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Laboratory feeding of *Bulinus truncatus* and *Bulinus globosus* with *Tridax procumbens* leaves

O. M. Agbolade*, O. W. Lawal and K. A. Jonathan

Department of Plant Science and Applied Zoology, Parasitology and Medical Entomology Laboratory, Olabisi Onabanjo University, P.M.B. 2002, Ago-Iwoye, Ogun State, Nigeria.

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Suitability of *Tridax procumbens* leaves in laboratory feeding of *Bulinus truncatus* and *Bulinus globosus* was assessed in comparison with *Lactuca sativa* between September and October, 2011. The snails were collected from Eri-lope stream in Ago-Iwoye, while *T. procumbens* were collected from the Mini Campus of the Olabisi Onabanjo University, Ago-Iwoye, Ijebu North, Southwestern Nigeria. For *B. truncatus*, fresh, sun-dried and oven-dried *T. procumbens* were used, while only fresh *T. procumbens* were used for *B. globosus*. The mean percentage survivals of *B. truncatus* fed with fresh, sun-dried and oven-dried *T. procumbens* compared with those of the corresponding control snails showed no significant difference (χ^2 = 0.51, 1.85, and 2.21, respectively). *B. truncatus* fed with fresh *T. procumbens* had the highest mean live-weight percentage increase (46.4%) as compared to those fed with sun-dried and oven-dried (χ^2 = 45.65). The mean percentage survival of *B. globosus* fed with fresh *T. procumbens* (79.2%) was similar with that of the control (84.6%) (χ^2 = 0.18). The percentage increase in mean live-weight of *B. globosus* fed with fresh *T. procumbens* (24.0%) was lower as compared to the control (χ^2 = 5.34). This study showed that feeding the studied snails using *T. procumbens* may be profitable in Ijebu North, Southwestern Nigeria.

Key words: *Bulinus truncatus*, *Bulinus globosus*, laboratory feeding, *Tridax procumbens*.

INTRODUCTION

All species of *Bulinus*, including *Bulinus truncatus* and *Bulinus globosus*, are freshwater gastropod snails of the family Planorbidae. *Bulinus* species are widespread in Africa, having been reported from regions such as Northwest Africa, Ethiopia, Sudan, Egypt, Tanzania and Nigeria (Brown, 1994; Chitsulo et al., 2000). *B. globosus*, *B. truncatus* and some other *Bulinus* spp. are established vectors of *Schistosoma haematobium* (Ukoli, 1984; WHO, 1993). Therefore, much attention has been consistently devoted towards understanding the biology of the aforementioned vectors and other vector snails towards sustainable control of human schistosomiasis in tropical Africa including Ijebu North, South-western Nigeria (Adewunmi et al., 1991; Agbolade et al., 2004; Madsen and Stauffer, 2011).

Tridax procumbens is a dicotyledonous plant in the Daisy family and is a commonly widespread weed and pest plant in the tropical, sub-tropical and mild temperate regions of the world (http://en.wikipedia.org/wiki/Tridax_procumbens).

Nevertheless, some studies have revealed some usefulness of *T. procumbens*. It has been reported that the plant is rich in nutritionally valuable substances such as protein, fat, carbohydrate, fibre, sodium, potassium, calcium, carotenoids and flavonoids (Jude et al., 2009). Moreover, it is known that the leaves of *T. procumbens*

*Corresponding author. E-mail: agbolmos@yahoo.com. Tel: +2348055475864.

are eaten by *Archachatina marginata* (Odaibo, 1997), and a recent study showed that domestication of *Lanistes libycus* (an edible freshwater apple snail) using the leaves of *T. procumbens* could be a profitable venture (Agbolade et al., 2010).

