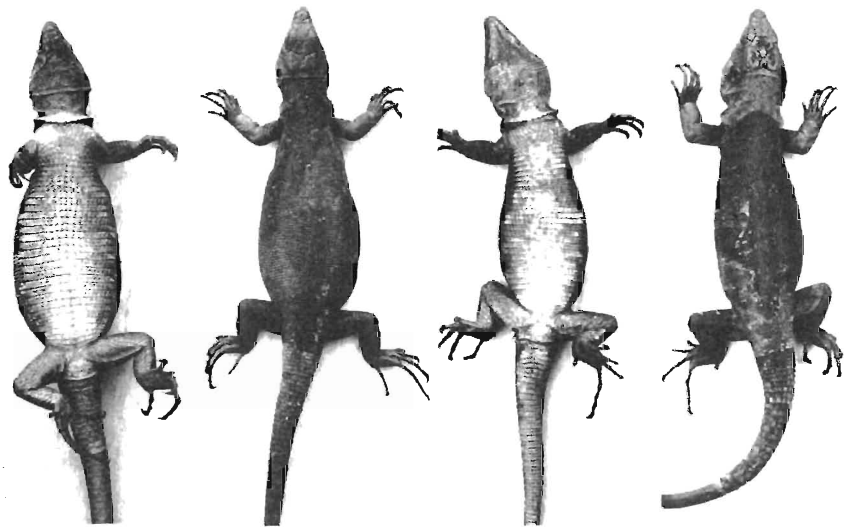


Fig. 28: Hierro Giant lizard. Right: Male V-3 in dorsal and ventral view; Left: Female V-4 in dorsal and ventral view. Photo A. Machado.

Explanation of footnotes

1 Various spots baited and visited 3—4 days afterwards to check presence of excrements. This was done in Valle de El Golfo at Punta de Arelmo and La Mella, cliffs above Las Puntas, Mirador de Vascos and cliff base below; in the SE, Morro Negro (in front of the Parador Nacional), Rincón de la Palmita, Cantadal del Pajero de Bernabé, Punta de Arena de los Cardones and Mirador de las Playas.

