Manglar

Manglar 17(3): 275-278, 2020

Mycoherbicide associated with the leaf spot of *Chenopodium album* L.

Micoherbicida asociado a la mancha foliar de *Chenopodium album* L.

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ABSTRACT

The objective this research was identify the fungi associated with the *Chenopodium album* leaf spot. Samplings were carried out at Universidad Autonoma Agraria Antonio Narro in a manner directed towards the weeds (10 plants) that showed signs and symptoms of this disease (pycnidia and a yellow halo on the leaves) and were later taken to the phytopathology laboratory for isolation and identification. The weed identified by morphological criteria. Pathogen was identified by morphocultural of 100 conidia criteria using AxioVision Release 4.5 software. The purification of the isolates was performed by hypha tip in PDA. *Macrophoma* sp. was identified damaging the weed *C. album* whit conidia ellipsoidal to subglobose, of 18.21 µm length and 2.56 µm width. Therefore a future investigation of this pathogen and host is recommended.

Keywords: weed; fungi; leaf spot; conidia; mycoherbicide.

RESUMEN

El objetivo de esta investigación fue identificar los hongos asociados con la mancha foliar de *Chenopodium album*. Los muestreos se realizaron en la Universidad Autónoma Agraria Antonio Narro de manera dirigida hacia las malezas (10 plantas) que presentaban signos y síntomas de esta enfermedad (picnidios y un halo amarillo en las hojas) y posteriormente fueron trasladados al laboratorio de fitopatología para su aislamiento e identificación. La maleza fue identificada por criterios morfológicos. El patógeno se identificó mediante criterios morfoculturales de 100 conidios utilizando el software AxioVision Release 4.5. La purificación de los aislados se realizó mediante punta de hifa en PDA. *Macrophoma* sp. fue identificado en la maleza *C. album* con conidios elipsoidales a subglobosos, de 18,21 µm de largo y 2,56 µm de ancho. Por lo tanto, se recomienda una investigación futura de este patógeno y huésped.

Palabras clave: maleza; hongo; mancha foliar; conidios; micoherbicida.

Recibido: 09-09-2020.
Aceptado: 30-09-2020.

DOI: http://dx.doi.org/10.17268/manglar.2020.040

INTRODUCTION

Mycoherbicides are formulations of plant pathogenic fungi that kill unwanted plants (USDA, 2020). Unlike chemical herbicides, which are made in factories, applied to plants and then degraded, mycoherbicides can be considered as living factories of chemicals, always ready to kill and prevent the growth of others plants (Jeremy, 2005). Weed account for more than 30% of total losses caused by all the pests (Gadermaier *et al*., 2014). A considerable number of plant pathogens have been studied for possible use in weed control and some have been shown to be virulent enough to control weed species and compete commercially with chemical herbicides. However, most weed pathogens are not useful in their wild form because they are not sufficiently host specific or virulent (Sands, 2009). *C. album* is the best example of herbicide resistance, as it has become resistant to synthetic herbicides (Aper *et al*., 2014; Nawaz *et al*., 2016) Barton 2005 mencionated such *Colletotrichum*, *Phoma*, *Sclerotinia*, *Alternaria*, *Fusarium* and *Puccinia* as bioherbicide candidates. New groups of phytopathogens are being integrated into the control of weeds such as bacteria and viruses, some are already available in the market (Harding and Raizada, 2015). Dagno *et al*. (2012) mentioned 15 available mycoherbicides. Aneja *et al*. (2013) integrates two making a total of 17 mycoherbicides on the market.

Phytopathogenic fungi in *C. album* are: *Cercospora dubia* (Riess) Wint., *Dothiorella chenopodii* Ahmad., *Eutypella russodes* (Berk. & Br.) Berl., *Leptosphaeria gallicola* Sacc., *Metasphaeria ambigua* (Dur. & Mont.) Sacc., *Peronospora effusa* (Grev.) Rabenhorst., *Peronospora variabilis* (Gaeumann) Mitteil., *Phoma chenopodii* Ahmad., and *Phoma herbarum* West. (Ahmad *et al.,* 1997), *Peronospora variabilis* (Frinking and Linders, 1986), *Ascochyta caulina* (Evidente, 2000; Vurro *et al*., 20 01; Pacciolla *et al*., 2016), *Alternaria alternata* Nees (Siddiqui, 2009), *Alternaria japónica* Groves and Skolko (Dutta, 2015), *Drechslera rostrata* Leonard (Akbar *et al*., 2017) *Fusarium equiseti* (Corda) Saccardo (Jiang, 2019). Due to the previously mentioned, the objective this research was identify the fungi associated with the *C. album* leaf spot.

MATERIAL AND METHODS

Sampling

Sampling was performed on August, 2017 at Universidad Autonoma Agrarian Antonio Narro (25 ° 21'30.7" N 101 ° 02'20.8" W). Ten weed plants of the Chenopodiaceae family with signs and symptoms of the disease (pycnidia and a yellow halo on the leaves) were cut and taken to the phytopathology laboratory.

Identification of the weed *C. album*

The identification of the weed plants of the Chenopodiaceae family at the species level was done using the taxonomic keys of Villareal (1983) and Vibrans (2011).

Insolation and purification

Cuts of leaves of diseased and healthy tissue approximately 1 cm length y 0.3 cm width, disinfected with 2% hypochlorite for 1 min, and washed with distilled water (three times), 4 sections were placed equidistant per Petri dish with PDA with 10 replicates, and kept at 25 °C for 168 h. The purification of the isolates was performed by hypha tip in PDA, which were stored at 4 °C.

