anesthetized using CO_2 and identified using a dichotomous key of North American Drosophilids. Female flies of species requiring male characteristics for identification were held in vials containing Carolina Instant Media + 5% propionic acid + yeast until they produced offspring; then their male offspring could be identified.

During the 2013 survey, we encountered 13 *Drosophila* species, nine of which were found during the 1986 survey, along with four new species: *D. algonquin*, *D. putrida*, and *D. simulans*, and *D. suzukii* (Table 1). *D. suzukii* did not appear in collections until August, possibly a result of die-off during the preceding winter. Perhaps of some concern, when considering total fly counts during the year, the invasive *D. suzukii* ranked as the most common species in the Philadelphia area in 2013 (Figure 1).

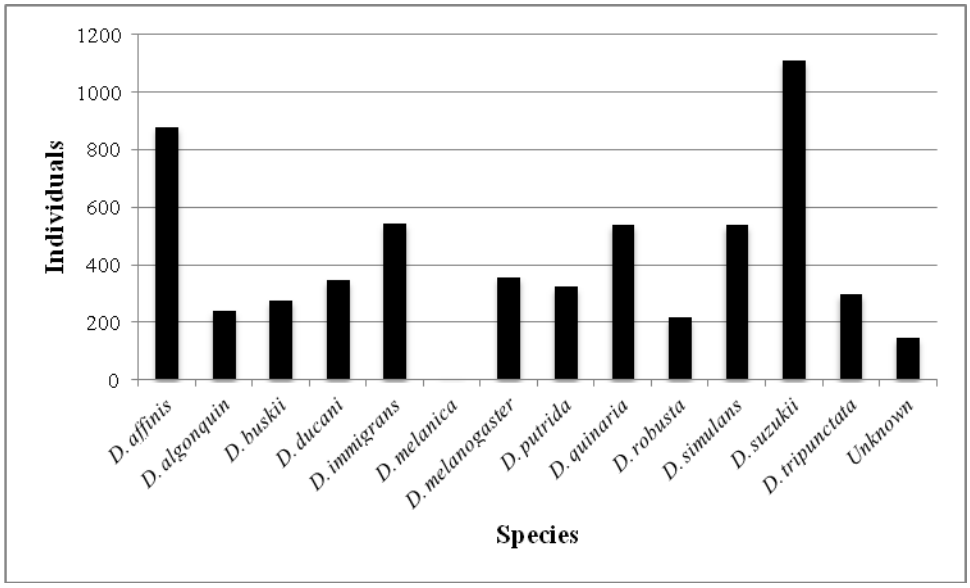

Figure 1. Total individuals/species for 2013.

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References: Bolda, M.P., R.E. Goodhue, and F.G. Zalom 2010, Update, University of California Giannini Foundation of Agricultural Economics 13: 5–8; Carvajal, J.I., 2010, Dros. Inf. Serv. 93: 67-68; Cini, A., C. Ioriatti, and G. Anfora 2012, Bulletin of Insectology 65: 149–160; Freda, P.J., and J.M. Braverman 2013, Entomological News 123(1): 71-75; McRobert, S.P., and L. Tompkins 1983, Dros. Inf. Serv. 59: 143; McRobert, S.P., and L. Tompkins 1986, Dros. Inf. Serv. 63: 95; Walsh, D.B., M.P. Bolda, R.A. Goodhue, A.J. Dreves, J. Lee, D.J. Bruck, V.M. Walton, S.D. O'Neal, and F.G. Zalom 2011, Journal of Integrated Pest Management 2(1): G1-G7.

Extension of *Drosophila melanogaster* lifespan by *Decalepis hamiltonii* root extract.

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Introduction

Harman's free radical theory of aging (Harman, 1956) proposes that the free radicals, such as highly reactive derivatives of oxygen, are produced during the normal course of cellular metabolism. The organism fails to counteract all the damage done to macromolecules by free radicals as the balance between oxidants and antioxidants, such as free radical-detoxifying enzymes, acts in favor of oxidants. Over a period of time, these unrepaired damages accumulate due to the altered homeostasis leading to aging and death.

The hypothesis that states free radicals, or more specifically oxygen radicals, cause the biological damage leading to the physiological decline is only now beginning to be adequately appreciated. Although there is no general agreement about the mechanisms underlying aging, the free radical theory of aging has held considerable appeal for many years. Some predictions were made from the free radical theory. According to these, adding antioxidants to the diet that changes the balance between oxidants and antioxidants should increase longevity. Increase in the activity of antioxidant enzymes is also expected to increase longevity. Attempts to relate free radical theory to lifespan in *Drosophila* were initiated by Loeb and Northrup (1917). *Drosophila* is particularly an attractive model to study the aging process as many candidate plant compounds can be easily mixed with food for feeding the larvae or adult flies. The *Drosophila* model could be useful for translational research for discovery of new therapeutic strategies to prevent or ameliorate age-related damage including neurodegenerative disorders (Kim *et al.,* 2011).

