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Comparison of the Efficacy of Different Traps and Attractants for Tabanidae and *Stomoxys* in Mali

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ABSTRACT

In the Soudano-guinean zone of Madina-Diassa Ranch in Mali a comparative study was carried out to assess attractiveness of Biconical, Cubical (F3), Pyramidal and "Vavoua" traps and/or odour associations: acetone/1-octen-3-o1, acetone/1-octen-3-ol/meta-cresol, 1-octen-3-ol/meta-cresol and acetone/1-octen-3-o1/cow urine.

In the woody savannah, Cubical, "Vavoua" and Pyramidal traps were found to be efficient against tabanidae than the Biconical trap. They attracted respectively 6.4, 5.9 and 4.2 times more than the Biconical trap. The "Vavoua" trap was most efficient against *Stomoxys*. It caught 15.6 tines more than the Cubical one, 15.4 times more than the Biconical trap and 6.2 tines more than the Pyramidal one.

In the forest gallery, the Cubical trap attracted 2.0 times more tabanidae than the Pyramidal trap and 4.4 times more than the Biconical trap. The "Vavoua" trap was 3 times more efficient against tabanidae than the Biconical trap. It caught 2.4, 3.2 and 12.2 times more *Stomoxys* than respectively the Cubical , Pyramidal and Biconical traps.

As far as odours are concerned, tabanidae were more attracted by the associations of acetone/1-octen-3-o1/cow urine, acetone/1-octen-3-ol/metal cresol and 1-octen-3-ol/meta-cresol. In the woody savannah, *Stomoxys* were more attracted by the combination acetone/1-octen-3-ol/meta-cresol and 1-octen-3-ol/meta-cresol; in the forest gallery they are more attracted by acetone/1-octen-3-ol and acetone/1-octen-3-ol/cow urine associations than the others.

The Biconical trap is more effective against tsetse flies, but less effective against tabanidae. The "Vavoua" trap is very attractive for tsetse flies and *Stomoxys*. Therefore we recommend the use of "Vavoua" traps for vectors control. However, it appears necessary to integrate the control of all the vectors of African Trypanosomiasis, including tsetse flies, tabanidae and *Stomoxys*.

INTRODUCTION

Mali is a land-locked country in the centre of West Africa, and it has an area of 1,241,000 km^2 of which the northern half is desert. Livestock is an important economic activity of the country, but this activity has been seriously affected by an endemic draught.

Approximately 200,000 km^2 of the national land are infested with three species of tsetse flies *Glossina morsitans, G. palpalis gambiensis* and *G. tachinoides* (Djiteye et al. 1997). Livestock population in Mali is essentially composed of Zebu cattle (84%). The routine cattle breed (tryoanotolerant) represents only 16% of the total population. Data on the geographical distribution of African animal trypanosomiasis are available, but studies on its prevalence are not yet completed. Pathogenic species for livestock found in Mali include *Trypaosoma vivax, T. congolense, T. brucei* and *T. evansi.*

The female of the majority Tabanidae species (horse and deer flies) are blood-feeders and are considered to be of considerable economic importance due to their known and potential role as vectors of disease and to their nuisance value.

In April 1977, a technical assistance team from Texas A & M University, based at the Central Veterinary Laboratory, Bamako, Mali, initiated studies of trypanosomiasis of cattle and its primary vector, tsetse flies. In 1978, the objectives of the project were expanded to include studies of other vectors, or potential vectors, of hemoparasites of cattle. The Tabanidae were one of the groups selected for study. As a result, the fauna of Mali in now known to include 48 species: *Chrysops* (3), *Hippocentrum* (1) *H. versicolor* Austen, *Haematopota* (12), *Ancala* (3), *Atylotus* (3) and *Tabanus* (26), four of which are newly discrived, *Haematopota athylna* Goodwin (1981), *Tabanus sowi*, *T. maliensis* and *T. pseudogratus* (Goodwin et al. 1981).

Tabanus rubidius, in China were found to be 24.24 - 64% infected by *Trypanosoma evansi* (Lin and Ou 1991). Tabanids have been associated with the transmission of over 35 pathogenic agents including *T. evansi* and other trypanosomes (Foil 1991).

