NATURAL BILBERRY FIELDS MANAGEMENT: INFLUENCE OF BEEKEEPING ON ITS FRUCTIFICATION

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Abstract
Natural bilberry fields are one of the most important habitats for the conservation of the Capercaillie (Tetrao urogallus L.) and the Brown Bear (Ursus arctos L.), both species in risk of extinction.
It is estimated that the 80% of the plants with flowers, including the bilberry, need the honeybee (Apis mellifera L.) to produce viable seeds. A vital importance of the honeybee as pollinating agent in these fields can be supposed. In this way, improving the traditional beekeeping (suffering a drastic decline in Spain) can be seen as an interesting measure to increase bilberry fruit production.
Our main goal was to analyze the importance of the honeybee pollination on the bilberry production. Three natural bilberry fields were chosen in the north of Palencia province (Spain), in the south range of the Cantabrian Mountains. One hive was placed in each zone. The samples sites were placed at different distances around the hive. Each sample site consists in three types of plots: fenced honeybee exclosure, fenced ungulate and bumblebee (Bombus spp.) exclosure and a control plot.
The percentage of fruits per flower is estimated in each type of plot and sample site. So, we assessed the effect of the exclosures and the distance to the hive and the influence of the honeybee, in the yield of natural bilberry fruits.
The results suggest that the use of honeybees as pollinating agents in natural bilberry fields might be a good instrument to increase their fruit production, and, therefore, to enhance natural regeneration of this species. They also prove that beekeeping could be a right way of habitat management of wild bilberry fields providing wildlife with better habitat conditions, with special impact on endangered species like Capercaillie and Brown Bear.

Keywords: capercaillie, brown bear, endangered species, *Apis mellifera*, habitat management, conservation.

INTRODUCTION

Natural bilberry fields are one of the most important habitats for the conservation of the Capercaillie (*Tetrao urogallus* L.) and the Brown Bear (*Ursus arctos* L.). Both species are in risk of extinction in Spain.

The bilberry (*Vaccinium myrtillus* L.) is a key species for these species. It is an important source of food, and it's also a refuge and a source of invertebrates for the chicks of the bird.

It is estimated that 80% of the plants with flowers, including the bilberry, need the honeybee (*Apis mellifera* L.) to produce viable seeds (Calatayud y Simó, 2007). The honeybee is suffering a drastic decline in Spain, that it's considered as a cause of the decrease of the pollination and, therefore, a reduction of fruit production (Fernández-santos *et al*., 2007).

The production of the fruits of the bilberry has diminished in the study area in the last years in a critical way.

A vital importance of the honeybee as pollinating agent in these fields can be supposed. In this way, improving the traditional beekeeping (suffering a drastic decline in Spain) can be seen as an interesting measure to increase bilberry fruit production.

Our main goal was to analyze the importance of the honeybee pollination on the natural bilberry production, to improve its productivity, and so, to be able to increase the food disponibility for the Capercaillie and Brown Bear (Drummond, 2003).

For many years, have been made studies that prove the importance of the honeybee as pollinator in commercial bilberry harvests (Dorr y Martin, 1966; Eck, 1988; Sampson y Cane, 2000; Dedej y Delaplane, 2003). In this project we assess this importance, but in wild bilberry fields.

MATERIALS AND METHODS

Three natural bilberry fields were chosen at sites with presence of Capercaillie and Brown Bear in the southern range of the Cantabrian Mountains, in the north of Palencia province (Spain).
One hive per zone was placed, and we selected ten sampling sites at different distances around the hive. Each sampling site consisted of three plots treatments:

- fenced honeybee exclosure

- fenced ungulate and bumblebee (*Bombus* spp.) exclosure

- control plot

Ten bilberry twigs per plot were chosen and the number of flowers per twig was counted in May, pollinated flowers were counted two months later, and at the end of August fruit production was measured.

The percentage of fruit per flower, and of pollinated flowers per flower, was estimated in each type of plot and each sampling site to assess the effect of honeybee in bilberry fruit production.

