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OROBANCHE CERNUA SEED DISPERSAL THROUGH SUNFLOWER ACHENES

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INTRODUCTION

Orobanche cernua Loefl. (*O. cumana* Wallr.; broomrape) is a troublesome parasitic weed of confectionery sunflower (*Helianthus annuus* L.). It is probably the most widespread species of all *Orobanche spp.*, as it affects extensive areas of sunflower in Southern and Eastern Europe and Middle East (*Parker*, 1986). In Spain this species was first detected in 1958 at Toledo Province (*Diaz-Celayeta*, 1974). *Gonzalez-Torres, Jimenez-Diaz and Melero-Vara* (1982) reported the spreading of the infestation to Cuenca Province and to Fuente Piedra (Malaga Province). Recently *O. cernua* has also heavily infested another important confectionery sunflower area of about 20,000 ha at El Coronil (Sevilla Province) (*Castejon, Romero-Munoz and Garcia-Torres*, 1987). The area planted to confectionery sunflower has been drasticaly reduced because of this parasite.

O. cernua seeds are pear shaped and extremely small, from 250 to 380 μm long and 150 to 240 μm wide (*Joel*, 1987). The description of the surface characteristics of *Orobanche* spp. seeds is reported by *Musselman* and *Mann* (1976) and a key for their identification using these characteristics was developed by *Joel* (1987). The morphology of sunflower achenes is described by *Knowles* (1978), indicating the presence of straight hairs inclined outward or appressed in the pericarp or hull, and of an armor layer in some cultivars where the outer layer of cells developed in an unusual way, creating pointed cones or hooklets. Although some authors have previously suggested the possibility of *O. cenua* seed dispersal through sunflower achenes (*Vranceanu*, 1974) no data have ever been reported to actually confirm it. The aim of this paper is to report studies that evidence and quantify the dispersal of *O. cernua* through sunflower achenes.

MATERIAL AND METHODS

O. cernua seeds on sunflower heads

In July 1987, sunflower achenes were collected from sunflower head in five moderate to highly *O. cernua* - infested fields at El Coronil, Sevilla, Spain. An average of 100 sunflower achenes, from 15 sunflower heads, were collected at ramdom at each field before mechanical harvesting took place. Each achene was then observed under a

binocular microscope, the *O. cernua* seeds adhered to each achene counted and data expressed as the percentage of *O. cernua* - infester sunflower achenes per field.

Infection of *O.cernua* - free area

a) With sunflower achenes from commercial stores

Achene samples from two commercially grown confectionery sunflower cultivars, "Israeli" and "Gigante" (local ecotype) at El Coronil, infested with *O. cernua* plants during the 1986 season, were taken after being harvested and cleaned by standard machinery. These achenes were used in the spring of 1987 in order to plant about 25 ha for each sunflower cultivar at Carmona (Sevilla), an *O. cernua* - free area, about 25 km apart from El Coronil, where no confectionery sunflower was cultivated in previous years. The final emergence of *O. cernua* was then assesed at random.

b) With *O. cernua* - infested achenes.

Three thousand *O. cernua* - free sunflower achenes of "Gigante" were deliberately mixed with .05 g of *O. cernua* seeds (about 19,200 seeds) before planting. These achenes were then planted using an average of 2 seeds per drill, later thinned to 1 plant per drill. Final *O. cernua* emergence assessment was then randomly carried out on four replications of 126 sunflower plants each and data expressed as percentages of *O. cernua* plants per 100 sunflower plants. The percentage of *O. cernua* seeds that finally reached maturation in the first year was estimated.

RESULTS AND DISCUSSION

O. cernua seeds on sunflower heads

The presence of *O. cernua* seeds on a sunflower achene could be clearly observed under a binocular microscope at about x 80. The percentage of *O. cernua* - infested achenes ranged from 2% to 9% in the least and the most infested field, respectively. The average was 5.0% +/- 2.7 *O. cernua* - infested sunflower achenes averaged over the five surveyed fields.

Infection of *O. cernua* - free areas

a) With sunflower achene samples from commercial stores

The resulting percentage of *O. cernua* - infested sunflower plants was 1.0% and 1.86% for the "Gigante" and "Israeli" cultivars, respectively. They had an infestation intensity of .04 and .023 emerged broomrape plants per sunflower plant, respectively.

b) With *O. cernua* - infested achenes.

The emergence of *O. cernua* plants was 35.5 +/- 12.4 per 100 sunflower plants, averaged over four replications. Just about 2.79% of the *O. cernua* seeds adhered to

sunflower achenes reached maturation in the first year after dispersal through sunflower achenes.

The presence of *O. cernua* seeds adhered to the achenes in the plant head indicates that at least for short distances the wind is an important vehicle for *O. cernua* dispersal. The transport of *O. cernua* seeds with the sunflower achenes explains the long distance dispersal of this parasitic weed. The information reported herein should lead to the reinforcement of sanitary measures of confectionery sunflower seeds for planting in order to prevent further dispersion of *O. cernua* from infested areas.

CONCLUSIONS

The dispersal of *Orobanche cernua* seeds through sunflower achenes was evidenced and quantified. This explains the infestation of *O. cernua* - free areas with sunflower achenes from faraway *O. cernua* - infested areas. The observation of *O. cernua* seeds adhered to the sunflower achenes in the plant head also indicates that at least for short distances the wind is an important vehicle for *O. cernua* dispersal.

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DISSÉMINATION DES SEMENCES DE *Orobanche cernua* PAR LES GRAINES DE TOURNESOL

RÉSUMÉ

La dissémination des graines de *Orobanche cernua* par l'intermédiaire des graines de tournesol a été mise en évidence et quantifiée. Elle explique l'infestation de zones indemmes de *O. cernua* par des semences de tournesol provenant de zones lointaines et infestées par ce parasite. L'Observation de semences de *O. cernua* adhérant au achénes des capitules indique que, au moins sur de courtes distances, le vent est un important vecteur de la dispersion d'*O. cernua*.

DISPERSION DE LAS SEMILLAS DE *Orobanche cernua* A TRAVES DE LOS AQUENIOS DEL GIRASOL

RESUMEN

Se ha puesto en evidencia y cuantificado la dispersión de semillas de jopo (*O. cernua*) en los aquenios del girasol dos formas: a) observando en el microscopio binocular la presencia o ausencia de semillas de *O. cernua* en muestras de aquenios de girasol procedentes de campos infestados con jopo y, recogidas en los mismos capitulos; y b) constatando la infeocion de campos antes no infestados de jopo mediante la siembra de aquenios de girasol natural o intencionadamente infestados.

Las observaciones efeotuadas explican claramente la infeccion de areas antes no infestadas con aquenios de girasol portadores de semillas de jopo. El haber observado semillas de jopo en aquenios todavia en los capitulos, o sea antes de recolectar estos, explica asimismo que al menos para distancias cortas, el viento es un vehiculo importante en la dispersión de *O. cernua*.