Five species of Stomoxyinae (*Stomoxys calcitrans* Linnaeus, *S. niger bilineatus* Grunberg, *S. sitiens* Rondani, *Haematobia minuta* Bezzi and *H. thirouxi* Roubard were collected in Mali. The adults of *Haematobia* range from 2-3 mm in length, those of *Stomoxys* 4-8 mm; otherwise the adults are very similar to others in the same genus except for characters used in the keys (Goodwin et al. 1981).

According to Lain and Our (1991), *Stomoxys calcitrans*, in China were found to be 46.48 - 85.50% infected by *Trypanosoma evansi*. *Haanatobia exiqua*, in China were found to be 38.26% infected by *Trypanosoma evansi* (Lain and Our, 1991).

1. OBJECTIVES

1.1. To assess the attractiveness of different types of traps for tabanids species and *Stomoxys*

1.2. To assess the efficacy of these traps associated with olfactory attractants.

2. METHODOLOGY

2.1. Comparison among traps:

4 different types of traps:

i) Biconical (Challier-Laveissiére 1973)
ii) Monoconical "Vavoua" (Laveissiére 1988)
iii) Pyramidal (Lancien 1981)
iv) Cubical "F3" (Flint 1985)

were compare in the Soudano-Guinean zone of Madina-Diassa ranch in Mali.

The latin square systems (4x4) were used four tines in two bitopes (two sites in savannah woodland and one site in forest gallery) during the dry and rainy seasons.

2.2. Comparison among odours:

i) acetone/l-octen-3-ol
ii) acetone/1-octen-3-ol/meta-cresol
iii) l-octen-3-ol/meta-cresol
iv) acetone/l-octen-3-ol/cow urine
v) trap without odour (control)

Again latin square systems (5x5) were used four times, using biconical and "Vavoua" in forest gallery, pyramidal and cubical in savannah woodland, during the dry and rainy seasons.

3. RESULTS

3.1. Comparison among traps:

3.1.1. Total catches in savannah woodland.

	Tabanids		
	Rainy season	Dry season	Total
"Vavoua"	42	85	127
Biconical	7	14	21
Cubical (F3)	91	50	141
Pyramidal	47	42	89
Total	187	191	378

Cubical (F3) and Monoconical "Vavoua" caught respectively 6.7 and 5.9 times more tabanids than the Biconical.

	Stomoxys spp.		
	Rainy season	Dry season	Total
"Vavoua"	343	12	355
Biconical	22	1	23
Cubical (F3)	15	7	22
Pyramidal	60	7	67
Total	440	27	467

Monoconical "Vavoua" was 16 or 15 times as superior in catching of *Stomoxys* spp. than Cubical or Biconical and caught 5 tines as many more than the Pyramidal.

3.1.2. Total catches in forest gallery.

	Tabanids		
	Rainy season	Dry season	Total
"Vavoua"	4	77	81
Biconical	1	27	28
Cubical(F3)	28	97	125
Pyramidal	9	53	62
Total	42	254	296

Cubical(F3) and "Vavoua" caught respectively 4.4 and 2.8 times more tabanids than the Biconical.

	Stomoxys spp.		
	Rainy season	Dry season	Total
"Vavoua"	25	24	49
Biconical	4	0	4
Cubical(F3)	17	3	20
Pyramidal	13	2	15
Total	59	29	88

"Vavoua" was 12.2 or 3.2 times as superior in catching of *Stomoxys* spp. than Biconical or Pyramidal and caught 2.4 times as many more than the Cubical.

