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Vitis vinifera (L) Derived Herbal Formulations for Qualitative Silk Cocoons from Silkworm, *Bombyx mori* (L).

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KEYWORDS

Grape-Seed-Oil, Linalool, Drakshasav, Tissue Somatic Index (TSI), Shell Ratio, Denier Scale of Silk.

ABSTRACT:

In sericulture, scientific evidences for the efficiencies of many herbal-treatments remains limited. Plant-based products (Herbal Formulations) are used to treat diseases or to maintain health of animals. are called herbal products, botanical products, or phytomedicines. The present attempt deals with utilization of herbal-juvenoid-formulations and herbal juvenoid compound (derived from grape and available in market) for qualitative silk cocoons from silkworm, Bombyx mori (L). The nutrition quality and health of larval instars exert influence on quality of the silk yield in sericulture. The acetone solutions of Grape-Seed-Oil (10 ml Grape-Seed-Oil dissolved in 90 ml acetone) and ten microliters of acetone solutions of Linalool (100 ppm) were used in present attempt for the topical application to the fifth instar larval stages of silkworm, Bombyx mori (L) (Double Hybrid Race). Group of larvae fed Mulberry leaves treated with aqueous solution Drakshasav; group of larvae topically applied with acetone solutions of Grape-Seed-Oil (10 ml Grape-Seed-Oil dissolved in 90 ml acetone) followed by feeding Mulberry leaves treated with aqueous solution Drakshasav were also maintained. Fifth Instar Larval Life Duration (Hours) and Tissue Somatic Index (TSI) of silk glands of fifth instar silkworms of control group, Grape-Seed-Oil treated group; Linalool treated group; group fed with mulberry leaves treated with aqueous solution of Drakshasav and group treated with Grape-Seed-Oil treated acetone (topical) followed feeding by mulberry leaves treated with aqueous solution of Drakshasav were recorded 145.33 (□ 13.786), 31.426; 168.73(□ 13.221), 52.625; 177.46 (□ 13.786), 52.728; 162.87(□14.572), 52.759 and 168.58(□18.789), 53.854 units respectively. Shell Ratio of cocoon spun by fifth instar silkworms of control group, Grape-Seed-Oil treated group; Linalool treated group; group fed with mulberry leaves treated with aqueous solution of Drakshasav and group treated with Grape-Seed-Oil treated acetone (topical) followed feeding by mulberry leaves treated with aqueous solution of Drakshasav were recorded 19.422; 23.970; 27.989; 28.048 and 28.378 units respectively. Denier scale of silk filament spun by fifth instar silkworms of control group, Grape-Seed-Oil treated group; Linalool treated group; group fed with mulberry leaves treated with aqueous solution of Drakshasav and group treated with Grape-Seed-Oil treated acetone (topical) followed feeding by mulberry leaves treated with aqueous solution of Drakshasav were recorded 3.243; 4.706; 4.793; 4.882 and 4.948 units respectively. The range of improvements of tissue somatic index of silk glands (TSI); Shell Ratio of cocoon and Denier scale of silk filament through treatment was 52.625 to 53.854; 23.970 to 28.378 and 4.706 to 4.948. Efficient use of source of juvenoids like linalool, grape seed oil and drakshasav in desired solvent for treating the silkworm larvae serve to orchestrate the fortification of health through the preventing the infection of microbial pathogens; extension of larval age, consumption and utilization of nutrition for significant yield of silk product.

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INTRODUCTION

The significant feature of autotrophic and heterotrophic lives on earth is orchestrate progression. Autotrophic plants are serving as innovative and the richest sources of nutrients for the animal lives. The heterotrophic lives (like animals) utilize the nutrients (in the form of functional food material and biochemical nutrient-compounds) and derive energy to lead successful life. In a virtual sense, synthesis of energy rich food-material (in the form of biochemical compounds) by autotrophs through the use of chlorophyl is for the purpose of their own-life [1].

The common grape vine *Vitis vinifera* (L.), the common grape vine, is a species of the plants with flowers. The variety of grapes, process of vinification, grape-maturation, and grape-aging are the factors associated with qualities of aroma of grape-wine. Monoterpenols, particularly linalool, geraniol and nerol, are responsible for the characteristic floral aroma in grapes [2-5]. In grapes, terpenoids exist both free and as glycosides, being some of the bound terpenoids released either chemically or by natural β-glycosidase activity of either the grape or of yeasts and bacteria during the vinification phases [6 – 13]. Linalool is a colorless oil, belongs to "Acyclic Monoterpenoid". In plants, linalool is a volatile-metabolite with antimicrobial property [3,4].

Grape seed oil is a derived from the grape-seeds. Grape-seed is by-product of winemaking industry. Grape seed oil is commonly used as an edible oil. It has a light taste and a content of polyunsaturated fat, making it suitable for use in salad dressing, mayonnaise and as a base for oil infusions of garlic, rosemary, or other herbs or spices. It is widely used in baked goods, pancakes, and waffles. It is used for spraying on raisins to help them retain their flavor [14]. The "Drakshasava", ayurvedik tonic is derived from grapes. It is in the form of partial fermentation. Utilization of raisin concentrate is also followed for the preparation of "Drakshasava", ayurvedik tonic. The "Drakshasava" is claimed to be beneficial for ailments (such as conditions of lethargy, weakness-conditions and heat- burnout (or heart-exhaustion). The most significant categories of metabolites and herbal formulations derived from *Vitis vinifera* (L) linalool, grape seed oil and "Drakshasava", ayurvedik tonic [15].

