SYMPTOMS AND EPIDEMIOLOGICAL IMPLICATIONS ASSOCIATED WITH OOSPORE FORMATION OF ALBUGO TRAGOPOGONIS ON SUNFLOWER IN ARGENTINA.

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Summary

White blister disease, associated with asexual reproduction of Albugo tragopogonis, is common on sunflower in Argentina. In the southeast of the Province of Buenos Aires, hitherto unknown symptoms were observed in late plantings during autumn 1984. The symptoms consisted of greyish-green areas on stems, petioles and receptacles of sunflower plants in the post-flowering stage. The cortical tissues underlying those discoloured areas contained numerous oospores of A. tragopogonis; oogonia and antheridia were also present. The affected areas, especially on the receptacles, were invaded by other fungi known to produce head rots, such as Alternaria zinniae, A. alternata, Alternaria sp., Botrytis sp., and Rhizopus sp. The abundant oospore formation might constitute an important source of inoculum in the soil as well as on sunflower achenes.

Resumen

SINTOMAS E IMPLICACIONES EPIDEMIOLOGICAS ASOCIADAS CON LA FORMACION DE OOSPORAS DE ALBUGO TRAGOPOGONIS SOBRE GIRASOL, EN LA ARGENTINA.

La "roya blanca" del girasol, causada por el estado asexual de Albugo tragopogonis, es una enfermedad común en la Argentina. Durante el otoño de 1984 se observó una sintomatología desconocida hasta entonces, sobre girasol de siembra tardía en el sudeste de la provincia de Buenos Aires. Manchas de color verde-grisáceo aparecieron en tallos, pecíolos y receptáculos de plantas en estado de post-antesis. El tejido cortical en estas áreas contenía numerosas oosporas de A. tragopogonis; también se observaron los oogonios y anteridios del hongo. Las áreas afectadas, especialmente en los receptáculos, fueron luego invadidos por otros hongos, involucrados en la etiología de la podredumbre del capítulo, tales como Alternaria zinniae, A. alternata, Alternaria sp., Botrytis sp. y Rhizopus sp. La abundante formación de oosporas puede constituir una importante fuente de inóculo, tanto en el suelo como sobre los aquenios de girasol.

Introduction

In the southeast of the Province of Buenos Aires, sunflower is normally planted in November. In recent years however there has been a growing tendency to implement a second planting period, from mid-January to the beginning of February, in fields where wheat has been harvested shortly before. The climatic conditions of this second cropping period -temperature, photoperiod, rainfall and humidity- may be quite different from those of the "normal" sunflower growing period, thus affecting the incidence of diseases (see also, Kiehr-Delhey and Delhey, these Proceedings).

White blister rust of sunflower, caused by Albugo tragopogonis (Pers.) S.F. Gray, has long been known in Argentina (Spegazzini, 1899). It is a common

disease which can occur in any growing season and is believed to cause some yield reduction (Luciano and Davreux, 1967). However, its actual significance has still not been determined.

The fungus is normally present in its asexual form, producing white to yellowish raised spots on the upper surface of the lamina and whitish sori on the underside. Zoosporangia are produced in these sori and are then disseminated by the wind. Large areas of the laminas may be covered by such white blisters. When serious infection occurs early in the seedling stage, plants may under certain conditions die as a consequence of the attack; this has been observed occasionally in late seeded fields.

Observations

In the southeast of Buenos Aires in March 1984 we observed an atypical symptomatology on some plants in the budding stage of late seeded fields. Large continuous areas bordering the veins of apical leaves were covered by the white fungal growth, indicating a semisystemic infection. In extreme cases the fungus had systemically invaded the whole plant top, showing deformation of the upper leaves in addition to the whitish fructification.

Still another type of symptom occurred in late crops at the post-flowering stage: dark greyish-green areas were observed on the stems, petioles and receptacles. In the case of the petioles it was the basal portions which were particularly affected, whereas with the receptacles the discoloured areas were found mainly at the base of the bracts.

On microscopic examination of the affected areas, numerous oospores were found in the cortical tissue but none in the epidermis or the central cylinder. Oogonia and antheridia were also present in the cortical tissue. The oospores were found to be situated in the intercellular spaces, and it is possible that their sheer number exerts such pressure as to cause the cells to separate. This may explain why the affected tissues become brittle. In some instances, breakage of petioles and defoliation has been observed.

The mature oospores were dark brown in colour and showed the reticulate epispor typical of A. tragopogonis (Mukerji, 1975). Measurements of 91 mature oospores (without the oogonial wall) revealed a diameter of 36,8 - 48,0 - 57,8 u. These figures are in good agreement with those given by Mukerji (1975).

The affected areas on the receptacles soon took on a black colouration and expanded. Microscopic examinations revealed the presence of other fungi, the most frequently observed being Alternaria zinniae and a further, unidentified species of Alternaria; A. alternata, Botrytis sp. and Rhizopus sp. were also found.

Discussion

The normal appearance of A. tragopogonis on sunflower in Argentina is in the form of discrete blisters which result from localized infections of the asexual stage. We have so far observed systemic infections only in the budding stage of late seeded plants. According to Kajornchaiyakul and Brown (1976), early events in the infection process -germination of the zoosporangia and penetration- are favoured by temperatures of 10 to 15°C; the post-penetration phase has its optimum at 20 to 25°C. The conditions leading to atypical systemic infections are not known, but it is possible that the high temperatures of

February (average temp. 20.3°C) and the first ten days of March 1984 (19.2°C)[1] enabled the fungus to systemically invade the tissue of young seedlings.

Allen and Brown (1980) in Australia were the first to describe the unusual symptoms associated with oospore formation of A. tragopogonis. We have now found essentially the same symptoms in Argentina. In both cases the symptoms are confined to late crops. Allen and Brown (1980, 1982) believe the sexual reproduction of the fungus to be a response to the cooler temperatures late in the growing season. However, it is equally possible that daylength -either alone or in combination with temperature- is the influencing factor in the formation of sexual structures. Photoperiod and temperature might act either directly on the fungus or its host, or on the interactions between them.

The economic significance of the disease described in this paper is still not clear. Premature defoliation as a consequence of petiole infections is reported to be severe during some seasons and in certain localities of Australia, in which cases fungicide treatment has been proposed (Allen and Brown, 1982).

Our own observations have so far been made only in a few fields in the southeast of Buenos Aires, and only during one growing season. Breakage of petioles has been found only occasionally. It is possible that breakage of stems may also occur, but we have not yet observed this phenomenon. What seems to us the most important aspect is the association of headrot producing fungi with oospore-containing tissues on the receptacles. Headrot already constitutes a severe problem in sunflower production in the region, and this could become magnified if A. tragopogonis infection serves to facilitate the entrance of other pathogens.

The abundant formation of oospores which are probably the overwintering form of A. tragopogonis might contribute to the build-up of a higher inoculation potential for the future if the practice of late seeding is extended. It is also feasible that sunflower fruits harvested from affected heads are contaminated with oospores, thus spreading the disease to fields and regions hitherto free of it.

References

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[1] Data obtained from the Agrometeorological Station of INTA, Balcarce.