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FINAL REPORT

INTEGRATING LIVESTOCK INTO CROPPING SYSTEMS USING NATURAL BIODEGRADABLE REPELLENTS: GOATS AS RUMINANT MODELS

USAID Historically Black Colleges and Universities Research Program
Project No. DAN-5053-G-001023-00

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INTEGRATING LIVESTOCK INTO CROPPING SYSTEMS USING NATURAL BIODEGRADABLE REPELLENTS: GOATS AS RUMINANT MODELS

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FINAL REPORT (1991-1994)

SUMMARY

Three major experiments were conducted to determine the effects of predator scents on feeding behavior of dairy goats. The objective of this research was to identify chemicals that repel and deter goats from grazing crops. The specific objectives were: 1) To screen for repellent properties from fecal sources from large feline carnivores; 2) To compare feeding responses of goats in the presence of fecal scents from predator and non-predator sources; 3) To identify and characterize chemicals from the most effective fecal scents from large felids that have repellent properties; and 4) To compare repellent properties of known chemicals and chemicals characterized from predator fecal scents as feeding deterrents.

In experiment 1 fecal extracts of predator and non predator sources were tested, goats made fewer head entries into, and ate less feed from feed buckets containing dried fecal extracts of predators. The amount of feed consumed from buckets containing puma, gazelle, gnu and solvent treatments were statistically indistinguishable, but less feed was consumed from them than from buckets containing the goat-scented or plain papers. No significant differences among treatment were detected with respect to head insertions.

In experiment 2, chemical scents isolated from lion feces were tested. Three of eight non sulfur-containing compounds (2-methyl-3-buten-2-ol, 2-methylhexanoic acid, and isobutyric acid) were found to significantly reduce feed intake of goats with isobutyric acid being the most

effective. Feed intake was reduced 30% by 2-methyl-3-buten-2-ol ($P<.05$), 41% by 2-methylhexanoic acid ($P<.02$), 48% by isobutyric acid ($P<.003$), 86% ($P<.005$) by methyl disulfide (MD), 64% ($P<.02$) by 1-mercapto-2-propanol (MO) and 71% ($P<.02$) by 3-mercapto-1,2-propanediol (MI) at 100% concentration compared to control. Other compounds (3-phenyl-1 propenol, propyl butyrate, 4-methyl valeric acid, 2 octenoic acid, and 2-methyl valeric acid) had no deterrent properties. The four scents most effective in deterring feed intake were re-tested at a 10% concentration in a 5 x 5 Latin square and MD, MO and MI depressed FI by 25% ($P<.004$), 27% ($P<.003$) and 19% ($P<.02$) respectively. The feed intake/head insertion ratio was reduced 98 g/HI ($P<.005$) with MD, 82 g/HI ($P<.02$) with MI and 59 g/HI ($P<.06$) with MO. This study demonstrated that S-containing compounds MD, MI and MO, isolated from lion feces, could be used to deter feeding of Alpine does in confinement even at 10% concentration.

In experiment 3, six chemical scents, Δ^3-Isopentenyl methyl sulfide (IPMS), 2,5-dihydro-2,4,5-trimethylthiazole (TMT), 2-propylthietane (PT), and 3-propyl-1,2-dithiolane (PDT) were found extremely effective in repelling goats. Feed intake and feed intake per head insertion were significantly ($P < .0001$) reduced compared with control [PEG or poly(ethylene glycol)], although the number of HI was similar for all treatments. When tested at 3% concentration (Trials 2 and 3), all but PDT were found effective. Feed intake was reduced by 49% ($P > .05$), 43% ($P < .004$), 57% ($P < .0001$), and 34% ($P < .002$) with 3-propyl-1,2-dithiolane, Δ^3-Isopentenyl methyl sulfide, 2-propylthietane and 2,5-dihydro-2,4,5-trimethylthiazole, respectively. The ratio of FI/HI was reduced by 114.2 g with PDT ($P > .05$), 68.3 g with IPMS ($P < .006$), 107 g with PT ($P < .0005$), and 114 g with TMT ($P < .0004$). Number

of HI increased by 2.3 times ($P < .01$) with TMT. Results of this experiment revealed that both 2-2- dimethylthietane and 3-3 dimethyl-1,2-dithiolane reduced feed intake of goats: FI was reduced by 43.5 g ($P < .0001$) and 12.5 g ($P < .01$) while FI/HI was depressed by 75.1 g ($P < .03$) and 28.7 g ($P > .05$), respectively.

