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The Growth of *Launaea taraxacifolia* (Asteraceae) and its Response to Shading

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Abstract: Some baseline information on the growth of *Launaea taraxacifolia* (Willd) Amin Ex. C Jeffrey was gathered. Rhizomes sprouted within 10 days. The sprouted rosettes bolts in about 56 Days After Planting (DAP) and seeds are formed in about 70-75 DAP. There was only 17% branching in the shoot. Number of flowering branches and number of buds on each flowering branch among other reproductive parameters were observed. Differences were observed in the habit and growth of *L. taraxacifolia* grown in the open and under shade. All growth parameters, except plant height, were significantly reduced by shading (although this was reversed during the flowering stage). Plants in the shade did not flower at all. Nutritionally, *L. taraxacifolia* was observed to be a good source of mineral elements like Phosphorus and Iron. It also contains some protein. The best time for the harvest appears to be between the 6th and 8th weeks after planting.

Key words: *Launaea taraxacifolia*, shade, rhizomes, growth, Asteraceae, vegetable

INTRODUCTION

Launaea taraxacifolia (Willd) Amin Ex. C Jeffrey occurs mainly in the tropics. It is an erect perennial herb with leaves at the base of the stem in a rosette form. The higher leaves are auriculate and toothed with the lower leaves tapering at the base. Apart from its being used as a common vegetable, it is also eaten by some people as a salad or cooked in soups and sauces. *L. taraxacifolia* leaves are fed to lactating cows in northern part of Nigeria (to increase the milk yield) and to sheep and goats mixed with natron to produce multiple births (Burkill, 1985). Medicinally, the leaves are rubbed on limbs to make children in Nigeria and Ghana walk, their leaves are also mixed with ashes to cure yaws (Ayensu, 1978). The Yorubas of southern Nigeria mix the leaves with local bathing black soap to prevent and/or cure skin diseases. Adegbite (1987) reported that the milky latex produced by the plant could be used to cure eye disease known as conjunctivitis/Apollo. The species is said to be so ubiquitously appreciated that the plant features in a Yoruba invocation for someone to become well-known in the community. Obi *et al.* (2006) reported that consumption of *L. taraxacifolia* could, to a large extent, prevent infection, or even if infection has occurred, could prevent further replication of the measles virus. In tests with animals in Ghana, leaves of *L. taraxacifolia* showed a cholesterol-lowering effect (Adebisi, 2004).

It is known as 'yanrin' among the Yorubas of the South-Western part of Nigeria, 'ugu' among the Ibos of the Eastern part of Nigeria and 'nonon barya' among the Hausas of the Northern part of Nigeria. *L. taraxacifolia* is one of the traditional leafy vegetables in Nigeria which are currently endangered, threatened with extinction and are grossly understudied. There are no records of production (Adebisi, 2004). It is mostly collected from the wild even in the rural areas and can be found in the local market, cooked and rolled into balls for sale. According to Ayodele (2005), about

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60% of the documented leafy vegetables are available in the rural areas including 11% obtained in the wild. Only a fraction of leafy vegetables are known to urban dwellers and contribute to their diet. Adebooye *et al.* (2003) reported that most of the leafy vegetables are not easily available as farmers now gather them with great drudgery and difficulty from the few stands available in the wild. Not much is documented about the growth of *L. taraxacifolia* apart from the fact that it has some level of tolerance to drought (Van Epenhuijsen, 1974). It is also known to have low seed viability (Adegbite, 1987). Asexual method of propagation is adopted by sprouting vigorously from proliferating rhizomes. Agronomic research as well as research into its cultivation as a vegetable, are necessary. The objectives of this study were therefore to obtain and document baseline information on the growth and development pattern of *L. taraxacifolia,* quantify shading effects on growth of the plant and to estimate some of the chemical/nutritive composition of *L. taraxacifolia.*

MATERIALS AND METHODS

Rhizomes for planting were obtained from *Launaea taraxacifolia* plants growing in the wild. About 40 roots of approximately 10 cm in length (Van Epenhuijsen, 1974) and about 1.0-1.8 cm in thickness were planted in May, 2006 on a nursery bed inside the screen house of Department of Botany, Obafemi Awolowo University, Ile-Ife, Nigeria. The plants were then continuously watered until well established before transferring to individual pots. Weeding of the area was carried out periodically in order to minimize competition of any type. The pots were divided into two groups. The first group was placed under the shade of a *Lagerstroemia indica* tree. The second group was placed in the open under the direct impact of sunlight. The seedlings were transplanted into individual pots two weeks after planting.