3.1.3. Tabanids species.

Table 1: Tabanids species captured in different traps

SPECIES	VAVOUA	BICONICAL	CUBICAL	PYRAMIDAL	TOTAL
Ancala spp.	1 - 0.48%	0	4 - 1.50%	0	5 - 0.74%
Atylotus spp.	5 21.73% 2.40%	1 4.34% 2.04%	9 39.13% 3.38%	8 34.78% 5.29%	23 100% 3.41%
Chrysops spp.	22 64.70% 10.57%	0	1 2.94% 0.37%	11 32.35% 7.28%	34 100% 5.04%
Tababanus biguttatus & T. brumpti	2 - 0.96%	0	0	4 - 2.64%	6 - 0.89%
Tabanus gratus	138 36.60% 66.34%	45 11.93% 91.83%	116 30.76% 43.60%	78 20.68% 51.68%	377 100% 55.93%
Tabanus nyasae	5 7.81% 2.40%	1 1.56% 2.04%	53 82.81% 19.92%	5 7.81% 3.31%	64 100% 9.49%
Tabanus par	4 9.52% 1.92%	1 2.38% 2.04%	27 64.28% 10.15%	10 23.80% 6.62%	42 100% 6.23%
Tabanus taeniola	29 26.60% 13.94%	1 0.91% 2.04%	45 41.28% 16.91%	34 31.19% 22.51%	109 100% 16.17%
Tabanus spp.	2 14.28% 0.96%	0	11 78.57% 4.13%	1 7.14% 0.66%	14 100% 2.07%
TOTAL	208 30.86% 100%	49 7.27% 100%	266 39.46% 100%	151 22.40% 100%	674 100% 100%

In each case are superimposed the number of individual flies captured and percentages of the colon and line

3.2. Comparison among odours:

3.2.1. Total catches in savannah woodland.

	Tabanids		
	Pyramidal	Cubical	Total
Acetone/octenol	83	57	140
Acetone/octenol/m. cresol	114	45	159
Octenol/m. cresol	60	49	109
Acetone/octenol/urine	101	69	170
Control	41	45	86
Total	399	265	664

Catches of tabanids were increased with pyramidal traps
2.7 Times by acetone/octenol/m . cresol
2.4 Times by acetone/octenol/cow urine
2.0 Times by acetone/octenol

	Stomoxys spp.		
	Pyramidal	Cubical	Total
Acetone/octenol	814	151	965
Acetone/octenol/m. cresol	1042	403	1445
Octenol/m. cresol	673	401	1074
Acetone/octenol/urine	754	312	1066
Control	462	171	633
Total	3745	1438	5183

Catches of *Stomoxys* spp. were increased
2.2 Times by acetone/octenol/m. cresol with Pyramidal and
2.3 Times with Cubical traps
2.3 Times by octenol/m. cresol with Cubical traps

3.2.2. Total catches in forest gallery.

	Tabanids		
	"Vavoua"	Biconical	Total
Acetone/octenol	57	7	64
Acetone/octenol/m. cresol	42	3	45
Octenol/m. cresol	68	9	77
Acetone/octenol/urine	103	17	120
Control	20	33	29
Total	290	39	239

Catches of tabanids were increased with "Vavoua" traps
5.1 Times by acetone/octenol/cow urine
3.4 Times by octenol/m. cresol
2.8 Times by acetone/octenol
2.1.Times by acetone/octenol

	Stomoxys spp.		
	"Vavoua"	Biconical	Total
Acetone/octenol	60	4	64
Acetone/octenol/m. cresol	53	0	53
Octenol/m. cresol a	52	4	56
Acetone/octenol/urine	56	4	60
Control	31	0	31
Total	252	12	264

Catches of *Stomoxys* s pp. were increased
2 Times by acetone/octenol

3.2.3. Tabanids species.

Table 2 : Tabanids species attracted with different odour associations

SPECIES	ACET./ OCT.	ACET./ OCT./ M.CR.	OCT./ M.CR.	ACET./ OCT./ URINE	CONTROL	TOTAL
Ancala spp.	0	3 18.75% 1.47%	4 25.00% 2.15%	6 37.50% 2.06%	3 18.75% 2.75%	16 100% 1.61%
Atylotus spp.	21 23.07% 10.29%	25 27.47% 12.25%	10 10.98% 5.37%	22 24.17% 7.37%	13 14.28% 11.92%	91 100% 9.16%
Chrysops spp.	10 20.00% 4.90%	11 22.00% 5.39%	10 20.00% 5.37%	12 24.00% 4.13%	7 14.00% 6.42%	50 100% 5.03%
Tabanus biguttatus & T. brumpti	7 41.17% 3.43%	6 35.29% 2.94%	2 11.76% 1.07%	1 5.88% 0.34%	1 5.88% 0.91%	17 100% 1.71%
Tabanus gratus	57 18.62% 27.94%	46 15.03% 22.54%	74 24.18% 39.78%	102 33.33% 35.17%	27 8.82% 24.77%	306 100% 30.81%
Tabanus nyasae	15 13.76% 7.35%	12 11.00% 5.88%	39 35.77% 20.96%	20 18.34% 6.89%	23 21.10% 21.10%	109 100% 10.97%
Tabanus par	38 23.75% 18.62%	44 27.50% 21.56%	23 14.37% 12.36%	40 25.00% 13.79%	15 9.37% 13.76%	160 100% 16.11%
Tabanus taeniola	55 23.40% 26.96%	53 22.55% 25.98%	23 9.78% 12.36%	86 36.59% 29.65%	18 7.65% 16.51%	235 100% 23.66%
Tabanus spp.	1 11.11% 0.49%	4 44.44% 1.96%	1 11.11% 0.53%	1 11.11% 0.34%	2 22.22% 1.83%	9 100% 0.90%
TOTAL	204 20.54% 100%	204 20.54% 100%	186 18.73% 100%	290 29.20% 100%	109 10.97% 100%	993 100% 100%

