Kongwa weed *(Astropomoea hyoscyamoides)* a threat to some grazing lands in North Eastern Tanzania

Ephraim J. Mtengeti
Department of Animal, Aquaculture &Range Sciences
Sokoine University of Agriculture
Email: emtengeti@gmail.com

Abstract
A short study on the evaluation of the plant structure and seed production of Kongwa Weed (Astropomoea hyoscyamoides) was conducted in Mzeri Hill Ranch in August, 2017. Two transect lines running diagonally were fitted in the grazing field of 2.5 ha. The field was partly established with Cenchrus ciliaris, Chloris gayana and some parts was dominated by natural grasses mainly Cynodon nlemfuensis, Panicum infestum and Urochloa sp. The size of every sampling point was 2 m x 2 m and were 20 m apart along the diagonal line. A total of twelve sampling points was obtained in each diagonal line. In each sampling point only one mature tallest Kongwa weed plant was picked at random. Plant height of the main stem, total branches of the plant, and number of fruits from one of the selected branches were recorded instantly. Total number of branches per plant ranged from 4 – 26, while the height of the main branch ranged from 71 – 203 cm. The fruits per branch ranged from 3 – 275. The weed was not found in areas dominated by Cenchrus ciliaris and Cynodon nlemfuensis grasses unlike for Chloris gayana, Panicum infestum and Urochloa mosambensesis grasses. Since kongwa weed is under Convolvulaceae family whose fruit has 4 seeds, it can be concluded that with favorable environment factors a Kongwa weed plant can produce up to 28, 600 seeds per season. Despite

Kongwa weed aggressiveness in terms of seed productivity, as was shown in the current study, certain pasture species such as Cenchrus ciliaris and Cynodon nlemfuensis may reduce its abundance unless they are overgrazed. Further studies on the influence of land use and plant association on the spread of Kongwa weed are recommended.

Key words: *Plant height, Branches, Weed, Fruits*

Introduction

Astropomoea hyoscyamoides (Vatke) Verde, a species of *Convolvulaceae* Family and commonly known Kongwa weed in Tanzania, is an erect, branched, short-lived perennial or annual herb, covered with grayish hairs, and reaching a height of 2m with alternate, simple leaves and showy, white and purple flowers (Ivens, 1989). It is a plant of drier grassland types and open bush at altitudes below 1200m in the country. It was first noted in Kongwa, Tanzania (Baker, 1949). Currently the weed has invaded various semiarid and arid areas of Tanzania including Dodoma, Kilimanjaro, Manyara, Moroggoro and Tanga regions. It has been the commonest weed in drier grassland, especially where there are overgrazing, but also can be seen dominating opened grassland for cultivation. The invasion of some grazing lands by Kongwa weed have caused deterioration in livestock production due to shortage of pasture (Nkombe *et al.* 2018).

It is unpalatable and problematic weed in pasture establishment. The plant's ability to thrive in a wide variety of soils in the tropics, and its short juvenile stage, long flowering period and prolific seed production all contribute to its invasiveness. A short juvenile period has been associated with invasiveness in pines

(Rejmánek and Richardson 1996) and with annual weeds (Perrins *et al*. 1992). High reproductive output of the plant reduces its extinction and is well correlated to its invasiveness ability to outcompete other desirable plants in terms of its abundance (Baker 1965, 1974). Moreover, early and longer flowering period as for the annual Kongwa weed, in addition of outcompeting other desirable plants on soil moisture and nutrients may help to attract increased number of pollinators in outcrossing species which will result in high viable seed production (Perrins *et al*. 1992). Such a character is also correlated with the length of the fruiting period. Likewise, the length of the fruiting period is positively correlated with the probability of dispersal (Stiles 1980). Information on Kongwa weed seed productivity characteristics is still scanty. The aim of this short study was therefore to assess *A. hyoscyamoides* plant morphology and seed productivity.

Materials and Methods

Study area

Mzeri ranch is one of the National Ranching Company (NARCO) ranches spread all over Tanzania main land. It is located in Handeni District, Tanga region. The ranch lies between latitude 6º 30᾽ and 6º 45᾽ South and between 38º 30᾽ and 38º 45᾽ East. It is 48 km south-west of Korogwe town. The dominant grass types of the ranch are *Panicum maximum, Panicum infestum, Hyperrhenia rufa, Urochloa mosambensis, Cynodon nlemfuensis* and common legumes are *Rhynchosia spp* and *Teramnus labialis*. The soils vary from loam to sandy clay along the valleys. The land scape is rather undulating at 1, 305 meters above sea level in sub-humid climatic zone. The ranch falls under bimodal rainfall with long rains from March to May and short rains from October to

December. Annual rainfall ranges from 760 – 900 mm with temperatures range from 18 ºC to 32 ºC.

Methods

The study was conducted in a 2.5 ha grazing field in Mzeri Ranch. Two transect lines running diagonally were fitted in the grazing field. In the last four years the field was partly established with of *Cenchrus ciliaris, Chloris gayana* and some parts was dominated by natural grasses mainly *Cynodon nlemfuensis, Panicum infestum* and *Urochloa sp.* The size of every sampling point was 2 m x 2 m and were 20 m apart along the diagonal line. A total of twelve sampling points was obtained in each diagonal line.

