

# **Reproduction of *Ageratum conyzoides* depending on light and flower colour**

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## **Abstract**

This study carried out in Amani Nature Reserve, focused on the reproduction of a grassland plant *Ageratum conyzoides*. The comparison of the Reproduction Allocation (RA) and the density of this species in open and semi-shaded area in two different habitats showed no difference. We carried out the study in five different sites and two different (flower) colour-type of the plant. Reproductive Allocation was not dependent on habitat, but differed from site to site. The mean density showed no difference between the habitats. For the plant with two different colours (violet, white), the leaves and flowers weight showed difference between the two colours of flower. In biomass, violet-flowered plants had high weight than white-flowered plants. White flowers had higher biomass than violet flowers.

## **Introduction**

Amani Natural Reserve (A.N.R) has many species of plants; some endemics while others are alien. Some of the alien plants are invasive and detrimental to native plants or have negative effects on their competitors through root exudates (C. de Mazancourt, 2003). A weed from South America *Ageratum conyzoides* in the family Compositae or Asteraceae also occurs in Amani. Compositae is one of the largest flowering plant family with about 1,100 currently accepted genera, and 25,000 species. Most of its members are evergreen, mostly herbs (V. H. Hewood, 1993). *A. conyzoides* is an annual herb, commonly found on waste ground, and disturbed places. The inflorescence has mauve, blue or white flowers heads. The plant grows between altitudes of 30m-2500m. The plant has medicinal value of healing wounds and is good food for animals (cows) (L. Laugherty, 1997).

In annual plants, the trade off between investment in vegetative growth and reproduction is generally resolved in favour of a simple switch. 100% investment in vegetative growth is followed by a switch to 100% investment in reproduction. It is more usual to find that increased reproduction is correlated with shorter life span. Annual plants appear to have two great advantages: they reproduce early, so they have the potential for very high intrinsic rate of increase, and they can survive adverse condition as dormant seeds in the soil (M. J. Crawley, 1997).

In our early observation in the Amani forest, we noted that *A. conyzoides* is not found under the canopy but only in areas with light. This seemed to suggest that the reproduction and distribution of this species is associated with light intensity. Therefore, we decided to study the effect of light on the reproduction of *A. conyzoides*. We expected that plants in open area have higher reproduction than plants in 43 semi shaded area. Specifically, we hoped to answer the following questions:

- 1) There is difference on reproduction of *A. conyzoides* in the open and semi shaded area?
- 2) There is different on reproduction between white flowers and violet one?

## **Objective**

To compare the reproduction of the *A. conyzoides* in two different habitats of open and semi shaded, and the reproduction and leave density between white- and violet-flowered phenotypes of *A. conyzoides* in A.N.R.

## **Methods**

### **Study site**

The study took place at A. N. R in East Usambara Mountains, Muheza District, Tanga, Tanzania. A. N. R lies at altitude range of 300-1130masl. The area has high rainfall and mean temperature of 20°C. Sampling sites in the reserve were located with a few site far from the rest house on grassland, and studies conducted from 15 to 27 September 2003.

### **Effect of light and reproduction:**

Five sites were chosen, each containing two habitats: open and semi shaded. In each habitat, a transect line, 18m long was established and one (40cm x 40cm) quadrant taken at random every 2 meter. In each quadrant, the number of individual plants was counted and three individuals of small, median and high height dug out for further analysis. Amount of light available in each quadrant was also taken. Later, the total wet biomass of the plants, leaves, flowers, and stem biomass were measured.

### **Effect of colour on pollination and reproduction:**

Plants with two different colours were compared. Three sites were chosen randomly, and three (40cm x 80cm) quadrant taken. Three individuals of each colour were taken randomly. The total biomass, leaf, stem, and flower weights were compared.