In view of the public health significance of *B. truncatus* and *B. globosus*, it is often necessary to culture them in the laboratory for research purposes. Unfortunately, *Lactuca sativa* (lettuce) conventionally used to feed freshwater snails seems scarce and expensive in Ijebu North area, Southwestern Nigeria. This study was therefore designed to assess the suitability of the leaves of *T. procumbens* in the laboratory feeding of *B. truncatus* and *B. globosus*.

MATERIALS AND METHODS

Samples' source and collection methods

B. truncatus and *B. globosus* specimens were collected from Eri-lope stream in Ago-Iwoye. Ago-Iwoye (6° 56' 55" N, 3° 54' 40" E) is the location town of the main Campus of the Olabisi Onabanjo University, and it is located in Ijebu North area of Ogun State, Southwestern Nigeria. The snails were collected by picking them from among submerged and emergent plants, fallen leaves and twigs in the water body. The specimens were transported to the laboratory in a well-aerated container. *T. procumbens* plants were hand-collected from the Mini Campus of the Olabisi Onabanjo University, Ago-Iwoye. *L. sativa* (lettuce) was purchased from a market in Lagos, Nigeria. Snails' collection and culturing were carried out between September and October, 2011.

Culturing method

In the laboratory, the specimens were identified and sorted into species with reference to Brown and Kristensen (1993). Specimens of each species were divided into size classes after initial shell length measurement. For *B. truncatus*, the snails were later divided into three categories according to their diet, placed in bowls labelled fresh, sun-dried, and oven-dried. Each category had three replicates (A, B, C), and one control. Each of the bowls was lined with transparent nylon to make easy the collection of eggs. De-chlorinated water was added to each culture bowl. 20 g of fresh and 10 g of dried *T. procumbens* leaves (for trial bowls) and *L. sativa* (for control bowls) were used in feeding *B. truncatus* snails as appropriate. For *B. globosus*, only fresh *T. procumbens* leaves (for trial bowls) and *L. sativa* (for control bowls) were used. There were four trial replicates (A, B, C, D) and one control.

For both species of *Bulinus*, each of the trial and control bowls was covered with polythene mosquito net held in place with rubber band to prevent snails from escaping. Changing of water and feeding were done every other day. Any mortality was recorded and the specimen was removed immediately on detection. Shell length measurement of the snails was done once a fortnight. The mean live-weight of the snails in each bowl was measured using weighing balance on day 0 (initial weight) and subsequently fortnightly. The final shell length and live-weight measurements were taken at the end of the 7th week.

Statistical analysis

Percentage increase in live-weight and shell length were calculated by comparing the mean values on day 0 with the corresponding mean values at the end of the 7th week using the following formulae:

Live-weight increase (%) = (Final live-weight – Initial live-weight / Initial live-weight) × 100

Shell length increase (%) = (Final length – Initial length / Initial length) × 100

Chi-square (χ^2) was used to compare percentages of survival and increase in live-weight and shell length. For mean live-weight and shell length, the replicates with the least values of percentage increase were used as benchmarks for comparison with the control values.

RESULTS

The survival, live-weight and shell length of *B. truncatus* fed with fresh, sun-dried and oven-dried *T. procumbens* leaves are summarised in Table 1. At the end of the 7th week, the percentages of surviving control snails fed with fresh (84.6%), sun-dried (84.6%) and oven-dried (85.7%) *L. sativa* were not significantly different (χ^2 = 0.01, df = 2, P > 0.05). The mean percentage survivals of *B. truncatus* fed with fresh (75.6%), sun-dried (67.8%) and oven-dried (67.3%) *T. procumbens* were not significantly different (χ^2 = 0.62, df = 2, P > 0.05). The mean percentage survivals of snails fed with fresh, sun-dried and oven-dried *T. procumbens* when compared with those of the corresponding control snails (fresh = 84.6%, sun-dried = 84.6%, oven-dried = 85.7%) showed no statistically significant difference (χ^2 = 0.51, 1.85, and 2.21, respectively; df = 1, P > 0.05 for each category).

