

ORIGINAL RESEARCH ARTICLE

Anti-Insect Activity of Fruit Extract from Tropical Soda Apple (*Solanum viarum* Dunal) Against *Aphis gossypii* (Glover) (Hemiptera: Aphididae)

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ABSTRACT

In the present study, were tested against *A. gossypii* and the results anti-insect properties of various accessions of *S. viarum* showed different degrees of anti-insect activities, when extracted and bioassayed. When comparing the extracts obtained by following Soxhlet, Cold and aqueous extraction methods, cold extraction method is superior to other methods. Among the bioassay methods experimented, topical bioassay registered the maximum of 33.33% mortality and proved inefficient. Poison food bioassay surpassed topical bioassay in all the treatments. In general *S. viarum* did not cause effective mortality on *A. gossypii*.

Keywords: Tropical Soda Apple (*Solanum viarum*), *Aphis gossypii*, Anti-insect activities.

INTRODUCTION

Though synthetic organic pesticides have saved agricultural production, many of them are hazardous to environment even at a very low concentration [1-3]. Quandaries such as health hazards and harming to beneficial organism viz., natural enemies and pollinators are also experienced because of the extensive use of broad spectrum synthetic chemical pesticides [4-6]. Moreover, botanical insecticides are shown best suited for organic food production by many authors [7-9]. In this context the present study evaluation of the insecticidal effect of different extracts of fruits of *S. viarum* is a member of the economically important family Solanaceae which consisting of 75-90 genera and more than 2,500 species of plants is getting importance. Much of the literature on *S. viarum* concerns its cultivation for the richer source of solasodine, a nitrogenous analogue found in the mucilaginous layer that surrounds the seeds which is a precursor in the industrial production of steroid hormones [10]. Solasodine was reported to be effective by [11] against Epilachna beetles and it showed be studied on Lepidopteran and Hemipteran insects also. *A. gossypii* (Hemiptera) which was taken as test in this study is considered as a highly polyphagous pest in many countries with tropical, subtropical and temperate climates. However, its optimum environment lies in areas with higher temperature.

In India it is commonly called as cotton aphid and occurs in all parts of the country wherever suitable host plants grown [12].

MATERIALS AND METHOD**Collection of berries**

Berries of *S. viarum* were collected from Kollihills (6 Accessions), Pachamalai hills (4 Accessions) and Annamalainagar Variety: *Arka Sanjeevini*. The botanical identification of the plant was done by Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University, Tamilnadu, India.

Rearing of *Aphis gossypii* (Glover)

Cotton aphid, *Aphis gossypii* (Glover) (Aphididae: Hemiptera) was reared in screen house using natural host. Ten days old cotton seedlings were used in rearing. These seedlings were kept inside nylon mesh netted insect cages. Fresh seedlings were introduced once in five days or whenever the seedlings started withering. Aphids migrated to new seedlings on their own and colonized them within a day. Thus a continuous culture of aphid was maintained using fresh cotton seedlings. Rearing was done at $25 \pm 2^\circ\text{C}$ and $65 \pm 5\%$ RH [13].

Preparation of extracts

Berries of *S. viarum* collected from Kollihills (6 Accessions), Pachamalai hills (4 Accessions) and

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Annamalainagar (Variety: Arka Sanjeevini) were extracted using various solvents such as n-hexane, benzene, ethyl acetate, acetone and combinations of solvents at different ratio viz., n-hexane and benzene (50:50), benzene and ethyl acetate (50:50) and ethyl acetate and acetone (50:50).

Two methods such as Soxhlet extraction method and Cold extraction method (room temperature extraction method) had employed in extracting berries by using solvents. In addition, aqueous extract was obtained using HPLC water.

Screening against *A. gossypii*

I. Poison food bioassay (Seedling spray bioassay)

Cotton seedling (10 days old) grown in paper cups (at two seedling/cup) were sprayed with 1% concentration of each extract at 2ml/cup. After air drying, seedlings were infested with wingless adult aphids at 10/seedling and kept inside a cage (1'x1'x1'). All the cages were kept under controlled conditions of $25 \pm 2^\circ\text{C}$ temperatures and $65 \pm 5\%$ relative humidity. Each treatment was replicated three times and observations on mortality were taken once in six hours after the treatment^[14].