In each case are superimposed the number of individual flies captured and percentages of the colon and line

Table 3 : Number and apparent densities of tabanids (mean ± std = number/trap/day) catches in savannah and forest gallery with different forms of traps, during rainy and dry seasons (latin squares 4 x 4 four times = 16 days, V = variance)

BIOTOPE	SEASON	VAVOUA TRAP	BICONICAL TRAP	CUBICAL TRAP (F3)	PYRAMIDAL TRAP
Woody Savannah n°1	rainy	21 1.31 ± 0.78 V= 2.589	5 0.31 ± 0.02 V= 0.339	47 2.93 ± 2.01 V= 16.933	28 1.75 ± 1.39 V= 8.062
	dry	46 2.87 ± 1.72 V= 12.359	1 0.06 ± 0.40 V= 0.058	10 0.62 ± 0.34 V= 0.4843	18 1.12 ± 0.59 V= 1.484
Woody Savannah n°2	rainy	21 1.31 ± 0.70 V= 2.069	2 0.12 ± 0.10 V= 0.109	44 2.75 ± 2.93 V= 35.812	19 1.18 ± 0.71 V= 2.152
	dry	39 2.43 ± 1.14 V= 5.496	13 0.81 ± 0.43 V= 0.777	40 2.50 ± 1.61 V= 10.875	24 1.50 ± 0.71 V= 2.125
Forest Gallery	rainy	4 0.25 ± 0.21 V= 0.187	1 0.06 ± 0.40 V= 0.058	28 1.75 ± 1.23 V= 6.312	9 0.56 ± 0.62 V= 1.621
	dry	77 4.81 ± 1.45 V= 8.777	27 1.68 ± 0.84 V= 2.964	97 6.06 ± 2.26 V= 21.433	53 3.33 ± 1.14 V= 5.464
TOTAL	rainy and dry	208	49	266	151

Table 4 : Number and apparent densities of *Stomoxys spp.* (mean ± std = number/trap/day) catches in savannah and forest gallery with different forms of traps, during rainy and dry seasons

(latin squares 4 x 4 four times = 16 days, V = variance)

BIOTOPE	SEASON	VAVOUA TRAP	BICONICAL TRAP	CUBICAL TRAP (F3)	PYRAMIDAL TRAP
Woody Savannah n°1	rainy	263 16.43 ± 15.22 V= 965.87	19 1.18 ± 1.45 V= 8.777	10 0.62 ± 0.41 V= 0.734	30 1.87 ± 1.03 V= 4.484
	dry	12 0.75 ± 1.19 V= 5.937	0	0	0
Woody Savannah n°2	rainy	80 5.00 ± 2.21 V= 20.50	3 0.18 ± 0.20 V= 0.277	5 0.31 ± 0.28 V= 0.339	30 1.87 ± 1.06 V= 4.734
	dry	0	1 0.06 ± 0.40 V= 0.058	7 0.43 ± 0.83 V= 2.871	7 0.43 ± 0.51 V= 1.121
Forest Gallery	rainy	25 1.56 ± 1.23 V= 5.371	4 0.25 ± 0.30 V= 0.562	17 1.06 ± 0.94 V= 3.683	13 0.81 ± 0.95 V= 3.777
	dry	24 1.50 ± 2.84 V= 33.75	0	3 0.18 ± 0.35 V= 0.527	2 0.12 ± 0.23 V= 0.234
TOTAL	rainy and dry	404	27	42	82

