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APHRODISIAC EFFECT OF *ALOE VERA* GEL SUPPLEMENTATION IN DIET OF *DROSOPHILA MELANOGASTER* MEIGEN

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ABSTRACT

The well-established model organism *Drosophila melanogaster* Meigen was used in the present study to ascertain the aphrodisiac property of *Aloe vera* gel supplementation in diet on it's mating behaviour and fitness parameters. The results revealed that the gel supplementation enhanced its reproductive performance. Male *Drosophila* individuals with high vigour (short mating latency period) reacted quickly in a female's presence, while a male with less vigour (a large mating latency period) responded slowly. Copulation duration was found to be negatively correlated with mating latency. Treated groups showed longer copulation duration and shorter mating latency period. Female fecundity was observed to be significantly and positively correlated with copulation duration. Increased copulation duration in *A. vera* supplement fed females revealed increased egg lying. Thus, *A. vera* gel supplemented diet enhances the reproductive fitness parameters in *D. melanogaster.*

Key words: *Drosophila melanogaster*, *Aloe vera* gel, antioxidant, aphrodisiac, copulation duration, fecundity, oxidative stress, mating latency, reproductive fitness

Plants have been considered a source of medicine in the past for centuries as they provide nutritional and therapeutic benefits from the presence of an extensive array of secondary metabolites. The plethora of herbs and spices mentioned in traditional medical systems like Ayurveda holds an extra advantage due to its time-tested formulations. Various medicinal plant extracts have been investigated for their fertility activity in animal models. Several reports present the aphrodisiac activity attributed to plants (Adimoelja, 2000; Amin et al., 1996). *Aloe vera* plant has immense ethnopharmacological importance, rich traditional history, and several pharmacological uses. Although there are many studies, only a few studies are available, which demonstrate the reproduction enhancing the potential of *Aloe vera* in different model organisms (Mehrdad and Alireza, 2014).

For most species (*Drosophila melanogaster* Meigen inclusive), two sexes (male and female) must come together or mate to achieve the task of living. *D. melanogaster* has been long time used as a model in evolutionary biology because of its advantages over other animal models, such as its ease-of-use, little space occupation, and short generation time, i.e., its life cycle is short (11-12 days) depending on environmental factors. Besides procreation, coming together has psychological, physical, and social benefits to the union. One main advantage of interest to a biologist is its characterization of life history traits (e.g., life span, fecundity, mating competitiveness). During mating, males of the arthropods transfer substances that suppress female remating propensity, increase the rate of offspring production, stimulate females physically, and weaken sperm from previous matings (Simmons 2001; Edvardsson and Canal 2006). Copulation duration in arthropods has a significant effect on the outcome of sperm competition through several mechanisms (Simmons, 2001; Barbosa, 2011). Some males prolong copulations to guard females to keep away other males from mating (Simmons 2001). These adaptive strategies were found to increase reproductive success in a competitive environment (Singh and Singh 2014). In *D. melanogaster*, mating latency is one of the parameters, which indicates the vigour of male *Drosophila* individuals. Successful mating depends on male activity and female receptivity.

Aphrodisiacs are substances that stimulate or increases sexual desire and performance. Fecundity is a measure of reproduction in *D. melanogaster*, an estimate of the number of potentially viable embryos

(eggs) laid by the animal. Fecundity can be a direct estimate of the number of young flies that emerged within a given period. It is equally a widely used proxy for fitness estimation in animals. Therefore, in the present study, copulation duration and mating latency of male individuals and fecundity of female individuals of *D. melanogaster* were analyzed to evaluate the aphrodisiac potential of *Aloe vera* gel.

MATERIALS AND METHODS

Wild type Oregon-K *D. melanogaster* flies were used in the experiment conducted at the Department of Biotechnology, University Institute of Engineering and Technology, Maharshi Dayanand University, Rohtak from October 2018 to December 2019. The flies were separated between 9.00 and 11.00 am, a suitable time for eclosion according to the biological rhythm. Virgin flies (n= 500) were separated genderwise by identifying the sex comb present on the forelegs of male. Both male and female individuals were further divided into control and treated groups. Control groups were provided standard *Drosophila* diet, whereas treated groups were provided with *Aloe vera* gel diet in 3ml, 5ml, and 7ml concentration/ l of regular diet. On the 6th day, mating assays were performed. Control and *A. vera* treated males were allowed to mate control, and treated females separately and vice versa. Copulation duration and mating latency were observed for mated pairs (30 pairs/ group) at 9.00 to 11.00 am. After mating, inseminated females were put in their respective fresh food vials, i.e., control females in standard *Drosophila* food and treated females in *A. vera* supplemented diet. The daily fecundity of all the four groups was counted for two weeks. The fecundity period from 7th to 21st day is considered the peak time for egg-laying in *Drosophila* individuals. For all the traits (copulation duration, mating latency and fecundity) mean values along with SE were used for analyses. Trait variability within as well as between treatments groups was analyzed through ANOVA. Statistical calculations and illustrations were made with the help of Statistica 5.0.

