IN VITRO EVALUATION OF PESTICIDES ON THE BASE OF PLANT EXTRACTS TOWARDS ALTERNARIA SOLANI

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Abstract-The effectiveness of several pesticides on the base of plant extracts (ethanol extracts from leaves from smoke tree (Cotinus coggygria), acorns from pedunculate oak (Quercus robur) and seeds from Japanese pagoda tree (Styphnolobium japonicum (L.) Schott)) was evaluated in the in vitro conditions towards Alternaria solani - plant pathogen causing tomato and potato early blight diseases. The conducted trials reveal the extremely strong action of plant extracts towards the tested phytopathogen, (especially extracts from acorns of Quercus robur) and their potential be a developed as protective fungicides against Alternaria solani with application both in the organic and conventional agriculture as well as in the integrated pest management schemes.

Keywords: plant extracts, Alternaria solani, early blight, tomato, potato, Cotinus coggygria, Quercus robur, Styphnolobium japonicum, organic agriculture

I. INTRODUCTION

The plant derivated extracts were used from centuries as effective pesticide remedies far before the appearance of the first synthetic pesticides [1]. From the antiquity through Medieval Ages and Renascence, medicinal plants provide as human disease cures as remedies for management with in some cases fearsome plant disease and pests [2]. With rising of the popularity of the organic agriculture the interest of pesticides, there are the increasing interests to the pesticides on the base of plant extracts [3]. However mostly investigated and used in the agricultural practice plant extracts prepared as water or ethanol solutions possess some significant disadvantages as non-persistence, non-stability, phytotoxicity, a variation of the effectiveness towards abiotic and biotic conditions of the environment and bad physicochemical properties as wetting and sticking ability [4]. From the other side, plant extracts can be mixed with other type organic pesticides - plant soaps [5] and the such kind combinations have several advantages as biodegradation, application without or with minimal post-harvest intervals, easily and low-cost manufacture, multicide action - can act as insecticides, especially against soft body insects like aphids [6], fungicides, herbicides and multicides [7]. The addition of the other type of non-toxic chemical substances with strong antifungal action as potassium sorbate [8] and zinc undecylenates [9] can significantly increase the effectiveness of mixtures and make them more applicable in the agricultural practices.

In present investigations ethanol plant extracts from popular in the region of Bulgaria medicinal plants: leaves from smoke tree (Cotinus coggygria), acorns from pedunculate oak (Quercus robur) and seeds from Japanese pagoda tree (Styphnolobium japonicum (L.) Schott) were evaluated in the in vitro conditions for antifungal action towards Alternaria solani. The plants, especially smoke tree are used from centuries as herbal remedies against numerous human diseases [10, 11, 12]. However, there is also several scientific papers revealing their potential as a source of pesticides [13, 14] and respectively - fungicides against plant pathogenic fungi. Such kind investigations are extremely important in the light of the increasing popularity of organic agriculture and tightening the criteria for approving of pesticide products in the European Union [15]. The studies of pesticide activity of different plant extracts will lead to more plant protection products on the agricultural market in the future and producing the more healthy and safe food [16].
II. MATERIALS AND METHODS

Phytopathogen cultures of Alternaria solani were isolated from naturally infected tomato plants (variety "Ideal") . Leaves from smoke tree (Cotinus coggygria), acorns from pedunculate oak (Quercus robur) and seeds from Japanese pagoda tree (Styphnolobium japonicum (L.) Schott) were collected from the area of Bulgarian National Park "Central Balkan" and ethanol extracts were prepared by mixing the plant parts (leaves, acorns and seeds) with ethanol (95 % v/v) in 10 % (m/v) concentrations. After 72 hours soaking with periodically shaking, the ethanol was evaporated via vacuum rotary evaporator. The received products were mixed with distilled water and were tested in the in vitro conditions against Alternaria solani via germ tube inhibition tests [17] and radial growth assays [18] for determination of their fungidal efficacy.

R language for Statistical Computing [19] together with drc package [20] was used for Dose - Response Modeling and R language custom function for calculation of the apparent infection rate [21]. The percent effectiveness was calculated with the formulae of Abbot [22].

III. RESULTS

The conducted trials reveal that all extracts from tested plant materials can have a fungicidal action towards Alternaria solani compared to the efficacy of Dithane M 45® on the base of mancozeb used at 0.2 %(m/v) as an standard variant.

In the conducted germ tube inhibition test, ethanol extract acorns from pedunculate acorns from pedunculate oak (Quercus robur) was able completely to inhibit the germination of conidiospores of Alternaria solani at 0.25 % concentration (m/v) while the extracts made from leaves of smoke tree (Cotinus coggygria) and seeds of Japanese pagoda tree (Styphnolobium japonicum (L.) Schott) achieve such inhibition in 3.0 % (m/v).

In the radial growth assays, established LD50 of the tested extracts were:
- 0.5 % (m/v) for acorns of Quercus robur (Fig. 1)
- 4.3 % (m/v) for leaves of smoke tree (Cotinus coggygria) (Fig. 2)
- 4.9 % (m/v) for the seeds of Styphnolobium japonicum (L.) Schott (Fig. 3)

![Figure 1. Dose - Response Curve of ethanol extract from acorns of Quercus robur towards Alternaria solani](image-url)
IV. CONCLUSIONS

Conducted in vitro trials reveal the fungicidal action of ethanol extracts from acorns of Quercus robur, leaves Cotinus coggygria and seeds Styphnolobium japonicum (L.) Schott. Surprisingly, although the leaves shape of the smoke tree (Cotinus coggygria) are famous for centuries of their strong anti-inflammatory and anti-microbe properties with traditional use in Bulgarian folk medicine against inflamed wounds, gums, and hemorrhoids, their action towards Alternaria solani was weaker than acorns of Quercus robur. The acorns are used primary as a food for livestock and
have no significant economic value. As the result shows the simple ethanol extracts can manifest significant effectiveness towards one of the most important plant pathogen for tomato and potato cultural plants.

V. REFERENCES