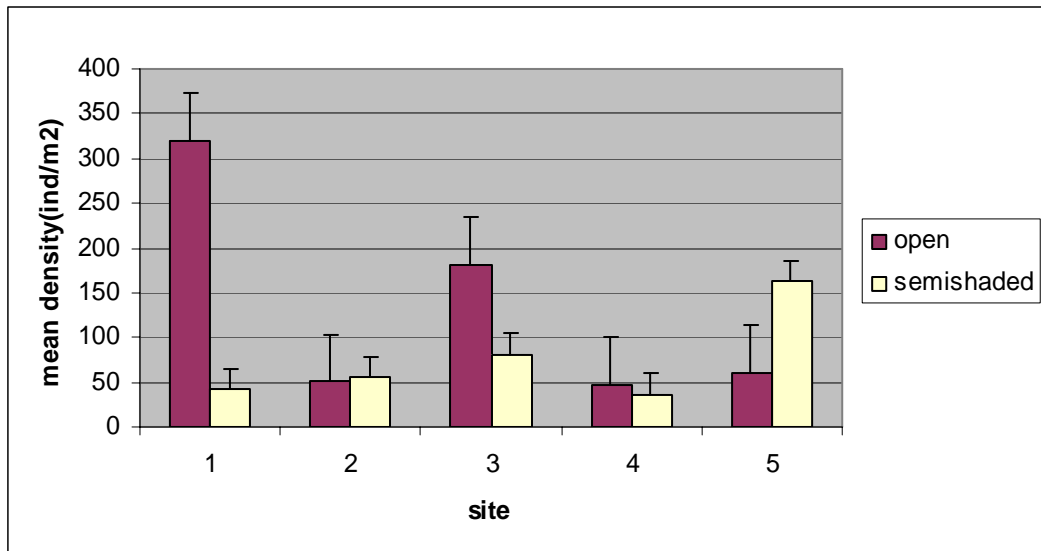
### **Statistical analysis:**

For analysing data, we used Minitab to perform T-test and ANOVA model (Linear General Model).

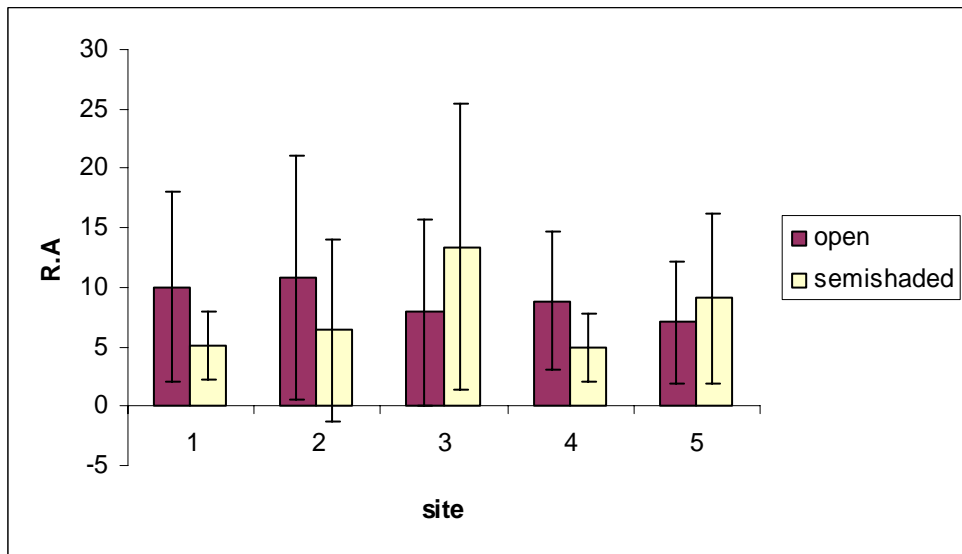
## **Results**

The density of *A. conyzoides* was higher in the open than in the semi-shaded areas in sites 1, 2 and 3 ( $t=2.44$ ,  $df=4$ ,  $p<0.05$ ;  $T=-0.15$ ,  $df=4$ ,  $p<0.05$  and  $t=3.45$ ,  $df=4$ ,  $p<0.05$ , respectively). At site 5 plants were less dense in the open area than in the semi-shaded ( $t=2.75$ ,  $df=4$ ,  $p<0.05$ ). Site 4 had no difference ( $t=1$ ,  $df=4$ ,  $p>0.05$  respectively) in plant density as shown in figure1.

We found that the Reproductive Allocation of *a. conyzoides* in the semi-shaded area lower than in the open area in sites 2 and 4 ( $t=1.16$ ,  $df=9$ ,  $p<0.05$  and  $t=1.52$ ,  $df=9$ ,  $p<0.05$ , respectively). In sites1, 3 and 5, the Reproduction Allocation did not vary between open and semi-shaded areas ( $t=1.82$ ,  $df=9$ ,  $p>0.05$ ;  $t=1.54$ ,  $p>0.05$  and  $t=0.64$ ,  $df=9$ ,  $p>0.05$ , respectively). The results are shown in figure2.

