Insecticidal Activities of Plant Extracts against *Tetranchus urticae*

Lee, G. Y.[1], Han, Y. H.[1], Soh, H. S.[1], Lee, H. J.[1] & Kim, S. K.[1]

Key words: Plant extract, *Tetranchus urticae*, Insecticidal activity

Abstract

To find an alternative for synthetic pesticides, methanol extracts from 69 plant samples were tested for their insecticidal activity against two spotted mite (Tetranchus urticae Koch). Seven plant extracts including Angelica japonica *showed over 80% insecticidal activity at 5000 mg/L. Extract of Prunus armeniaca seed showed high insecticidal activity at 3000 mg/L. As a naturally occurring pesticide, P. armeniaca could be useful as a new botanic insecticide.*

Introduction

Generally, controls of insects are dependent on the application of synthetic pesticides. However, application of a synthetic pesticide may cause environmental pollution and also increase pesticide resistance among insects. Using bio-pesticides on plants would be better in terms of being more environmentally safe. Many researchers have been focusing on using plant extracts to develop bio-pesticides and some, such as *Sophora flavescens* and *Azadirachta indica*, have already been developed and used. Two spotted mite (*Tetranchus urticae* Koch) is a destructive pest of crops throughout the world and can cause damage to vegetables and fruit trees. To find an alternative pesticide, methanol extracts from plants samples were tested for their insecticidal activity against this particular insect.

Materials and methods

Plant materials and sample preparation

Plant samples were dried in the shade, and then ground into powder by using a mill. They were extracted with methanol for 48 hrs at room temperature and then concentrated using a rotary evaporator at 40 °C

Insecticidal activity assay on two-spotted *T. urticae*

The insecticidal activities of plant extracts against *T. urticae* were tested on bean (*Phaseolus vulgaris*) seedlings. Leaves of bean grown in greenhouse were collected, and a disk (2 cm diam.) was taken from each leaf. Twenty female adults specimen of *T. urticae* were placed onto the leaf disks in petri dishes. Three leaf disks were sprayed with the solution for 30 sec. After evaporation in a hood for 2 hrs, each petri dish was held in a room at 25±2 °C, under 50-60% RH, and a photoperiod of 16:8 (light/dark).

The plant extracts were dissolved in 5% methanol and suspended in distilled water containing triton X-100 at a concentration of 250 μg/ml. Insecticidal activities were applied with three replicates per treatment.

---

[1] Gyeonggi-do Agricultural Research & Extension Services, Hwaseong, Korea, E-Mail: liy71@gg.go.kr, Internet: www.nongup.gyeonggi.kr

Results

The plants were selected according to relevant literature. Firstly, the plant extracts were tested at a concentration of 5000 mg/L for *T. urticae*. Insecticidal activities of the plant extracts are shown in Tab. 1. Methanol extracts of *Prunus armeniaca*, *Angelica japonica*, *Artemisia apiacea*, *Trichosanthes kirilowii*, *Astragalus membranaceus*, *Cibotium barometz*, and *Viola manshurica* showed over 80% insecticidal activities on *T. urticae*. Furthermore at 3000 mg/L, insecticidal activities of most plant extracts were decreased (Tab. 2). But *P. armeniaca* extract showed above 80% insecticidal activity on *T. urticae*. Even though the yield of hexane extracts was high, insecticidal activity of the hexane extract was significantly lower than that of methanol extract. More detailed study is necessary for solubility of hexane extract. The control effect in extract of *P. armeniaca* seed was 59.5% in field (data is not shown).

Discussion

In a preliminary test, a concentration of 5000 mg/L of plant extract did not cause any problem, such as solubility and contamination for microorganism (Ahn, 1992). In bioassay with methanol extracts from plant samples, the efficacy varied with plant species. In the laboratory study with methanol extracts, the responses also varied with plant species. Park et al. (2002) pointed out that the most promising botanicals as bio pesticides for anthropod pests are *Zanthoxylum piperitum*. Also Lee (2000) reported that the extracts of *Oryza sativar*, *Panicum milaceum*, *Setaria italic*, and *Sorghum bicolor* showed insecticidal activity against *T. urticae*. In this study, the extract of *P. armeniaca* seed showed significant insecticidal activity among plant tested. The seed of apricot has been reported to be medically effective as an anticancer substance (Park et al., 2002). There are many compounds such as terpenoid, phenolics, and alkaloids in plants. These compounds contribute to biological activities. Further studies are needed to identify active compounds from plants.

Conclusions

This study was to find an alternative to synthetic pesticides from plants. The methanol extract of *P. armeniaca* seed showed strong insecticidal activities against *T. urticae* among plants tested.

Tab. 1: Insecticidal activities of plant extracts against *T. urticae* when applied at 5000 mg/L

Scientific name	Mortality (%)		Scientific name	Mortality (%)	
	24hr	48hr		24hr	48hr
Agrimonia pilosa	15.1	18.7	*Paeonia aliflora*	44.0	50.4
Aiasarum sieboldii	63.7	64.0	*Paeonia lactiflora*	15.9	21.6
Ailanthus altissima	29.9	55.7	*Paeonia moutan*	10.9	16.7
Albizzia julibrissin	33.3	34.8	*Pharbitis nil*	34.7	39.6
Allium ascalonicum	58.1	61.1	*Picrasma quassioides*	4.7	10.4
Allium senescens	48.4	57.7	*Pinus densiflora*	6.5	8.7
Allium tuberosum	64.3	71.8	*Plantago asiatica* .	50.7	55.9
Angelica japonica	89.9	95.4	*Polygala japonica*	44.8	50.4
Angelica koreana	33.2	46.7	*Polygonum aviculare*	32.1	41.5