Our experiments showing that carnivore fecal scents and some chemicals suppress feeding in goats suggest potential to use chemicals to deter browsing by goats. However, other studies are warranted to determine if predator-derived chemicals can be used to protect vegetation against browsing by goats.

Study 1. SUPPRESSION OF FEED INTAKE OF ALPINE GOATS (*CAPRA HIRCUS*) TO CARNIVORE FECAL SCENTS.

In this experiment, extracts were obtained from the feces of the Bengal tiger (Panthera tigris), Siberian tiger (P. tigris altaica), African lion (P. leo) and brown bear (Ursus arctos). Fecal samples were obtained from predators maintained at the Houston Zoological Gardens, Houston, Texas. The tigers and lion were fed Frozen Feline Diet (Animal Spectrum Inc., Lincoln, Nebraska). The bear was fed Spectrum Omnivore Diet (Animal Spectrum Inc.), mackerel, apples oranges, and carrots.

Fecal samples were obtained within 12 hr of defecation, placed into glass jars and stored at -20°C. Seventy-five grams of feces from each species were extracted in 500 ml of chloroform:methanol:water (1:2:0.08 by volumes). The slurry was stirred and filtered through Whatman #2. The extract (1.5 ml) was absorbed onto (15cm Whatman #2) on aluminum foil, and allowed to air-dry for 20 min. All filter papers were shredded in a Boston Electric paper shredder (Hunt Mfg. Co., Statesville, NC).

Ten mature dry Alpine does were randomly selected from the Institute's herd and placed in 122 cm X 50 cm x 88 cm individual pens for two weeks adaptation period. They were fed a complete mixed ration (16% CP and 65% TDN) *ad libitum* with free access to water. During the experimental period the animals were fasted for 15 hours prior to each test date.

Subjects were presented with 907 g of their regular feed in a 3.8 liter bucket (diameter = 25cm) covered with shredded filter paper containing fecal-scents, solvent or untreated filter papers. Each treatment was presented three times during the trial, with 3 min/presentation (total = 9 min). Subjects were exposed to all these conditions in a Latin-square design. The goats' behavior was recorded on a video recorder positioned 2.5 m behind the stall. The number of head insertions made by the goats into buckets were scored, and the buckets were weighed at the end of each session to determine feed intake.

In the fifth trial of this experiment, goats were tested for responses to extracts of the feces of the puma (Felis concolor), Dorcas gazelle (Gazella dorcas), white-bearded gnu (Connochaetes taurinus albojubatus) and goat. The gazelle and gnu were maintained on alfalfa and 16% Special Zoo Diet (Bluebonnet Milling Co., Ardmore, Oklahoma). The gnu received coastal bermuda hay and bread. Goat fecal donors were maintained on a bermuda pasture where they were supplemented fed a complete mixed diet (16% CP and 65%TDN). Differences between treatment means for head insertions and feed intake in all experiments was analyzed using GLM procedure of SAS and Duncan's Multiple Range Test was used to compare treatment means.

In all the trials of the first experiment, goats made fewer head entries into, and consumed less food from, buckets containing fecal extracts than from those containing plain or solvent-treated paper shreds (Table 1). Responses to plain and solvent paper shreds were similar.

The amounts of feed removed from buckets containing puma, gazelle, gnu, and solvent treatments were similar with a tendency for less feed consumption from puma and gazelle fecal extracts (Table 2).

Our results indicate that carnivore fecal scents reduce feed intake in goats suggesting a potential chemical deterrent browsing by this economically important species. Tests with other predator-derived materials e.g. urine and epidermal extracts, may provide other sources of aversive chemicals. Whether predator-derived chemicals can be used to protect vegetation against browsing by goats must to be evaluated in the field.

Study 2. SUPPRESSION OF FEED INTAKE OF ALPINE GOATS (*CAPRA HIRCUS*) BY CHEMICALS ISOLATED FROM LION FECAL SCENTS.