The percentage increase in the mean live-weight of *B. truncatus* specimens fed with fresh (70.0%) *L. sativa* was significantly the highest when compared with those fed with sun-dried (42.9%) and oven-dried (42.6%) *L. sativa* (χ^2 = 9.55, df = 2, P < 0.01). Similarly, mean live-weight percentage increase of *B. truncatus* fed with fresh *T. procumbens* (46.4%) was significantly the highest when compared with those fed with sun-dried (14.6%) and oven-dried (3.7%) *T. procumbens* (χ^2 = 45.65, df = 2, P < 0.001). The percentage increases in the mean live-weight of *B. truncatus* fed with fresh, sun-dried and oven-dried *T. procumbens* were significantly lower than those of the corresponding control snails (χ^2 = 4.78, P < 0.05; χ^2 = 6.96, P < 0.01; χ^2 = 16.34, P < 0.001, respectively; df = 1 for each category).

The percentage increases in the mean shell length of *B. truncatus* fed with fresh (8.8%), sun-dried (5.4%) and oven-dried (1.2%) *L. sativa* were not significantly different (χ^2 = 5.65, df = 2, P > 0.05). Likewise, the percentage increases in mean shell length of *B. truncatus* fed with fresh (5.9%), sun-dried (1.8%) and oven-dried (0.8%) *T. procumbens* leaves were not significantly different (χ^2 = 5.16, df = 2, P > 0.05). In addition, comparison of feeding with fresh, sun-dried and oven-dried *L. sativa* (control) and *T. procumbens* (trial) showed no significant differences

Table 1. Survival, live-weight and shell length of *B. truncatus* fed with fresh, sun-dried and oven-dried *T. procumbens* leaves.

Week	Replicate	Fresh			Sun-dried			Oven-dried		
		No. (%) surviving	Mean live-weight (g)	Mean shell length (mm)	No. (%) surviving	Mean live-weight (g)	Mean shell length (mm)	No. (%) surviving	Mean live-weight (g)	Mean shell length (mm)
0	A	24 (100)	0.29	3.50	23 (100)	0.41	5.80	20 (100)	0.51	12.00
	B	26 (100)	0.30	3.40	23 (100)	0.42	5.60	23 (100)	0.54	11.90
	C	24 (100)	0.28	3.50	25 (100)	0.41	6.00	27 (100)	0.55	11.90
	Control	26 (100)	0.30	3.40	26 (100)	0.42	5.60	21 (100)	0.54	12.08
2	A	22 (91.7)	0.33	3.55	21 (91.3)	0.43	5.80	18 (90.0)	0.52	12.01
	B	24 (92.3)	0.34	3.45	21 (91.3)	0.44	5.63	21 (91.3)	0.55	11.93
	C	22 (91.7)	0.31	3.58	22 (88.0)	0.43	6.05	24 (88.9)	0.56	11.93
	Control	25 (96.2)	0.35	3.48	25 (96.2)	0.47	5.68	20 (95.2)	0.60	12.08
4	A	20 (83.3)	0.37	3.60	19 (82.6)	0.45	5.80	16 (80.0)	0.53	12.05
	B	22 (91.7)	0.37	3.50	19 (82.6)	0.46	5.65	19 (82.6)	0.55	11.95
	C	20 (83.3)	0.35	3.65	19 (76.0)	0.44	6.10	21 (77.8)	0.57	11.95
	Control	24 (92.3)	0.41	3.55	24 (92.3)	0.51	5.75	19 (90.5)	0.66	12.15
6	A	18 (75.0)	0.40	3.65	17 (73.9)	0.47	5.80	15 (75.0)	0.53	12.08
	B	21 (80.8)	0.41	3.55	18 (78.3)	0.47	5.68	18 (78.3)	0.56	11.98
	C	19 (79.2)	0.38	3.65	16 (64.0)	0.46	6.15	19 (70.4)	0.57	11.98
	Control	23 (88.5)	0.46	3.63	23 (88.5)	0.56	5.83	18 (85.7)	0.71	12.23
7	A	17 (70.8)	0.44	3.70	16 (69.6)	0.49	5.80	14 (70.0)	0.54	12.10
	B	20 (76.9)	0.44	3.60	17 (73.9)	0.49	5.70	15 (65.2)	0.56	12.00
	C	19 (79.2)	0.41	3.80	15 (60.0)	0.47	6.20	18 (66.7)	0.58	12.00
	Control	22 (84.6)	0.51	3.70	22 (84.6)	0.60	5.90	18 (85.7)	0.77	12.23