Ardisia japonica	63.4	75.6	*Polygonum cuspidatum*	12.6	17.6
Areca catechu	71.6	71.1	*Portulaca oleracea*	69.0	64.9
Artemisia apiacea	80.2	80.0	*Prunella vulgaris*	68.1	77.9
Artemisia iwayomogi	34.7	37.9	*Prunus armeniaca*	61.4	81.6
Astragalus membranaceus	79.3	89.3	*Pteridium aquilinum*	66.2	67.2
Carpesium abrotanoides	42.4	58.8	*Punica granatum*	23.5	26.0
Cassia obtusifolia	26.1	49.1	*Quisqualis indica*	60.7	59.6
Chenopodium album	75.4	76.1	*Rhus verniciflua*	40.7	50.2
Cibotium barometz	86.7	89.5	*Ricinus communis*	18.1	28.0
Cinnamomum cassia	11.1	11.8	*Rosa multiflora*	7.0	16.0
Cirsium japonicum	65.8	65.4	*Sambudus williamsii*	67.7	72.0
Coix lachryma-jobi	39.9	64.7	*Sanguisorba officinalis*	11.7	26.7
Cucurbita pepo	52.2	66.8	*Sedum sarmentosum*	44.7	54.8
Dioscorea tokora	51.3	52.6	*Sophora angustifolia*	20.1	31.1
Dryopteris crassirhizoma	35.4	42.6	*Sorbus commixta*	16.6	20.1
Eriobotrya japonica	16.3	25.3	*Spirodela polyrhiza*	74.4	73.7
Evodia officinalis	37.5	37.6	*Stemona japonica*	41.0	39.6
Geranium nepalense	75.0	77.6	*Syzygium aromaticum*	18.8	33.4
Ginkgo biloba	13.1	20.3	*Taraxacum platycarpum*	70.0	78.2
Kochia scoparia	64.6	77.0	*Thalictrum aquilegifolium*	16.6	22.3
Lonicera japonica	61.3	46.3	*Trichosanthes kirilowii*	65.6	98.2
Lycopus lucidus	67.8	73.3	*Ulmus davidiana*	16.5	25.4
Melia azedrach	35.4	46.3	*Viola mandshurica*	86.9	89.7
Melia azedrach	19.3	26.7	*Zanthoxylum piper*	23.3	34.1
Momordica charantin	53.2	53.1			

Tab. 2: Insecticidal activities of plant extracts against *T. urticae* when applied at 3000mg/L

Scientific name	Mortality (%)		Scientific name	Mortality (%)	
	24hr	48hr		24hr	48hr
Aiasarum sieboldii	26.3	26.4	*Cucurbita pepo*	21.0	39.4
Allium ascalonicum	12.6	20.9	*Geranium nepalense*	22.4	27.3
Allium tuberosum	6.8	10.1	*Kochia scoparia*	45.8	71.1
Angelica japonica	15.3	20.9	*Lycopus lucidus*	11.3	18.6
Ardisia japonica	10.3	15.2	*Portulaca oleracea .*	49.7	45.4
Areca catechu	14.5	21.2	*Prunella vulgaris*	35.7	47.1
Artemisia apiacea	10.4	18.0	*Prunus armeniaca*	50.5	81.9
Astragalus membranaceus	16.0	23.3	*Sambudus williamsii*	22.6	29.5
Chenopodium album	47.5	49.1	*Spirodela polyrhiza*	67.7	75.0
Cibotium barometz	52.9	64.2	*Taraxacum platycarpum*	32.5	42.7
Cibotium barometz	43.5	50.8	*Trichosanthes kirilowii*	45.2	49.1
Coix lachryma	7.0	15.1	*Viola mandshurica*	44.5	65.1

Tab. 3: Insecticidal activities of *P. ameniaca* extracts against *T. urticae* depending on extraction solvent

Extraction solvent	Conc. (mg/L)	Mortality (%)		Yield (%)[z]
		24hr	48hr	
Methanol	3,000	66.5	81.3 a	3.3
	1,500	51.4	61.1 a	
n-Hexane	3,000	22.3	27.4 b	48.8
	1,500	3.2	15.8 b	

[z] (D.W. of solvent extract/D.W. of the sample)*100.

References

Ahn Y. J., Kim G. K., Park N. J., Cho K. Y. (1992): Establishment of bioassay system for developing new insecticides II. Differences in susceptibilities of the insect species to insecticides according to different application methods. Korean J. Appl. Entomol. 31:452-460.

Choi S. P., Song Y. K., Kim K.J., Lim H. H. (2005): Amygdalin extract from *Armeniacae semen* induces apoptosis through bax-dependent caspase-3 activation in human cervical cancer cell line ME-180. Korean J. of Oriental Medicine. 26:130-142.

Lee H. S., Choi G. J., Cho K. Y., Lee S. G., Ahn Y. J. (2000): Fungicidal and insecticidal activities of various grain extracts against five pests and six phytopathogenic fungi. The Korean J. of Pesticide Science. 4:7-14.

Park I. K., Park J. D., Kim C. S., Shin S, C., Ahn Y. J., Park. S. C., Lee S. G. (2002): Insecticidal and acaricidal activities of documestic plant extracts against five major arthropod pests. The Korean J. of Pesticide Science. 6:271-278.