Many more compounds of herbal origin; compounds of synthetic categories and animal derived biochemicals appearing in the classified list of compounds with features analogous with Insect Juvenile Hormone / J.H. The compounds of herbal origin; compounds of synthetic categories and animal derived biochemicals with the analogous features and mechanism of working of natural "Insect-Juvenile-Hormone" (JH) are designated as a special category as "Juvenoids" by Williams in the year: 1956 [16,17]. The topical applications of exogenous insect juvenoid compounds through appropriate solvent (like acetone) to the larval stages of silkworms of specific age (in hours) are reported to exert inhibition of deposition of chitin in the body wall and extension of the larval age [18,19]. That is to say, the compounds of "Insect-Juvenoid" class belong to herbal category through suitable solvents are reported for the potent natural "Insect-Juvenile-Hormone" (JH) activities through impressive sum of all the metabolic reactions (turnover), alterations of constituencies of metabolites like proteinaceous compounds, lipid compounds, carbohydrate compounds, pool of amino-acids, pool of fatty-acids & chitin (long chain of polymer compound of N-acetyl-glucose-amine) [20,21]. There are several citations and reports on improvements in the physiological conditions of bodies of larval stages of insect lives through the recipiency of exogenous JH and analogues (or Juvenoids). The exogenous compounds of herbal origin; compounds of synthetic categories and animal derived biochemicals with the analogous features and mechanism of working of natural "Insect-Juvenile-Hormone" (JH) are reported for the topical spray (or application) to the individuals of fifth instar silkworms for the qualitative improvements in the silk yield [22,23,24]. The "Terpene" and "Terpenoids" are the largest and varied group of chemical compounds of organic nature. The terpene compounds are with strong odor. They are concerned with protection of the plants through deterring herbivorous animals and through attracting predators and parasites of herbivorous animals [25,26,27,28].

The insect "Juvenile-Hormone" (J.H.) exert the influence concerned with maintenance of juvenile stage (younger and younger stage) of insect life. Inhibition of deposition of chitin in the body wall and extension of the larval age are the most significant effects exerted by natural JH (and exogenous juvenoids) in the larval stage of silkworm. The concentrations or titers of the natural insect moulting

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hormone (M.H.) serves to proceed to the next phase of life. That is to say, the concentration or titer of the insect "Moulting-Hormone" (M.H.) serve to proceed further metamorphosis through many events of physiological actions (including enhancement of deposition of chitin in specific parts of the larval body-frame). In presence of particular / specific concentrations or titers of the hormone of Moulting (M.H.) in the haemolymph (blood) of insect life stage, the mechanism of deposition of chitin in the parts of body-frame appears to be at higher rate. The distinct feature of JH and analogues is inhibition of morphogenetic program at determined in advance by the embryonic constitution (predetermined) and group specific ontogenetic or embryonic developmental positions. It appears that, insect metamorphosis is the outcome of the integrations of fruitful-interplays of specific titers of the JH and MH [16]. The JH and MH, with their specific concentrations are working for the smooth progression of metamorphosis from larval stage to the pupa; from the stage of pupa to the adult stage. In the earlier attempts of authors, topical application (in the form of spray) of acetone extractives of stem pieces of grape, *Vitis vinifera* (L.) was found effecting significant increase in both soluble and total protein contents of silk glands [20]. Therefore, further to analyze the influence of acetone solution of grapeseed oil (topical application); acetone solution of linalool (topical application) and aqueous solution of Drakshasav (Through Mulberry Leaves) on economic parameters in silkworm, *Bombyx mori* (L.) (fifth instar larval life duration; weight of cocoon; weight of shell of cocoon; silk shell ratio and denier scale of silk), present attempt has been sketched out.

MATERIAL AND METHOD

The attempt has been completed through the four major steps which include: Rearing of larval instars of Silkworm; Preparation of acetone solution of grape seed oil; Preparation of acetone solution of linalool; Preparation of aqueous solution of drakshasav; Feeding the larvae with mulberry leaves; Provision of Mountage for Spinning; Cocoon Harvesting; Reeling; collection of data on economic parameters and Analysis through the statistical methods. The standard sericultural method of silkworm-rearing as prescribed by Krishnaswami, *et al*. was followed [20, 29]. The race of silkworm, Bombyx mori (L.) utilized in the present attempt was double hybrid [(CSR6 x CSR26) (hybrid bivoltine) x CSR2 x CSR27) (hybrid bivoltine)]. The grape seed oil; linalool and drakshasav were procured from Ases Chemical Works (Brahm Bagh, Jalori Gate, Jodhpur- 342001 India) through local supplier.

