University of Eldoret
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March 2021

POLICY BRIEF

Euphorbia Plant Extracts: The Solution to the Tomato Wilt Disease

Figure 1: Bacterial tomato wilt disease caused by bacterial and fungal agents

Rationale for action on the problem

The wilt disease is one of the devastating tomato diseases accounting for about 40% of the losses in tomato production globally and is also responsible for huge losses to tomato farmers in Kenya. A photo of tomato plants infected by the wilt disease is shown in Figure 1. The conventional way of controlling this disease is through the application of chemical pesticides. However, the indiscriminate and continued use, and misuse of chemical pesticides have led to development of multi-drug resistant pathogens and environmental problems because they often persist in the environment and have the risk of being biomagnified up food chains. The continued use of chemical pesticides is also not favorable to non-target organisms This calls for exploration of plant extracts as alternative therapeutic and biological control agents to combat microbial infections.

Context of the Problem

Tomato is one of the most important vegetables in Kenya and plays a critical role in income generation and creation of employment for both rural and urban populations, in addition to meeting food nutritional requirements. Tomato is a nutritious vegetable that provides good quantities of vitamins A and C. The crop is grown for the domestic market under both rain-fed and irrigated conditions. Due to its high demand, most farmers have extensively adopted high-yielding varieties and modern technologies such as greenhouse production to ensure year-round and increased production. However, tomato farming is still threatened immensely by several pests and disease, the most devastating of these being bacterial and fungal wilt disease, with some farmers experiencing 80-100% yield losses per growing season. The objectives of the present study were to evaluate the potential of extracts of different plants (See Figure 2) against the tomato wilt causing pathogens.

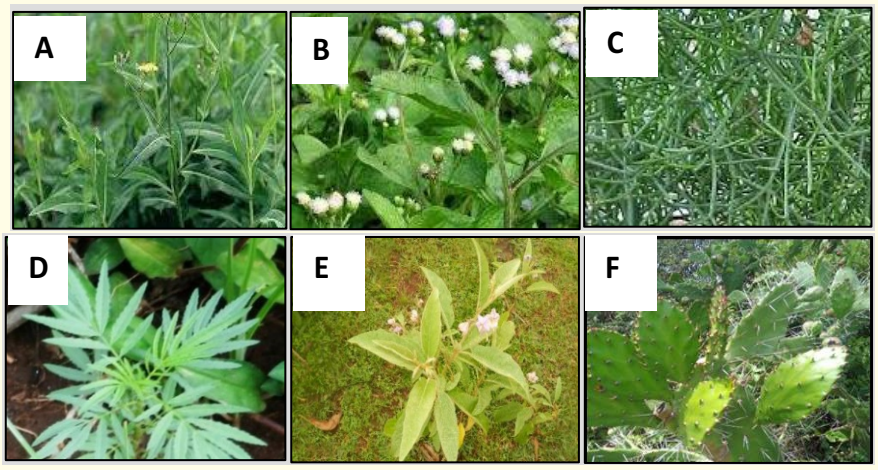

Figure 2: The plants studied for the activities of their extracts against tomato wilt causing fungal and bacterial agents

A: *Laurnea cornuta* (Bitter Lettuce)
B: *Ageratum conyzoides* (Goat Weed)
C: *Eurphobia tirucalli L* (eurphobia)
D: *Tagetes minuta L* (Mexican Marigold)
E: *Solunum incanum L* (Sodom Apple)
F: *opuntia monacantha* (Prickly Pear)

Methodology and Outcomes

The fresh leaves, flowers, barks and roots of the six plants were cleaned, dried and crushed into fine powder. From each plant part, three different concentrations were formulated by weighing and suspending 1 g, 5 g and 15 g each into 100 ml of sterile distilled water to formulate concentrations of 0.01, 0.05, and 0.15 grams per litre respectively. These three different concentrations were denoted as low, medium and high respectively throughout the study. The test tomato disease causing agents were isolated from soils and plant materials of diseased tomato plants from farmers' fields. Antimicrobial assays were performed in petri dishes using laboratory media and zones of inhibition were analyzed after 24 hours of incubation at 37°C. The qualitative and quantitative analysis of different phytochemicals in the different plant extracts was performed using the High-Performance Liquid Chromatography at the Tea Research Institute of Kenya and various plant-chemicals which are the maid disease fighting agents in plants were identified. A greenhouse experiment was set up to evaluate the efficiency of the plant extracts on tomato disease-causing agents. Seeds of tomato plant were sown in plastic buckets filled with sterilized soil. The results showed that high concentrations of the plant extract successfully controlled the wilt causing agents in the potted plants. The extracts were especially very effective at controlling the fungal wilt causing organism (See Table 1).

After germination, the healthy seedlings in the pots were divided into three equal sets and infected with the three disease-causing agents respectively. Control experiments were maintained in 3 pots by growing tomato plants without infection. Three different concentrations of 23 plant extract samples made out of leaves, barks, roots and flowers of the 6 plants were introduced into each of the three sets of pots while excluding three pots in each set to act as controls of those experimental sets. The control pots in each set were not be sprayed with any plant extract but instead sterile distilled water was used to serve as control pots.