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DATA ANALYSI

ANOVA: To assess the influence of various factors (Location, Distance to the hive, and Exclosure) on the yield of bilberry fruits.

SIMPLE REGRESSION: To analyse the linear relationship between fruit production, and pollinated flowers, and distance in each exclosure.
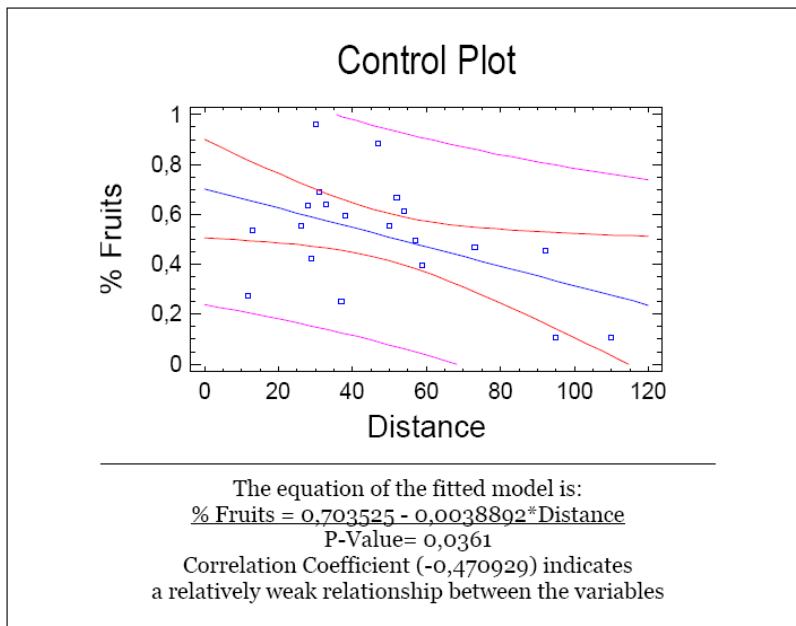
RESULTS AND DISCUSSION

EFFECTS OF EXCLOSURE:

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                        P- Value
Location                0.885225
Distance                7.949e-05  ***
Exclosure               6.376e-07  ***
Location:distance       0.006478  **
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Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
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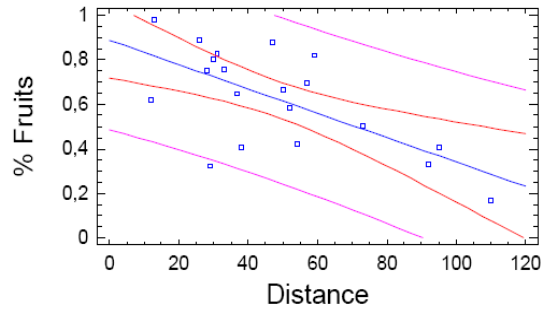
Exclosure has a high statistically significant effect on Fruit Production (ANOVA).
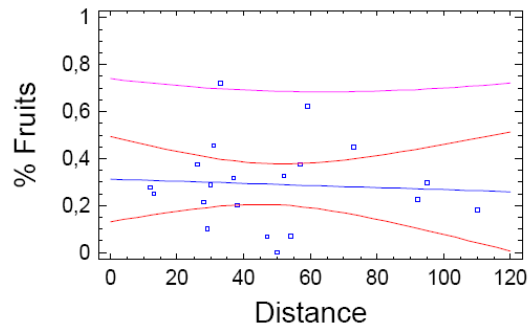
EFFECTS OF DISTANCE TO THE HIVE:

The equation of the fitted model is:
% Fruits = 0,703525 - 0,0038892*Distance
P-Value= 0,0361
Correlation Coefficient (-0,470929) indicates
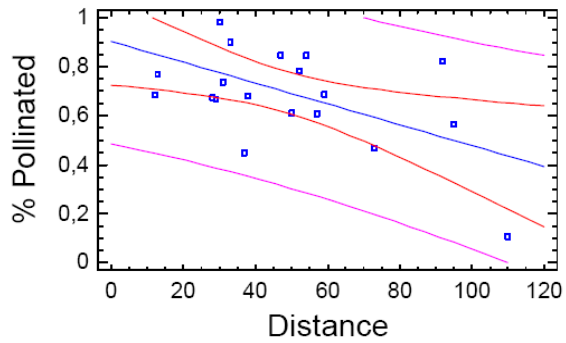a relatively weak relationship between the variables