Morphological parameters such as plant height, leaf length, leaf area and number of leaves were observed and measurements taken for all the plants at 2 weeks interval. Leaf area was obtained by multiplying leaf length (L) and leaf width (W) (the widest point of the leaf blade) by a factor 0.75 (used to correct for the leaf shape) (Hoyt and Bradfield, 1962). At the onset of flower bud formation, a number of observations were made daily. This included time of bud formation, distribution of flowers on the flowering stalk and number of flowering branches.

For proximate analysis, the fresh leaves were macerated in a mortar with Na_2CO_3 in order to aid digestion (Table 1). Proximate analysis was done by the method of the Association of Official Analytical Chemist (AOAC, 1980). Some mineral constituents (P, Fe, Mg, Ca), of the leaves were also determined (Table 2). The student t-test was used for statistical analysis.

Table 1: Proximate analysis of *Launaea taraxacifolia* leaf (fresh)

Constituents	(%)
Total nitrogen/crude protein	2.5266
Moisture	89.2900
Ash	1.4550
Ether extract	3.7300
Crude fibre	2.1650
Carbohydrate	0.8334

Table 2: Mineral analysis of *Launaea taraxacifolia* leaf (fresh)

Elements	(mg L^{-1})
Iron (Fe)	6.40±0.80
Calcium (Ca)	0.07±0.02
Phosphorus (P)	23.36±0.01
Magnesium (Mg)	0.68±0.01

RESULTS

The 24 rhizomes planted on the nurserybed produced 40 new shoots on sprouting after 10 days of cultivation in the screen house (Fig. 1). About 40% of the rhizomes planted gave rise to more than one shoot. It was observed that the plants generated from thicker rhizomes developed more rapidly than plants generated from thinner rhizomes. The occurence of branching was 17% and only observed in plants under direct sunlight. Fifty eight percent of the plants under direct sunlight generated new shoots from their rhizomes while there was no sprouting of new shoots in plants growing under the shade.

Generally, the height for all the plants under direct sunlight and shade increased throughout the duration of the experiment. The height of the plants for the two conditions was not significantly different (p>0.05) at the beginning of the experiment. From the 4th week (28 DAP: Days after Planting) to the 6th week (42 DAP) of the experiment, the shaded plants were significantly taller than those not shaded. But from the 8th week (56 DAP) till maturity (84 DAP), the plants under direct sunlight were significantly taller than the shaded plants (Fig. 2).

At 14 days after planting, there was no significant difference in the number of leaves between the direct sunlight and shaded plants. From the 4th week till maturity, number of leaves was significantly higher in plants under direct sunlight than those under shade (Fig. 3). The leaf areas of the plants under direct sunlight were also significantly higher than those under the shade throughout the experimental period (Fig. 4).