II. Topical bioassay (Direct Spray)

Ten numbers of wingless aphids were released in a petriplate (80 mm). One ml of 1per cent concentration of each extract of *S. viarum* fruit were sprayed separately potters tower^[15]. Then after air drying the aphids were then transferred to 10 days old cotton seedlings. All the seedlings were kept under controlled conditions of $25 \pm 2^\circ\text{C}$ temperatures and $60 \pm 5\%$ relative humidity. Each treatment was replicated three times and observations on mortality were taken once in six hours after the treatment^[16].

Statistical analysis

All the percentage data were subjected to arc - sine transformation and whole numbers were log transformed. Lethal concentrations were worked out by using probit analysis. Analysis was done with ANOVA and the means were compared by following Duncan's multiple range test (DMRT) at $p = 0.05$ ^[17].

RESULTS

Screening against *A. gossypii*

I. Poison food bioassay (Seedling spray bioassay)

1. Soxhlet extract

Acetone extract of *S. viarum* recorded the per cent mortality ranging from 3.33 to 26.66 against *A.*

gossypii in a poison food technique bioassay. Kollihills accessions such as KH-2, KH-4 and KH-6 recorded 26.66% mortality against *A. gossypii*. All the pachamalai hills accessions exerted only 6.66% mortality. The variety *Arka sanjeevini* exerted the per cent mortality of 3.33 (Table 1 & Fig 1).

2. Cold extract

Various accessions of *S. viarum* fruits extracted by following cold extraction procedure showed more or less similar results as soxhlet extraction procedure. Cold extracts using acetone showed the range of mortality from 3.33 to 33.33% against aphids.

The extracts obtained using Kollihills accessions were superior to Pachimalai accessions and variety *Arka sanjeevini*. n-hexane, benzene, ethyl acetate, n-hexane and benzene (50:50), Benzene and ethyl acetate (50:50) and untreated check showed no mortality in any of the replications (Table 2 & Fig 1).

3. Aqueous Extract

Aqueous extract of *S. viarum* fruits showed different degree of mortality against *Aphis gossypii*. KH-2 recorded the highest per cent mortality of 33.33. It was followed by KH-1, KH-3, KH-4 and KH-6. Among pachamalai accessions, PH-2 recorded 20% mortality and was followed by PH-1, PH-4 and PH-3. Untreated check recorded no mortality in any of its replications (Table 3 & Fig 1).

II. Topical bioassay (Direct Spray)

1. Soxhlet extract

Topical application of *S. viarum* extract of Kollihills accessions showed very low mortality against *A. gossypii*. In most of the treatments the mortality percentage was below 1.0 per cent. Pachamalai accessions exerted still lower mortality percentage and in many of the treatments zero per cent mortality was noted. The variety *Arka sanjeevini* was also not good in exerting mortality against *A. gossypii*. Untreated check showed zero per cent mortality in all the replications (Table 4 & Fig 1).

2. Cold extract

S. viarum accessions extracted by following cold extraction procedure showed less than 1% mortality in all the treatment against *A. gossypii*. There was no clear differentiation between treatment when analysed statistically (Table 5 & Fig 1).

3. Aqueous Extract

Aqueous extract of *S. viarum* also recorded below 1% mortality. The maximum mortality of 0.26%

recorded in KH-4 and was followed by KH-5, KH-2, KH-3 and KH-1 (Table 6 & Fig 1).

Table 1: Efficacy of fruit extracts (Soxhlet method) of *S. viarum* accessions on *A.gossypii* – Poison food bioassay

T. No	Treatment	*Per cent mortality at 1% concentration										
		KH-1	KH-2	KH-3	KH-4	KH-5	KH-6	PH-1	PH-2	PH-3	PH-4	AS-I
1	n-hexane extract	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b
2	Benzene extract	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b
3	Ethyl acetate extract	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b
4	Acetone extract	20.00 (26.57) ^a	26.66 (30.79) ^a	16.66 (23.85) ^a	26.66 (30.79) ^a	20.00 (26.57) ^a	26.66 (30.79) ^a	6.66 (12.28) ^a	6.66 (12.28) ^a	6.66 (12.28) ^a	6.66 (12.28) ^a	3.33 (6.14) ^a
5	n-hexane and benzene (50:50) extract	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b
6	Benzene and ethyl acetate (50:50) extract	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b
7	Ethyl acetate and acetone (50:50) extract	0.00 (0.00) ^b	0.00 (0.00) ^b	16.66 (23.85) ^a	6.66 (12.28) ^b	6.66 (12.28) ^b	6.66 (12.28) ^b	0.00 (0.00) ^b				
8	Un treated check	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b
#9-15	Solvent controls	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^c
CD (0.05)		3.01	4.52	4.25	7.72	6.58	8.43	6.58	6.58	6.58	6.58	9.14