Acetone solution of grape seed oil was prepared by dissolving 10 mg grape seed oil in 90 ml acetone solvent. The acetone solution of linalool of 100 ppm (mg/litre) strength was prepared by dissolving 10 mg linalool in 100 ml acetone solvent. Aqueous solution of drakshasav was prepared by dissolving 10 ml drakshasav in 90 ml distilled water (as a solvent). All the three solutions were prepared just few minutes before their utilization. The fifth stage silkworm larvae were utilized for the attempt on treatment. Shortly after lasting moult of fourth number, the larval stages of fifth number were used to transfer in a separate tray (disinfected). The larval stages of fifth number were divided into seven groups (1. Untreated Control Group; 2. Acetone / solvent Treated Control Group; 3. Water / solvent Treated Control Group; 4. Topical application of Acetone Solution of Grapeseed Oil; 5. Topical application of Acetone Solution of Linalool; 6. Treating the mulberry leaves with Aqueous Solution of Drakshasav for feeding and 7. Topical application of Acetone Solution of Grapeseed Oil followed by feeding mulberry leaves treated with Aqueous Solution of Drakshasav).

Each and every group of the larval stages of fifth instars of silkworm was containing hundred individuals. Each and every group of the larval stages of fifth instars of silkworms was in the set of triplicates. First group of the fifth instar silkworm larvae in the attempt was considered as: Untreated Control Group. The second group of the fifth instar silkworm larvae in the attempt was considered as: Solvent (Acetone) Treated Control Group. The third group of the fifth instar silkworm larvae in the attempt was considered as: Water / solvent Treated Control group. The fourth group of the fifth instar silkworm larvae in the attempt was considered as: Topical application of Acetone Solution of Grapeseed Oil Treated Group. The fifth group of the fifth instar silkworm larvae in the attempt was considered as: Topical application of Acetone solution of linalool Group. The sixth group of the fifth instar silkworm larvae in the attempt was considered for Treating the mulberry leaves with Aqueous Solution of Drakshasav and feeding fifth instar larvae of silkworm. The seventh group of the

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fifth instar silkworm larvae in the attempt was considered for Topical application of Acetone Solution of Grapeseed Oil followed by feeding mulberry leaves treated with Aqueous Solution of Drakshasav.

There was no any topical application to the "Untreated control group" of larval stages of fifth numbered silkworms. The solvent treated group of larval stages (hundred) of fifth numbered silkworm received the spray ten milliliters of plain solvent (acetone) at forty-eight hours following the fourth moult.

The grape seed oil (through acetone) treatment to the fifth stage silkworm larvae (hundred) was in the form of uniform spray of ten milliliter solution of acetone solution of grape seed oil and was executed at forty-eight hours following the process of fourth numbered moulting (on second day of fifth stage silkworm larvae). Hand-sprayer (household category) was used for spraying the solution of grape seed oil in acetone to the fifth stage silkworm larvae.

The linalool (through acetone) treatment to the fifth stage silkworm larvae (hundred) was in the form of uniform spray of ten milliliter solution of acetone solution of linalool and was executed at forty-eight hours following the process of fourth numbered moulting (on second day of fifth stage silkworm larvae). Hand-sprayer (household category) was used for spraying the solution of grape seed oil in acetone to the fifth stage silkworm larvae.

The Drakshasav (through distilled water) treatment to the fifth stage silkworm larvae (hundred) was in the form of feeding mulberry leaves treated with aqueous solution of Drakshasav. 100 mg of fresh mulberry leaves were used to keep immersed in 100 ml of aqueous solution of drakshasav for about an hour. The treated mulberry leaves were decanted and used for feeding to the fifth instar larvae of silkworm at forty-eight hours after fourth moult. The solvent treated group was fed with water treated mulberry leaves.

The seventh group of the fifth instar silkworm larvae in the attempt was considered for Topical application of Acetone Solution of Grapeseed Oil followed by feeding mulberry leaves treated with Aqueous Solution of Drakshasav.

uniform spray of ten milliliter solution of acetone solution of linalool and was executed at forty-eight hours following the process of fourth numbered moulting (on second day of fifth stage silkworm larvae). Hand-sprayer (household category) was used for spraying the solution of grape seed oil in acetone to the fifth stage silkworm larvae.

The parameters considered for the present attempt include the age of larval stage of fifth instar; weight of entire cocoon; weight of silk-shell; pupal weight (weight of pupa); length and weight of silk fibers (filament) belong to individual cocoon. The age of the fifth stage silkworm larvae was counted from the initial time of release of fourth moult to the fifty percentage of completion of spinning the silk cocoon. Explanation of features of the data (fact of information in digital form) used to analyze; for explorations of the relations of the data belongs to underlying groups; summarizations of association of the data to elemental groups; validity setting up for the proof of the replica (model) and to heed the analytics of prediction are the consequences of any analysis through the methods of statistics. Identification of the trends parameters in the attempt appears to be the sole aim of data analysis[32]. Each and every event of attempt of the present experimentations were repeated for thrice. The aim of repetitions of the attempt in present experimentation is to obtain the result of category of consistent qualities. Parameters expected in statistics include: mean, standard deviation and percent change. All these parameters were calculated through the use primary data collected in all the attempts. Finally, the data subjected for the statistical analysis. The percent variations and student "t" – tests were considered for knowing the levels of significance [30,31,32].