RESULTS AND DISCUSSION

In the present study, copulation duration was observed to be longer in experimental culture than in control culture; and mating latency was observed to be maximum with control culture compared to those from *A. vera* supplemented ones. For treated groups, 5 ml concentration of *A.vera* gel is more effective in decreasing the mating latency period and improving the copulation duration than 3 and 7 ml concentration (Fig. 1). Copulation duration was found to be negatively correlated with mating latency (Fig. 2), and fecundity improved with *A. vera* gel supplementation (Fig. 3). Both mating latency and copulation duration are affected by *A. vera* gel supplementation. A decrease in mating latency means an increase in the vigour of males. Thus, *A. vera* gel in diet increased the copulation duration in *D. melanogaster*. *Aloe vera* gel also affects mating latency. These results corroborate with those of previous studies which show that male *Drosophila* individuals with high vigour responded quickly in the presence of a female fly whereas male with fewer vigour response was slow (Eastwood and Burnet, 1977; Markow, 1998). Courtship is a prerequisite for copulation in *D. melanogaster*. Copulation duration is the time between initiations of copulation to termination of copulation of each pair. Naturally, copulation is severely affected when courtship is affected. The results revealed that *A. vera* gel affects behaviour, thus affecting copulation duration. Dieng et al. (2018) observed that the herbal

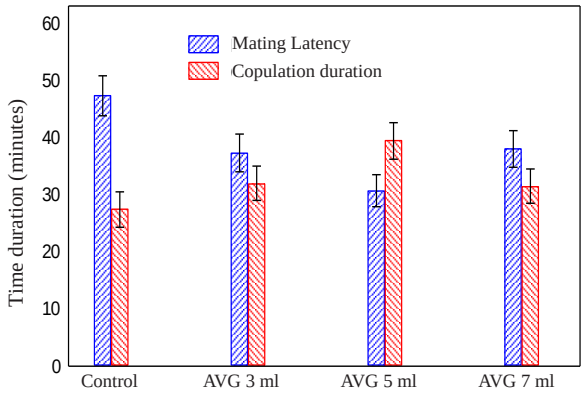

Fig. 1. Mating latency and copulation duration in *D. melanogaster*

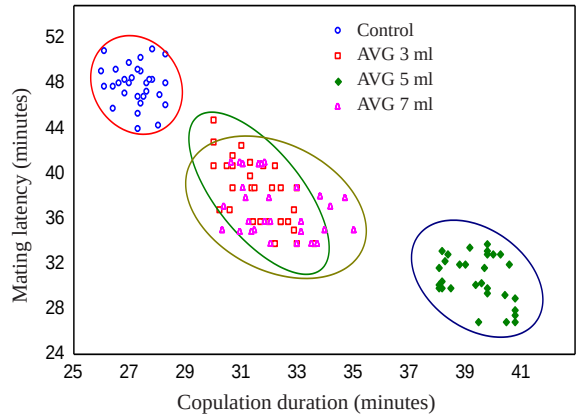

Fig. 2. Mating latency vs. copulation duration in *D. melanogaster*

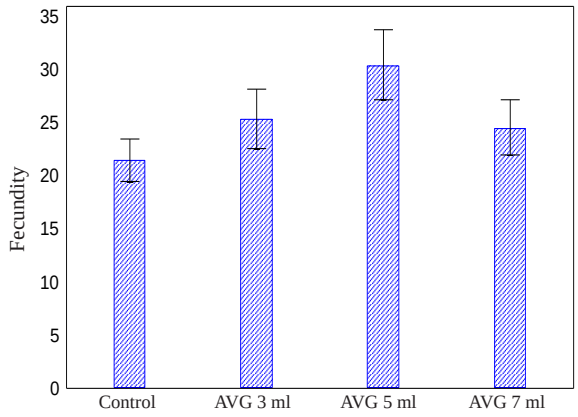

Fig. 3. Fecundity in *D. melanogaster*

aphrodisiac *Eurycoma longifolia*, stimulated the sexual activity of *Aedes aegypti* and may be useful for improving the mating competitiveness of sterile males. Mehrdad and Alireza (2014) observed that *A.vera* supplementation affects spermatogenesis in mice directly via stimulating activity of germinal cells and indirectly via stimulating Leydig cells and increasing testosterone hormone affecting the pituitary-hypothalamus-testis axis.

Varsha (2013) observed that the aqueous *Moringa oleifera* seed extract enhanced the sexual behaviour in male rats. According to Pathak et al. (2011), a longer duration of copulation permits the transfer of more sperms. This extension of copulation duration enhances the fitness of males. Fecundity is one of the fitness parameters in the different *Drosophila* spp. The present results observed a significant increase in the number of eggs laid with *Aloe vera* supplemented flies. Egg production depends on the quantity of sperm transferred during copulation (Ullah et al., 2017). The positive correlation between copulation duration and fecundity indicated that the seminal substances helped females increase their egg production and, in a time-dependent manner. It is believed that oogenesis requires a stimulus, such as seminal fluid proteins produced in the reproductive tract tissues of male *D.melanogaster*, which is transferred to females during mating; thus, stimulus induces egg production, ovulation, and/or egg-laying rates (Avila et al., 2011). *Aloe vera* supplemented groups, have increased fecundity and it may be accounted for because the phytochemicals of *A.vera* gel help male flies copulate for a longer period. Several reports support the view that chemicals alter the fertility in *Drosophila* (Pathak et al., 2011; Clare and Luckinbill, 1985; Graves, 1993). In conclusion, it is observed that worldwide numerous herbs have been used in one form or other for improving sexual performance. The utilization of herbal medicine and safer herbal products for improving sexual dynamics could provide ameliorative effects of sexual dysfunction. The present study has shown that *A. vera* gel has aphrodisiac property, which has enhanced copulation duration and reduced mating latency of male *Drosophila* individuals.

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