MEININGER, P. L. & MULLIE, W. C., 1981. Egiptian wetlands as threatened wintering areas for waterbirds. *Sandgrouse*, 3: 62-77.

VILAGRASA, X., CARRERA, E. & PARDO, R., 1982. Hivernage de la Sterne caugek *Sterna sandvicensis* sur les cotes de la Catalogne et du Levant (Espagne). *Alauda*, 50: 108-113.

Carrera, E., Martínez, A., Motis, A. & Pardo, R., 1981 (1983). Nota sobre la invernada de *Chlidonias hybrida* (Pallas) (Aves, Sternidae) en el Mediterráneo Ibérico. *Misc. Zool.*, 7: 222-224. Barcelona.

E. Carrera, c/. Consell de Cent 341, 4rt 1a, Barcelona 7.– A. Martínez, A. Motis, Dpt. de Zoologia (Vertebrats), Fac. de Biologia, Univ. de Barcelona, Av. Diagonal 645, Barcelona 28.– R. Pardo, c/. Ciscar 18, Valencia 5.

ON THE SISKIN'S ABILITY TO DISCRIMINATE BETWEEN EDIBLE AND ABORTED PINE SEEDS

Pine and Spruce seeds are a very important source of food for a great number of birds and mammals (SVÄRDSON, 1957). These seeds are inside a protective structure, the cone. Every cone has a variable number of edible seeds and also an indeterminate number of aborted ones.

Birds, in general, spend an important part of their time collecting food; therefore it should be to their advantage to be able to disminate *a priori* between edible and aborted pine seeds. Three species of birds (Corvidae) have been described as having this ability: the Piñon Jay *(Gymnorhinus cyanocephalus)* (LIGON & MARTIN, 1974), the Eurasian Nutcracker *(Nucifraga caryocatactes)* (REIMER, 1959), and the American Nutcracker *(Nucifraga columbiana)* (VANDER WALL & BALDA, 1977).

The Fringillidae are highly specialized on the use of conifer seeds, as for instance crossbills or siskins. In order to see if Carduelinе finches have the ability of discriminating between edible and aborted seeds, the Siskin *(Carduelis spinus)* was chosen to carry out a series of experiments. This specie was chosen since it is one of the smallest birds thus having a very hight metabolism, and since conifer seeds are its main source of food during the reproductive season (NEWTON, 1972; NETHERSOLE-THOMPSON & WATSON, 1974). The experiments were carried out on a captive flock, composed of 6 individuals (4 males and 2 females) and kept in an outdoor flight cage (125 x 60 x 125 cm). I used *Pinus halepensis* for this experiment because while some of its aborted seeds can be visualy detected others are identical to edible ones. The Siskins were given 500 seeds, which were administered in very small quantitites and at a certain height above the ground in order to detect quickly the ones which were discarded and dropped on the ground.

Siskins dropped 55 of the 500 seeds they took (11%). The dropped seeds were opened and it was determined that 70% of them were aborted (table 1). Moreover, Siskins were never seen opening aborted seeds. The conclutions from the analisis of table 1, are that there was a great dependence between the behaviour of the Siskin and the kind of seed it was eating ($X^2 = 344,44; P<0,001$): the seeds were discarded if they were aborted, and eaten if they were edible. Therefore Siskins have the ability to discriminate between aborted and edible seeds before opening them, this being very important for the energy and time it saved. For species like Siskins, with a very high metabolism and a short life-span (ERIKSSON, 1970), this ability has a very important survival value.

However, it must be pointed out that 30% of the discarded seeds were edible (table 1). To discard edible seeds might be a waste of time, although it is perhaps a security factor:

Table 1. Contingency table on Siskin's response to edible and aborted seeds. Expected frequencies in brackets. Independence test $X^2=344,44$ $P<0,001$.

	edible seeds	aborted seeds
eaten	445 (410)	0 (34,7)
not eaten (discarded after touching)	16 (50,7)	39 (4,3)

presumably, it would be better for Siskins not to eat an edible seed than to open an aborted one. This fact would also facilitate the dispersion of the seeds.

There seem to be three important characteristics which establish a difference between edible and aborted seeds: color (which can be more or less important depending of the conifer species), density, and sound qualities (LIGON & MARTIN, 1974; VANDER WALL & BALDA, 1977).

According to LIGON & MARTIN (1974), Piñon Jays, before eating or dropping a seed, determine its density by clicking it in its bill two or three times or by holding it in its beak momentarily (' bill weighing '). For testing sound cues, the seeds are clicked in the beak many more times (' bill clicking ').

There seems to be several differences between the Siskins and the corvids in the method they used during seed discrimination. Siskins only showed 'bill-weighing', dropping all the aborted seeds after momentarily holding them. Corvids used mainly the color, and in general, aborted seeds were not even extracted from the cone. However, sometimes they did show 'bill-clicking' to discriminate between spoiled and edible seeds, and sometimes also 'bill-weighing' (VANDER WALL & BALDA, 1977).

The fact that Siskins do not use the color factor could have two explanations. On the first place, Siskins are not specialized in eating the seeds of a particular conifer, as is the case of the American Nutcracker, which mainly feeds on Piñon pine *(Pinus edulis)*, in which the aborted seeds can easily be differentiated from the edible ones by the color (VANDER WALL & BALDA, 1977). Since some species of pines have aborted seeds that cannot be distinguished by color, it is not a good strategy for Siskins to use color. Secondly, the American Nutcracker is able to open the cones by himself in a way that leaves the seeds highly visible while on the other hand, Siskins cannot open them and must eat from the ones that already are partially opened, or follow the crossbills and take advantage of the ones opened by them (TURCEK, 1956). In these cases, the seeds are not visible, and it makes it more difficult for the Siskin to differentiate by color before taking seeds.