RESULTS AND DISCUSSION

The results dealing with utilization of Grape Seed Oil (GSO) through acetone; Linalool through acetone and Drakshasav through water for qualitative and quantitative silk yield from silkworm larvae [Race: Bivoltine Double Hybrid] are presented through tabular form (table No.1,2 and 3) and presented through plotting the graphs (figures: 1,2 and 3). The age (hours) of larval stages of fifth numbered silkworm, *Bombyx mori* (L) [Race: (CSR6 x CSR26) (hybrid bivoltine) x CSR2 x CSR27) (hybrid bivoltine)] of the untreated control group; acetone treated control group and water treated control group was found recorded 145.33 (±13.786); 145.33 (±13.786) and 146.59 (±13.003) hours

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respectively (table- 1 and Fig.1.A). The age (hours) of fifth stage silkworm larvae belong to the group treated with topical application of Grape seed oil (GSO) (through acetone) and the group treated with topical application of linalool (through acetone) was found recorded 168.73 (± 13.221) and 177.46 (± 13.786) hours respectively (table- 1 and Fig.1.A). The age (hours) of fifth stage silkworm larvae belongs to the group received the leaves of mulberry treated with aqueous solution of Drakshasav and the group received the topical application of acetone solution of Grape Seed Oil (GSO) followed by feeding with leaves of mulberry treated with aqueous solution of Drakshasav was found recorded 162.87 (± 14.572) and 168.58 (± 18.789) hours respectively (table- 1 and Fig.1.A).

Tissue-Somatic-Index (TSI) signifies the percentage of tissue in entire body. Tissue-Somatic-Index (TSI) of the silk glands of silk larvae in the untreated control group; acetone treated control group and water treated control group was found recorded as 31.426 units (table- 1 and Fig.1.B). Tissue-Somatic-Index (TSI) of the silk glands of silkworm larvae in the group treated with topical application of acetone solution of Grape Seed Oil (GSO) and topical application of acetone solution of Linalool was found recorded 52.625 and 52.728 units respectively (table- 1 and Fig.1.B). Tissue-Somatic-Index (TSI) of the silk glands of silkworm larvae belongs to the group received the leaves of mulberry treated with aqueous solution of Drakshasav and the group received the topical application of acetone solution of Grape Seed Oil (GSO) followed by feeding with leaves of mulberry treated with aqueous solution of Drakshasav was found recorded 52.759 and 53.854 units respectively (table- 1 and Fig.1.B).

The weight (unit: gm) of entire cocoon (with floss); weight (unit: gm) of whole cocoon (deflossed) of the group of untreated control group was found recoded 2.962 (±0.487) and 2.873 (±0.441) respectively (table-2. And Fig.2.A). The weight (unit: gm) of entire cocoon (with floss); weight (unit: gm) of whole cocoon (deflossed) of the group of Acetone treated control group was found recorded 2.962 (±0.439) and 2.873 (±0.493) respectively (table-2. And Fig.2.A). The weight (unit: gm) of entire cocoon (with floss); weight (unit: gm) of whole cocoon (deflossed) of the group of water treated control group was found recorded 3.146 (±0.831) and 3.051 (±0.557) respectively. The weight (unit: gm) of entire cocoon (with floss); weight (unit: gm) of whole cocoon (deflossed) of the group of topical application of acetone solution of Grape Seed Oil (GSO) was found recorded 5.381 (±1.078) and 5.219 (±1.081) respectively. The weight (unit: gm) of entire cocoon (with floss); weight (unit: gm) of whole cocoon (deflossed) of the group of topical application of acetone solution of Linalool was found recorded 5.596 (±1.788) and 5.427 (±1.149) respectively. The weight (unit: gm) of entire cocoon (with floss); weight (unit: gm) of whole cocoon (deflossed) of the group of larvae received mulberry leaves treated with Drakshasav was found recorded 5.691 (±1.739) and 5.519 (±1.557) respectively. The weight (unit: gm) of entire cocoon (with floss); weight (unit: gm) of whole cocoon (deflossed) of the group of topical application of acetone solution of Grape Seed Oil (GSO) followed by feeding the larvae with mulberry leaves treated with Drakshasav was found recorded 5.738 (±2.013) and 5.564 (±1.786) respectively.

Silk shell ratio (percentage) of the cocoons harvested from the group of untreated control group was found recoded 19.422. Silk shell ratio (percentage) of the cocoons harvested from the group of Acetone treated control group was found recoded 19.422. Silk shell ratio (percentage) of the cocoons harvested from the group of water treated control group was found recoded 19.436. Silk shell ratio (percentage) of the cocoons harvested from the group of topical application of acetone solution of Grape Seed Oil (GSO) was found recorded 23.970. Silk shell ratio (percentage) of the cocoons harvested from the group of topical application of acetone solution of Linalool was found recoded 27.989. Silk shell ratio (percentage) of the cocoons harvested from the group of larvae received mulberry leaves treated with Drakshasav was found recorded 28.989.

Denier scale of silk obtained from the cocoons harvested from the group of the Untreated Control Group; Acetone Treated Control and Water Treated Control Group was found recorded 3.243; 3.243 and 3.241 respectively.