Table 5 : Apparent densities of tabanids (mean ± std = number/trap/day) catches in woody savannah with odours or odour associations in pyramidal and cubical traps, during rainy and dry seasons (latin squares 5 x 5 four times = 20 days, V = variance)

TRAP	SEASON	ACETONE/OCTENOL	ACET./OCT./M.CRE.	OCT./M.CRESOL	ACET./OCT./UR.	CONTROL
PYRAMIDAL	rainy	77 3.85 ± 1.85 V = 17.827	112 5.60 ± 3.76 V = 73.940	54 2.70 ± 1.34 V = 9.41	92 4.60 ± 2.58 V = 34.84	40 2.00 ± 1.13 V = 6.70
	dry	6 0.30 ± 0.28 V = 0.41	2 0.10 ± 0.10 V = 0.19	6 0.30 ± 0.20 V = 0.41	9 0.45 ± 0.42 V = 0.947	1 0.05 ± 0.10 V = 0.047
CUBICAL	rainy	38 1.90 ± 1.90 V = 20.09	33 1.65 ± 1.21 V = 7.627	39 1.95 ± 1.21 V = 7.647	55 2.75 ± 2.00 V = 20.987	37 1.85 ± 1.78 V = 16.627
	dry	19 0.95 ± 0.67 V = 2.347	12 0.60 ± 1.05 V = 5.74	10 0.50 ± 0.40 V = 1.05	14 0.70 ± 0.52 V = 1.41	8 0.40 ± 0.50 V = 1.54
TOTAL	rainy and dry	140	159	109	170	86

Table 6 : Apparent densities of *Stomoxys spp.* (mean ± std = number/trap/day) catches in woody savannah with odours or odour associations in pyramidal and cubical traps, during rainy and dry seasons (latin squares 5 x 5 four times = 20 days, V = variance)

TRAP	SEASON	ACETONE/OCTENOL	ACET./OCT./M.CRE.	OCT./M.CRESOL	ACET./OCT./UR.	CONTROL
PYRAMIDAL	rainy	802 40.10 ± 28.80 V = 4319.79	1040 52.00 ± 35.74 V = 6651.30	672 33.60 ± 19.67 V = 2016.14	754 37.70 ± 20.61 V = 2211.51	462 23.10 ± 10.95 V = 625.29
	dry	12 0.60 ± 0.75 V = 2.940	2 0.10 ± 0.10 V = 0.190	1 0.05 ± 0.10 V = 0.047	0	0
CUBICAL	rainy	151 7.55 ± 5.49 V = 157.247	399 19.95 ± 17.97 V = 1682.94	400 20.00 ± 19.90 V = 2071.00	312 15.60 ± 16.95 V = 1493.34	171 8.55 ± 7.83 V = 319.347
	dry	0	4 0.20 ± 0.30 V = 0.76	1 0.05 ± 0.10 V = 0.047	0	0
TOTAL	rainy and dry	965	1445	1074	1066	633

Table 7 : Apparent densities of tabanids (mean ± std = number/trap/day) catches in woody savannah with odours or odour associations in biconical and "Vavoua" traps, during the rainy and dry seasons (latin squares 5 x 5 four times = 20 days, V = variance)

TRAP	SEASON	ACETONE/OCTENOL	ACET./OCT./M.CRE.	OCT./M.CRESOL	ACET./OCT./UR.	CONTROL
BICONICAL	rainy	2 0.10 ± 0.10 V = 0.08	0	3 0,15 ± 0.15 V = 0.127	5 0.25 ± 0.18 V = 0.187	0
	dry	5 0.25 ± 0.30 V = 0.487	3 0.15 ± 0.15 V = 0.127	6 0.30 ± 0.30 V = 061	12 0.65 ± 0.68 V = 2.427	3 0.15 ± 0.20 V = 0.427
"VAVOUA"	rainy	12 0.60 ± 0.44 V = 1.040	16 0.80 ± 0.67 V = 2.36	11 0.55 ± 0.48 V = 1.247	29 1.45 ± 0.68 V = 2.447	8 0.40 ± 0.40 V = 0.939
	dry	45 2.25 ± 1.04 V = 5.687	26 1.30 ± 0.58 V = 1.81	57 2.85 ± 1.07 V = 6.027	74 3.70 ± 1.69 V = 14.91	12 0.60 ± 0.48 V = 1.240
TOTAL	rainy and dry	64	45	77	120	26