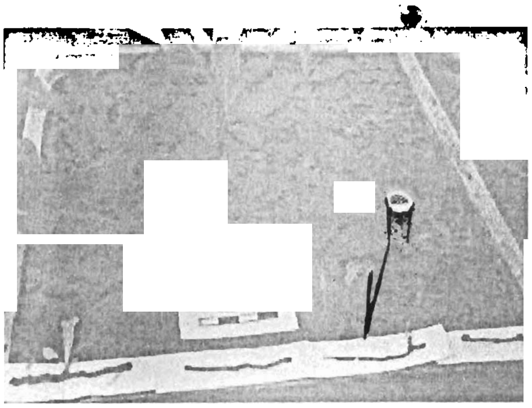

Fig. 1: The sizes of the roots planted and the resultant plants after sprouting

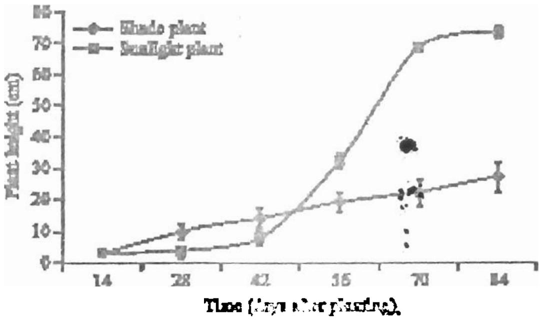

Fig. 2: Effect of light on height of the plant

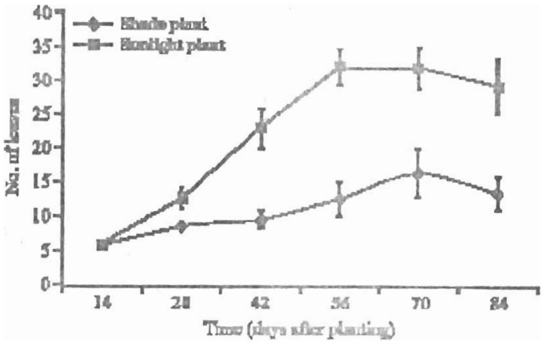

Fig. 3: Effect of light on the number of leaves produced

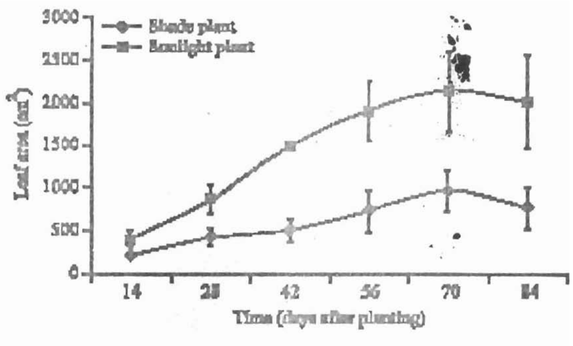

Fig. 4: Effect of light on the leaf area of the plant

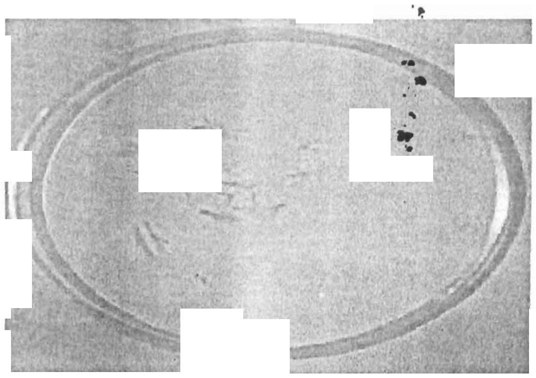

Fig. 5: The two types of seeds found in *L. taraxacifolia*

Flowering was totally inhibited in plants that were subjected to shade till the end of the experiment while plants under direct sunlight began to flower from the 8th week (56 DAP). At the onset of flowering, 56 DAP, the number of leaves produced by the plants was reduced and there was sudden increase in the height of the plants. The number of buds produced on each shoot was very high ranging from 30-50 initially (62 DAP) to about 20-25 buds later (74 DAP). The number of flowering branches on maturity (80 DAP) ranges from nine to ten per plant. It was also observed that frequency of the buds on each flowering branch ranges from four to six between distances of 10 cm from the base and 10 to 12 between distances of 10 cm from the apex.

The achenes were observed to be of two kinds; black achenes (which appear to be filled and with embryos but fewer in number and appear only in flowers with pappus ready for dispersal) and the light brown seeds (that are smaller and numerous) (Fig. 5). The number of seeds from each flower varies from 20 to 22 (with an average of two to three (2-3) black and 18 to 20 light brown seeds).

At the end of the experiment, the average dry weight of the rhizomes of plants under the shade was 0.632 mg while that of the plants in direct sunlight was 23.557 mg. Rhizomes of plants under the shade had higher moisture content (79%) than those in direct sunlight (68%).

DISCUSSION

The success of the plant despite the low fertility rate of seeds can be attributed to the high efficiency of sprouting of the rhizome. Rhizome diameter as small as 1.0 cm, can also be used to propagate the plant. However, rhizomes with bigger diameters (1.8 cm) emerged faster and had higher success rates that those with smaller diameters (1.0-1.2 cm).

The study shows that the height of *Launaea taraxacifolia* plant subjected to light stress was higher than that of the plant under direct sunlight at the initial stage of the experiment. Reductions in light availability and in the ratio of red-to-far red light have been reported to be associated with increases in stem elongation (Brainard *et al*., 2005; Morgan and Smith, 1981). Due to selective absorption in certain wavelength by plant, high far-red light under shade promotes stem elongation/extension. Boyd and Murray (1982) also reported in a related experiment that plant height increases with decreasing irradiance until photosynthate production becomes limiting. In shaded plants, stem elongation continued throughout the experimental period. This result suggests that light stress begins from the 4th week (28 DAP). Increase in stem height in plant under direct sunlight can be attributed to bolting (production of flowering stalk/shoot).

