

# Attraction of the tsetse fly *Glossina morsitans submorsitans* to acetone, 1-octen-3-ol, and the combination of these compounds in West Africa

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## RÉSUMÉ

POLITZAR (H.), MÉROT (P.). — Pouvoir attractif pour *Glossina morsitans submorsitans* de l'acétone, du 1-octen-3-ol seuls ou associés, en Afrique occidentale. *Rev. Elev. Méd. vét. Pays trop.*, 1984, 37 (4) : 468-473.

Le pouvoir attractif du 1-octen-3-ol (octenol) et de l'acétone ayant été montré au Zimbabwe pour *G. pallidipes* et *G. m. morsitans*, ces deux produits ont été testés vis-à-vis de *G. m. submorsitans* au Burkina Faso. Les essais, faits successivement en saison des pluies puis en saison sèche, ont été réalisés selon le protocole des carrés latins. L'analyse des résultats obtenus en saison des pluies a mis en évidence un accroissement significatif des captures de 6,7 fois lorsque les deux produits étaient associés au piège. L'augmentation était de 5,9 fois pour les mâles et 7,5 fois pour les femelles. Les résultats de saison sèche étaient également significatifs, quoique inférieurs du fait de la plus grande attractivité visuelle du piège. Cette importante augmentation des captures de *G. m. submorsitans* par un piège lorsque des attractifs olfactifs y sont associés permet d'envisager une réduction du nombre de pièges actuellement utilisés dans les opérations de lutte au Burkina Faso de 33 à 5 ou 6/km<sup>2</sup>.

**Mots-clés :** *Glossina morsitans submorsitans* - Acétone - 1-octen-3-ol - Pouvoir attractif.

## SUMMARY

POLITZAR (H.), MÉROT (P.). — Attraction of the tsetse fly *Glossina morsitans submorsitans* to acetone, 1-octen-3-ol, and the combination of these compounds in West Africa. *Rev. Elev. Méd. vét. Pays trop.*, 1984, 37 (4) : 468-473.

1-octen-3-ol (= octenol) and acetone that had proved to be potent olfactory attractants in Zimbabwe for *G. pallidipes* and *G. m. morsitans* were tested against *G. m. submorsitans* in Burkina Faso. Experiments were carried out in the rainy season and in the dry season. To compare the efficacy of acetone, octenol, acetone-plus-octenol — baited and non baited traps, a series of randomised 4 × 4 latin squares was utilised. Analysis of tsetse catches in the rainy season showed a significant 6,7 fold increase of catches for the trap with acetone plus octenol in comparison to non-baited traps. Capture data for males and females separately showed a 5,9 fold increase for males and 7,5 fold for females. The latin square replicates of the dry season also showed a significant superiority of the association of acetone and octenol in comparison with single odour and non-baited traps but the relative superiority of odour baited traps was reduced. The important increase in capture of *G. m. submorsitans* per trap by the use of olfactory attractants may permit lowering the number of traps now used for control operations in Burkina Faso from 33/km<sup>2</sup> to about 5-6/km<sup>2</sup>.

**Key-words :** *Glossina morsitans submorsitans* - Acetone - 1-octen-3-ol - Attraction.

## INTRODUCTION

The use of insecticide impregnated traps and screens against riverine tsetse has been highly

successful in an area of approximately 3 500 km<sup>2</sup> in western Burkina Faso (3). A 94 p. 100 reduction of *G. tachinoides* and 88 p. 100 of *G. p. gambiensis* was followed by releases of

sterile males of these two species and subsequently eradication was achieved along more than 650 km of rivers. However a linear arrangement of traps or screens along riverine vegetation proved completely inefficient against the savannah species *G. m. submorsitans* (4). Alternating an equal number of traps and screens in a savannah area of 18 km<sup>2</sup> at a density of 0,33 traps or screens per ha, to act as a barrier against reinvasion, proved almost 100 p. 100 effective but was too expensive for a large scale control operation against this species. Since 1-octen-3-ol (= octenol) and acetone have been found to be potent attractants for *G. pallidipes* and *G. m. morsitans* in Zimbabwe (5), experiments were carried out to test their efficacy against *G. m. submorsitans* in West Africa. The aim was to reduce the number of traps and associated costs by increasing the efficacy of traps and screens using olfactory attractants. The present paper reports results obtained using acetone and octenol either separately or together compared with the use of non baited traps.