*Mean of three replications

Values in parentheses one arc sine transformed values

Values with different alphabets differ significantly

KH – Kollihills accessions

PH – Pachamalai hills accessions

AS – Arka sanjeevini (Released variety)

It includes solvent controls such as (T9-T15) n-hexane, benzene, ethyl acetate, acetone, n-hexane and benzene (50:50), benzene and ethyl acetate (50:50) and ethyl acetate and acetone (50:50)

Table 2 Efficacy of fruit extracts (Cold extraction method) of *S. viarum* accessions on *A. gossypii* – Poison food bioassay

T. No	Treatment	*Per cent mortality at 1% concentration										
		KH-1	KH-2	KH-3	KH-4	KH-5	KH-6	PH-1	PH-2	PH-3	PH-4	AS-I
1	n-hexane extract	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b
2	Benzene extract	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b
3	Ethyl acetate extract	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b
4	Acetone extract	26.66 (30.79) ^a	33.33 (35.08) ^a	20.00 (26.57) ^a	26.66 (30.75) ^a	20.00 (26.57) ^a	26.66 (30.79) ^a	10.00 (18.43) ^a	10.00 (18.43) ^a	10.00 (18.43) ^a	10.00 (18.43) ^a	3.33 (6.14) ^a
5	n-hexane and benzene (50:50) extract	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b
6	Benzene and ethyl acetate (50:50) extract	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b
7	Ethyl acetate and acetone (50:50) extract	0.00 (0.00) ^b	0.00 (0.00) ^b	16.66 (23.85) ^a	10.00 (18.43) ^b	10.00 (18.43) ^b	10.00 (18.43) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b
8	Un treated check	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b
#9-15	Solvent controls	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^c
CD (0.05)		4.52	4.53	2.90	4.52	5.28	4.52	6.58	6.58	6.58	6.58	9.14

*Mean of three replications

Values in parentheses one arc sine transformed values

Values with different alphabets differ significantly

KH – Kollihills accessions

PH – Pachamalai hills accessions

AS – Arka sanjeevini (Released variety)

It includes solvent controls such as (T9-T15) n-hexane, benzene, ethyl acetate, acetone, n-hexane and benzene (50:50), benzene and ethyl acetate (50:50) and

Table 3: Efficacy of fruit extracts (aqueous method) of *S. viarum* accessions on *A. gossypii* – Poison food bioassay

T. No	Treatment	*Per cent mortality at 1% concentration
1	<i>Solanum viarum</i> (KH1)	26.66 (30.79) ^{ab}
2	<i>Solanum viarum</i> (KH 2)	33.33 (35.01) ^a
3	<i>Solanum viarum</i> (KH 3)	26.66 (30.79) ^{ab}
4	<i>Solanum viarum</i> (KH 4)	26.66 (30.79) ^{ab}

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5	<i>Solanum viarum</i> (KH 5)	26.66 (30.79) ^{ab}
6	<i>Solanum viarum</i> (KH 6)	26.66 (30.79) ^{ab}
7	<i>Solanum viarum</i> (PH 1)	16.66 (23.85) ^b
8	<i>Solanum viarum</i> (PH 2)	20.00 (23.85) ^b
9	<i>Solanum viarum</i> (PH 3)	13.33 (26.57) ^{ab}
10	<i>Solanum viarum</i> (PH 4)	16.66 (21.14) ^b
11	<i>Solanum viarum</i> (AS)	20.00 (0.00) ^b
12	Untreated check	0.00 (00.00) ^d
CD (0.05)		9.77

*Mean of three replications

Values in parentheses one arc sine transformed values

Values with different alphabets differ significantly

KH – Kollihills accessions

PH – Pachamalai hills accessions

AS – Arka sanjeevini

Table 4: Efficacy of fruit extracts (Soxhlet method) of *Solanum viarum* accessions on *Aphis gossypii*

