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FIELD INTERBREEDING OF RELEASED FARM-REARED RED-LEGGED PARTRIDGES (*ALECTORIS RUFA*) WITH WILD ONES

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ABSTRACT

Twenty farm-reared red-legged partridges, Alectoris rufa *(ten females and ten males, between six- and eight-months old) were released for restocking in a 4-km² study area in the Malaga Province, southern Spain in March 2000. From March to September 2000, they were monitored using radio-tracking to assess their breeding success. Two radio-marked females paired with wild males. Competitive interactions (aggressive behaviour) between the mixed pairs and other wild pairs were found for the nesting site in relation to its habitat quality. Only one farm female finally nested and hatched 11 chicks in the field. These chicks were also radio-hatched and a 91% high chick mortality rate was found. One chick survived, grew up to adult size and integrated the wild population. Because the existence of a gene admixture between the wild population and the released partridges is assessed, when releasing farm-reared partridges into the wild one must take the risk of reducing the genetic diversity in the wild populations into account.*

I. INTRODUCTION

Animal releases for restocking is a widespread game management action in the Iberian Peninsula. The animals are hand-reared in captivity by the hunters or bought in industrial farms specialized in game species. BALLOU (1993) has warned about the sanitary and genetic risks of this kind of releases. If minimum quality guarantees are not observed in the rearing process, the released animals can become vectors to transfer diseases or impoverishing the genet-

ic diversity in wild populations (VIGGERS *et al.*, 1993; HODDER and BULLOCK, 1997).

With the wild rabbit, *Oryctolagus cuniculus*, and the partridges, *Alectoris* sp. and *Perdix* sp., it is possible to cross wild individuals with domestic ones or to use hybrids to obtain more productive and docile animals for the industrial production and captivity management (DOWELL, 1992). The main risk of interbreeding within species is a decrease in genetic diversity and the outbreak of abnormal phenotypes. It is also possible, but not legitimate, to cross different species of partridges since some species may produce natural hybrids in some reduced ecotones of their distribution range (RANDI and BERNARD-LAURENT, 1999).

In fact it has been reported the existence of hybrids between *A. rufa* and *A. graeca,* and of abnormal phenotypes of red-legged partridge in Spain that maybe came from industrial farm-rearing (ARRUGA *et al.*, 1996), and a methodology has been developed to detect these hybrids (NEGRO *et al.*, 2001). Once in the field, these mixed partridges may manage to breed with wild individuals. The possibility of crossings between wild rabbits and released ones has been shown by BRANCO *et al.* (1997) in the South of Spain. However, until now there was no evidence of field pairing of farm partridges with wild ones. In this note we present observations of the interbreeding of wild red-legged partridges with released farm-reared ones.

II. MATERIAL AND METHODS

The study area (4 km^2) was located in the private estate of "La Algaida" (Benahavís, Málaga Province, South of Spain). This is a rocky area covered by pines, *Pinus pinaster*, cork oaks, *Quercus suber*, and carob trees, *Ceratonia siliqua*, with Mediterranean shrubs like *Pistacia lentiscus*, *Cistus ladanifer* and *Erica scoparia*.

In the beginning of the year 2000, the hunters of this estate bought a local farm and released forty red-legged partridges. These chicks had hatched in the previous year. They released the animals at the beginning of the partridge breeding season with the aim of improving the wild breeding population. The restocking programme included habitat improvement actions around the release points. They sowed some cereal and sunflower fields, managed selective clearings in the shrubs and installed water points.

Twenty partridges (ten females and ten males) between six- and eight-month old were radio-tagged in February with 11-g TW-3 necklaces (Biotrack, UK). Bird sex and age was determined according to SÁENZ DE BURUAGA *et al.* (1991). The animals were kept in two parks at the release points during one month for acclimatization. In March, the partridges were released by leaving the door of the parks open. At this time partridge reproduction had already started and wild paired partridges could be seen in the area.