Ten mature dry Alpine does (mean BW = 62 kg) individually housed in individual crates as in study 1, were used in complete randomized block design to determine feed deterrent ability of 11 individual chemical scents isolated from lion feces. In all trials, an 11 cm diameter filter paper was saturated with 1 ml of chemical. The chemicals were purchased from Aldrich Chem. Co., Inc. Milwaukee, WI and tested at 100% concentration. The treatments were: (1) Control: plain paper and/or poly(ethylene glycol); (2) Non-S compounds: isobutyric acid, 2-methyl-3-buten-2-ol, 2-methylhexanoic acid, 2-methylvaleric acid, 4-methylvaleric acid, 2-octenoic acid, 3-phenyl-1-propanol, and propyl butyrate; and (3) S-compounds: mercapto-1,2-propanediol, 1-mercapto-2-propanol, and methyl disulfide. Each goat was offered feed with scented paper on

the top for three minutes and feed intake (FI) and number of head insertions (HI) into the bucket were measured. Because of the variability in FI and HI for the control diet (unscented filter paper) between squares, all treatments were expressed as deviation from their respective controls. Feed intake was reduced 30% by 2-methyl-3-buten-2-ol ($P<.05$), 41% by 2 methylhexanoic acid ($P<.02$), 48% by isobutyric acid ($P<.003$), 86% (P,.05) by methyl disulfide, 64% ($P<.02$) by 1-mercapato-2-propanol and 71% ($P<.02$) by 3-mercapto-1,2-phenyl-1 propenol, propyl butyrate, 4-methyl valeric acid, 2-octenoic acid, and 2-methyl valeric acid had no deterrent properties. The four scents that were most effective in deterring feed intake were retested at a 10% concentration (.1 ml on filter paper) using a complete randomized block design. Methyl disulfide, 1-mercapto-2-proponol and 3-mercapto-1,2-propanediol depressed intake by 25% ($P<.004$), 27% ($P<.003$) and 19% ($P<.02$) respectively. The feed intake/head entry ratio was depressed 98 g/head insertion ($P<.05$) with methyl disulfide, 82 g/head insertion with 1-mercapto-2-proponol, and 59 g/head insertion with 3-mercapto-1,2-propanediol. This study demonstrated that S-containing compounds methyl disulfide, 1-mercapto-2-proponol and 3-mercapto-1,2-propanediol, isolated from lion feces, could be used to deter feeding of goats.

Study 3. SUPPRESSION OF FEED INTAKE OF ALPINE GOATS (*CAPRA HIRCUS*) BY SYNTHETIC SEMIOCHEMICALS FROM SMALL CARNIVORES.

Ten mature dry Alpine does (mean BW = 62kg), individually housed AS IN STUDY 1, were used in complete randomized block design to determine feeding response in the presence of six chemical scents isolated from the urine of red fox and from anal gland secretions of the stoat and the ferret. The chemicals were: Δ^3-Isopentenyl methyl sulfide (IPMS), 2,5-Dihydro-

2,4,5-trimethylthiazole (TMT), 2-Propylthietane (PT), 3-Propyl-1,2-dithiolane (PDT), 2-2-dimethylthietane (DMT), and 3-3-dimethyl-1,2-dithiolane (DMD). In all trials, an 11 cm diameter filter paper was impregnated with 1 ml of scent. IPMS, TMT, PT, and PDT were tested at 10 and 3% concentrations, whereas DMT and DMD were applied at 3% concentration. Polyethylene glycol was used as an odor fixative and to dilute the chemicals to desired concentrations. Shredded filter paper was placed on top of 500 g complete mixed ration and then offered to animals that had been fasted for 24 h. Each goat was offered the feed with a different scented paper for three minutes, during which feed intake (FI) and number of head insertions (HI) into the feed bucket were determined. Because of the variability in FI and HI for the control diet (unscented filter paper) between squares, all treatments were expressed as deviation from their respective controls. At 10% concentration, IPMS, PT, TMT, and PDT were found effective ($P < .0001$) at reducing FI 65%, 75%, 80% and 67% and FI/HI ratio by 81 g, 82 g, 91 g and 86 g/HI respectively when compared to the control. At 3% concentration, all chemicals except PDT, were found to be effective repellents. Feed intake was reduced by 49% ($P > .05$), 43% ($P < .004$), 57% ($P < .0001$), 34% ($P < .002$), 28% ($P < .0001$), and 10% ($P < .01$) with PDT, IPMS, PT, TMT, DMT, and DMD, respectively. The ratio of FI/HI was reduced by 114 g/HI with PDT ($P > .05$), 68 g/HI with IPMS ($P < .006$), 107 g/HI with PT ($P < .0005$), 114 g/HI with TMT ($P < .0004$), 75 g/HI ($P < .03$) with DMT, and 29 g/HI ($P > .05$) with DMD. In conclusion, semiochemicals of red fox urine and anal gland secretions of the ferret and the stoat deterred feeding of goats in confinement.