## MATERIAL AND METHODS

The experimental area was situated in the flood-plain and adjacent Guinea savannah of the Comoe river valley in south-western Bur-

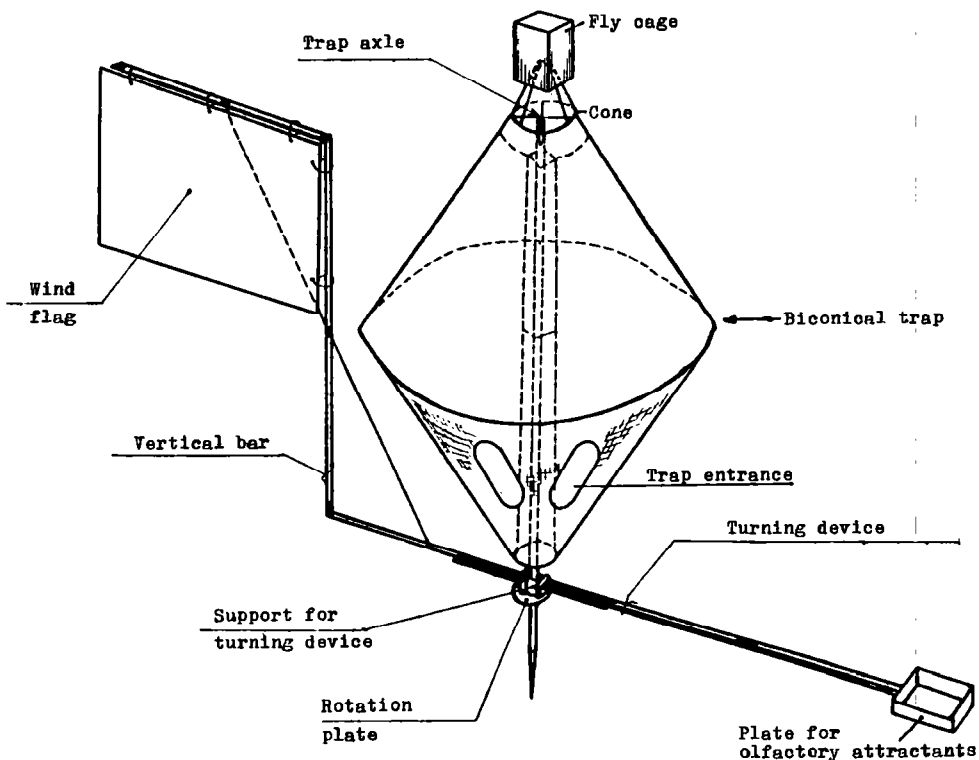
kina Faso, near the border of Ivory Coast. It is an unpopulated area which ensures minimum disturbance for experiments with olfactory stimulants. Game is abundant and sustains a sufficiently high fly density throughout the whole year.

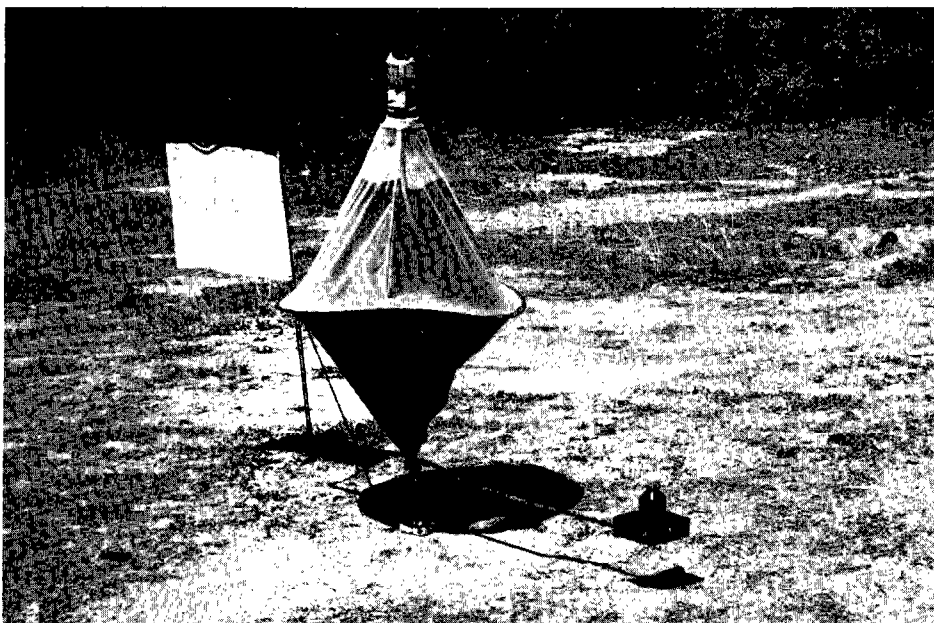
Experiments were carried out in the rainy season when trap visibility was very restricted and in the dry season, when olfactory and visual stimulants can compete.

The traps were biconical traps with blue lower cones (1) and were equipped with a turning device consisting of a flag on one side and the attractants on the other (Fig. and photo) to orientate these constantly one meter upwind of the traps.