The number of leaves and leaf area of the plants under direct sunlight was higher than those of the plants under shade from the 4th week (28 DAP) to the 12th week (84 DAP). Casey *et al*. (2004) working with *Eryngium foetidum* also reported reduction in number of leaves and leaf area in plants grown under shade.

The lower number of leaves produced in the shade plants may be attributed to an increased use of existing reserves to maintain growth during the period of declining photosynthate production. According to Craker *et al*. (1983), the most important factor affecting leaf development is the light energy. Panetta (1977) reported that root systems developed more slowly and were smaller in shaded than in unshaded seedlings of *Baccharis halimifolia*. This corresponds to observations in this experiment where the average dry weight of the rhizomes of plants under the shade was significantly smaller compared to that in full sunlight indicating the necessity of light for below ground vegetative parts either through increased photosynthate production for partitioning to below ground vegetative production or otherwise. De Simone *et al*. (2000) also reported that no root hair was formed in lettuce (*Lactuca sativa*) seedlings grown in the dark irrespective of pH condition. There was also no initiation of root under far red light which is characteristic of shade condition. The moisture content of the rhizomes grown under shade was higher than those grown in full sunlight suggesting limited evapotranspiration in the shade plants.

Flower production and even production of viable seeds has been reported in other plants grown in shade (Steckel *et al*., 2003; Naumburg *et al*., 2001). The observation in this investigation suggests that each species has a minimum irradiance level at which it can produce flower and vegetative buds and below which flowering do not occur, although sparse flowering may occur at irradiance levels slightly higher than the minimum. Photoperiod, light intensity and light quality influence plant growth and development from seed germination to flowering.

Oluwatosin (1988) reported no significant differences in number of flower buds in *Synedrella nodiflora* for both shaded and unshaded condition, produced flower buds was higher in unshaded species in *Ageratum conyzoides* while flower buds production was higher in unshaded species of *Tridax procumbens*.

L. taraxacifolia produced a large quantity of seeds whose fertility rate was very low hence; it is still propagated largely by the rhizomes which are highly efficient. The two kinds of seeds observed in the plant are not actually 2 types of seeds but, rather the bigger black seeds appears to be the fully matured ones which may or may not be fertilized. The brown seeds are most likely immature seeds. This phenomenon is probably due to the effect of prolonged vegetative propagation (Olorode, Personal Communication). This implies that the percentage of matured seeds produced is just about 12% and out of which only some may be fertilized. More assimilates are partitioned for vegetative growth and genotype tends to be fixed because of vegetative propagation. The chemical analysis, showed that *L. taraxacifolia* contains small quantities of important mineral elements like Iron (Fe), Calcium (Ca), Magnesium (Mg), Phosphorus (P) that function in major metabolic processes of the cells in Man. The Phosphorus contained in *L. taraxacifolia* is reported to be of considerably higher values than that present in some other vegetables (Fasuyi, 2006). Like all lettuce it has very high water content with very few calories. Generally, vegetables are considered to be a good dietary source of mineral, carbohydrate and protein (Mosha *et al*., 1995). *Launaea taraxacifolia* is no exception.

In conclusion, it was observed that *Launaea taraxacifolia* requires minimum inputs for its growth especially under direct sunlight. Effects of shading have been quantified supporting the statement of Ayodele (2005) that *Launaea taraxacifolia* plants need a sunny place and do not tolerate shade. The plant provides a readily available source of Phosphorus and Iron required by the body system and is relatively inexpensive compared to common vegetables like *Telfairia occidentalis* or its widely cultivated relative *Lactuca sativa*. It is also a good source of dietary fibre. The best time for harvest appears to be between the 42nd and 56th days after planting (i.e., between the 6th and 8th weeks after planting). Its cultivation should therefore be encouraged.

A limitation to cultivation and domestication of this plant that has such potentials is a lack of variability imposed by vegetative mode of propagation. Any process that can overcome seed sterility/viability will therefore be useful for creating variability in this plant. This will enhance variability and therefore selection and improvement through breeding. Embryo rescue technique has been proposed as a solution to the seed sterility problem of the crop. Therefore, in vitro propagation protocol for this crop is being investigated.

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