CONCLUSIONS

1. Fecal scents from lion,tiger, and bear repelled goats; goat's attempt to feed was reduced more by scents from African lion and Siberian tiger compared to those from Bengal tiger.

2. The S-containing compounds MD, MPO and MPE isolated from lion feces reduced feeding of Alpine goats in confinement at 10% but not at 3% concentration.

3. Synthetic semiochemicals isolated from the red fox (TMT and IPMS) and mustelid carnivores (PT, DMT and DMD) repelled goats at 3% concentration. Further research is required to establish long-term responses of goats under field conditions to such chemicals. Tests with other predator-derived materials e.g. urine and epidermal extracts, may indicate other sources of aversive chemicals. The use of predator-derived chemicals to protect vegetation against browsing of selective plant species by goats must be evaluated in the field where habituation effects, the persistence of predator scents, and other parameters likely to effect feeding suppression can be assessed.

RECOMMENDATIONS

1) Chemicals proven to be effective should be tested in the field.

2) Effectiveness of these chemicals with or without carrier should be evaluated under field conditions.

3) A delivery system for chemicals in the field for sustained aversion should be developed.

4) Effectiveness of these chemicals for deterring for other species including dog, cats, deer, etc. should be evaluated.

5) Effectiveness of lower dosage of these chemicals should be evaluated.

6) For developing countries applied studies could be conducted using raw fecal materials from indigenous predators to prevent grazing of cash crops in farming systems.

7) Feasibility and environmental assessment on the possible use of natural scents should to be carried out.

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TABLE 1. Mean (±SE) head entries into, and food consumed (g) from, buckets containing fecal-scented, solvent-treated, and plain filter papers

	Feces	Solvent	Plain
Bengal tiger			
Head entries	2.9±0.7[a]	7.1±0.5[b]	6.9±0.4[b]
Food consumed	30.0±13.6[a]	231.1±36.5[b]	259.1±37.7[b]
Siberian tiger			
Head entries	0.4±0.2[a]	5.9±0.9[b]	7.2±1.0[b]
Food consumed	9.1±4.5[a]	194.5±33.1[b]	178.2±30.0[b]
African lion			
Head entries	0.9±0.3[a]	5.2±0.6[b]	4.6±0.4[b]
Food consumed	8.2±5.4[a]	293.2±20.3[b]	302.2±23.7[b]
Brown bear			
Head entries	1.8±0.7[a]	5.1±0.5[b]	4.8±0.4[b]
Food consumed	22.7±10.1[a]	274.5±30.3[b]	228.2±22.1[b]

[ab]Means with different letters are significantly different ($P \leq 0.05$).

TABLE 2. Mean (±SE) head entries into, and food consumed (g) from, buckets containing fecal-scented, solvent-treated, and plain filter papers

	Puma	Gazelle	Gnu	Goat	Solvent	Plain
Head entries	4.3±0.5[a]	5.3±0.6[a]	5.4±0.6[a]	5.4±0.5[a]	5.7±0.7[a]	5.3±0.5[b]
Food consumed	145.1±27.2[a]	204.1±13.6[a]	158.7±27.2[b]	267.0±27.2[b]	217.7±31.7[a]	263.1±22.6[b]

[ab]Means with different letters are significantly different ($P \leq 0.05$).

Table 3. Effects of pure chemical scents isolated from lion feces on feed intake (FI), number of head insertions (HI), and feed consumed per head insertion (FI/HI) of Alpine goats[1]

Trial/Chemical	FI,g	HI	FI/HI,g
Trial 1			
Control	71.0	3.8	32.3
3-Phenyl-1-propanol	- 1.8[2]	-1.3	- 0.3
2-Methyl-3-buten-2-ol (MBT)	-22.0*	2.0	-22.7
Propyl butyrate	-17.0	2.0	-23.4
Trial 2			
Control	66.5	3.3	28.3
2-Methyl hexanoic acid	-27.8*	-0.3	-11.0
4-Methyl valeric acid (MVA)	-12.0	0.9	- 4.3
2-Octenoic acid	-18.0	0	-13.0
Trial 3			
Control	168.8	2.3	93.6
2-MVA	-34.5	0.8	-32.0
MBT	-46.0*	1.0	-46.4
Isobutyric acid	-82.5**	1.0	-37.6
Trial 4			
Control	110.5	1.0	110.5
Methyl disulfide	-96.0**	0.3	-103.7***
1-Mercapto-2-propanol	-71.0*	-0.3	- 82.0**
Mercapto-1,2-propanediol	-78.8*	-1.0	- 91.7**