Identification of *Macrophoma*

Identification was performed whit a microscope using AxioVision Release 4.5 software (ZEISS, 2020), based on the characteristics of the mycelium, color and shape of the colony, color, length and width of 100 conidia, following Barnett and Hunter 2006.

RESULTS AND DISCUSSION

Weed *Chenodopium album* was identified and the presence of the phytopathogenic genus *Macrophoma* (Sacc.) Berl. and Voglino, was found. Mycelium brown-brown, septate, aerial and branched, pycnidia black and subglobose. Microscopically: Conidia, simple, ellipsoidal to subglobose, of 18.21 µm length and 2.56 µm width (Figure 1), results that agree by Barnett and Hunter, 2006 report. Stem black spot is a disease caused by *Macrophoma* sp. (FAO, 2020) and in severe attacks the incidence percentages can reach 30-100%, in this research the incidence was 100%. This fungus requires certain environmental conditions that favor its development, such as a one to two-week dry period before developing (Sánchez *et al*., 1991, ANAVMP, 2020) and the climate in the study area was warm 35-38 °C. In controlled environment studies *Macrophoma* sp was pathogenic for the genus *Amaranthus* and the closely related genus *Celosia* (Chin, 1995). The impact of plant disease is determined by a tripartite interaction involving the host the pathogen and the environment (Agrios, 1988). Disease development can be constrained by various plant, pathogen and environmental factors with low virulence of the pathogen and fastidious environmental conditions the two major biological constraints (Watson and Wymore, 1990). However, *Macrophoma* causes diseases in importants crops as guava (*Psidium guajava* L), corn (*Zea mays* L.), tea (*Camellia* spp.), grape (*Vitis vinifera* L.), mango (*Mangifera indica* L.), berries (*Rubus fruticosus* L., *Rubus idaeus* L.,

Fragaria L.) among other crops. *Phoma macrostoma* was pathogenic to many dicotyledonous plant species, but nonpathogenic to monocots (Bailey *et al.,* 2011) pathogen has a good potential as mycoherbicide in *Parthenium weed*. (Kaur and Kumar, 2019). Cimmino *et al*. (2013) reported that *Phoma chenopodicola* as bioherbicide in *C. album*, *Cirsium arvense*, *Setaria viridis*, *Mercurialis annua* and *Annual mercury*. Qing-yun *et al*. (2019) reported *Aureobasidium pullulans* as mycoherbicide in *C. album*, pathogen of the class Dothideomycetes, same that *Macrophoma*. There are numerous Phoma-like phytopathogenic fungi that are phytotoxin-producing. Todero *et al*. (2018) reported that combining adjuvants with culture filtrate of *Phoma* sp. showed phytotoxic efficiency against *Bidens pilosa* L.*, Amaranthus retroflexus* L. and *Conyza canadensis* L. Brun *et al*. (2016) reported that metabolites produced by submerged fermentation of *Phoma* sp. presented activity in pre-emergence, post-emergence, and detached leaves of *Cucumis sativus* L. and *Sorghum bicolor* L. Mönch and it could be an alternative in the future for weed control.

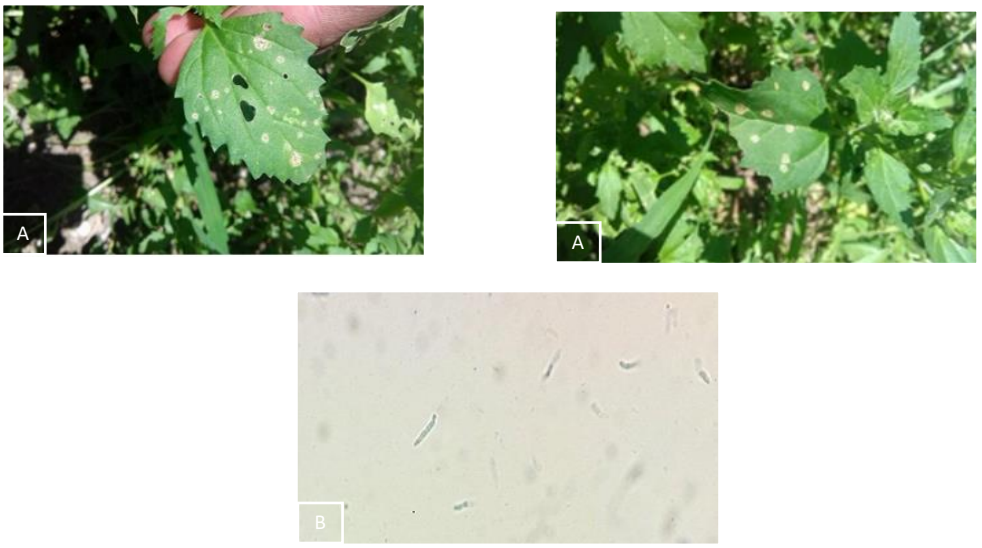

Figure 1. A) *C. album* plants with symptoms and symptoms, B) *Macrophoma* sp. conidia.

CONCLUSION

Macrophoma sp. was identified damaging the weed *C* album whit conidia, ellipsoidal to subglobose, of 18.21 µm length and 2.56 µm width. Therefore a future investigation of this pathogen and host is recommended.

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