2 Access is very difficult and only possible with an extremely good sea. One has to jump and cling to prominences on its SE face, which is the only climbable access.
3 Some plant identifications have been checked by M. Aguilar and C. León-Arencibia Department of Botany, University of La Laguna.
4 Boettger & Müller (1914) recorded *Gallotia galloti caesaris* from the Roque Grande, where it still lives (obs. July 1983, A. Martín, pers. comm.).
5 On page 83, under Reptiles "... y el lagarto verde y pardusco dorado (*Lacerta galloti*), peculiar del pais, y muy colérico, del cual se encuentra una clase corpulenta y temible en uno de los Roques de Salmor, hacia la parte norte de la isla del Hierro." / ... and the green golden brown lizard (*Lacerta galloti*)peculiar to this country, and very choleric, of which a corpulent and fearful type is found on one of the Rocks of Salmor, in the north of the island of El Hierro (literal transl.).
6 The well known reference of Viera y Clavijo has its origins in a manuscript presented to him for correction, by his Teneriffan friend, Urusáustegui, who visited Hierro in 1779. This very interesting manuscript together with some letters of Viera to Urusáustegui has been published only recently (see Urusáustegui 1983).
7 The most extended version originates from a very talkative man who was quite young (12 years) when events occurred. He tells today of lizards of 5 kg (see Salvador 1971), of one meter long and more (nine in Tilsdall 1984), huge glass bottles with at least 25 specimens and about the animals jumping into the water, swimming, and climbing the rock again ... (J. B. P., interview Aug. 24, 1984).
8 H. B. Cott gives this address in his paper on *Hyla arborea meridionalis* in Gran Canaria (1934).
9 A plastic pot allowed to roll off from the habitat was found later in the same place as the excrements, just below. According to herders' information, the lizards extended to the base of the cliff but were killed by dogs some twenty years ago. Regressional aspects will be discussed in another paper.
10 Other lichens recorded in the lizard's habitat are: *Candelariella vitellina* (Hoffm.) Müll. Arg., *Collema ryssoleum* (Thuck.), *Dimelaeana radiata* Tuck., *Lecanora sulphurella* Hepp., *Lecanora* cf. *atra*, *Lecidea subincongrua* Nyl., *Rinodia* sp., *Squamarima cartilaginea* (Vith.) P. James and *Toninia toepfferi* (B. Stein) Naváz. All have been identified either directly from samples or from color photographs by Mr. L. Sánchez-Pinto (Museo Insular de Ciencias Naturales, Tenerife).
11 Carlos Silva, formerly the ecologist of the Cabildo Insular de Tenerife, visited the area several times and took the first pictures of the lizard that were published (Blas Aritio 1976) and used for a conservationist campaign. As a result, a program was made by Spain's national television in 1978.
12 See: A. Martín & A. Machado: Nidificación de la Lechuza Común (*Tyto alba*) en la Isla de El Hierro, y datos sobre su alimentación. — Vieraea 15 (1985): 43—46.
13 The ants were identified by Dr. J. Barquín, Departement of Zoology, University of La Laguna.
14 Analysis of a sample revealed: pH 7.9, Organic mat. 1.19; Carbon 0.69; conductivity 8.42; Thick sand = 61.71 %, fine sand = 25.12 % and clay + lime = 13.17 % (Dr. M. Tejedor, Department of Edaphology, University of La Laguna).
15 Measurements taken with an American Instrument Company Mini-Reader.
16 Giant lizards that were kept overnight in plastic tubes, commenced activity the next day at 6 and 7.30 a. m. (body temperature 21.6° C, air temperature 19.8° C).
17 *Euphorbia* spp. have latex but this seems not to be an impediment — at least in dendroid euphorbias — for lizards (see Molina Borja 1981).
18 An analysis conducted by Dr. M. Tejedor (Department of Edaphology, University of La Laguna) with a Microprobe (starting at Na) revealed the following percentages: White portion, for Mg = 10.78 %, Al = 50.81 %, Si = 10.56 %, S = 3.66 %, Fe = 4.65 % and Cu = 19.45 %; yellow portion, for Al = 47.70 %, S = 11.42 % and Cu = 40.88 %.
19 Unpublished data from analysis carried out by INCIA (Instituto Canario de Investigaciones Agrarias) and generously transmitted by Miss P. Méndez reveals following contents: Total protein = 16.53 %, total fats = 6.45 %, total fiber = 35.09 %, ash = 6.21 %.
20 *Aeonium* rosettes are succulent too and very rich in water. However, the signs I observed on those having been eaten, always corresponded to mice and to beetles, probably tenebrionids (*Hegeter* and *Pimelia*).
21 Small insects are probably ingested by large lizards when feeding on plant leaves and buds.
22 Weight increase (in milligramms) calculated as an average of 7 Giant lizards and 6 *caesaris*, is, for each millimeter of snout to vent size, 880 mg and 136 mg respectively.
23 Dr. J. M. Molina (Department of Animal Physiology, University of La Laguna) visited the lizard's habitat on two occasions: September 1975 (with Dr. J. P. Martínez Rica) and October, 1978.

24 An adult semi-narcotized male placed on the back of my hand to take a portrait of both of us, dedicated to me an "impression" display ("exhibición", see Molina 1980) when I drew my face near.

25 This stripe may be continuous in other specimens. *Gallotia stehlini* presents both "striped" and "spotted" young (see Bischoff 1974: 101).

26 Head width was measured at the eyes level.

27 Data: *Gallotia stehlini*, Maspalomas, snout-vent length = 205 mm, weight = 328 gr; Arguineguín, snout-vent length = 228 mm, weight = 397 gr.

28 Other names used in literature could guide to confusion. Salvador (1971) and Martínez Rica (1982) use the name "Lagarto Negro del Hierro" which means the "Black lizard" of El Hierro. *Gallotia galloti caesaris* present melanic individuals (black males) which are well known by people in El Hierro as "meritos".

29 *Tarentola boettgeri boettgeri* Steind. is endemic to Gran Canaria.