[1]Expressed as deviations from Control (a negative value indicates net depression below the control's mean). Chemicals were purchased from Aldrich Chem. Co., Inc. Milwaukee, WI.

[2]Compared against control: *significant ($P<.05$) **($P<.01$) ***($P<.001$).

Table 4. Effects of chemical scents at 10% (Trial 5) and 3% (Trial 6) concentrations in poly(ethylene glycol) or PEG on feed intake (FI), number of head insertions (HI), and feed consumed per head insertion (FI/HI) of Alpine goats[1]

Trial/Chemical	FI,g	HI	FI/HI,g
Trial 5			
Control-PEG	180.8	1.6	145.0
Isobutyric acid	-12.8	1.0	-28.0
Methyl disulfide	-46.4***	2.4	-98.1***
1-Mercapto-2-propanol (MPO)	-50.2***	0.4	-59.9*
Mercapto-1,2-propanediol (MPE)	-35.2*	0.8	-82.3*
Trial 6			
Control	182.4	2.0	99.3
PEG	-9.2	1.4	-10.6
Methyl disulfide	-24.0	2.6	-47.3*
MPO	-28.4	1.7	-50.2*
MPE	-16.2	1.7	-32.7

[1]Expressed as deviations from Control (a negative value indicates net depression below the control's mean). Chemicals were purchased from Aldrich Chem. Co., Inc. Milwaukee, WI.

[2]Compared against control: *significant ($P<.05$) **($P<.01$) ***($P<.001$).

Table 5. Effects of individual chemical scents isolated from anal gland secretions of the stoat and ferret on feed intake (FI), number of head insertions (HI), and feed consumed per head insertion (FI/HI) of Alpine goats[1]

Trial/Chemical	FI,g	HI	FI/HI,g
Trial 1 - 10% concentration in poly(ethylene glycol) or PEG			
PEG	111.8	1.3	102.1
Chloroform	-8.0	0.5	-30.3*
Δ^3-Isopentenyl methyl sulfide (IPMS)	-72.8***	0.8	-80.5***
2,5-Dihydro-2,4,5-trimethylthiazole (TMT)	-84.5***	0.7	-82.0***
2-Propylthietane (PT)	-89.7***	1.7	-90.8***
3-Propyl-1,2 -dithiolane (PDT)	-76.0***	0.8	-86.0***
Trial 2 - 3% concentration in chloroform and PEG			
PEG	133.3	1.0	133.3
Chloroform	-21.3	1.0	-31.8
PDT	-66.0	1.7	-114.2
Trial 3 - 3% concentration in PEG			
PEG	150.3	1.3	142.3
IPMS	-65.5***	0.5	-68.3***
PT	-87.0***	1.0	-107***
TMT	-51.5***	2.3**	-114***
Trial 4 - 3% concentrations in PEG			
Control	124.5	1.3	109.6
PEG	- 0.3	0	- 0.5
2-2-dimethyl -thietane	-43.5***	1.3*	-75.1*
3-3-dimethyl -1,2-dithiolane	-12.5*	0.5	-28.7

[1]Expressed as deviations from Control (a negative value indicates net depression below the control's).

[2]Compared against control: *significant ($P<.05$) **($P<.01$) ***($P<.001$).

PROJECT PERSONNEL

Dr. T. H. Teh, Principal investigator

Dr. Trung Le-Trong, Co-investigator

Dr. Tilahun Sahlu, Co-investigator

LIST OF PUBLICATIONS

Teh, T.H., P.J. Weldon and L.T. Trung. 1992. Alpine goats (*Capra hircus*) are repelled by carnivore fecal scents. J. Anim. Sci. 70 (Suppl.):157. (Paper enclosed).

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Trung, L.T., T.H. Teh, M.F. Luo, T.A. Gipson and A.D. Woolhouse. 1993. Synthetic semiochemicals of small carnivores deter feeding of goats. For submission to Small Ruminant Research. (Paper in review).