Natural compounds with free-radical scavenging activity play a potential role in maintaining human health and preventing diseases. Antioxidant phytochemicals promote human health by exhibiting diversified physiological and pharmacological effects namely, inactivating carcinogens, stimulating the immune system, protecting the heart from free-radical attack, and in preventing the eye lens cataracts (Srivastava *et al.,* 2011). Studies have shown that plant-derived antioxidant nutraceuticals scavenge free radicals and modulate oxidative stress-related degenerative effects (Thatte *et al.,* 2000). There is a great deal of interest in newer natural bioactive molecules with health-promoting potential (Srivastava *et al.,* 2006). Uysal *et al.* (2009) reported that an aqueous extract obtained from the lichen *Usnea* (*Dolichousnea*) *longissima* Ach. (Ascomycota, Parmeliaceae) enhanced lifespan and fecundity of *D. melanogaster* at low doses, but had deleterious effects at higher doses. In addition, the extract obtained from the epiphytic lichen *Lobaria pulmonaria* (L.) Hoffm. (Lobariaceae) caused a dose-dependent increase in the longevity of male and female populations of *D. melanogaster* (Uysal *et al.,* 2010).

Decalepis hamiltonii (family: Asclepediaceae) grows wild in the forests of peninsular India. Its tubers are consumed as pickles and also as juice for its health-promoting properties (Harish *et al.,* 2005; Srivastava *et al.,* 2006). The root extract of *D. hamiltonii* is a cocktail of novel antioxidants that exhibit cytoprotective and chemoprevention potential *in vitro* and *in vivo* (Srivastava *et al.,* 2007, 2011, 2012). *D. hamiltonii* root extract also shows neuroprotective property *in vivo* in *Drosophila* (Jahromi *et al.,* 2013). In view of the health-promoting potential of *D. hamiltonii* root extract, we investigated whether it could have an impact on longevity in *Drosophila*.

Materials and Methods

Drosophila melanogaster (Oregon K strain) obtained from the Drosophila Stock Center, Manasagangotri, Mysore was employed for the study. This stock was maintained in a vivarium at 22 ± 1°C on standard wheat cream agar medium with 12:12 light and dark cycles. Synchronized eggs

were collected (Delcour, 1969) and were raised under uniform conditions of temperature, humidity, food medium, and density. The flies obtained from these cultures were used for the adult lifespan assay. Both methanolic and aqueous extracts of *D. hamiltonii*, which are mixed thoroughly in the cream agar medium, were used for the present study. Three concentrations of aqueous extract (0.1%, 0.5%, and 1%) were prepared and were mixed into the culture medium. The flies obtained from standard experimental cultures served as control. Mixing and feeding of flies with the extract were standardized. This medium was changed every 5-7 days depending upon the condition of the culture media. Five vials for each concentration (20 flies in each vial) were taken. The mortality rate was recorded every day. This procedure was carried out until the death of all flies in all the vials.

Results

Lifespan assay carried out with *D. hamiltonii* extract showed that the methanolic extract does not have much effect in extending lifespan when compared with the aqueous extract in *Drosophila melanogaster*. Therefore, for the current study, only aqueous extract was employed. Our results revealed significant effect of *D. hamiltonii* on lifespan extension in *D. melanogaster* (Figure 1). This result further showed a difference in the male and female lifespan ratio of *D. melanogaster* fed with *D. hamiltonii*. There was a significant survivability of females over males both in flies treated with and without *D. hamiltonii*. There was also significant difference in the lifespan between males and females in both control and *D. hamiltonii*-fed groups. 1% aqueous extract was found to significantly extend the lifespan more than the other two lower concentration extracts. Therefore, 1% aqueous extract was employed for all the experiments that were conducted later.