To avoid any interaction of odour plumes traps were spaced at intervals of 500 m along a small road in a north-south direction because prevailing winds in the rainy season are from the south-west and in the dry season from the north-east.

In the rainy season targets were placed at the end of 50 m zig-zag paths cut into the long grass, to assure they presented no visual stimulants at a distance and that only olfactory attraction would be operative. A cleared area of 4 m diameter was created around each trap to allow free movement of the turning device.





Experiments were carried out at the same places during the dry season after grass fires had passed through the area rendering the traps totally visible for 200-300 m.

Traps with the attractants were installed immediately after dawn between 6 and 6<sup>30</sup>. During the day, all unnecessary activity near the sites was avoided. Catches were counted between 5 and 5<sup>30</sup> in the evening at which time traps and attractants were removed. To compare the efficacy of traps baited with the two odours separately and together with the control trap, a series of randomised 4 × 4 latin squares was utilised. One trap with acetone (up to 1 200 mg/h), one with octenol (0,5 mg/h) and one with acetone and octenol (same dosages) combined were compared to one non baited trap.

During the wet season four replicates of each latin square were carried out. However during the dry season due to the constantly declining fly density 6 replicates had to be performed to achieve a sufficiently high capture.

Octenol dispensers were glass vials (40 × 17 mm) received from VALE and corresponding exactly to the description of dispenser (1) in his paper (5). Acetone was evaporated from 500 ml glass bottles with perforated

rubber tops. A wick consisting of a 3 mm diameter string projected 1 cm from a hole in the top and reached the acetone in the bottle.

## RESULTS

Evaporation rates of acetone varied from 400 to 1 200 mg/h depending upon temperature, humidity and windspeed, while octenol evaporation was more constant, being approximately 0,5 mg/h. Catches of tsetse flies were separately registered according to species and sex. No substantial changes in the sex ratio were observed during the experiments and catches were pooled for statistical analysis.

Analysis of the total tsetse catches of Table I (log transformed) of each latin square in the rainy season showed a significant difference between the trap with acetone plus octenol and the other three arrangements. A mean 6.7 fold increase in catch with acetone and octenol baited traps was achieved in comparison to non baited traps (Table II, III). Additionally an overall analysis of these four latin squares showed a significant difference between the catches of the traps baited with acetone and the unbaited control trap. The trap with octenol alone showed no significant

difference in capture efficiency compared with the control trap or the one with acetone alone. Analysis of the capture data for males and females separately showed a 5,9 fold increase for males and 7,5 fold for females when acetone and octenol were used together as baits.

The six latin square replicates of the dry season showed considerable variation in

captures because of alternating cloudy days or harmattan. Nevertheless a global analysis showed a significant superiority of the association of acetone and octenol in comparison with the three other traps (Table IV). Differences between the traps were not significant in each latin square because the daily capture figures were too small at that time

TABLE N°I-Total tsetse catches in the rainy season in attractant baited traps and non baited traps

Latin square n°	Acetone			1-octen-3-ol			Acetone + 1-octen-3-ol			non baited		
	♂	♀	Total	♂	♀	Total	♂	♀	Total	♂	♀	Total
1	53	135	188	52	136	188	276	510	786	31	88	119
2	68	124	192	28	81	109	105	310	415	26	26	52
3	37	82	119	31	50	81	122	194	316	23	29	52
4	30	88	118	22	58	80	78	208	286	18	28	46
Total	188	429	617	133	325	458	581	1222	1803	98	171	269

TABLE N°II-Efficacy of traps by use of different attractants in the rainy season

Latin square n°	Acetone	1-octen-3-ol	Acetone + 1-octen-3-ol
1	x 1,58	x 1,58	x 6,70
2	x 3,69	x 2,10	x 7,98
3	x 2,29	x 1,56	x 6,08
4	x 2,57	x 1,87	x 6,22
Mean value	x 2,29 (a) <sup>2</sup>	x 1,72 (a) <sup>2</sup>	x 6,70 (b) <sup>2</sup>

1. Numbers in the body of the table are multiplication factors, i.e. number of flies captured in baited traps divided by the numbers captured in the non baited traps.

