

First graphical representation (Display-action-pattern graph) of a male headbobbing display in a lacertid (*Gallotia galloti eisentrauti*)

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ABSTRACT. *First graphical representation (display-action-pattern graph) of male headbobbing display in a lacertid (Gallotia galloti eisentrauti).*- Display-action-pattern graphs are graphical representations of headbobs and dewlap extension involved in displays performed in different contexts and have been well documented for iguanids, agamids and chamaeleonids. For lacertids only preliminary data have been published on this matter. For the first time a display-action-pattern graph of a male headbobbing display of the lizard *Gallotia galloti eisentrauti* is presented. The recorded display was exhibited in the vicinity of a female and consisted of nine headbobs lasting around 5 s. Two kinds of headbobs, of high amplitude-low duration and low amplitude-high duration, have been described.

KEYWORDS. Display behaviour, Display-action-pattern graph, Lacertids, Courting, *Gallotia*

Males of several vertebrate species exhibit species-specific behavioural patterns which are performed previously to mating behaviours. These patterns, usually named courtship displays, may consist of movements of different body parts and/or emission of some sounds and are sometimes very elaborate (Huxley, 1914; Halliday, 1975).

As these displays are one of the signals on which female choice may depend (Jenssen, 1970; Crews, 1975a) they have a crucial importance in sexual selection. Other display types are used during agonistic interactions.

In Reptiles aggressive/courtship displays usually involve body postures and movements of the head and the forepart of the body (see Carpenter & Ferguson, 1977 for a review). Most of the detailed display analyses in these vertebrates have been done on iguanids (Carpenter, 1962, 1965, 1967; Jenssen,

1970, 1971, 1975; Crews, 1975b; Jenssen & Hover, 1976; Jenssen & Gladson, 1984; Carpenter, 1986; Font & Kramer, 1989). These analyses have implied the recording, graphical representation (display-action-pattern graphs) and quantitative analysis of successive headbobs and dewlap extension of the males. In lacertids only some narrative descriptions and drawings of courtship postures have been published (Kramer, 1937; Kitzler, 1941; Weber, 1957; Verbeek, 1972). This last author compiled data on *Podarcis sicula*, *Lacerta melisellensis*, *P. hispanica* and *L. vivipara* and cited throat extension as one of the patterns exhibited by the males during courtship (with the exception of *L. vivipara*). Vertical head movements which are so typical in iguanid displays, have only been described for *Podarcis sicula* (Verbeek, 1972), *Algyroides marchi* (Eikhorst et al., 1979), *Gallotia simonyi* (Machado,

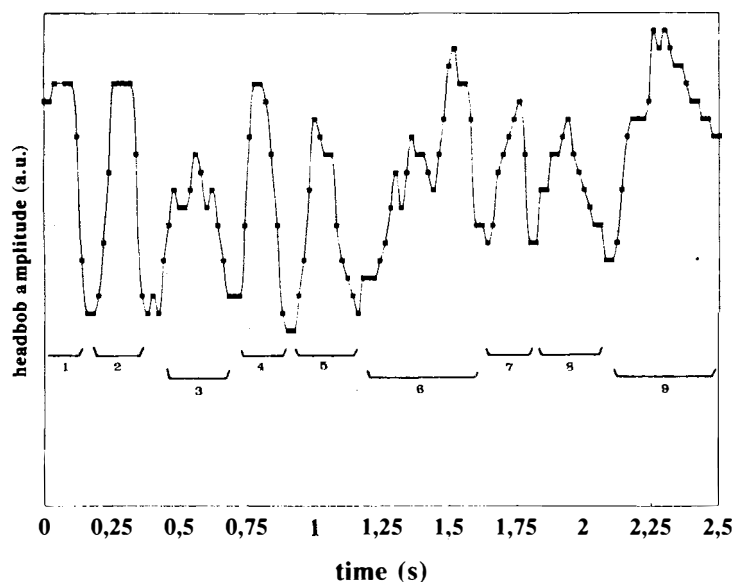


FIGURE 1. Display-action-pattern graph of a courtship display in *Gallotia galloti eisentrauti*. Numbers under the graph correspond to the successive headbobs during the display. Ordinates: amplitude of head bobs in arbitrary units (a.u.).

[Modelo de acción de exhibición de un cortejo en *Gallotia galloti eisentrauti*. Los números bajo la gráfica corresponden a los cabeceos sucesivos durante la exhibición. En ordenadas: amplitud de los cabeceos en unidades arbitrarias (a.u.).]

1985) and *Lacerta lepida* (Vicente, 1989) although not always have been related to courtship activities. In den Bosch (1986) cited for *Psammodromus hispanicus* a behaviour pattern named "Schnauzenwippen" ("Snout bobbing?") but from his description it seems that it could be performed by one male in response to another male or to a female and he considered it to be related to dominance-submission interactions.

For the canarian lizards, belonging to the endemic genus *Gallotia* (Arnold, 1973) of the family Lacertidae, Bischoff (1971, 1974) cited throat extension and rapid head movements by the males as initial patterns in the courtship of *G. galloti* (from Tenerife) and *G. stehlini* (from Gran Canaria) observed in laboratory cages. However, to this date

no graphical representation of vertical head movements during courtship or other display type has been made of any lacertid.