The partridges were monitored between March and September 2000 and located on a daily basis. During the monitoring we searched for breeding evidences such as the existence of a nest with a female laying or incubating. When a female stayed for more than three days brooding in the same place, even without eggs, we considered the existence of a selected nest. Any agonistic behaviour display of partridges, such as direct fighting between wild

and released ones, was also monitored. After hatching, we also captured eleven chicks, radio-tagged them with 0.9 – 1.3-g TW-4 glue-mounted backpacks (Biotrack, UK) and monitored them at a daily basis to estimate their survival rate (KENWARD *et al.*, 1993). All locations were made using portable Yagi antennas and the homing-in technique (WHITE and GARROTT, 1990). Survival rate was estimated directly by recovering transmitters from partridge carcasses.

III. RESULTS

The global survival rate of the 20 radioequiped partridges was 15% three months after the release. Only two surviving females tried to breed. Both of them were paired with wild males, but only one managed to select a nest site and layed. The female that did not breed never layed and no evidences of nesting selection were found. The other female selected four successive sites for nesting (Table I) but in the first three places competitive interactions were detected. Fighting between the female and the wild pairs resulted in an expulsion from the place before any egg was laid. Each new place was farther away from the area with better habitat quality (*i.e.* existence of water points and sown patches) than the previous one. At least, one marginal site was selected, outside the managed area (Table I).

TABLE I
Features of the successive nesting sites selected by a farm-reared red-legged partridge, *Alectoris rufa*, hen released into a study area in the Malaga Province, southern Spain, in March 2000, and success of the attempt.

TABLEAU I
Caractéristiques (distances, en mètres, au point d'eau le plus proche, au champs ensemencé le plus proche, à la parcelle débroussaillée la plus proche et au point de lâcher) des 4 sites successifs de nidification choisis par une poule perdrix rouges, *Alectoris rufa*, d'élevage relâchée dans une aire d'étude de la province de Malaga, au sud de l'Espagne en mars 2000, et réussite de l'essai de nidification (oui/non).

Habitat feature	Distance (m) between the nesting site and a specific habitat feature			
	Site 1	Site 2	Site 3	Site 4
The closest water point	22	20	50	130
The closest sown patch	200	450	490	560
The closest cleared shrub patch	40	30	30	140
The release point	240	480	510	580
Success of the attempt	No	No	No	Yes

This females laid a clutch of eleven eggs. The hatching period was twenty-four days. All eggs hatched and the chicks were equipped with radiotransmitters. During the first ten days after hatching 91% of the chicks died. Some transmitters were found alone and others near chick carcasses. The only chick predator that could be identified was the jay, *Garrulus glandarius*. The progressive chick mortality was verified by a reduction in the covey size, monitored through the female transmitter. Only one chick grew up to adult size and was still alive at the end of the monitoring period, integrated in the winter coveys with wild individuals.

IV. DISCUSSION

The results show the existence of a gene intermixture between the wild population and the released partridges. We also found a chick of a mixed pair that had integrated the wild population. In Portugal, CARVALHO *et al.* (1997), CARVALHO and BORRALHO (1997) reported increases in partridge breeding population in the spring after releases. They suggested that the released partridges were nesting, but supported this only with indirect data (*i.e.* by measuring brood production in the release area or with line-transect density estimations before and after the releases). In fact, our results were already known. In France PEROUX (1984) and CATUSSE *et al.* (1988) had shown that released farm-reared red-legged partridges may reproduce in the wild. HAVET and BIADI (1990) did also report this. POTTS (1989) had shown that wild red-legged partridges may breed with released reared birds of another species of partridge, *Alectoris chukar*, or with hybrids of both species. However, the reproduction of hand-reared red-legged partridges with wild ones has never exactly been proved in the field. Our results show in a direct way that pairing may occur, even in the same spring the animals are released.

The low survival rate found and the small number of released individuals might reduce the pairing likelihood in this experience. It is likely that in restocking programmes with high numbers of released birds the number of pairings could increase. It is worth considering that in Spain more than 3.5 millions of farm-reared partridges are released every year (LUCIO and PURROY, 1992a). So, in the field there may be more mixed pairs than we expected.

