A STUDY OF EFFECTS OF SEED EXTRACTS OF SOME PLANTS ON DEVELOPMENT OF LARVAE, ADULT OVIPOSITION AND HATCHING OF EGGS OF *Aedes aegypti* L.

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DEDICATION

This project is dedicated to Almighty God, the Alpha and Omega and to my parents Dn. and Mrs S. A. Adepoju. Your love throughout the years has greatly enriched my life.

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I give thanks to God Almighty through Jesus Christ my Lord for being my source of strength and sustenance during this work and in my entire life endeavour. Unto him be all the glory, majesty, honour and praise for ever (Amen).

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ABSTRACT

The study determined larval development of *Aedes aegypti* in the boiled and dissolved extracts of *Moringa oleifera, Citrus aurantifolia* and *Carica papaya* and the effects of these plant extracts on ovipostion of *A. aegypti.* It also assessed eggs hatchability of *A. aegypti* in the extracts and compared the effectiveness of boiled and dissolved extracts of the three plant materials with a view to providing information on the effectiveness of plant extracts in biological control of mosquitoes.

Eggs of *A. aegypti* were obtained from Department of Pharmacognosy, Obafemi Awolowo University, Ile-Ife. Larvae were fed with edible yeast until adult emergence and adults were fed with glucose and blood meal. The eggs laid by the females were collected, reared and used for main experiment. The fruits of *M. oleifera, C. aurantifolia* and *C. papaya* were purchased from a local market in Ile-Ife and the fruits were identified and authenticated at IFE Herbarium. Each of the three seeds was ground into powder with a blender. The powdered seeds were measured out in 4, 8 and 12 g and were dissolved in 2 L of distilled cold water for 24, 48 and 72 hours respectively. The same weights of powdered seeds were also put in 2 L of distilled cold water and boiled for 5, 10 and 15 minutes respectively. Each of the mixture was filtered using muslin cloth to obtain clear solutions that were stored in labelled bottles used for subsequent experiments. Data obtained were analyzed using One-way ANOVA and Students' T-test.

Dissolved extracts of *M. oleifera, C. aurantifolia* and *C. papaya* at 24, 48 and 72 hours and in 4, 8 and 12 gL^{-1} concentrations of extracts affected the survival of *A. aegypti* at various developmental stages. *M. oleifera* was the most effective causing significant reduction in adult emergence at 4 and 8 gL^{-1} concentrations with no emergence of adults at 12 gL^{-1} in extracts dissolved for 24, 48 and 72

hours respectively compared with *C. aurantifolia* at the same concentrations with adult emergence of 13.00 ± 3.28, 5.00 ± 2.00 and 0.00 ± 0.00 followed by *C. papaya* with 13.33 ± 1.52, 11.67 ± 4.16 and 3.33 ± 3.05 respectively. The effects of boiled extracts of *M. oleifera, C. aurantifolia* and *C. papaya* were concentration dependent and also increased with increase in period of boiling from 5 - 15 minutes. Number of eggs laid decreased with increase in periods of boiling and duration of dissolved extracts and was also concentration dependent in the three plant seed extracts from 4 - 12 gL^{-1} respectively. The eggs deposited in the dissolved extracts were higher than those deposited in the boiled extracts. *M. oleifera* had the lowest number of eggs in 12 gL^{-1} at 48 hours dissolved extract with 9.00 ± 1.68 eggs and 6.33 ± 3.33 eggs in 12gL^{-1} of 15 minutes boiled extract compared with *C. aurantifolia* (55.75 ± 4.00 and 19.67 ± 2.61 eggs) and *C. Papaya* (78.33 ± 4.67 and 44.67 ± 1.33 eggs). There was hatching in the boiled and dissolved extracts of *M. oleifera, C. aurantifolia* and *C. papaya* at 4 -12 gL^{-1} at various concentrations.

The study concluded that boiled extracts of *M. oleifera, C. papaya* and *C. aurantifolia* at different concentrations were more effective than the dissolved extracts in inhibiting the development of larvae and pupae of *A. aegypti*. There was also reduction in oviposition of gravid females of *A. aegypti* in the boiled and dissolved plant extracts. *M. oleifera* was found be the most effective among the three plant materials in controlling the mosquito.

