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Effect of *Aloe vera* Gel Extract on Cocoon and Reeling Parameters of Silkworm *Bombyx mori* L.

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Abstract

An experiment was conducted to study the *Aloe vera* gel extract on cocoon and reeling parameters of silkworm *Bombyx mori* L. during 2008-09. Silkworms reared on mulberry leaves smeared with *Aloe vera* gel extracts exhibited significant differences with respect to *in-vivo* studies the silkworm ($PM \times CSR_2$) reared on mulberry leaves smeared with *Aloe vera* gel extracts 100% concentration at 10^{-3} *Bacillus* sp. Spore dilution had effective enhancement of cocoon weight (1.93 g), shell weight (0.340 g), silk productivity (4.45 cg/day) and filament length (903.94 m) were significantly maximum in 100% *Aloe vera* gel extract, besides lower denier (2.62) compared to other treatments and control.

Key words : *Aloe vera*, Gel extract, Cocoon and reeling parameters, Mulberry, *Bombyx mori* L.

The mulberry silkworm, *Bombyx mori* L. is one of the productive insects exploited for silk of commerce. Mulberry being only food of mulberry silkworm, its nutrient management should aim at nutritional requirements of silkworm like carbohydrates, proteins, minerals and moisture content of mulberry leaves. Silkworms are affected by diseases due to various biological, chemical, physical, nutritional and environmental causes. Being poikilotherms, silkworms respond very quickly to the environmental changes, particularly to temperature and relative humidity. Higher or lower temperature, humidity, ventilation and silkworm feed adversely affect the physiological functions of silkworms, as a result of which they become highly susceptible to diseases (1). *Aloe vera* gel is composed mainly of water (99%) and mono- and polysaccharides (25% of the dry weight of the gel), also contains lignin, salicylic acid, saponins, sterols, and triterpenoids. The fresh gel contains the proteolytic enzyme carboxypeptidase (which breaks down bradykinin), glutathione peroxidase, and several isozymes of superoxide dismutase (2, 3). The *Aloe vera* gel also contains vitamins A, C, E, B_{12}, thiamine, niacin and folic acid, as well as the minerals sodium, potassium, calcium, magnesium, manganese, copper, zinc, chromium and iron (4, 5). Anthraquinones, which are present in *Aloe vera* gel, have direct viricidal effects. The anthraquinone present in *Aloe vera* gel was shown to inactivate various enveloped viruses at low concentrations (6), and exhibit significant antiviral activity. Many higher plants produce organic compounds which possess antimicrobial activities viz., species of *Adathoda vasica* (Adusoge), *Aegle marmelose* (Bilvapatre), *Ocimum sanctum* (Vishnu tulasi), *Phyllanthus niruri* (Kirunelli), *Tylophora indica* (Adumuttadha balli), *Tinospora cordifolia* (Amrutha balli), *Solanum nigrum* (Black nightshade), *Withania somnifera* (Ashwaghanda) and *Aloe vera* (L.) N. Burman.

Methods

The required quantity of fresh leaves of *Aloe vera* were collected and surface sterilized with 70% ethyl alcohol and then washed with sterile distilled water and slit open longitudinally, the gel was scooped with sterile stainless steel knife and homogenized in a domestic mixi and filtered through a sterile stainless steel tea strainer. The extract was filtered through double layered muslin cloth, and extract was maintained as stock solution (100% gel) from which different concentrations were made by using distilled

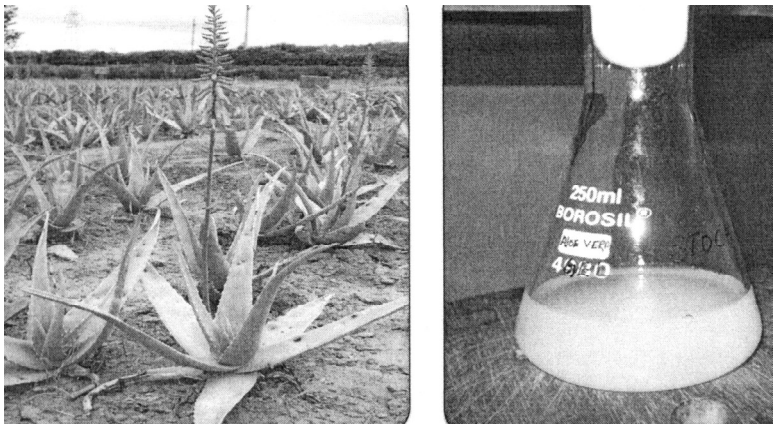

Figure 1. *Aloe vera* plant and stock.

water to arrive at 75, 50 and 25 per cent concentrations. Different concentrations of *Aloe vera* gel extracts were smeared on mulberry leaves and air dried for 5—10 minutes, then fed to the silkworms (PM × CSR_2) once a day during fourth instar first day. The remaining feeds were provided with normal mulberry leaf. The control lot was maintained without any treatment. Hundred uniform worms were maintained in each treatment and each replication. The package of practices for silkworm rearing was carried out as per recommendation (7).

