CSL 3: First results of investigations into causes of diseases of cultivated chamomile (*Matricaria recutita* L.) in Germany

Ute Gärber, Katja Sommerfeld

Julius Kühn-Institute, Federal Research Centre for Cultivated Plants, Institute for Plant Protection in Horticultures and Forests, Stahnsdorfer Damm 81, D-14532 Kleinmachnow, Germany, e-mail: ute.gaerberl@julius-kuehn.de

DOI 10.5073/jka.2016.453.013

Abstract

Diseases on cultivated chamomile have occurred in Germany since 2007, which have severely been affecting the crop yields. The causes of damage are very complex and have not been identified yet. Additionally to the damage in the stems caused by larvae, fungal pathogens are of relevance. Tests of the Julius Kühn-Institute first revealed that a new, not yet identified fungus is pathogenic to chamomile. Symptoms observed in infection tests like chlorosis, browning and black coloration of stems and leaflets were identical to those in the field. The fungus sporulated on diseased plant parts under the conditions of climatic chamber (20 °C to 22 °C and 12 hours of light, 122 µmol) from 17 days after inoculation (dai) and could be reisolated on agar plates. The identification, biology and epidemiology of the fungus as well as the specific harmful effect and interaction with other harmful factors, especially animal pests, are being studied presently in a project funded by the Agency for Renewable Resources (Fachagentur Nachwachsende Rohstoffe, FNR). The goal is to develop sustainable plant protection concepts based on the knowledge about the pathogens to enable a stable cultivation of chamomile in Germany.

Keywords: chamomile, *Matricaria recutita*, diseases, pathogen, pathogenicity

Introduction

Chamomile (*Matricaria recutita* L.) is one of the economically most important medicinal plants in Germany. The dried blossoms of chamomile are a plant-based source material for a great number of herbal medicines, cosmetics, and tea products for the food sector. Chamomile blossoms (*Matricaria flos*) are produced on a total area of 1.150 hectares in Germany, of which 1.030 hectares are located in Thuringia; whereas the rest of it is found in Hesse and Saxony (Plescher and Schmitz, 2012). 2007 first experienced the occurrence of disease symptoms in chamomile cultures in Thuringia, which deteriorated in the following years and have since been accompanied by a severe loss in yield. "New" fungal pathogens and not yet identified pests occur in addition to those which have been known. First investigations of the Julius Kühn-Institute and Pharmaplant GmbH have shown that the causes of the damage are very complex (Gärber et al., 2013). On the one hand, a species of fungus of the genus *Septoria* was found, on the other hand a fungus morphologically similar to *Entylomella trailii* was detected, however belonging to ascomycetes according to DNA-sequences. For the latter, it is still unclear whether it is two different fungi. Furthermore, damage caused by larvae was detected in the stems of chamomile, which is still to be identified. According to preliminary studies about the pathogenicity, the importance of certain harmful organisms for the disease can not be estimated yet. Since the beginning of 2016, the causes of the damage have been intensively studied in a project funded by the Agency for Renewable Resources (Fachagentur Nachwachsende Rohstoffe FNR) aiming to find out the significance of single harmful organisms for the disease process. Starting from the results of diagnosis, biology and epidemiology of the pathogens, first approaches for plant protection should be developed to enable a stable cultivation of chamomile in Germany with high yields and consistently high product quality. This paper will present both the general phytopathological problems in cultivated chamomile and first investigations into the pathogenicity of a not yet identified fungus.

Materials and Methods

Diseased plant samples from several fields in Thuringia were tested for harmful organism at the JKI in 2009 to 2015 resulting in isolation of several strains of a single, yet unknown fungus which is assumed to be a potential pathogen. The fungus belongs to the genus cf. *Rhexocercosporidium* according to the DNA sequence (Gärber et al., 2013). Aiming to find out the pathogenicity of this fungus, tests were performed in climatic chambers at temperatures of 20 °C to 22 °C and twelve hours of light (122 µmol). Seven-week-old chamomile plants were inoculated by spraying a conidial suspension (10^4 conidia/ml suspension, run off) and placed in growing chambers closed with a lid for three days to retain a high humidity. The fungus was incubated on chamomile-agar and MYP (Malt Yeast Peptone)-agar for 14 days at 20 °C and 14 hours of light (47 µmol) to produce inocula. The conidial slime was scrapped off the agar surface with a slide and transferred into destilled water. The density of conidia in the suspension was counted in a Thoma counting chamber.

Results

First symptoms like chlorosis as well as black coloration on stems and leaflets were visible from 17 days after inoculation (figures 1a and 1b).

Fig. 1a und 1b: Diesease symptoms on chamomile after inoculation with a conidial suspension (104 conidia/ ml suspension) of not yet identified fungus (17 dai)

Some days later, the symptoms occurred more severely on all inoculated plants. Single shoots died. The symptoms were identical to those in the field. The fungus could be first detected microscopically on several plants 20 days after inoculation (figure 2).

Fig. 2: Sporulating fungus on chamomile

The fungus could be reisolated, complying with Koch's postulates on the pathogenity of the fungus. As the disease progressed, plants browned more and more. At that time, first disease symptoms were found in the control variant of non-inoculated plants, which might indicate the spread of the fungus by air movement in the climatic chamber. The fungus could be detected microscopically on control plants four week later than on inoculated plants. The significance of the fungus in the disease process, its specific harmful effect and interaction with other harmful factors, especially animal pests, are to be identified in further studies. Fundamental investigations shall cover the study of the biology and epidemiology of the yet unknown fungus, including its identification. The knowledge of the phytopathogens should be used in the breeding process in a target-oriented way in order to improve the resistance of varieties. The aim is to develop sustainable plant protection concepts to ensure a stable cultivation of chamomile in Germany using the knowledge about the pathogens and first control approaches gained in the project.

References

GÄRBER, U., PLESCHER, A., HAGEDORN, G., 2013: Auftreten von Krankheiten und Schädugungne im Anbau von Kamille (Matricaria recutita L.). Zeitschrift für Arznei und Gewürzpflanzen **18**(3), 124-131

PLESCHER, A. UND SCHMITZ, N., 2012: Stand des Anbaus von Arznei-, Gewürz-, Aroma-, Diät- und Kosmetikpflanzen in der Bundesrepublik Deutschland 2011. Unveröffentlichter Bericht an die Fachagentur Nachwachsende Rohstoffe e.V.; 2012