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Table-1: Characters of the fifth instar larvae of silkworm treated with Vitis derived herbal juvenoid formulations.

Parameter Group	Fifth Instar Larval Life Duration (Hours)	Fifth Instar Larval Weight (Gram)	Fifth Instar Silk Gland Weight (Gram)	Tissue Somatic Index of Silk Glands
Untreated Control	145.33 (± 13.786) 00.000	03.478 (±00.332)	01.093 (±00.107)	31.426
Acetone Treated (Topical) Control	145.33 (± 13.786) 00.000	03.478 (±00.337)	01.093 (±00.111)	31.426
Water Treated (Through Mulberry Leaves) Control	146.59 (± 13.003) 00.867	03.478 (±00.339)	01.093 (±00.119)	31.426
Acetone Solution of Grapeseed Oil Treated (Topical)	168.73* (± 13.221) 16.101	05.294* (±00.569) 52.213	02.786* (±00.213) 154.89	52.625*
Acetone Solution of Linalool Treated (Topical)	177.46** (± 13.786) 22.108	05.479** (±00.623) 65.353	02.889* (±00.339) 186.00	52.728*
Aqueous Solution of Drakshasav (Through Mulberry Leaves)	162.87** (± 14.572) 12.069	05.563** (±00.786) 59.948	02.935** (±00.362) 168.52	52.759**
Acetone Solution of Grapeseed Oil Treated (Topical) followed by Aqueous Solution of Drakshasav (Through Mulberry Leaves)	168.58*** (± 18.789) 15.998	05.786*** (±00.674) 66.359	03.116*** (±00.519) 173.01	53.854***

- Each figure is the mean of the three replications; -Figure with ± sign in the bracket is standard deviation.; -Figure below the standard deviation is the increase for calculated parameter and percent increase for the others over the control.
*: $P < 0.05$; **: $P < 0.005$; ***: $P < 0.01$

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Table-2: Characters of cocoon spun by the fifth instar larvae of silkworm treated with Vitis derived herbal juvenoid formulations.

Parameter Group	Weight of Whole (with floss) Cocoon (Gram)	Weight of Whole (without floss) Cocoon (Gram) (A)	Weight of Silk Shell of Cocoon (without floss) (Gram) (B)	Silk Shell Ratio [(B÷A) x 100]
Untreated Control	2.962 (±0.439) 00.000	2.873 (±0.441) 00.000	0.558 (±0.017) 00.000	19.422
Acetone Treated (Topical) Control	2.962 (±0.487) 00.000	2.873 (±0.493) 00.000	0.592 (±0.033) 00.000	19.422
Water Treated (Through Mulberry Leaves) Control	3.146 (±0.831) 00.000	3.051 (±0.557) 00.000	0.593 (±0.041) 00.000	19.436
Acetone Solution of Grapeseed Oil Treated (Topical)	5.381* (±1.078) 81.667	5.219* (±1.081) 81.667	1.251* (±0.069) 124.19	23.970*
Acetone Solution of Linalool Treated (Topical)	5.596** (±1.788) 88.667	5.427** (±1.149) 88.896	1.519** (±0.347) 172.22	27.989**
Aqueous Solution of Drakshasav (Through Mulberry Leaves)	5.691*** (±1.739) 92.133	5.519*** (±1.557) 92.098	1.548*** (±0.786) 176.88	28.048***
Acetone Solution of Grapeseed Oil	5.738*** (±2.013) 93.720	5.564*** (±1.786) 93.665	1.579*** (±0.998) 182.79	28.378***

- Each figure is the mean of the three replications; -Figure with ± sign in the bracket is standard deviation.; -Figure below the standard deviation is the increase for calculated parameter and percent increase for the others over the control.
*: P < 0.05; **: P < 0.005; ***: P < 0.01

Table-3: Characters of silk reeled from the cocoon spun by the fifth instar larvae of silkworm treated with Vitis derived herbal juvenoid formulations.

Parameter Group	Silk Filament Length (meter) (C)	Silk Filament Weight (gm) (D)	Denier Scale of Silk Filament [(D ÷ C) x 9000]
Untreated Control	1173.88 (±119.53) 00.000	0.423 (±0.087) 00.000	3.243 00.000
Acetone Treated (Topical) Control	1173.88	0.423	3.243