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___Growth Symposium, July 11 (Posters only)
___Lactation Workshop, July 10 (Posters only)

Corresponding author:
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Phone No. 405/466-3836

ADSA/ASAS
Joint Annual Meeting
1994 Abstract Form
July 11-15, 1994
Minneapolis, MN

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Note: The Abstract Form has been chosen to accommodate the size of the *Journal of Animal Science* (8 1/2 x 11). There will be four abstracts on each page under this format.
MEDIA APPEAL (check if you consider paper to be of interest to news media) X Yes

Feeding response of Alpine dairy goats to chemicals isolated from lion fecal scents. T.H. Teh*, L.T. Trung, M.F. Luo, T.A. Gipson, and Z. Fang. E (Kika) de la Garza Institute for Goat Research, Langston University, Oklahoma.

Ten mature dry Alpine does (mean BW = 62 kg), individually housed in crates, were used in four 4 x 4 Latin square experiments to determine feeding deterrent ability of 11 chemical scents isolated from lion feces. In all experiments, an 11 cm diameter filter paper was saturated with 1 ml of scent. The shredded filter paper was placed on top of 500 g complete mixed ration and offered to animals. Each goat was offered a feed with scented paper for three min. and feed intake (FI) and number of head insertions (HI) into the feed bucket were measured. Because of the variability in FI and HI for the control diet (unscented filter paper) between squares, all treatments were expressed as deviation from their respective controls. Feed intake was reduced 30% by 2-methyl-3-buten-2-ol ($P<.05$), 41% by 2-methylhexanoic acid ($P<.02$), 48% by isobutyric acid ($P<.003$), 86% ($P<.005$) by methyl disulfide (MD), 64% ($P<.02$) by 1-mercapto-2-propanol (MO) and 71% ($P<.02$) by 3-mercapto-1,2-propanediol (MI) at 100% concentration. Other compounds such as 3-phenyl-1 propenol, propyl butyrate, 4-methyl valeric acid, 2 octenoic acid, and 2-methyl valeric acid had no deterrent properties. The four scents most effective in deterring feed intake were re-tested at a 10% concentration in a 5 x 5 Latin square and MD, MO and MI depressed FI by 25% ($P<.004$), 27% ($P<.003$) and 19% ($P<.02$) respectively. The FI/HI ratio was depressed 98 g/HI ($P<.005$) with MD, 82 g/HI ($P<.02$) with MI and 59 g/HI ($P<.06$) with MO. This study demonstrated that S-containing compounds MD, MI and MO, isolated from lion feces, could be used to deter feeding of Alpine does in confinement even at low concentration.

Key Words: Predator scents, Goat, Repellents

EXAMPLE OF ABSTRACT HEADING AND ABSTRACT

Effects of interferon-γ on the production of tumor necrosis factor during acute *Escherichia coli* mastitis. L.M. Sordillo*, Pennsylvania State University, University Park and J.E. Peel, CIBA-GEIGY Ltd., St. Aubin, Switzerland.

The effects of recombinant bovine interferon (rBoIFN-γ on the production of tumor necrosis factor (TNF) in 10 dairy cows with *Escherichia coli* mastitis were determined. Prophylactic administration of recombinant rBoIFN-γ prior to the experimental *E. coli* challenge was effective in modifying the production of...

List up to 3 key words at end of abstract inside blue lines for indexing purposes (consult *CAB Thesaurus*).

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Synthetic semiochemicals of small carnivores deter feeding of goats. T.H. Teh, [1], L.T. Trung[1], M.F. Luo[1], Z. Fang[1], T.A. Gipson[1], J.R. Wang[1*] and A.D. Woolhouse[2]. [1]E (Kika) de la Garza Institute for Goat Research, Langston University, Oklahoma and [2]Industrial Research Ltd., New Zealand.