in mean shell length percentage increases of *B. truncatus* (χ^2 = 0.57, 1.80, 0.08, respectively; df = 1, P > 0.05 for each category). Table 2 summarises the survival, live-weight and shell length of *B. globosus* fed with fresh *T. procumbens* leaves. The mean percentage survival of *B. globosus* fed with fresh *T. procumbens* (79.2%) was not significantly different from that of control (84.6%) (χ^2 = 0.18, df = 1, P > 0.05). The percentage increase in mean live-weight of *B. globosus* fed with fresh *T. procumbens* (24.0%) was statistically lower as compared to the control (42.9%) (χ^2 = 5.34, df = 1, P < 0.05). However, the percentage increase in the mean shell length of *B. globosus* fed with fresh *T. procumbens* (2.35%) was not significantly different from that of the control (4.71%) (χ^2 = 0.79, df = 1, P > 0.05).

DISCUSSION

The results of this study show clearly that *Bulinus* spp. can be cultured in the laboratory using the free available *T. procumbens* instead of the

Table 2. Survival, live-weight and shell length of *B. globosus* fed with fresh *T. procumbens* leaves.

Week	Replicate	No. (%) surviving	Mean live-weight (g)	Mean shell length (mm)
	A	25(100)	0.49	8.70
	B	25(100)	0.47	8.90
0	C	25(100)	0.50	8.80
	D	26(100)	0.49	8.50
	Control	26(100)	0.49	8.50
	A	24(96.0)	0.53	8.80
	B	23(92.0)	0.52	8.96
2	C	23(92.0)	0.55	8.88
	D	24(92.3)	0.54	8.55
	Control	25(96.2)	0.54	8.60
	A	23(92.0)	0.57	8.90
	B	21(84.0)	0.57	9.05
4	C	21(84.0)	0.61	8.95
	D	22(84.6)	0.59	8.60
	Control	24(92.3)	0.60	8.70
	A	22(88.0)	0.61	9.00
	B	20(80.0)	0.62	9.13
6	C	20(80.0)	0.66	9.03
	D	21(80.8)	0.64	8.65
	Control	23(88.5)	0.65	8.80
	A	21(84.0)	0.65	9.10
	B	19(76.0)	0.62	9.20
7	C	19(76.0)	0.66	9.10
	D	21(80.8)	0.64	8.70
	Control	22(84.6)	0.70	8.90

expensive *L. sativa* with similar results in terms of percentage survival. This may give a sigh of relief for freshwater snails' researchers who may thereby expend their often meagre finance with higher frugality.

The observed laboratory survival of *B. truncatus* and *B. globosus* exclusively on *T. procumbens* leaves diet in this study is the first of its kind from Ijebu North area, Southwestern Nigeria. Literature shows, for instance, that the leaves of *T. procumbens* are consumed by *A. marginata* (Odaibo, 1997). Similarly, the leaves of this plant have earlier been found to better support *L. libycus*, in comparison with some other common dicotyledonous plants, in laboratory cultures (Agbolade et al., 2010). Survival of *B. truncatus* and *B. globosus* fed with *T. procumbens* corroborates the established nutritional values of the plant (Jude et al., 2009). In this study, *B. truncatus* seems to survive most on fresh *T. procumbens* leaves as opposed to *L. libycus* which prefers dried *T. procumbens* leaves. Although, in this study, *B. globosus* was fed only on fresh *T. procumbens* leaves; previously unreported observations suggest that fresh leaves of *T. procumbens* are likely to yield the best result on the survival of this species.