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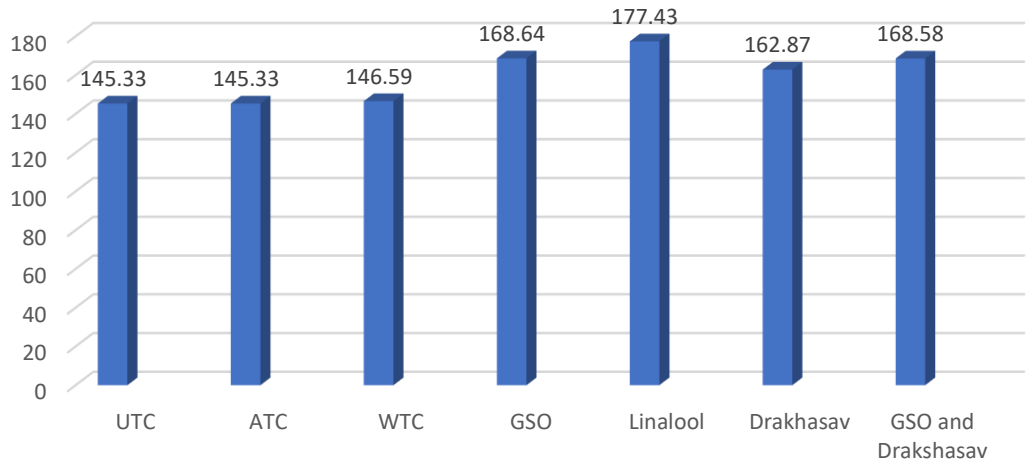
	(±119.53) 00.000	(±0.087) 00.000	00.000
Water Treated (Through Mulberry Leaves) Control	1171.84 (±113.52) 00.000	0.422 (±0.089) 00.000	3.241 00.000
Acetone Solution of Grapeseed Oil Treated (Topical)	1497.21* (±216.64) 27.543	0.783** (±0.123) 85.106	4.706*** 01.463
Acetone Solution of Linalool Treated (Topical)	1494.61* (±169.55) 27.322	0.796** (±0.118) 88.179	4.793*** 01.550
Aqueous Solution of Drakshasav (Through Mulberry Leaves)	1509.55* (±173.55) 28.594	0.819** (±0.129) 93.617	4.882*** 01.639
Acetone Solution of Grapeseed Oil Treated (Topical) followed by Aqueous Solution of Drakshasav	1533.28* (±352.78) 30.616	0.843** (±0.387) 99.290	4.948*** 01.705

- Each figure is the mean of the three replications; -Figure with ± sign in the bracket is standard deviation.; -Figure below the standard deviation is the increase for calculated parameter and percent increase for the others over the control.
*: P < 0.05; **: P < 0.005; ***: P < 0.01

Fig.1.A: Influence of grape seed oil, linalool and Drakshasav on the age (Hours) of fifth instar larvae of silkworm, *Bombyx mori* (L.)



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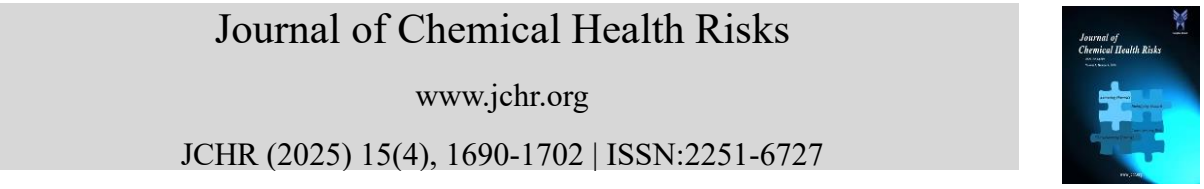


Fig.1.B: Influence og grape seed oil (GSO); Linalool and Drakshasav on Tissue Somatic Index (TSI) in the fifth instar larvae of silkworm.

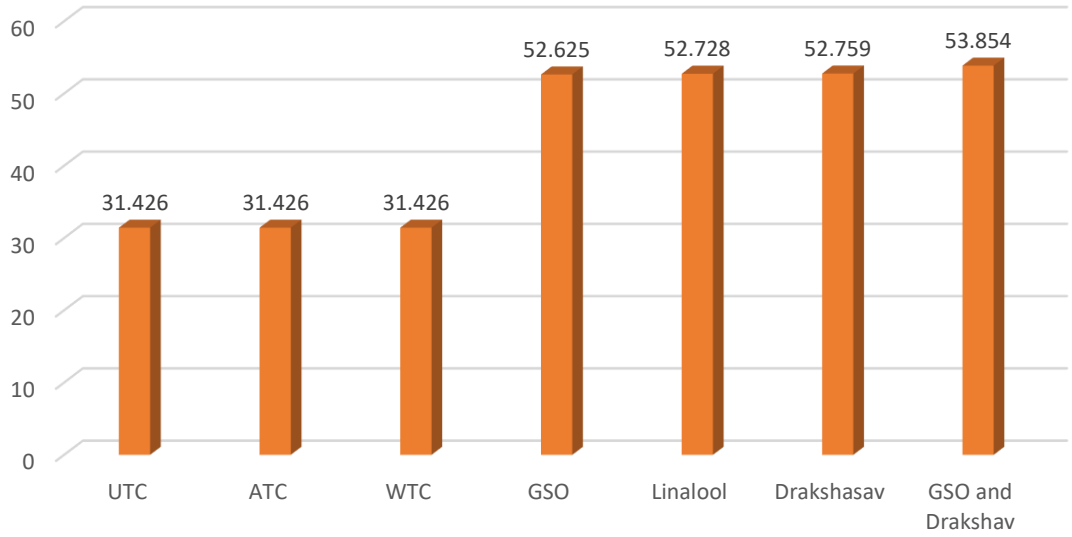
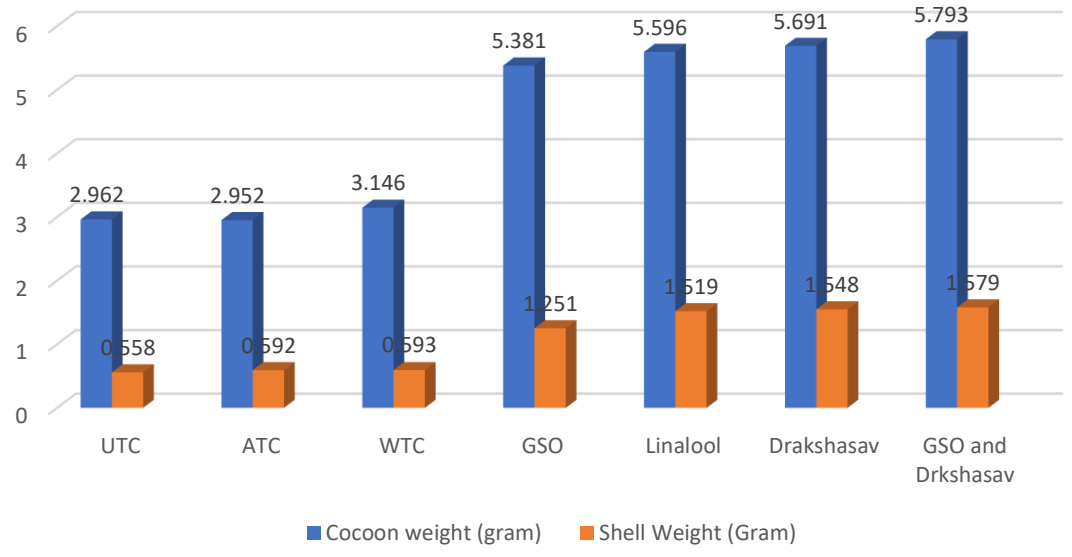