CSERMELY *et al.* (1984), PAGANIN and MENEGUZ (1992) and PUTAALA and HISSA (1995) showed that farm-reared partridges have ethological, physiological and anatomical limitations that reduce their fitness in comparison with wild partridges. A lower breeding success of hand-reared grey partridges, *Perdix perdix*, was found by PUTAALA and HISSA (1998), although NIEWOONDER *et al.* (1998) found that the offspring of hybrid pheasants, *Phasianus colchicus*, was more productive than of the pure species, while BIRKAN and DAMANGE (1977) found no differences in the production of young by adult hens present in August, between reared hens and wild hens of grey partridges in the wild. In the present case the breeding success of the wild population was not monitored and the small sample size does not allow any statistical comparisons. Nevertheless, the clutch size and the laying period agree with the mean values recorded in the bibliography for the Iberian Peninsula (LUCIO, 1989). Only the chick survival rate was low. We cannot

reject any effect of the transmitters on chick survival (WHITE and GARROTT, 1990) nor of habitat quality (PANEK, 1997). KENWARD *et al.* (1993) tested the effects of the glue-mount technique on chick survival and did not find any adverse evidence. If we consider the habitat effect, the competitive interactions found for the nesting site were always in favour of the wild pairs. The farm female was only able to nest when it found an empty place and far away from the managed area, so its quality was likely lower than the nesting places around the managed area, occupied by the wild pairs, and probably inadequate to the survival of the chicks. However, in this study we did not find any direct evidences that the selection of a bad quality nesting site would result in low chick survival.

The use of reared partridges for restocking is a reliable way to improve wild populations, as shown by several authors (NADAL, 1992; CARVALHO and BORRALHO, 1997). Our results also show that habitat quality plays an important role in these releases through the competitive interactions between wild and released partridges to obtain the best nesting sites. Habitat improvement around the release areas may improve restocking success (CAPELO *et al.* 1999). Released partridges select the managed areas in a preferential way and attempt to use the best quality habitat patches (DUARTE *et al.*, 2002). Therefore, two important key factors should be taken into consideration before starting a restocking programme: habitat condition and the genetic purity of the birds to be released.

The changes in the genetic pool of the wild red-legged partridge through the existence of individuals hatched from mixed pairs could be a serious risk for the viability of the wild populations (VAN DER LOO *et al.*, 1991; TEMPLETON, 1994; CALVETE *et al.*, 1995). Most of the European red-legged partridge population is in the Iberian Peninsula (AEBISCHER and LUCIO, 1997). To the habitat quality problems and the unsustainable harvesting rates from which this species is suffering (LUCIO and PURROY, 1992b) we must add these genetic risks. It could be possible that small wild populations isolated by habitat fragmentation would recruit some of these birds, enter a bottleneck phase and endanger their wild genetic pool. This would result in a loss of genetic variability (PRIMACK, 1993). This is why the priority is to check the quality of the farms and to regulate all uncontrolled releases through a conservation policy for the wild game species in Spain.

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CROISEMENT ENTRE PERDRIX ROUGES (*ALECTORIS RUFA*) D'ÉLEVAGE LÂCHÉES DANS LA NATURE ET SAUVAGES

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MOTS CLÉS : Perdrix rouge, *Alectoris rufa*, élevage en captivité, repeuplement, croisement dans la nature, radio-pistage, Espagne.

RÉSUMÉ

Vingt perdrix rouges, Alectoris rufa*, d'élevage (dix poules et dix coqs âgés de 6 à 8 mois) ont été lâchées dans la nature pour repeupler une aire d'étude de 4 km² dans la province de Malaga au sud de l'Espagne en mars 2000. Elles ont été suivies par radio-pistage de mars à septembre 2000 afin d'évaluer la réussite de leur reproduction. Deux poules équipées d'émetteurs radio se sont accouplées avec des coqs sauvages. Nous avons mis en évidence l'existence d'une compétition pour la qualité du site du nid entre les couples hybrides et les autres couples sauvages, qui s'est manifestée par un comportement agressif de ces derniers par rapport aux premiers. Seule une poule d'élevage a finalement fait son nid et a réussi à faire éclore 11 poussins dans la nature. Chez ces poussins, qui après leur éclosion ont été suivis par radio-pistage, on a relevé un fort taux de mortalité (91 %). Un seul poussin a survécu qui a grandi jusqu'à l'âge adulte et s'est intégré à la population sauvage. Puisque l'existence d'un échange de gènes entre la population sauvage et celle des perdrix lâchées a été démontré, il faut prendre en compte le risque d'un appauvrissement de la diversité dans la population sauvage lorsque l'on relâche des perdrix d'élevage.*

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