Ten mature dry Alpine does (mean BW = 62kg), individually housed in crates, were used in four 4 X 4 Latin square experiments to determine feeding response in the presence of six chemical scents isolated from the urine of red fox and from anal gland secretions of the stoat and the ferret. The chemicals were: Δ^3-Isopentenyl methyl sulfide (IPMS), 2,5-Dihydro-2,4,5-trimethylthiazole (TMT), 2-Propylthietane (PT), 3-Propyl-1,2-dithiolane (PDT), 2-2-dimethylthietane (DMT), and 3-3-dimethyl-1,2-dithiolane (DMD). In all trials, an 11 cm diameter filter paper was impregnated with 1 ml of scent. IPMS, TMT, PT, and PDT were tested at 10 and 3% concentrations, whereas DMT and DMD were applied at 3% concentration. Polyethylene glycol was used as an odor fixative and to dilute the chemicals to desired concentrations. Shredded filter paper was placed on top of 500 g complete mixed ration and then offered to animals that had been fasted for 24 h. Each goat was offered a feed with a different scented paper for three minutes, during which feed intake (FI) and number of head insertions (HI) into the feed bucket were determined. Because of the variability in FI and HI for the control diet (unscented filter paper) between squares, all treatments were expressed as deviation from their respective controls. At 10% concentration, IPMS, PT, TMT, and PDT were found effective ($P < .0001$) at reducing FI 65%, 75%, 80% and 67% and FI/HI ratio by 81 g, 82 g, 91 g and 86 g/HI respectively when compared to the control. At 3% concentration, all chemicals except PDT, were found to be effective repellents. Feed intake was reduced by 49% ($P > .05$), 43% ($P < .004$), 57% ($P < .0001$), 34% ($P < .002$), 28% ($P < .0001$), and 10% ($P < .01$) with PDT, IPMS, PT, TMT, DMT, and DMD, respectively. The ratio of FI/HI was reduced by 114 g/HI with PDT ($P > .05$), 68 g/HI with IPMS ($P < .006$), 107 g/HI with PT ($P < .0005$), 114 g/HI with TMT ($P < .0004$), 75 g/HI ($P < .03$) with DMT, and 29 g/HI ($P > .05$) with DMD. In conclusion, semiochemicals of the red fox urine and anal gland secretions of the ferret and the stoat deterred feeding of goats in confinement.

Key Words: Semiochemicals, Goat, Repellents

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AMERICAN SOCIETY OF ANIMAL SCIENCE & INTERNATIONAL SOCIETY OF APPLIED ETHOLOGY

ANNUAL MEETING
1992 ABSTRACT FORM
August 8-11, 1992
Pittsburgh, PA

Last name of first author

NOTE: The ASAS Abstract Form has been changed to accommodate the new size of the *Journal of Animal Science* (8 1/2 x 11) starting January 1992. There will be four abstracts on each page under the new format.

Alpine goats (Capra hircus) are repelled by carnivore fecal scents. T.H. Teh[1], P.J. Weldon[2] and L.T. Trung*[1], [1]E. (Kika) de la Garza Institute for Goat Research, Langston University, Oklahoma and [2]Texas A&M University, College Station.

This research was conducted to determine the effects of predator scents on goat feeding response. Ten mature female Alpine goats were used in four separate trials; each trial followed a randomized complete block design involving three treatments, viz. untreated, solvent-treated, and predator scent treated filter papers. The solvent was chloroform: methanol:water (1:2:0.08, v/v/v). Filter paper (Whatman #2) containing the desired treatment was shredded and placed on top of 1 kg complete feed contained in one of three separate buckets. Each goat was randomly offered one bucket at a time for three minutes, during which feed intake and the number of head insertions (feeding times) were determined. The filter papers containing fecal extracts from bear (BR), lion (LN), Siberian tiger (ST), and Bengal tiger (BT) were used in the first, second, third and fourth trials, respectively. The number of head insertions to the feeder was reduced by the predator scents (1.5 vs 5.8 times; $P<0.01$) as was dry matter intake (0.04 vs 0.57 kg; $P<0.01$) with no significant differences between control and solvent-treated (5.9 times and 0.55 kg). These findings were consistent from the first through the fourth trials. While no significant difference was found in feed intake, the number of head insertions were significantly ($P<0.05$) lower with fecal scents from LN and ST than BT. The results strongly suggest that the goat is repelled by the predators fecal scents.

Key Words: Goats, predator scents, repellents

EXAMPLE OF ABSTRACT HEADING AND ABSTRACT

Growth-prompting effects of relaxin on the uterus of prepubertal pigs are estrogen dependent. C. J. Huang*, Y. Li, and L. L. Anderson, Iowa State University, Ames.

This experiment was conducted to determine the effects of relaxin on the growth and modification of collagen in the uterus and uterine cervix of prepubertal pigs. Sixteen...

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