Fig.2.A: Influence of Grape Seed Oil (GSO); Linalool and Drakshasav on the parameters of cocoon (cocoon weight and shell weight) spun by silkworm, *Bombyx mori* (L.).



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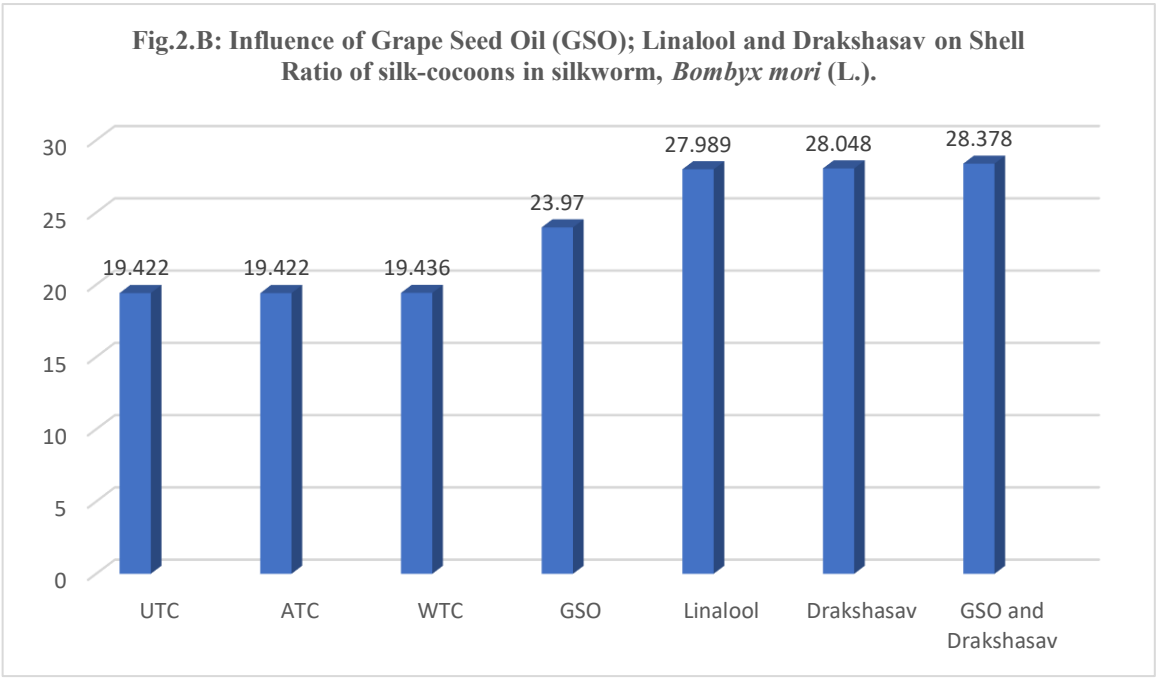