TABLE N° III-Analysis of variance for comparison of the performance of traps baited with acetone, 1-octen-3-ol and the two compounds combined. in the rainy season

Source of variations	S S	d f	M S	F	Significance
Between days	2,80	12	0,23	1,92	N. S.
Between sites	3,69	12	0,31	2,98	p < 0,05
Between traps	31,09	3	0,36	86,33	p < 0,001
Between squares	5,95	3	1,98	16,50	p < 0,001
Residual	4,05	33	0,12		

TABLE N°IV-Total tsetse catches in the dry season

Latin square n°	Acetone			1-Octen-3-ol			Acetone + 1-Octen-3-ol			Non baited trap		
	o	♀	Total	o	♀	Total	o	♀	Total	o	♀	Total
1	30	62	92	48	93	141	51	146	197	21	31	52
2	24	34	58	26	24	50	43	57	100	30	25	55
3	24	28	52	19	15	34	32	39	61	20	10	30
4	47	28	75	38	17	55	58	31	89	8	4	12
5	48	34	82	34	17	51	43	60	103	20	22	42
6	37	19	56	39	24	63	61	49	110	34	12	46
Total	210	205	415	204	190	394	288	372	660	133	104	237

TABLE N°V-Efficacy of traps by use of different attractants in the dry season

Attractant	Acetone	1-Octen-3-ol	Acetone + 1-Octen-3-ol
Latin square n°			
1	x 1,77	x 2,71	x 3,79
2	x 1,05	x 0,94	x 1,82
3	x 1,73	x 1,13	x 2,03
4	x 6,25	x 4,58	x 7,42
5	x 1,95	x 1,21	x 2,45
6	x 1,22	x 1,37	x 2,39
Mean value	x 1,75	x 1,66	x 2,78

1. Numbers in the body of the table are multiplication factors, i.e. number of flies captured in baited traps divided by the numbers captured in the non baited traps.

TABLE N°VI-Analysis of variance for comparison of the performance of traps baited with acetone, 1-Octen-3-ol and the two compounds combined, in the dry season

Source of variations	S S	d f	M S	F	Significance
Between days	8,12	18	0,45	1,61	p < 0,05
Between sites	22,76	18	1,26	4,50	p < 0,001
Between traps	12,62	3	4,21	15,03	p < 0,001
Between squares	4,77	3	1,59	5,68	p < 0,001
Residual	14,42	51	0,28		

of the year. The relative superiority of odour baited traps over unbaited traps was reduced in the dry season owing to the visual attractiveness of the traps which was not an important factor in the rainy season.

## DISCUSSION AND CONCLUSIONS

Results demonstrate that acetone and octenol are efficient olfactory attractants for the West African subspecies *G. m. submor-*

*sitans*. They also show clearly the superiority of the combination of these two chemicals compared with the use of the compounds separately or of non baited traps. During the rainy season when the visual attraction of a trap in the high grass in practically nil the combination of these two products is synergistic. The efficacy is even higher than that stated by VALE for *G. m. morsitans* (pers. comm.) but still lower than the increase reached in Zimbabwe for the main target species *G. pallidipes*. Their use can maintain the efficacy of control operations during an important period where non-baited insecticide impregnated targets lose most of their efficacy due to reduced visibility. Capture figures were too small and variances too great in daily captures for the apparent increase in the percentage of females caught to be demonstrated statistically. The same applies to the olfactory effect of octenol

whose superiority could not be demonstrated alone but only in combination with acetone.

The important increase in capture of *G. m. submorsitans* per trap by the use of olfactory attractants may permit lowering the number of traps used for control operations in Burkina faso from 33/km<sup>2</sup> to about 5-6/km<sup>2</sup>. This should decrease the costs of campaigns against this species to an economically acceptable level and will be tested in the near future in several large scale control operations in Burkina Faso.

#### ACKNOWLEDGEMENTS

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#### RESUMEN

POLITZAR (H.), MÉROT (P.). — Poder atractivo para *Glossina morsitans submorsitans* de la acetona, del 1-octen-3-ol utilizados solos o asociados, en África occidental. *Rev. Elev. Méd. vét. Pays trop.*, 1984, **37** (4) : 468-473.

Siendo demostrado el poder atractivo del 1-octen-3-ol (octanol) y de la acetona para *G. pallidipes* y *G. m. morsitans* en Zimbabwe, se experimentaron dichos dos productos para con *G. m. submorsitans* en Burkina Faso. Se realizaron los ensayos según el sistema de los cuadrados latinos. El análisis de los resultados obtenidos durante la estación de las lluvias evidenció un incremento

significativo de 6,7 veces de las capturas con trampa y ambos productos. El aumento era de 5,9 veces para los machos y 7,5 veces para las hembras.

Los resultados durante la estación seca eran también significativos aunque inferiores a causa del mayor poder atractivo visual de la trampa. Este importante aumento de las capturas de *G. m. submorsitans* por una trampa cuando asociada con productos atractivos olfativos permite disminuir el número de trampas actualmente utilizado para operaciones de lucha de 33 a 5 o 6/km<sup>2</sup>.

*Palabras claves* : *Glossina morsitans submorsitans* - Acetona - 1-octen-3-ol - Poder atractivo.

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