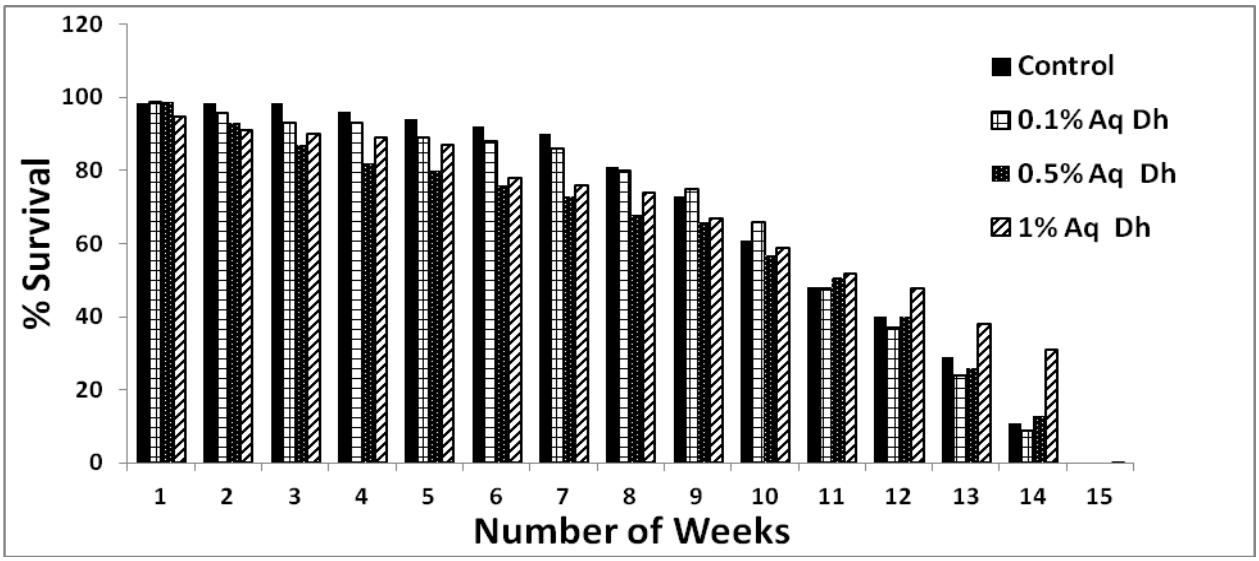

Figure 1. Survival curves of *D. melanogaster* fed with 0.1%, 0.5%, and 1% aqueous (Aq) *D. hamiltonii* (*Dh*) root extract.

Discussion and Conclusion

Oxidative stress occurs when a variety of antioxidant defense mechanisms are overwhelmed by environmental exposure or intrinsic factors, and may lead to cell damage and death. Therefore, major focus of therapeutic research has been to reduce oxidative stress using antioxidant compounds.

Peng *et al.* (2009) have showed that black tea extract, a mixture of epicatechins and theaflavins, when added to the culture medium, prolonged the survival of wild-type *Drosophila* exposed to paraquat or hydrogen peroxide. Similar beneficial effects on survival were observed with combinations of catechin, epicatechin, and glutathione, which have high superoxide-scavenging activity (*cf.*, Kim *et al.*, 1997). It has been earlier shown that the root extracts of *D. hamiltonii* contain at least a dozen distinct antioxidant compounds that scavenge free radicals and chelate metal ions (Harish *et al.*, 2005; Srivastava *et al.*, 2006). In the present study, we have found that the aqueous extract of *D. hamiltonii* significantly extends the lifespan of *D. melanogaster*, which could be attributed to the free radical scavenging and cytoprotective property of the bioactive molecules. Further, we have recently shown that *D. hamiltonii* root extract shows neuroprotective potential in *Drosophila*, which strongly implies that neurodegenerative changes associated with aging are delayed (Haddadi *et al.*, 2013). Therefore, *D. hamiltonii* roots could be useful natural antioxidant-rich supplement that exhibits therapeutic potential in aging individuals.

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References: Delcour, J., 1969, Dros. Inf. Serv. 44: 133–134; Haddadi, M., S.R. Jahromi, T. Shivanandappa, and S.R. Ramesh 2013, Behav. Brain. Res. 249: 8–14; Harish, R., S. Divakar, A. Srivastava, and T. Shivanandappa 2005, J. Agric. Food Chem. 53: 7709–7714; Harman, D., 1956, J. Gerontol. 11: 298–300; Jahromi, S.R., M. Haddadi, T. Shivanandappa, and S.R. Ramesh 2013, Neurochem. Res. 38: 2616–2624; Kim, S.J., J-W. Jung, Y-J. Ahn, L.L. Restifo, and H-W. Kwon 2011, J. Asia. Pac. Entomol. 14: 509–517; Loeb, J., and J.H. Northrup 1917, J. Biol. Chem. 32: 103–121; Peng, C., H.Y. Chan, Y.M. Li, Y. Huang, and Z.Y. Chen 2009, Exp. Gerontol. 44: 773–783; Srivastava, A., S.R. Harish, and T. Shivanandappa 2006, LWT 39: 1059–1065; Srivastava, A., S.R. Harish, and T. Shivanandappa 2006, J. Agric. Food Chem. 54: 790–795; Srivastava, A., L.J.M. Rao, and T. Shivanandappa 2007, Food Chem. 103: 224–233; Srivastava, A., L.J.M. Rao, and T. Shivanandappa 2011, Food Chem. 132: 1959–1965; Srivastava, A., L.J.M. Rao, and T. Shivanandappa 2012, Mol. Cell. Biochem. 364: 1–9; Thatte, U., S. Bagadey, and S. Dahanukar 2000, Mol. Cell. Biochem. 46: 199–214; Uysal, H., D. Altun, H. Askın, and A. Aslan 2009, Fresenius. Environ. Bull. 18: 699–703; Uysal, H., D. Altun, and A. Aslan 2010, TUBAV Bilim. 2: 271–276.

Radiation induced toxicity in *Drosophila melanogaster*.

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Radiotherapy is an important treatment regimen for cancer that could be used as a single treatment or along with surgery and/or chemotherapy. However, use of ionizing radiation is compromised by the side effects that result from radiation-induced damage to normal tissue. Radiation treatment leads to destruction of proliferating cells in tissues, such as lymphoid organs, bone marrow, intestinal crypts, testes, and ovaries, and long-term fibrotic damage to the soft tissues that limit their function (Hall, 2000). *Drosophila melanogaster* is an excellent model organism for