T. No	Treatment	*Per cent mortality at 1% concentration										
		KH-1	KH-2	KH-3	KH-4	KH-5	KH-6	PH-1	PH-2	PH-3	PH-4	AS-I
1	n-hexane extract	0.13 (2.01) ^{ab}	0.06 (1.15) ^{ab}	0.08 (1.62) ^{bc}	0.08 (1.62) ^{bc}	0.08 (1.62) ^{ab}	0.08 (1.62) ^{ab}	0.02 (0.46) ^{ab}	0.06 (1.4) ^a	0.04 (0.93) ^a	0.24 (2.41) ^a	0.02 (0.46) ^b
2	Benzene extract	0.08 (1.62) ^{ab}	0.15 (2.23) ^a	0.17 (2.29) ^{ab}	0.063 (1.15) ^{bc}	0.08 (1.62) ^{ab}	0.08 (1.62) ^{ab}	0.04 (0.93) ^a	0.02 (0.46) ^{bc}	0.00 (0.00) ^b	0.00 (0.00) ^b	0.02 (0.46) ^b
3	Ethyl acetate extract	0.13 (2.01) ^{ab}	0.11 (1.54) ^{ab}	0.06 (1.15) ^{cd}	0.10 (1.78) ^{ab}	0.10 (1.84) ^a	0.10 (1.84) ^a	0.0 (0.0) ^b	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b
4	Acetone extract	0.19 (2.15) ^a	0.10 (1.78) ^a	0.24 (2.76) ^a	0.19 (2.51) ^a	0.08 (1.62) ^{ab}	0.08 (1.62) ^{ab}	0.00 (0.0) ^b	0.04 (0.93) ^{ab}	0.00 (0.00) ^b	0.00 (0.00) ^b	0.11 (1.54) ^a
5	n-hexane and benzene (50:50) extract	0.08 (1.62) ^{ab}	0.08 (1.62) ^{ab}	0.02 (0.46) ^{de}	0.00 (0.00) ^d	0.02 (0.46) ^{cd}	0.02 (0.46) ^{cd}	0.00 (0.00) ^b	0.00 (0.00) ^c	0.00 (0.00) ^b	0.04 (0.93) ^b	0.02 (0.46) ^b
6	Benzene and ethyl acetate (50:50) extract	0.10 (1.84) ^{ab}	0.02 (0.46) ^{bc}	0.00 (0.00) ^e	0.02 (0.46) ^{cd}	0.04 (0.93) ^{bc}	0.04 (0.93) ^{bc}	0.00 (0.00) ^b	0.00 (0.00) ^c	0.00 (0.00) ^b	0.06 (1.15) ^{ab}	0.02 (0.46) ^b
7	Ethyl acetate and acetone (50:50) extract	0.08 (1.32) ^b	0.00 (0.00) ^c	0.00 (0.00) ^e	0.00 (0.00) ^d	0.00 (0.00) ^d	0.00 (0.00) ^d	0.00 (0.00) ^b	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b
8	Un treated check	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^e	0.00 (0.00) ^d	0.00 (0.00) ^d	0.00 (0.00) ^d	0.00 (0.00) ^b	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b
#9-15	Solvent controls	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^e	0.00 (0.00) ^e	0.00 (0.00) ^e	0.00 (0.00) ^e	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^c
CD (0.05)		1.106	1.302	.987	.968	.892	.892	.682	.682	.500	1.455	.984

*Mean of three replications

Values in parentheses one arc sine transformed values

Values with different alphabets differ significantly

KH – Kollihills accessions

PH – Pachamalai hills accessions

AS – Arka sanjeevini (Released variety)

It includes solvent controls such as (T9-T15) n-hexane, benzene, ethyl acetate, acetone, n-hexane and benzene (50:50), benzene and ethyl acetate (50:50) and ethyl acetate and acetone (50:50)

Table 5: Efficacy of fruit extracts (Cold extraction method) of *S. viarum* accessions on *A. gossypii* - Topical bioassay