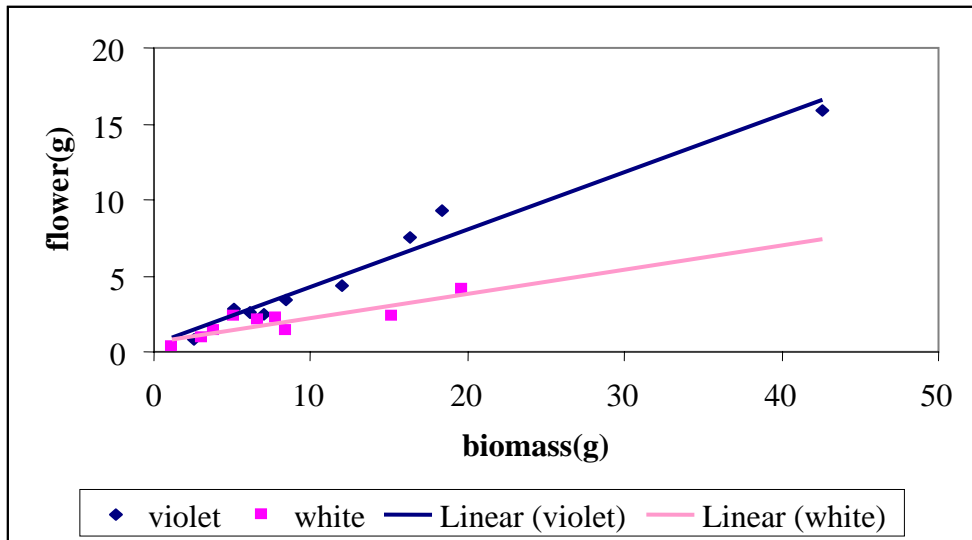


**Figure 1.** Mean density of *A. conyzoides* in open and semi-shaded habitats.

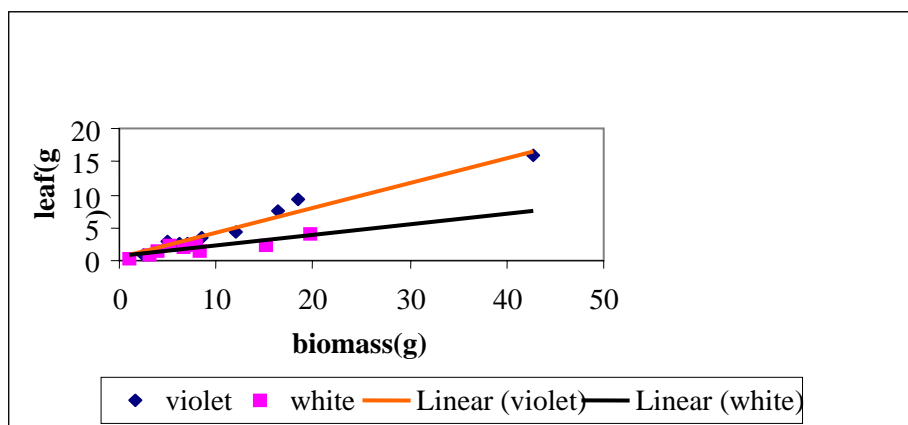


**Figure 2.** Reproductive Allocation (RA) of *A. conyzoides* in open and semi-shaded areas

The comparison reproductive phenotypes showed higher biomass of white than violet flowers for phenotypes of equal total plant biomass. This suggests that Reproduction Allocation was higher in white-flowered than violet-flowered individuals. Similar results were found when the leaf weight of the phenotypes were compared.



**Figure 3.** Flower weight versus biomass for violet and white flowers



**Figure 4.** Leaf weight versus biomass for violet-and white-flowered phenotypes

## Discussion

Reproductive Allocation (R.A) is a percentage of biomass allocated to flowers in flowering plants. The consensus of the study has been that Reproductive Allocation is proportional to total biomass. This study showed that habitat (semi-shaded and open) type had little effect on the density and the Reproductive Allocation of *A. conyzoides*. The difference in R. A and density were not consistent between sites. This indicates that other factors may be more important e.g. amount of shading at each site and soil

composition. The flowers and the leaf weight of the white and violet flowers varied in relationship to plant biomass. The leaves of violet-flowered individuals weighed more than those of plant with white flowers relative to their biomass.

Our observations also showed that, plants with white flowers attracted more insect pollinators, and have a higher Reproductive Allocation than plants with violet flowers. We would expect that plants with white flowers would be more abundant but this was not the case. The low abundance of white flowered individuals might be due to a lower competitive ability (if there is a trade-off between reproduction and competitive ability). This needs to be tested.

For the plant of equal biomass (both white- and violet-flowered), we found that the white-flowered produce more flowers than violet ones. The growth of the plant is limited by hormonal control to switch to reproduction. So, this switch might be depending on genotype which differs between the white and the violet-flowered individuals.

## **Recommendations**

The reproduction of *A. conyzoides* depends on many interactive factors: soil, light, habitat, altitude, competition between plants, etc. Further research should be done on the effects of soil composition, moisture and competition from native plants on the Reproduction Allocation and density of *A. conyzoides* to get better understanding of how this plant allocates resources.

We observed that the leaves of plants growing in semi-shaded areas were bigger, the plant were also larger and with more stem biomass. We suggest further studies into leaf size using the same method except for the mean biomass when we would to take random samples.

## **Acknowledgement**

We are grateful to the Tropical Biology Association for the opportunity to participate in the course. To Dr. Rosie Trevelyan for her assistance and tireless guidance during field work and data analysis. Thanks to our supervisor Dr. Claire de Mazancourt, to Mr.

Anthony Kuria for his advice, to Dr. Thomas Wagner and Prof. Brian Moss for their support, to Mr. Bruno Mallya and Mr. Sawe for their help and the staff of A.N.R for their warm welcome. We share with gratitude, this project to all participants in this course.

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