Results and Discussion

Cocoon Weight (g)

Cocoon weight showed significant differences after the worms were fed with mulberry leaves supplemented with *Aloe vera* gel extract ; 100% concentration of *Aloe vera* gel extract exhibited increase in the cocoon weight registering 1.93 g. The lowest cocoon weight was noticed in control (1.84 g) (Table 1).

Sujatha and Rao (8) studied that the application of *C. longa* stem extract on fourth instar larvae resulted in higher cocoon weight. Patil (9) observed that the larvae of *B. mori* administered with crude extract of *T. terrestris, P. coryleifolia* at 1,000 µg/larva registered increased cocoon weight of 1.6 and 1.8 g when compared to control (1.4 g). Similar, results were obtained by Gayathri (10) who reported an increased cocoon weight due to application of plant extracts of *E. prostrata, T. cordifolia, C. asiatica* and *B. monnieri* compared to controls. Murugesh (11) observed improvement in cocoon weight due to spraying of *T. procumbens, T. terrestris* and *P. hysterophorus* at 0.4% concentration over control. Mahesha (12) indicated an increased cocoon weight due to extrafoliation of *P. hysterophorus* (20%) and *T. procumbens* (30%). Further, based on the findings of Fatima et al. (13) administration of *Aloe vera* extract (100% gel) to silkworm by smearing to mulberry leaf showed increased cocoon weight (1.32 g) over con-

Table 1. *In-vivo* effect of *Aloe vera* (L.) N. Burman gel on cocoon and shell weights, shell ratio, filament length and denier of *Bombyx mori* L. (PM × CSR_2). * = Significant at 5%.

Treatments	Cocoon weight (g)	Shell weight (g)	Shell ratio (%)	Filament length (m)	Denier
T_1—25% *Aloe vera*	1.89	0.325	17.23	833.62	2.72
T_2—50% *Aloe vera*	1.90	0.330	17.30	869.95	2.69
T_3—75% *Aloe vera*	1.92	0.336	17.47	884.84	2.64
T_4—100% *Aloe vera*	1.93	0.340	17.60	903.94	2.62
T_5—Control	1.84	0.315	17.06	808.85	2.77
F - test	*	*	*	*	*
SE ±	0.006	0.002	0.125	2.700	0.015
CD at 5%	0.018	0.007	0.378	8.139	0.045

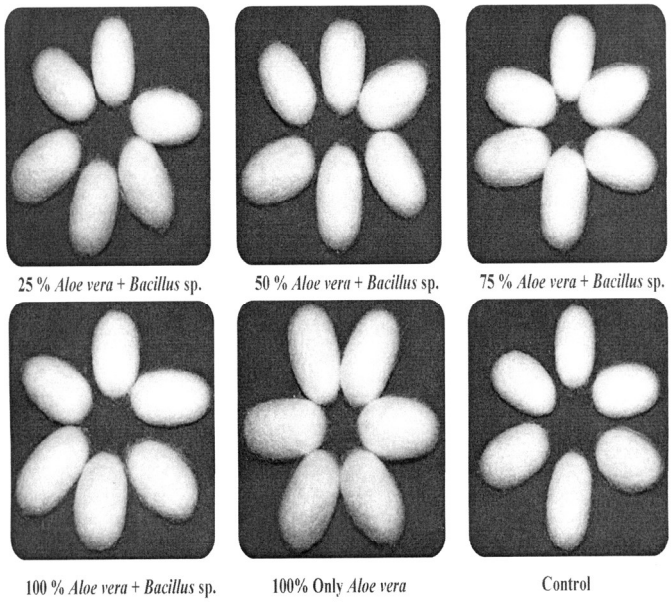

Figure 2. Different concentrations of *Aloe vera* gel and *Bacillus* sp. (10^{-3}) on cocoon.

trol (1.20 g) are in agreement with the present investigation.

Shell Weight (g)

Shell weight showed significant difference after the worms were fed with mulberry leaves supplemented with *Aloe vera* gel extract, where 100 per cent *Aloe vera* gel extract concentration recorded higher shell weight (0.340 g) compared to control which recorded lower shell weight of 0.315 g (Table 1).