T. No	Treatment	*Per cent mortality at 1% concentration										
		KH-1	KH-2	KH-3	KH-4	KH-5	KH-6	PH-1	PH-2	PH-3	PH-4	AS-I
1	n-hexane extract	0.06 (1.4) ^a	0.04 (1.93) ^{bcd}	0.00 (0.00) ^c	0.00 (0.00) ^b	0.08 (1.62) ^a	0.04 (0.93) ^{ab}	0.00 (0.00) ^c	0.02 (0.46) ^a	0.02 (0.46) ^{bc}	0.13 (2.01) ^a	0.00 (0.00) ^b
2	Benzene extract	0.83 (1.62) ^a	0.04 (0.933) ^b	0.00 (0.00) ^c	0.08 (1.62) ^a	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^c	0.06 (1.15) ^a	0.08 (1.32) ^{ab}	0.11 (1.54) ^a	0.00 (0.00) ^b
3	Ethyl acetate extract	0.13 (2.01) ^a	0.13 (2.01) ^a	0.04 (0.93) ^b	0.04 (0.93) ^{ab}	0.04 (0.93) ^a	0.06 (1.4) ^{ab}	0.00 (0.00) ^c	0.00 (0.00) ^a	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b
4	Acetone extract	0.13 (2.01) ^a	0.17 (2.39) ^a	0.13 (2.01) ^a	0.04 (0.93) ^{ab}	0.04 (0.93) ^a	0.06 (1.15) ^{ab}	0.15 (2.23) ^a	0.11 (1.54) ^a	0.10 (1.84) ^a	0.10 (1.84) ^a	0.06 (1.15) ^a
5	n-hexane and benzene (50:50) extract	0.08 (1.32) ^a	0.06 (1.40) ^{abc}	0.04 (0.93) ^b	0.02 (0.46) ^b	0.06 (1.4) ^a	0.08 (1.32) ^{ab}	0.11 (1.54) ^{ab}	0.08 (1.32) ^a	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b
6	Benzene and ethyl acetate (50:50) extract	0.04 (0.93) ^{ab}	0.02 (0.46) ^{cd}	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b	0.06 (1.15) ^{ab}	0.00 (0.00) ^c	0.00 (0.00) ^a	0.00 (0.00) ^c	0.06 (1.15) ^{ab}	0.00 (0.00) ^b
7	Ethyl acetate and acetone (50:50) extract	0.06 (1.4) ^b	0.08 (0.62) ^{ab}	0.13 (2.01) ^a	0.00 (0.00) ^b	0.00 (0.00) ^b	0.13 (2.01) ^a	0.04 (0.93) ^{bc}	0.04 (0.69) ^a	0.10 (1.84) ^a	0.04 (0.93) ^{ab}	0.02 (0.46) ^{ab}
8	Un treated check	0.00 (0.00) ^b	0.00 (0.00) ^d	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^c	0.00 (0.00) ^a	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b
#9-15	Solvent controls	0.00 (0.00) ^c	0.00 (0.00) ^c	0.00 (0.00) ^e	0.00 (0.00) ^e	0.00 (0.00) ^e	0.00 (0.00) ^e	0.00 (0.00) ^c	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^b	0.00 (0.00) ^c
CD (0.05)		1.146	1.029	.852	.728	.748	1.441	1.019	1.672	.960	1.208	.875

V Ramesh / Anti-Insect Activity of Fruit Extract from Tropical Soda Apple (*Solanum viarum* Dunal) Against *Aphis gossypii* (Glover) (Hemiptera: Aphididae)

*Mean of three replications

Values in parentheses one arc sine transformed values

Values with different alphabets differ significantly

KH – Kollihills accessions

PH – Pachamalai hills accessions

AS – *Arka sanjeevini* (Released variety)

It includes solvent controls such as (T9-T15) n-hexane, benzene, ethyl acetate, acetone, n-hexane and benzene (50:50), benzene and ethyl acetate (50:50) and ethyl acetate and acetone (50:50)

Table 6: Efficacy of fruit extracts (aqueous method) of *S. viarum* accessions on *A. gossypii* - Topical bioassay

T. No	Treatment	*Per cent mortality at 1% concentration
1.	<i>Solanum viarum</i> (KH1)	0.10 (1.84) ^{bcd}
2.	<i>Solanum viarum</i> (KH 2)	0.13 (2.01) ^{abc}
3.	<i>Solanum viarum</i> (KH 3)	0.13 (2.07) ^{abc}
4.	<i>Solanum viarum</i> (KH 4)	0.26 (2.92) ^a
5.	<i>Solanum viarum</i> (KH 5)	0.17 (2.39) ^{ab}
6.	<i>Solanum viarum</i> (KH 6)	0.13 (2.01) ^{abc}
7.	<i>Solanum viarum</i> (PH 1)	0.08 (1.62) ^{bcd}
8.	<i>Solanum viarum</i> (PH 2)	0.00 (0.00) ^e
9.	<i>Solanum viarum</i> (PH 3)	0.04 (0.93) ^{de}
10.	<i>Solanum viarum</i> (PH 4)	0.08 (1.38) ^{cd}
11.	<i>Solanum viarum</i> (AS)	0.04 (0.93) ^{de}
12.	Untreated check	0.00 (0.00) ^e
	CD (0.05)	.9771