Acknowledgements. Besides my gratitude to all colleagues referred to in the text and footnotes for their personal comments, data and determinations, I would like to express my sincere gratitude to the following persons: To my fellows of ICONA on Hierro, headed by Don Zósimo, for their collaboration; to Mr. Juan Pedro Pérez Machín, the watchmen of the Hierro Giant Lizard population, who helped me tremendously on the cliff and brought up the needed food and water every day; to Miss Cristina Machado for her assistance with the excrement study; to Mr. Keith Emmerson and Marnie Knuth for their great assistance with the English manuscript; to Mr. Luis Felipe López-Jurado (Las Palmas) for discussing the manuscript; to Dr. Rainer Hutterer for his help with the manuscript's edition, and especially, to all those persons on El Hierro who were extraordinarily collaborative during the research. This contribution is dedicated to the people of El Hierro.

Zusammenfassung

Im Auftrag des spanischen nationalen Naturschutzinstitutes ICONA erarbeitete der Autor einen Plan zum Schutz und zur Erhaltung der vom Aussterben bedrohten Hierro-Rieseneidechse. Im August 1984 führte er eine gezielte Befragung ortskundiger Hirten und eigene Untersuchungen aller als für die Art geeignet erscheinenden Biotope auf Hierro durch. Danach ist davon auszugehen, daß die Rieseneidechse nur noch mit einer Population in der Gorreta im Valle de Golfo existiert; diese ist seit 1975 bekannt.

Dieses Vorkommmen umfaßt eine Felsfläche von 1500—2000 m² im Risco de Tibataje. Trotz seiner geringen Größe bietet dieses Habitat den Eidechsen gute Lebensbedingungen. Sein topographischer und geologischer Aufbau, mikroklimatische Verhältnisse sowie die dort vorkommenden Pflanzen- und Tierarten werden beschrieben. Als Nahrungskonkurrenten der Eidechsen kommen verwilderte Ziegen vor, mögliche Freßfeinde sind Turmfalken (für Jungtiere) und verwilderte Hauskatzen.

Anhand unterschiedlicher Verfahren ergibt sich eine geschätzte Population von ungefähr 100 Rieseneidechsen in diesem Vorkommen, was einer Populationsdichte von 500 Individuen pro ha entspricht. Die geschätzte Populationszusammensetzung nach Größen/Altersklassen ist 0:2:8:5:1 (Jungtiere desselben Jahres / Jungtiere des vorhergehenden Jahres / Tiere mittlerer Körpergröße / große adulte Tiere / sehr große adulte Tiere). Nach der direkten Beobachtung wurde ein Anteil der Jungtiere an der Gesamtpopulation von 12.5 % geschätzt, nach Größenklassen der Kotballen an Anteil von 7.5 %. Damit ist der Anteil der Jungtiere so gering, daß die Gefahr besteht, daß die Population zusammenbricht, die Art also akut vom Aussterben bedroht ist.

75 % der gefangenen adulten Weibchen waren trächtig; sie hatten 8—12 Eier. Wahrscheinlich legen sie einmal im Jahr, ungefähr im September. Nach den wenigen gefundenen Eihüllen, aus denen Junge geschlüpft zu sein schienen, schließt der Autor auf einen möglichen Schlüpferfolg von nur 25 % pro Gelege.

Die Hierro-Rieseneidechsen sind am späten Vormittag und Nachmittag bis zum Sonnenuntergang aktiv, während der Mittagshitze ziehen sie sich in ihren Unterschlupf zurück. Weitere Verhaltensbeobachtungen werden berichtet. Die Vorzugstemperatur liegt bei 33.2°C.

Nach Kotanalysen ernähren sich die Tiere hauptsächlich von Pflanzen; im Untersuchungszeitraum machten Reste der eiweißreichen Leguminose *Psoralea bituminosa* L. 54 % des Gewichtes der analysierten Kotballen aus. In 66 % aller Kotproben fanden sich in unterschiedlichen Anteilen tierliche Reste, überwiegend Insekten. Bei jüngeren Tieren waren Insekten relativ häufiger. Damit besteht zwischen Jungtieren der Hierro-Rieseneidechse und den im gleichen Lebensraum vorkommenden, mehr auf Insektennahrung spezialisierten Westkanareneidechsen bis zu einem gewissen Grad Nahrungskonkurrenz; beide Arten unterscheiden sich allerdings auch etwas in ihrem Nahrungsspektrum. Reste von Westkanareneidechsen und Kanarengeckos waren nur in 2 % der Kotproben von Rieseneidechsen nachzuweisen.