The percentage of shell growth shows that fresh *T. procumbens* leaves yielded relatively the highest increase as compared to dried ones, although the difference is not statistically significant. From the results of this study, it seems drying diminishes the dietary composition of *T. procumbens* leaves, particularly when done in the oven. The difference in the nutritional values of fresh *T. procumbens* leaves and dried ones seems magnified by the recorded percentage of increase in live-weight of *B. truncatus* when fed with fresh leaves. This seems to show that oven-dried leaves are poorer nutritionally. A previous study revealed depreciation of live-weight of *L. libycus* fed with dried *T. procumbens* (Agbolade et al., 2010). Like argued in an earlier paper, drying *T. procumbens* leaves might cause the destruction of many essential nutrients (such vitamins and proteins) needed by the water snails.

By and large, the results of this study have shown that laboratory culturing of *B. truncatus* and *B. globosus* using *T. procumbens* leaves may constitute a great forward step to water snails' researchers in Ijebu North, South-western Nigeria, using this free and easily available plant from the environment. However, for optimal performance the snails should be fed with fresh *T. procumbens*. Nevertheless, further studies (particularly parallel studies) are required to assess the reproductive potentials of *Bulinus* snails cultured using *T. procumbens* leaves.

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REFERENCES

Adewunmi CO, Furu P, Christensen NO, Olorunmola F (1991). Endemicity, seasonality and focality of transmission of human schistosomiasis in 3 communities in South-western Nigeria. Trop. Med. Parasitol. 42: 332-334.

Agbolade OM, Akinboye DO, Fajebe OT, Abolade OM, Adebambo AA (2004). Human urinary schistosomiasis transmission foci and period in an endemic Town of Ijebu North, Southwest Nigeria. Trop. Biomed. 21(Suppl): 15-22.

Agbolade OM, Soewu DA, Bolanle OO, Momodu LA, Adegboyegun-King OO, Odubanjo AO, Owode JO, Asimi-Aina AB (2010). Preliminary study on culturing of *Lanistes libycus* using the leaves of some dicotyledonous plants. World J. Zool. 5: 252-256.

http://en.wikipedia.org/wiki/Tridax_procumbens. *Tridax procumbens*. Wikipedia, the free encyclopaedia. Accessed on14th January, 2013.

Brown DS (1994). Freshwater snails of Africa and their medical importance. 2nd Edn. Taylor and Francis Ltd., London, 609p.

Brown DS, Kristensen TK (1993). A field guide to African freshwater snails. West African species. Danish Bilharziasis Laboratory, Denmark, 55p.

Chitsulo L, Engels D, Montressor A, Savioli L (2000). The global status of Schistosomiasis and its control. Acta Trop. 77:41-51.

Jude CI, Catherine CI, Ngozi MI (2009). Chemical profile of *Tridax procumbens* Linn. Pak. J. Nutr. 8:548-550.

Madsen H, Stauffer JR (2011). Density of *Trematocranus placodon* (Pisces: Cichlidae): a predictor of density of the schistosome intermediate host, *Bulinus nyassanus* (Gastropoda: Planorbidae), in Lake Malawi. Ecohealth 8:177-189.

Odaibo AB (1997). Snail and snail farming: Nigerian edible land snails. Stirling-Horden Publishers Ltd., Ibadan, Nigeria, pp.10-11.

Ukoli FMA (1984). Introduction to parasitology in tropical Africa. John Wiley & Sons Ltd., Chichester. pp. 57-59

WHO (1993). The control of schistosomiasis: second report of the WHO Expert Committee. WHO Technical Report Series No. 830. World Health Organization, Geneva, Switzerland. pp. 51-54.