The results are in contrast with the findings of Fatima et al. (13) who reported that maximum shell weight was recorded due to the application of *Aloe vera* gel extract (100% gel) (0.26 g) compared to control (0.24 g). Mahesha (12) recorded maximum shell weight due to the application of *P. hysterophorus* and *T. procumbens.* Jeyapaul et al. (14) reported that silkworm fed on mulberry leaves treated with extract of *C. arabica* at the strength of 1 : 25 recorded higher shell weight as compared to control. Murugesh (11) also opined that the application *T. procumbens, T. terrestris* and *B. spectabilis* influenced the shell weight up to 34.0, 31.20 and 28.80% over control. Similar results were reported by Patil (9) on the larvae of *B. mori* L. administered topically with crude extract of *T. terrestris, P. corylifolia* at 1000 µl / larvae registered higher shell weight of 0.293 and 0.311 g when compared to control 0.270 g. Sridevi et al. (15) also recorded higher shell weight with *W. somnifera* followed by *T. arjuna* and *T. cordifolia.*

Shell Ratio (%)

Application of different concentrations of *Aloe vera* extract of 100 per cent concentration (17.60%) recorded higher shell ratio compared to control (17.06%) (Table 1).

These observations are comparable to those of Fatima et al. (13), who reported that administration of *Aloe vera* extract (100% gel) to silkworm by smearing to mulberry leaf showed increased shell ratio (21.92%) significantly over control (20.35%).

These results are also comparable to those of Mane (16), who reported that 10 per cent *A. spinosus, P. hysterophorus* and *T. procumbens* improved the cocoon shell ratio in eri silkworm ; this was inturn due to the insect growth regulatory activity of these plant products. Further, Patil et al. (17), also obtained 18.3% shell ratio in 20 per cent extract of *P. hysterophorus* and 16.5 per cent in aqueous control. The findings of Mahesha (12) also showed the highest shell ratio in *P. hysterophorus* treatment followed by *T. procumbens*. Similarly, Mamadapur (18) and

Santhosh Kumar (19) found the dust application of 5.0% *L. camara* and *C. inermae* leaves increased the shell ratio when applied to two day old fifth instar larvae. Sridevi (20) reported that, application of different concentrations of aqueous extract of *W. somnifera* recorded maximum shell ratio (19.76 and 21.12%) in case of $CSR_2 \times CSR_4$ and $PM \times CSR_2$.

Silk Filament Length (m)

The longest silk filament length was obtained in 100% concentration of *Aloe vera* gel extract (903.94 m) followed by 75, 50 and 25 percent concentrations (884.84, 869.95 and 833.62 m) respectively, while shortest silk filament was recorded in control (808.85 m) (Table 1).

Similar observations were reported by Fatima et al. (13), who recorded significantly longest filament length of 697.0 m when silkworms were reared on mulberry leaves administered with *Aloe vera* gel extract (100% gel). Murugesh (11) also reported that exogenous administration of leaf extracts of *T. procumbens, T. terrestris* and *P. hysterophorus* improved filament length. Patil et al. (17) reported longest filament of 873 m due to supplementation of 20% *Parthenium* leaf extract. Bhaskar et al. (21) also recorded longest silk filament length in *W. somnifera* leaf extract followed by *S. androgynous* and *P. niruri* compared to control. According to Mamadapur (18) dusting of 5% *L. camara* and *C. inermae* leaf powder on two day old fifth instar larvae increased the silk filament length. The silk filament length of 958.2 m was obtained when *P. coryleifolia* treated mulberry leaves were fed to silkworms. Gayathri (10) also recorded longest silk filament length with mulberry and *E. prostrata* leaf extract followed by *C. asiatica* and *T. cordifolia* compared to normal control. The present findings are also in close conformity with Murari et al. (22) who recorded significantly longest filament length of 983.86 m when silkworms were reared on mulberry leaves sprayed with *C. sativus* plant extract.

Denier

Administration of mulberry leaf smeared with *Aloe vera* gel extract to the larvae of *B. mori* produced significant results with respect to denier. Finer denier was recorded in 100% *Aloe vera* gel extract (2.62), while the control recorded coarser denier (2.77) (Table 1).

The present results are in agreement with that of Mahesha (12), where extrafoliation of aqueous leaf extracts of *P. hysterophorus* and *T. procumbens* recorded lowest denier values of 2.28 and 2.29 in NB_{18} and 2.31 and 2.34 in $PM \times NB_{18}$ breeds compare to control which was 2.39 in NB_{18} and 2.59 in $PM \times NB_{18}$. Patil et al. (17) recorded reduced denier due to supplementation of 20% *Parthenium*. According to Mamadapur (18) and Santhosh Kumar (19) dusting of 5% *L. camara* and *C. inermae* on two days old fifth instar larvae brought down the denier, these findings can be correlated with the present study.

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