Die 8 gefangenen und wieder ausgesetzten Hierro-Rieseneidechsen werden in ihrer Färbung, Zeichnung, Beschuppungsmerkmalen, Gewicht und Körpermaßen beschrieben. Sie unterscheiden sich von der Salmor-Rieseneidechse *Gallotia simonyi* (Steindachner, 1889) und der Gran Canaria-Rieseneidechse *Gallotia stehlini* (Schenkel, 1901) in Körperbau, Kopfform, Temporalbeschuppung und präanaler Beschuppung. *Gallotia simonyi* , mit der die Hierro-Rieseneidechse bisher als artgleich angesehen wurde, ist in historischer Zeit nur vom Roque de Salmor Chico nachgewiesen und heute ausgestorben. Der Beitrag enthält Daten zu den 10 bekannten Museumsexemplaren dieser Art. Der Autor sieht die Hierro-Rieseneidechse als eigenständiges, bisher unbeschriebenes Taxon an. Die genaue Klärung dieses Problems sollte jedoch sinnvollerweise erst dann erfolgen, wenn die einzige überlebende Population wieder mehr Individuen umfaßt.

Resumen

Al autor le fue encomendada por el Instituto Nacional para la Conservación de la Naturaleza (ICONA), la elaboración del programa de conservación del Lagarto Gigante del Hierro, el cual resultó ser una especie aun no descrita y diferente de *Gallotia simonyi* (Steind.), taxon al que se había asignado anteriormente. Este último, el Lagarto de Salmor, se ha de considerar como extinguido. Se describe en detalle su única localidad conocida, el Roque Chico de Salmor, a la vez que se aporta diversa información concerniente a los diez únicos ejemplares depositados en museos. Asimismo, se presentan los datos y medidas concretas del ejemplar bien preservado que existe en el Museo Insular de Historia Natural de La Palma.

Durante el mes de agosto de 1984 se realizaron diversas investigaciones relacionadas con el Lagarto Gigante, en la isla del Hierro (Islas Canarias). Mediante encuestas a los pastores e inspección directa de áreas apropiadas, se intentaron localizar más poblaciones del lagarto gigante, pero con resultados negativos. Su distribución actual parece restringida a la pequeña población de Gorreta (Valle del Golfo) que fue dada a conocer en 1975.

Su habitat se limita a la cresta de un saliente del farallón rocoso de Tibataje; unos 1500—2000 m² de terreno muy abrupto y rocoso, rico en grietas y otros refugios. Los límites actuales de la población se determinaron por presencia/ausencia de excrementos del lagarto, y se comentan algunos de los factores ecológicos involucrados. Se presenta una descripción general de la geomorfologia y geología del habitat, vegetación y fauna principal, influencias humanas y microecología. El biotopo, a pesar de ser reducido, parece ofrecer condiciones ambientales adecuadas — óptimas en el risco — para la vida reptiliana (temperatura, refugios, etc). A pesar de que la disponibilidad de alimento no parece ser un factor limitante, se infiere que la presión de las cabras sobre la vegetación es un factor de competencia adverso. Los cernícalos y los gatos cimarrones, especies

comunes en el risco, son considerados como depredadores potenciales, y una seria amenaza para los lagartos jóvenes y adultos, respectivamente.

La densidad de población fue calculada a base de segregar el habitat en sectores, marcar los lagartos con pintura en la cabeza y realizar conteos posteriores. Al extrapolar a todo el habitat los valores estimados para los sectores visibles, se obtiene una población total de un centenar de indivíduos (96—118). En consecuencia, la densidad resulta 15—20 m^2 por animal (500 exx/has).