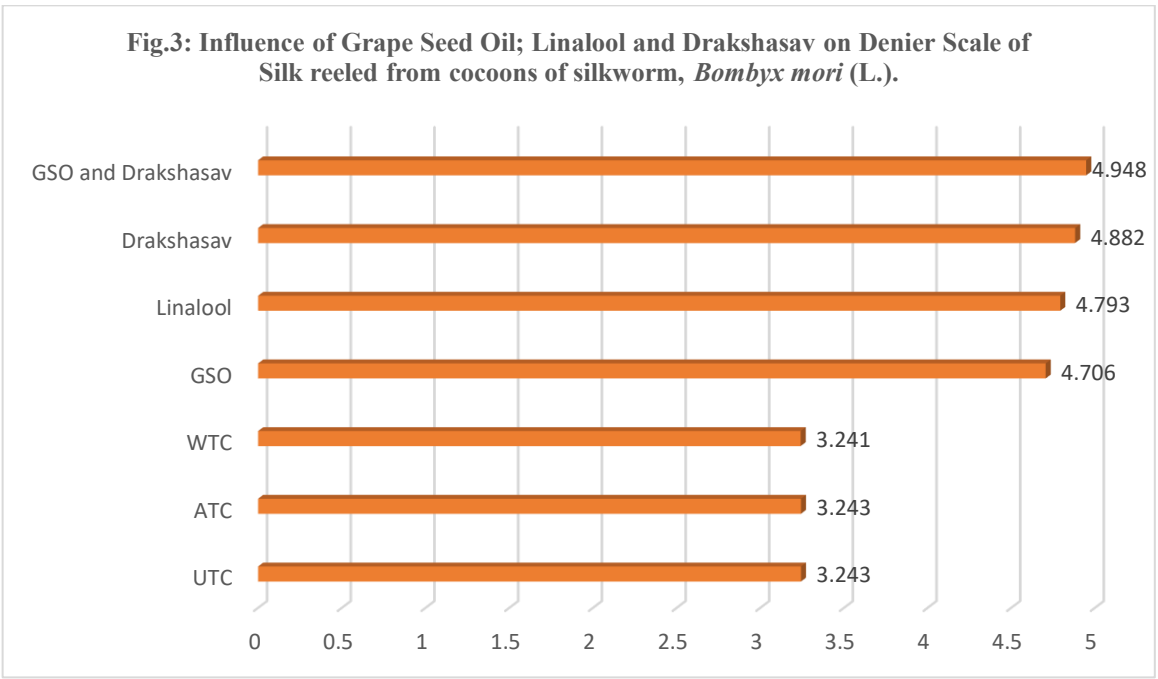

The Denier scale of silk obtained from the cocoons harvested from the group of Grape Seed Oil Treated (GSO) Group was found recorded 4.706 units. The Denier scale of silk obtained from the cocoons harvested from the group of the group of Linalool Treated group was found recorded 4.793 units. The Denier scale of silk obtained from the cocoons harvested from the group of larvae received the mulberry leaves treated with aqueous solution of Drakshasav was found recorded 4.882 units. The Denier scale of silk obtained from the group of larvae treated with acetone solution of Grape Seed Oil (GSO) followed by feeding the mulberry leaves treated with aqueous solution of Drakshasav was found recorded 4.948 units.

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The foremost and significant feature in sericulture lies in the silk yield in the form of silk-cocoon prepared (spun) by mature fifth stage silkworm larvae. The silk cocoon is the sole source for commercial silk-filament (silk fiber). Extension of the life of is the significant feature of insect larvae recipient of exogenous chemical compounds with juvenoid activity. Most of the compounds of "terpene" category utilized for treatment (for spray /topical application) to the silkworm larvae are mimicking the working mechanism of natural insect Juvenile Hormone Analogue (JHA) [20,21,22,23,24,25]. The significant increase (12.069 to 22.108 percentage) in the age of fifth instar larval stage in present attempt is sufficient to label the Grape Seed Oil (GSO); Drakshasav and Linalool as "Herbal source Insect Juvenoid Formulation" and "Insect Juvenoid compound" respectively. Most possible working mechanism of "Herbal source Insect Juvenoid Formulation" and "Insect Juvenoid compound" is to extend the larval duration / age. The larval instars of silkworm may have been utilized the system of extension of larval life for more consumption of food material, more secretion of silk, spinning the larger and fortified silk shell. For the fortification of the concept, further studies (on effect of Grape Seed Oil (GSO); Drakshasav and Linalool on chitin deposition in insect larval stages) are essential.

Use of "Herbal source Insect Juvenoid Formulation" and "Insect Juvenoid compound" for rearing the larval stages of silkworm appears to be much more easy method. Utilization of "Herbal source Insect Juvenoid Formulation" and "Insect Juvenoid compound" is going to open a new boulevard (avenue) in sericultural practices for the quantitative and nuanced research findings (qualitative) of yield of silk.

CONCLUSION:

The present attempt reports significant influence on the yield of silk through the utilization of acetone solution of Grape Seed Oil (GSO); Linalool for topical applications and feeding the larvae with mulberry leaves treated with aqueous solution of "Drakshasav" at forty-eight hours after the fourth moult to the fifth instared larval stages of silkworm, *Bombyx mori* (L) [Race: Double Hybrid - (CSR6 x CSR26) (hybrid bivoltine) x CSR2 x CSR27(hybrid bivoltine)]. The result on the "increase in the age of larval stage of silkworm, *Bombyx mori* (L) [Race: Double Hybrid - (CSR6 x CSR26) x CSR2 x CSR27] in the treated groups is sufficient to label Grape Seed Oil (GSO); "Drakshasav" and Linalool as "Herbal source Insect Juvenoid Formulation" and "Insect Juvenoid compound" respectively.

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