CHAPTER ONE

INTRODUCTION

1.1 *Aedes aegypti*

Insects are of importantce from public health and agricultural points of view in transmitting diseases while others are pests of stored and field crops (Collins and Paskewitz, 1995). Among species of insects, mosquitoes are very important because they transmit a number of diseases such as malaria, filariasis, dengue, Japanese encephalitis. (Jaswanth *et al.,* 2002). *A. aegypti,* is the primary carrier for viruses that cause dengue fever, dengue hemorrhagic fever, yellow fever, Zika virus and chikungunya fever *(*Yang *et al.,* 2009*)*.

Mosquito-borne diseases have an economic impact, including loss in commercial and labor outputs, particularly in countries with tropical and subtropical climates (Fradin and Day, 2002). Dengue fever has also increased four-fold since 1970 affecting nearly half the world's population (Gubler, 1998). In 1990, about 1.5 billion people lived in regions where the estimated risk of dengue transmission was greater than fifty percent (Hales *et al.,* 2002). Despite its debilitating effects, lymphatic filariasis is given a very low control priority (Ramaiah *et al.,* 2000). In the Western Pacific and Southeast Asia, *Aedes albopictus* has played a secondary role in transmitting dengue viruses during outbreaks (Gubler, 1998; Guzman and Kouri, 2002; Effler *et al*., 2003).

Majority of *A. aegypti* breeding places is primarily in man-made containers, including earthenware jars, concrete cisterns, ant traps containers, and other items that collect rainwater nearby houses (Swaddiwudhipong *et al*., 1992; Chansaeng *et al*.,1993; Kittayapong and

Strickman, 1993; Chareonviriyaphap *et al*., 2003a). *A. aegypti* prefers to rest inside houses, typically in sheltered places such as dark corners, undersides of furniture, hanging objects such as clothes and curtains, and on dark walls (Reiter *et al*., 1992; WHO, 1999; Scott *et al*., 2000a).

1.2 Phytochemicals

Phytochemicals are botanicals which are naturally occurring insecticides obtained from floral resources. Applications of phytochemicals in mosquito control were in use since the 1920s (Shahi *et al.,* 2010) but the discovery of synthetic insecticides such as DDT in 1939 side-tracked the application of phytochemicals in mosquito control programme. After facing several problems due to over application of synthetic insecticides in nature, there was renewed interest on phytochemicals that are easily biodegradable and have no ill-effects on non-target organisms. Since then, the search for new bioactive compounds from the plant kingdom and an effort to determine its structure and commercial production has been initiated. At present phytochemicals make up to one 1 per cent of world's pesticide market (Isman, 1997).

Several groups of phytochemicals such as alkaloids, steroids, terpenoids, essential oils and phenolics from different plants have been reported previously for their insecticidal activities (Shahi *et al.,* 2010). Insecticidal effects of plant extracts vary not only according to plant species, mosquito species, geographical varieties and parts used, but also due to extraction method adopted and the polarity of the solvents used during extraction.

The efficacy of phytochemicals against mosquito larvae vary significantly depending on plant species, plant parts used, age of plant parts, solvent used during extraction as well as upon the available vector species. Sukumar *et al.* (1991) have described the existence of variations in the

level of effectiveness of phytochemical compounds on target mosquito species *vis-à-vis* plant parts from which these were extracted.

1.3 *Moringa oleifera*

Moringa oleifera is the most widely cultivated plant species worldwide (Santos *et al.*, 2009) originating from western and sub-Himalayan region, parts of Asia and Africa (Mughal *et al.*, 1999). Its occurrence has thereafter spread to Cambodia, Philippines, Caribbean Islands and Central North and South America (Morton, 1991). The seeds of the plant exhibit anti-inflammatory, anti-tumor effects (Cáceres *et al.*, 1992) and antimicrobial, antispasmodic and diuretic properties (Babu and Murugan, 1998).

M. oleifera is the most nutrient-rich plant yet discovered. *M. oleifera* provides a rich and rare combination of nutrients, amino acids, antioxidants, antiaging and anti-inflammatory properties used for nutrition and healing (Fuglie, 1999). *M. oleifera* is a miracle tree with a great indigenous source of highly digestible proteins, Ca, Fe and Vitamin C. It contains all the essential nutritional elements that are essential for livestock and human beings as well (Fahey, 2005).