Therefore, we can conclude that the Eurasian Siskin is another one of the species which is able to discriminate *a priori* between aborted and edible seeds, this being very advantageous for the species.

ACKNOWLEDGEMENTS

I am very grateful to Rosario Nos, Toni Borras, John A. Wiens, Harrison B. Tordoff, Jim and Joan McPherson, an anonymous reviewer and specially to Anna Omedes for their helpful suggestions and comments on the manuscript.

RESUMEN

Las semillas de coníferas son una importante parte de la alimentación de muchas aves y mamíferos. En cada piña hay una pequeña proporción de semillas vanas.

Los pájaros gastan en general una cantidad importante de tiempo y energía en la explotación de estas semillas, y por tanto sería evolutivamente muy ventajoso la detección de las semillas vanas antes de abrirlas.

Esta capacidad ha sido ya observada en algunos córvidos. En este trabajo se comprueba que el Lúgano *(Carduelis spinus)* es también capaz de discriminar las semillas vanas a priori, existiendo una fuerte dependencia entre su comportamiento y el tipo de semilla que come ($X^2=344,44$; $P<0,001$): si la semilla es vana la tira tan solo tomarla con el pico, y si es buena se la come.

El Lúgano utiliza para esta discriminación la diferencia de densidad que existe entre las dos semillas mientras que los córvidos utilizan el color.

Dos causas se proponen para explicar esta diferencia: 1) los córvidos se alimenta de semillas en que las abortadas se distinguen fácilmente por el color. El Lúgano posee un régimen más variado.

2) los córvidos dejan los piñones altamente visibles al abrir las piñas. El Lúgano debe sacar los piñones de piñas entreabiertas para poder verlos.

REFERENCES

ERIKSSON, K., 1970. Age, mortality and average expectation of life in the Siskin, *Carduelis spinus*. *Sterna*, 9: 207-212.

LIGON, J. D. & MARTIN, D. J., 1974. Piñon seed assessment by the Piñon Jay. *Anim. Behav.*, 22: 421-429.

NEWTON, I. 1972. Finches. London: Collins.

NETHERSOLE-THOMPSON, D. & WATSON, A., 1974. *The Cairngorms*. pp. 93-97. London: Collins.

REIMERS, J. F., 1959. The nutcracker (*Nucifraga caryocatactes macrorhynchos* Brehm). *Trudy Biol. Inst. (Zool.) Akad. Naud. SSSR, Sib Otd.*, 5: 121-166. Translated by Leon Kelso.

SVÄRDSON, G., 1957. The 'invasion' type of bird migration. *Br. Birds*, 50: 314-343.

TURCEK, F. J., 1956. On the bird population of the spruce forest community in Slovakia. *Ibis*, 98: 24-33.

VANDER WALL, S. B. & BALDA, R. P., 1977. Coadaptations of the Clark's Nutcracker and the Piñon pine for efficient seed harvest and dispersal. *Ecol. Monogr.*, 47: 89-111.

Senar, J. C., 1981 (1983). On the siskin's ability to discriminate between edible and aborted pine seeds. *Misc. Zool.*, 7: 224-226. Barcelona.

J. C. Senar, Secció d'Ornitologia, Museu de Zoologia, Apt. de Correus 593, Barcelona 3.

BEMERKUNGEN ZUM TYPUS *MYOXUS MUNBYANUS* POMEL 1856, UND ZUM LECTOTYPUS *BIFA LEROTINA* LATASTE 1885. (MAMMALIA, RODENTIA, GLIRIDAE)

EINLEITUNG

Durch zahlreiche Diskussionen mit Herrn Professor Dr. H. Kahmann (München) und zwei gemeinsame Sammelreisen (Tunesien und Formentera) wurde ich auf den Gartenschläfer aufmerksam gemacht. In der hochinteressanten und wegweisenden Studie 'Über den Gartenschläfer *(Eliomys)* in nordafrikanishen Ländern', die mehr als der Versuch eines Überblicks ist (!), haben KAHMANN & THOMS (1981) deutlich auf die Lücken der Erforschung des Gartenschläfers hingewiesen. Der Holotypus *munbyanus* wird unterschiedlich beurteilt (vgl. RODE, 1945; ELLERMAN, 1940; COCKRUM & SETZER, 1977). Anläßlich eines Besuches im British Museum (Natural History) London konnte ich unter anderem auch den Lectotypus *Bifa lerotina* Lataste, 1885 vermessen (vgl. VESMANIS, 1980; Angaben von P. D. Jenkins brieflich v. 22.6. 1982 bestätigt). Im Muséum d'Histoire Naturelle de Paris wurde am 9.10.1981 der Typus *Myoxus munbyanus* Pomel 1856 untersucht.

ERGEBNISSE

1. *Bifa lerotina* Lataste, 1885 – Lectotypus: Nach ALLEN (1939), ELLERMAN & MORRISON-SCOTT (1966) und CORBET (1978) zu *Eliomys quercinus munbyanus* gehörend (vgl. auch THOMAS, 1919 und COCKRUM & SETZER, 1977).
Etikett: Bifa myoxina
Loc. typ : Ghardaia, Mzab, Algerien
Datum: keine Angaben auf dem Etikett
Coll. Nr.: BMNH 19.7.7.2884, Org. Nr. 41 (für den Balg). BMNH 19.7.7.2883, Org. Nr. 39 (für den Schädel)
Sex: ♀
Leg.: Massoutier (C.), Lataste (P.)
Schwanzfärbung: Oberseite – weiße Spitze, ca. 1 cm, dann 5 cm schwarz folgend. Unterseite – von der Spitze an etwa 4 cm weiß.
Schädel: Zähne nicht sehr stark abgekaut;