Table 1: Effects of different concentrations of different plant extracts on *Fusarium oxysporum*

	Ageratum conyzoides				*Opuntia monacantha*			
Treatment	**Root**	**Bark**	**Leaf**	**Flower**	**Root**	**Bark**	**Leaf**	**Flower**
-VE control	0.0±0.0a	0.0±0.0a	0.0±0.0a	0.0±0.0a	0.0±0.0a	0.0±0.0a	0.0±0.0a	0.0±0.0a
+VE control	6.0±0.7b	19.4±2.5d	6.0±0.7b	5.6±1.1bc	5.9±0.8b	5.9±0.9b	5.3±0.8b	6.0±0.7b
Low conc.	6.7±0.6b	3.7±0.1b	4.3±0.6b	5.0±0.6bc	5.3±0.6b	6.0±0.6b	6.0±0.6bc	8.0±1.0c
Med. conc.	7.3±0.6bc	4.7±0.6c	6.0±1.0b	6.3±1.0b	6.3±0.6bc	6.7±1.0b	6.7±1.1c	9.3±0.8d
High conc.	11.7±4.7c	5.7±1.2c	6.7±0.6c	6.3±0.6c	6.7±0.5b	6.7±1.2b	7.0±0.0b	11.0±2.5bc
	Tagetes minuta				***Solanum incanum***			
Treatment	**Root**	**Bark**	**Leaf**	**Flower**	**Root**	**Bark**	**Leaf**	**Flower**
-VE control	0.0±0.0a	0.0±0.0a	0.0±0.0a	0.0±0.0a	0.0±0.0a	0.0±0.0a	0.0±0.0a	0.0±0.0a
+VE control	8.3±0.9b	7.4±0.8b	9.0±0.7c	7.3±0.7b	8.1±0.9b	7.2±0.9b	8.7±0.5c	7.2±0.9b
Low conc.	7.7±0.6b	8.3±0.6bc	7.7±0.6bc	7.0±0.6c	8.3±0.6b	8.3±0.6c	7.0±1.0b	8.3±0.6b
Med. conc.	8.0±1.0b	8.3±3.4c	8.3±1.2b	7.7±0.0b	8.7±0.6c	8.7±1.2c	7.3±0.6b	9.0±1.0b
High conc.	8.7±1.5c	11.0±0.6bc	8.7±0.6b	8.7±1.2b	9.3 ±0.7bc	8.7±0.6c	7.0±0.0b	16.7±5.8c
	Euphorbia tirucalii				***Laurnea cornuta***			
Treatment	**Root**	**Bark**	**Leaf**		**Root**	**Bark**	**Leaf**	**Flower**
-VE control	0.0±0.0a	0.0±0.0a	0.0±0.0a		0.0±0.0a	0.0±0.0a	0.0±0.0a	0.0±0.0a
+VE control	8.0±0.0b	8.0±0.0b	8.0±0.0b		8.0±0.0b	8.3±0.5b	8.7±0.5b	8.0±0.0b
Low conc.	8.3±0.6b	9.0±1.0bc	8.0±0.0b		17.0±1.2b	14.3±2.5c	12.0±0.0c	10.7±0.7c
Med. conc.	9.7±0.8c	7.7±1.2b	10.3±2.5c		10.0±2.0c	16.3±3.7cd	11.0±2.0d	11.0±1.0c
High conc.	13.7±1.5d	12.0±3.6c	12.7±2.5c		15.7±4.0cd	20.0±0.0d	17.3±0.6e	16.3±3.2d

Means followed by the same letter(s) within each column do not differ significantly at P ≤ 0.05.

All experimental procedures were performed thrice and the plants were watered daily. After 8 weeks, disease severity was assessed on a scale of 1-5, where 0 = no symptoms observed; 1 = 1 to 20% of leaves infected; 2 = 21 to 50% of leaves infected; 3 = 51 to 80% of leaves infected; 4 = >80% of leaves infected and 5 = 100% of leaves infected to determine the efficiency of the plant extracts in controlling the tomato disease-causing agents.

Proposed Policy Options and Recommendations

Bacterial diseases generally have no known cure but antibiotics are commonly applied by tomato farmers in Kenya to control bacterial wilt disease. However, these are becoming problematic of late due to the development of antibiotic resistance and effects on non-target organisms in soils, some of which are very beneficial to soil health. The use of copper-based fungicides and other chemical pesticides for the control of tomato disease-causing agents and those of other crops is practiced extensively in Kenya. This, to a great extent helps in the elimination of these pathogens of plant extracts such as the ones outlined in this paper can be a viable option in the control of the disease-causing agents of tomato can be achieved using alternative mechanisms to chemical pesticides. The effective plant extracts should be formulated into Agri-products and commercialized to tomato farmers in the country in a bid to control the devastating tomato wilt pathogens sustainably and reduce the indiscriminate use of chemical pesticides.

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Link to original research/analysis

This policy brief is based on the plant extracts research at university of Eldoret. More information about this research can be obtained at https://www.ajol.info/index.php/acsj/article/view/189259.

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