*Mean of three replications

Values in parentheses one arc sine transformed values

Values with different alphabets differ significantly

KH – Kollihills accessions

PH – Pachamalai hills accessions

AS – *Arka sanjeevini*

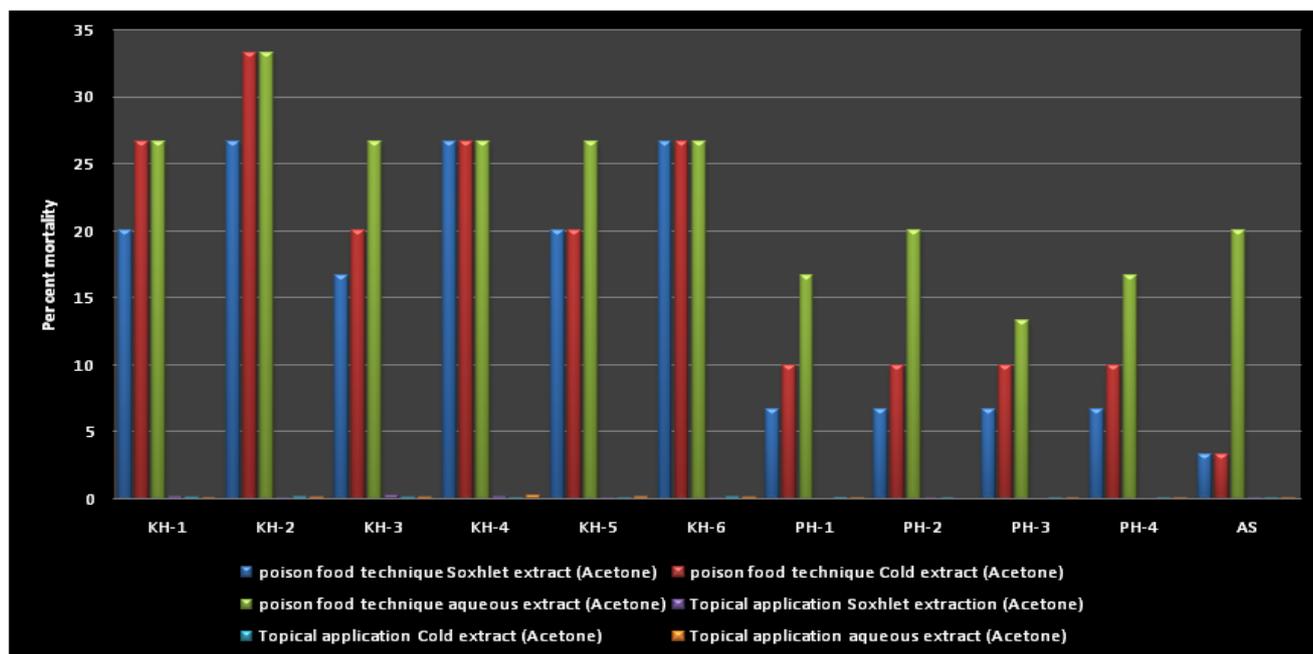


Fig 1: Comparison of the efficacy of acetone and aqueous extracts of *S. viarum* against *A. gossypii* (Poison food and Topical bioassay)

DISCUSSION

S. viarum berries extract was found not effective against *A. gossypii* when tested by two different methods. Poison food techniques extracted only the maximum of 33.33% mortality in one of the treatment and topical assay registered still lower efficacy. Though *S. viarum* was shown effective against *Epilachna* beetles [11] it is not effective in our study against *A. gossypii*. This variation may be due to the feeding habits of insects. Further the alkaloids of *S. viarum* may work as stomach

Poison rather than the contact poison. Variation in the active principle content of berries is obscure, because the climate and soil type are identical in kollihills and pachamalai and there is no deviation in the collection period (season) also. Our finding in relation to extraction procedure is in accordance with the statement of [18] who reported that *Azadirachta indica* A. Juss, *Melia azedirach* A. Juss and *Lantana camara* L. extracted by following cold extract method was effective than

sohlex method. Similarly ^[1] reported that *C. collinus* extracted by following cold extraction method was effective against *S. litura* than soxhlet and aqueous methods.

CONCLUSION

The fruit extracts of kollihills accessions were not successful against sucking insect *Aphis gossypii* (Glover) (Homoptera: Aphididae). *S. viarum* (Kollihills accessions) fruit extracts showed insecticidal properties when poison food technique was followed rather than topical application technique. Regarding extraction methods, cold solvent method using acetone and aqueous extraction method were found effective in extracting desirable active principle from the fruits of *S. viarum*.

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