La estructura de la población (fenofase estival) se estima como 0 : 2 : 8 : 5 : 1 a lo que se añade una visión complementaria deducida del histograma de frecuencias de clases de diámetero en 160 excrementos recolectados. La proporción de jóvenes que se obtiene de este modo es de 7.5 %; algo menor que en las observaciones de campo (1 : 8). Es muy probable que nos encontremos ante una población en proceso de colapsamiento. En consecuencia, el Lagarto Gigante de El Hierro ha de ser considerado en grave peligro de extinción.

No se vieron indivíduos nacidos en el año. La fertilidad de la población ronda el 75 % de las hembras (sex ratio 1 : 1). Las hembras grávidas portaban unos 8—12 huevos. Sin embargo, el hallazgo de sólo tres pellejos viejos con señales de salida normales, da pie a suponer que el fracaso en las puestas es muy alto (1/4?).

La actividad diaria de los lagartos es prolongada: empieza tarde por la mañana, se interrumpe en superificie a mediodía y continúa luego hasta el atardecer. La temperatura eccrítica obtenida es 33.2°C (media de 4 indivíduos). Se describen todas las observaciones directas de alimentación y se comentan aquellos otros aspectos des comportamiento observados, que revisten interés y que están relacionados con las interacciones inter- e intraespecíficas, manipulación con las patas delanteras, conducta sexual. producción de sonido, etc.

En gabinete se examinó el contenido de 100 excrementos, obteniéndose el espectro (cualitativo) de preferencias alimentarias del lagarto. La principal fuente energética son las plantas (hojas, yemas y frutos). Una leguminosa rica en proteinas, *Psoralea bituminosa* L., constituye el 54 % de los excrementos en esta época del año (verano). De todos modos, en el 66 % de los casos aparece materia animal en proporción variable (appr. 7—8 %), insectos, en su mayor parte. Esta proporción de insectos es mayor en los ejemplares jóvenes. La comparación con el contenido de 32 excrementos de *Gallotia galloti caesaris* (Lehrs, 1914), especie más entomófaga con la cual cohabita, refleja un cierto grado de competencia alimentícea entre ésta última y los jóvenes del Lagarto Gigante. No obstante, también se infiere also de separación de nichos. La predación del Lagarto Gigante del Hierro sobre *G. caesaris* y *Tarentola* parece ocurrir en bajas proporciones, 2 %.

Los ocho ejemplares capturados fueron narcotizados con éter para poderlos pesar, medir y fotografiar en detalle. Se aportan todos los datos obtenidos así como la descripciones de la coloración en jóvenes y adultos. La estructura general del cuerpo, la forma de la cabeza, las escamas de la región temporal y las de la región preanal son presentadas como las principales diferencias entre *Gallotia simonyi* (Steind., 1889), *Gallotia stehlini* (Schenkel. 1901) y el Lagarto Gigante del Hierro. Este ultimo se considera como un taxon independiente, aun no descrito (*Gallotia* aff. *simonyi*) y que deberá describirse en un futuro cuando la población esté en mejores condiciones y pueda retirarse un ejemplar para holotipo.

Este trabajo está dedicado a los habitantes del Hierro.

References

Arnold, E.N. (1973): Relationships of the Palaearctic lizards assigned to the genera *Lacerta*, *Algyroides* and *Psammodromus* (Reptilia: Lacertidae). — Bull. Br. Mus. nat. Hist. (Zool.) 25 (8): 289—366.

Bannermann, D.A. (1963): Birds of the Atlantic Islands. Volume one. A history of the birds of the Canary Islands and of the Salvages. — Edinburgh and London: Oliver & Boyd, 358 pp.

Bellairs, A. (1975): Los Reptiles. — T. 11 in Historia Natural Destino, 850 pp. (Barcelona).

— & J. Attridge (1978): Los Reptiles. — H. Blume Ediciones, 261 pp (Madrid).

Bischoff, W. (1973): Über eine bemerkenswerte Verhaltensweise von *Lacerta simonyi stehlini*. — Aquarien und Terrarien 20: 278—279.

— (1974): Beobachtungen bei der Pflege von *Lacerta simonyi stehlini* (Sauria, Lacertidae). — Salamandra 10 (3/4): 93—103.

—, H.K. Nettmann & S. Rykena (1979): Ergebnisse einer herpetologischen Exkursion nach Hierro, Kanarische Inseln. — Salamandra 15 (3): 158—175.