Data collection

In each sampling point only one mature tallest Kongwa weed plant was picked at random. Total braches of the plant, height of the main stem and number of fruits from one of the selected branches were recorded instantly.

Results and Discussion

The total number of branches per plant ranged from 4 – 26 and the height of the main branch ranged from 71 – 203 cm (Table 1). The result is agreement with Nkombe et al (2018) who recorded an average Kongwa plant height of 1.8 m in Kongwa district. The branching and height of the plant however, depends on the environment factors such as outcompeting plants in terms of light, soil moisture and nutrients. The weed was not found in areas dominated by *Cenchrus ciliaris* and *Cynodon nlemfuensis* grass with rhizomatious and Stoloniferous growth habit as recorded in sampling plots 3 and 4 transect line 1 and sampling plots 2 and 3 (Plate 1). The weed was however, found growing well in areas

dominated by *Chloris gayana*, *Panicum infestum* and *Urochloa mosambensesis* grasses with tuft growth habit. Failure of appearance of Kongwa weed in rhizomatious and stoloniferous grasses could be due to less light to the germinating weed seeds as compared to tuft or erect grass type. Environmental factors such as light, temperature and soil moisture have been reported to affect seed germination (Chachalis and Reddy 2000; Koger *et al*. 2004). This could be a basis of a in-detail research on the environmental factors limiting the aggressiveness of the Kongwa weed.

Figure 1 Kongwa weed found beyond *Cenchrus ciliaris* dominated area

The fruits per branch ranged from 3 – 275 (Table1). In addition to the soil fertility, fruiting depends on the degree of diseases and pests occurrence which may attack the leaves and/or flowers. In some plots the Kongwa weed plant leaves were rather culled and unhealthy possibly due to leaf blight. In addition, yellow spotted black beetle was found in some plots eating the flowers (Fig 2). This is another area of research to find out if there are some enemies of the Kongwa weed being disease pathogens or pests that can reduce its aggressiveness in a given range site. As it has been documented elsewhere (Perrins et al. 1992) for the

characteristics of noxious weed that they have prolonged flowering and fruiting, this was noted as shown in Fig 3.

Figure 2 Unhealthy Kongwa weed plant with culled leaves and yellow spotted black beetle eating the flower

Figure 3. Kongwa weed showing flowers, young and mature fruits

Since Kongwa weed is under Convolvulaceae family whose fruit has 4 seeds, it can be assumed that a well grown Kongwa weed plant could produce up to 26 branches x 275 fruits/branch x 4 seeds/fruit =28, 600 seeds per season. This is a tremendous quantity of seeds going to the soil seed bank and expected to

increase weed population in the field and overshadow the desirable pastures. Research on the quantity, viability and longevity of Kongwa weed soil seed bank is therefore worth to be investigated.

Table 1 *Astropomoea hyoscyamoides* plant morphological characteristics in Mzeri Hill Ranch August 2017

Transect line 1				Transect line 2			
Sampling plots	No of branches	Height of the main stem (cm)	Number of fruits	Sampling plots	No of branches	Height of the main stem (cm)	Number of fruits
1	19	83	24	1	4^{PI}	195	20
2	10	135	45	2	NR^{CN+U}	NR	NR
3	NR^{cc}	NR	NR	3	NR^{cc}	NR	NR
4	NR	NR	NR	4	8^{cc}	71	33
5	23^{CG}	115	23	5	22^{CG}	186	98
6	23^{PS}	88	10	6	6	180	79
7	9	127	9	7	26	104	28
8	12^{PI}	180	138	8^{PI}	14	150	88
9	5	190	275	9	13^{IL}	113	3
10	8	130	148	10	12	120	133
11	3	203	81	11	4^{IL}	145	7
12	5	140	75	12	6	188	108

Transect 1 ^{CC}*Cenchrus ciliaris* plots 3 and 4, ^{CG} *Chloris gayana* overgrazed plots 5 -7, ^{PI} *Panicum infestum*

Plots 8-10, ^{PS} Pest (Yellow spotted beetle, possibly *Astylus atromaculatus*)

Transect 2 ^{PI}*Panicum infestum* plot 1, $^{CN+U}$ *Cynodon nlemfuensis* and Urochloa sp plot 2

^{CC} *Cenchrus ciliaris* plots 3 and 4, ^{CG} *Chloris gayana* overgrazed plots 5 -7, ^{PI} *Panicum infestum* Plots 8-13,

^{IL} Leaves were highly infested by leaf blight possibly fungal infection

NR= Kongwa weed not recorded.

Conclusions

This short observational study has shown that Kongwa weed like other invasive annual weeds have prolonged flowering period

followed by lots of fruit production. Through this short study it has been observed that the weed seems to be outcompeted by the rhizomatious creeping grasses. It is not known yet if it is deficiency of light to the germinating seeds or seedling growth. The culled leaves could be due to leaf blight and yellow spotted beetle eating Kongwa weed flowers which were noted in this short study.

Recommendations

Rhizomatious grasses such as *Cenchrus ciliaris* and Stoloniferous grasses such as *Cynodon nlemfuensis* should be established and encouraged in pasture fields prone to Kongwa weed invasion. Overgrazing pasture fields prone to Kongwa weed invasion should be discouraged. Further studies on the influence of land use, plant association, and enemy disease pathogens and pests on the aggressiveness and spread of Kongwa weed are recommended.

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