Table 8 : Apparent densities of *Stomoxys spp.* (mean ± std = number/trap/day) catches in woody savannah with odours or odour associations in biconical and "Vavoua" traps, during the rainy and dry seasons (latin squares 5 x 5 four times = 20 days, V = variance)

TRAP	SEASON	ACETONE/OCTENOL	ACET./OCT./M.CRE.	OCT./M.CRESOL	ACET./OCT./UR.	CONTROL
BICONICAL	rainy	4 0.20 ± 0.29 V = 0.460	0	4 0.20 ± 0.17 V = 0.16	1 0.05 ± 0.10 V = 0.047	0
	dry	0	0	0	3 0.15 ± 0.20 V = 0.427	0
"VAVOUA"	rainy	54 2.70 ± 1.83 V = 17.51	42 2.10 ± 1.31 V = 8.990	50 2.50 ± 1.36 V = 9.649	46 2.30 ± 1.44 V = 10.91	30 1.50 ± 0.84 V = 3.750
	dry	6 0.30 ± 0.30 V = 0.610	11 0.55 ± 0.59 V = 1.847	2 0.10 ± 0.10 V = 0.08	10 0.50 ± 0.70 V = 3.150	1 0.05 ± 0.10 V = 0.047
TOTAL	rainy and dry	64	53	56	60	31

4. OBSERVATIONS

4.1. Comparison among traps:

Tabanus gratus and *T. taeniola* are found to be most abundant species (55.93% and 16.17% of individual flies captured, respectively).

The cubical trap is more efficient in catching *T. nyasae* (82.87%), *T. par* (41.28%) and *Atylotus genus* (39.13%).

The "Vavoua" trap attracts more *Chrysops* spp. (64.70%) and *T. gratus* (36.60%).

The Pyramidal trap is efficient against *Atylotus* spp. and *Chrysops* spp. (34.78% and 32.35% of individual flies captured, respectively).

The Biconical trap is less efficient against the different species of Tabanids.

In the Sudanese zone Biconical, Pyramidal, Cubical (F3) and "Malaise" traps were compared for their efficacy against Tabanids and *Stomoxys*. The Malaise trap was the most efficient against Tabanids (49.56%). The Cubical trap was the most efficient against *Stomoxys*, Pyramidal trap was less effective against tabanids and Biconical trap wasn't effective against *Stomoxys*.

4.2. Comparison among odours:

Tabanus gratus (30.81%), *T. taeniola* (23.66%) and *T. par* (16.11%)are found to be the most abundant species.

The acetone/octenol/cow urine association is more efficient in the catching of *Ancala* spp. (37.50%), *Tabanus taeniola* (36.59%) and *T. gratus* (33.33%).

Tabanus biguttatus and *T. brumpti* are more attracted by the acetone/octenol and acetone/octenol/m. cresol associations (41.17% and 35.29% of individual flies captured, respectively).

Tabanus nyasae were more attracted by the octenol/m. cresol combination (35.77%).

5. CONCLUSION

Our study has clearly shower that:

- The Cubical trap (expensive: 30 US $ / 1 trap) is not easy to manipulate, efficient against tabanidae but not against tsetse flies. They are venerable and may be easily destroyed by animals and termites.
- The Pyramidal trap (relatively cheaper: 11 US $ / 1 trap) is however not easy to install, may be distorted by wind. It is a little efficient against tabanidae and *Stomoxys*, but should not be recommended during mass control campaign.
- The monoconical "Vavoua" trap with an intermediate cost (12 US $ / 1 trap) and because of its high performance against *Stomoxys* and tsetse flies may be widely used during mass campaign for controlling tsetse flies as well as mechanical vectors such.
- The Biconical trap (16 US $ / 1 trap) was found to be less efficient against the different species of tabanidae, but the most performance against the 3 species of *Glossina* present in Mali, therefore should be recommended for assessing tsetse flies apparent densities.
- Biconical and "Vavoua" traps associated with olfactory attractants and impregnated with deltamethrin could be economically and efficiently used in trypanosomiasis vectors control.

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