Blas Aritio, L. (1976): El libro rojo de la fauna española. — Madrid: Incafo, 191 pp.

Boettger, C.R. & L. Müller (1914): Preliminary notes on the local races of some Canarian lizards. — Ann. Mag. nat. Hist. (8) 14: 67—78.

Böhme, W. & W. Bings (1975): Zur Frage des Überlebens von *Lacerta s. simonyi* Steindachner (Sauria: Lacertidae). — Salamandra 11 (1): 39—46.

— & — (1977): Nachträge zur Kenntnis der kanarischen Rieseneidechsen (*Lacerta simonyi*-Gruppe) (Reptilia, Sauria, Lacertidae). — Salamandra 13 (2): 105—111.

— & W. Bischoff (1976): Das Paarungsverhalten der kanarischen Eidechsen (Sauria, Lacertidae) als systematisches Merkmal. — Salamandra 12 (3): 109—119.

—, —, H.-K. Nettmann, S. Rykena & J. Freundlich (1981): Nachweis von *Gallotia simonyi* (Steindachner, 1889) (Reptilia. Lacertidae) aus einer frühmittelalterlichen Fundschicht auf Hierro, Kanarische Inseln. — Bonn. zool. Beitr. 32 (1—2): 157—166.

Boulenger, G.A. (1891): On Simony's Lizard, *Lacerta simonyi*. — Proc. zool. Soc., London, 1891 (13): 201—202, pl. 18—19.

— (1920): Monograph of the Lacertidae. Volume I. — London, Trust. Brit. Museum, 352 pp.

Bravo, (1982): Formaciones geológicas en la Isla de El Hierro. — Instituto de Estudios Canarios, T. 50 Aniversario, I Ciencias, 83—99 (S/C de Tenerife).

Cañizo, J. del (1954): Invasión de la langosta peregrina (*Schistocerca gregaria* Forsk.) en Canarias (Oct. 1954). — Bol. patol. veg. y ent. apl. 20: 409—431.

Champion, C.L. & L. Sanchez Pinto (1978): Catálogo preliminar de los líquenes de las Islas Canarias. — Instituto de Estudios Canarios. Santa Cruz de Tenerife.

Cott, H.B. (1934): On the ecology of *Hyla arborea* var. *meridionalis* in Gran Canaria, with special reference to predatory habits considered in relation to the protective adaptations of insects. — Proc. zool. Soc. Lond. 1934 (2): 311—331.

Fejervary, G.J. von (1914): Über kanarische Lacerten. — Verh. zool.-bot. Ges. Wien 64 (9/10): 320—333.

Fritsch, K. von (1870): Über die ostatlantischen Inselgruppen. — Ber. senckenb. naturf. Ges. 1870: 72—113.

Hausen, H. (1973): Outlines of the geology of Hierro (Canary Islands). Soc. Sci. Fennica, Comm. Phys.-Math. 43 (1): 65—148.

Heatwole, H. (1976): Reptile Ecology. — University of Queensland Press, 178 pp (Queensland).

Heselhaus, R. (1981): Der Lebensraum der Kanarischen Rieseneidechse, *Lacerta simonyi stehlini*. — Aquar. — u. Terrar. — z., 34 (2): 66—67.

Joger, U. & W. Bischoff (1983): Zwei neue Taxa der Gattung *Tarentola* (Reptilia: Sauria: Gekkonidae) von den Kanarischen Inseln. — Bonn. zool. Beitr. 34 (4): 459—468.

Klemmer, K. (1976): The Amphibia and Reptilia of the Canary Islands. — XV, pp. 433—456 in Kunkel, G. (ed.): Biogeography and Ecology in the Canary Islands. — Monographia biologica 30. The Hague, W. Junk Publishers.

Lorenzo Perera, M.J. (1980): El ara de sacrificio de Punta Gorda (Costa de Sabinosa. el Hierro), y algunas consideraciones sobre economía, sociedad y vida espiritual prehispánica herreña. — S/C de Tenerife, Aula de Cultura. Homenaje a Alfonso Trujillo, Arte y Arqueología. Tomo I. 831—892.

