JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Fruit and seed air dispersal mechanism– Inspirational Biomimetics for space exploration

Sowmya M
Assistant Professor
Governament Nature Cure, Yoga Medical College and Hospital
Mysore, Karnataka, India
Email: sowmyaskids@gmail.com

Abstract

Biomimatics on fruit and seed dispersal have improved air/space mission design.Scientists have applied the mechanism of dispersal through glide flight, spin parachute for space exploration. Complex challenges like gravity, vacuum, shock, motion are solved by mechanism of dry seeds and fruit flight in air.

Index Terms - *Adenocalymma allicea* Miser., *Hiptage madablota* Gaertn., Dry seeds and fruits, Biomimatics

Introduction

Seeds are link between successive generations of plants. Seed dispersal is a means of reproduction to spread thedescendantsthroughout the environment. Plants depend onseed dispersal as they lack mobility. The dispersal and survival of seeds are however are at the mercy of environmental factors. The efficient seed dispersal mechanism is dependent on number of seeds, behavioral and morphological adaptability mass, energy etc. Plants because of their adaptability towards change in environment have evolved with desirable characters. They control the development of seeds, design structural components for the dispersal, build molecular machineries to keep seeds dormant till the right timeand release during favourable environmental conditions.The samara seeds like *Adenocalymmaallicea* Miser.glide flight and fruits of *Hiptage madablota*Gaertn. With parachute spin have helped biomimetic solutions for designing air/spacecrafts.

Material and Methods

A. alicea Miser. is an evergreen slender stemmed heavy trendilled ornamental climber with trifoliate conjugate leaves bearing lavender coloured trumpet shaped flowers in large sprays. It flowers and set fruits during March to August. The fruits are 28-32 cm long having 40-50 seeds. The seeds are with lateral papery wings and measure 1.2-1.5×4-4.5 cm (Poornima and Shivamurthy 2006). The winged seeds are shed in mass and reach the ground with gliding flight. *H. madablota*Gaertn.is a handsome evergreen climbing shrub with attractive fragrant flowers and many medicinal properties (Chatterjee and Pakrashi 1994). It flowers and set fruits during March to July. Fruits are samaras with three spreading, papery, oblanceolate to elliptic wings, the middle wing being 4-6 cm long and the two lateral wings 2-3 cm

long. Dry fruits are propelled by wind to places where the seeds are released with parachute spinning flight. The seed germination studies have been conducted under laboratory conditions (Poornima and Shivamurthy 2006).

Seeds of *Adenocalymmaallicea*Fruits of *Hiptagemadablota*

Result and Discussion

A. allicea seeds which are winged samaras have shown gliding flight during dispersal. The gliding seeds have shown maximum lift ratio resulting in minimum rate of descent (Azuma and Okuno 1987). The samaras of *A. allicea* are similar to *Dioscorea japonica*, *Betulapatyphylla* (Miami and Azuma 2003) and *Alsomitra macrocarpa* which is said to have been an inspiration for the wing planform for the first air craft which first flown as kite and then as a glider. This was the first mile stone in aviation history (De Vries 1978). Gliding flights could be used in aerogravity assists. Gravity assist can be used to reduce the launch energy requirements for a given mission or to increase the science return by enabling more planetary, satellite or asteroid encounter. The study of the aerodynamic properties of gliding seeds could give some inspiration to advanced designs of air/spacecrafts performing aerogravity assist (Pandolfi and Izzo 2013). Fruits of *H. madablota* have parachute spinning flight. Spinning seeds have inspired many types of powered monocopters, such as the small unmanned vehicles SAMARAI, resembling the maple seed. In this small hovering monocopter, the active control of the feathering angle is able to generate a lateral motion (Ulrich *et al.* 2010). The self-stabilized descent of spinning seeds has also been studied for passive landing. Autorotation is well known in the aeronautical field, and it is already used to perform unpowered landings in the event of engine failures of helicopters. Similar concepts can be applied for the entry phase of a spacecraft into an extraterrestrial atmosphere. Autorotation could represent a valid alternative to parachutes. During autorotation, in fact, the rotor is not driven by an engine, but by the upward air-flow while the craft is descending (Pandolfi and Izzo 2013). Dispersal mechanisms of plant fruits and seeds have inspired scientists in designing air crafts. Seeds which are dispersed by wind have different modes of flight. The samara seeds of *A. allicea* show gliding flight and fruits of *H .madablota* have parachute spinning performances which could be efficiently used in designing some air/space crafts.

References

1. Azuma A and Okuno Y. 1987. Flight of a samara *Alsomitramacrocarpa.* Jr. Theor. Biol. 129:263-74

2. Chatterjee A and Pakrashi SC. 1994. Malphigiaceae. p130-131. In: the Treatise on Indian medicinal plants. Vol.3 publication and Information Directorate, New Delhi.

3. De Vries J. 1978. Taube dove of war. Temple city:Historical aviation album.

4. Miami S and Azuma A. 2003. Various flying modes of wind-dispersal seeds. Jr. Theor. Biol. 225:1-14

5. Pandolfi C and Izzo D. 2013. Biomimatics on seed dispersl: survey and insights for space exploration. Bioinspir. Biomim. 89.025003.

6. Poornima D and Shivamurthy GR. 2006. Seed germination and viability studies in *Adenocalymmaallicea* Miser. an ornamental woody climber. Jr. Eco. Environ. Cons. 12(1): 151-152.

7. Poornima D and Shivamurthy GR. 2006. Seed studies in *Hiptagemadablota*Gaertn. –a climbing shrub. Jr. Eco. Environ. Cons. 12(2): 305-306.

8. Ulrich E, Pines D and Humbert J. 2010. From falling to flying the path to powered flight of a robotic samara nano air vehicle. Bioinspir. Biomim. 89.025003.