Ongoing behavioural observations are currently underway in some localized populations of the Tenerife island lizards *G. g. eisentrauti* (from the North of the island) and *G. g. galloti* (from the South and Centre). Some of these observations were initially filmed with an 8 mm camcorder and more recently with a Hi8 video camera for further analysis at a later date. While observing some specimens on a concrete wall surrounding a culture field, the headbobbing display of an adult male *G. g. eisentrauti* located near an adult female was filmed on 8 mm film on June 1991. This movie sequence was posteriorly analysed using a S-VHS video

recorder equipped with a frame by frame facility (Panasonic NV-FS88). On each frame we measured the height of the head (head amplitude, from the snout tip) with reference to the substratum. As filming was done from the same height as that of the wall, the variation in head height on the video screen was proportional to the actual height of the head movement in the displaying animal. Therefore head heights in successive frames were measured throughout the sequence. Time reference was calculated considering the 25 frames per second temporal resolution of the video-recorder.

In figure 1 the corresponding graphical representation of the head height variation through time is represented. The whole sequence lasted about 5 s and has been initially split up in nine gross up and down head movements, occurring at a rate of less than 3 bobs per second. Some bobs had a high amplitude and a short duration -between 10 and 13 frames- (see headbobs 1, 2, 4, 5, 7 and 8 in fig. 1). Each of the other headbobs (3.6 and 9, lasting 15 to 19 frames) have been tentatively considered as single one on the basis of the greater amplitude range between the lowest and highest value, but in fact they include two to three very small bobs (small peaks within headbobs number 3.6 and 9 in fig. 1). During the whole display the male always had the gular region extended.

The display began when the male was within 50 cm of the female and was performed while he was approaching her. The interaction finished when the male was close to female and she retired. In other field observations (Molina-Borja, 1986, 1991) males engaged in successive sequences of three to five rapid vertical head movements with short intervals between them, so the graph presented here could correspond to an unfinished display. As in all the cases the display was clearly distinct from aggressive actions (which are also presented by males towards some females), and in some cases it was witnessed to be followed by copulation, a tentative courtship function has been assigned. Although other possible

functions of this display cannot be excluded (as identity signalling), this display type has not been observed in other male-male or male-female interaction contexts.

As no other graphic representation of a headbob display for a lacertid has been published, no comparison within this group can be done. Also, at this initial step in research, a comparison between lacertid and iguanid displays is not warranted.

Further recording and analysis of other individual headbobbing displays in *G.g. eisentrauti* should enable us to assess possible variations in the number/duration of the headbobs performed by different males (intermale variability). And it will also form a basis for comparison of displays in *Gallotia* species/subspecies from the same or other islands in the Canarian archipelago.

Moreover, as the quality and/or frequency of courtship by the males can be factors influencing their acceptance by the females, the recording of these displays in experimental conditions will provide a basis for determining which proximal factors (in the male's behaviour) affect female selection, if any.

Resumen

Primera representación gráfica (modelo de acción de exhibición) de una exhibición de cabeceo en el macho de un lacértido (Gallotia galloti eisentrauti).

Los patrones de exhibición mostrados por machos de diferentes especies de vertebrados durante el cortejo son señales importantes en la estimulación de procesos fisiológicos reproductivos en la hembra así como en la aceptación de un macho determinado por parte de ésta. Por otra parte, la comparación de dichos patrones en especies relacionadas puede dar idea de la posible evolución de estas pautas.

Las exhibiciones de cortejo/agresión en reptiles suelen implicar posturas y movimientos verticales de la cabeza y porción anterior del cuerpo. Descripciones y representaciones gráficas de los movimientos realizados por la cabeza se encuentran frecuentemente en la bibliografía para lagartos iguánidos, agámidos y camaleónidos, pero no para lacértidos.

Se presenta por primera vez una representación gráfica de la evolución temporal de los movimientos de cabeceo realizados por un macho del lacértido *G. g. eisentrauti* frente a una hembra. La exhibición, analizada a partir de una grabación en vídeo, consistió de al menos 9 cabeceos sucesivos y duró alrededor de 5 s. Tentativamente se describen cabeceos de alta amplitud-corta duración y de baja amplitud-larga duración (fig. 1). Durante toda la secuencia el macho mantuvo distendida la región gular. En otras exhibiciones observadas pero no grabadas, los machos de esta especie realizaban secuencias sucesivas de 3 a 5 cabeceos rápidos con intervalos cortos entre cada secuencia, por lo que la gráfica que se presenta podría corresponder a una exhibición incompleta. De hecho, el macho realizó la exhibición mientras se acercaba a la hembra, retirándose ésta cuando aquel estuvo muy cerca de ella.

Dado que no existen otras representaciones gráficas publicadas para lacértidos, no puede realizarse comparación alguna. Por otra parte, en este estadio inicial de la investigación en lacértidos, tampoco se puede establecer una comparación clara de sus exhibiciones con las de iguánidos.

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