Manrique y Saavedra, A.M. (1873): Elementos de Geografía é Historia natural de las Islas Canarias . . . — Las Palmas: Ramírez, 98 pp.

Meade-Waldo, E.G. (1890): Further notes on the birds of the Canary Islands. — Ibis, Ser. VI, 2: 429—438.

Martínez Rica, J.P. (1982): Primeros datos sobre la problación de lagarto negro (*Gallotia simonyi simonyi* Steind.) de la Isla de Hierro. — Amphibia-Reptilia 2 (4): 369—380.

Molina Borja, M. (1981): Etograma del lagarto de Tenerife, *Gallotia galloti galloti* (Sauria-Lacertidae). — Doñana, Acta Vertebrata 8: 43—78.

Molina, M., A. Marrero, A. Carnero & F. Perez (1980): Reptiles y anfibios de Canarias. 2. Biología y etología de los lacértidos canarios. — Aguayro, 123: 12—14.

Parker, H.W. & A. Bellairs (1975): Los Anfibios y los Reptiles. — T. 10 in Historia Natural destino, 423 pp (Barcelona).

Peters, G. (1961): Die Perleidechse (*Lacerta lepida* Daudin) gehört zum Subgenus *Gallotia* Boulenger. — Mitt. zool. Mus. Berlin 37 (2): 271—285.

Rogner, M. (1981): Einfach zu pflegende Kanarische Rieseneidechsen. — Das Aquarium, 15 (139): 38—40.

Salvador, A. (1971): Nota sobre el lagarto negro gigante de Canarias, *Lacerta simonyi*. Bol. R. Soc. Española Hist. Nat. (Biol.) 69: 317—320.

Santos Guerra, A. (1980): Contribución al conocimiento de la flora y vegetación de la isla de Hierro. (I. Canarias). — Fundación Juan March, Serie Universitaria 114, 51 pp (Madrid).

Schenkel, E. (1901): Achter Nachtrag zum Katalog der herpetologischen Sammlung des Basler Museums. — Verh. naturf. Ges. Basel 13 (1): 142—199.

Siebenrock, F. (1894): Das Skelett der *Lacerta Simonyi* Steind. und der Lacertidenfamilie überhaupt. — Sitzungsber. d. kais. Akad. d. Wiss., math.-naturw. Classe 103 (1): 205—292.

Simony, O. (1890): Ueber eine naturwissenschaftliche Reise nach der westlichen Gruppe der Canarischen Inseln. — Mitteil. der K. K. Geograph. Gesell. in Wien 3: 145—176; 4: 209—231.

— (1892): Die Canarischen Inseln, insbesondere Lanzarote und die Isletas. — Schrift. Vereins Verbr. naturwiss. Kenntnisse in Wien 32: 353—398.

SPA-15 (anonymous) (1975): Estudio científico de los recursos de agua de las Islas Canarias. — Madrid: SPA/69/515.

Steindachner, F. (1889): Ueber eine von Prof. O. Simony auf den Roques del Zalmor bei Hierro (Canarische Inseln) entdeckte neue Eidechsenart von auffallender Größe, *Lacerta simonyi* Steind. — Anz. Akad. Wiss. Wien 26 (27): 260—262.

— (1891): Ueber die Reptilien und Batrachier der westlichen und östlichen Gruppe der canarischen Inseln. — Annalen des k. k. naturhist. Hofmuseums 6 (3): 287—305.

Tisdall, M. & A. (1983): Tenerife and the Western Canary Islands. — Roger Lascelles, Cartographic and Traveller Publisher, 200 pp (Brentford).

Urusaustegui, D.J.A. (1983): Diario de viaje a la Isla de El Hierro en 1779. — La Laguna: Centro de Estudios Africanos. Colectivo Cultural Valle de Taoro, 149 pp (ed. de M.J. Lorenzo Pereral).

Wevers jr., A. (1909): *Lacerta Galloti* und *Lacerta simonyi* — Lacerta 1902 (2): 8.

Wijfells, L. (1956): *Lacerta simonyi stehlini* in het terrarium. — Lacerta 14 (11/12): 83—84.

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