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Ungulated and Bombus Exclosure

The equation of the fitted model is:
% Fruits = 0,887421 - 0,0054623*Distance
P-Value= 0,0016
Correlation Coefficient (-0,657132) indicates
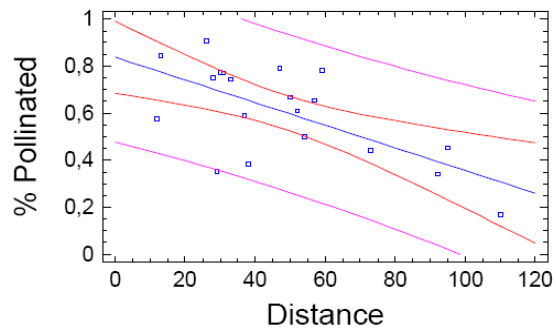a moderately strong relationship between the variables

Honeybee Exclosure

The equation of the fitted model is:
% Fruits = 0,310925 - 0,000438664*Distance
P-Value= 0,7840
Correlation Coefficient (-0,0654311) indicates
a relatively weak relationship between the variables

Control Plot

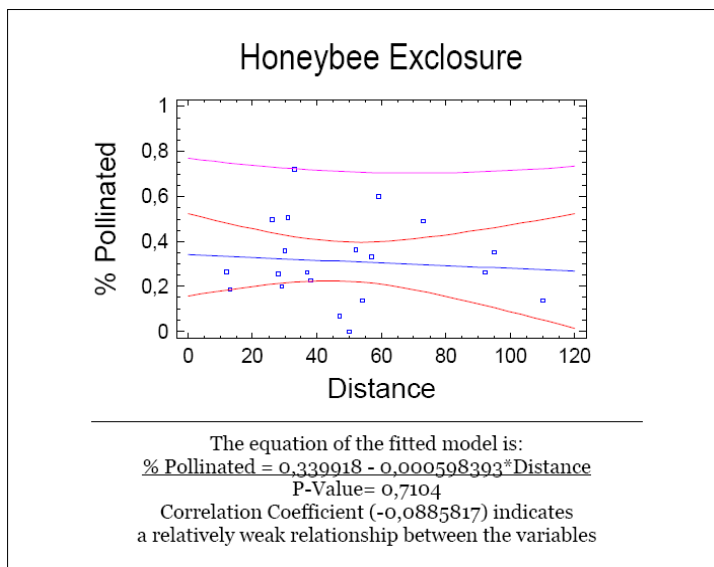The equation of the fitted model is:
% Pollinated = 0,903003 - 0,00424648*Distance
P-Value= 0,0129
Correlation Coefficient (-0,545212) indicates
a moderately strong relationship between the variables

Ungulated and Bombus Exclosure

The equation of the fitted model is:
% Pollinated = 0,837099 - 0,00480882*Distance
P-Value= 0,0020
Correlation Coefficient (-0,649159) indicates
a moderately strong relationship between the variables

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Honeybee Exclosure

The equation of the fitted model is:
% Pollinated = 0,339918 - 0,000598393*Distance
P-Value= 0,7104
Correlation Coefficient (-0,0885817) indicates
a relatively weak relationship between the variables

Distance has a high statistically significant effect on Pollinated Flower and Fruit Production at those plots where the honeybee is not excluded. Distance is not statistically significant at those where it's excluded.

CONCLUSION

The results suggest that the use of honeybees as pollinating agents in natural bilberry fields might be a good instrument to increase their fruit production, and, therefore, to enhance natural regeneration of this species. They also prove that beekeeping could be a right way of habitat management of wild bilberry fields providing wildlife with better habitat conditions, with special impact on endangered species like Capercaillie and Brown Bear.

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