

XYLAZINE HYDROCHLORIDE (ROMPUN) AND THE NEW RETRACTABLE-BARBED DART ("DROP-OUT" DART) FOR THE CAPTURE OF SOME NERVOUS AND AGGRESSIVE ANTELOPE SPECIES

by

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Abstract – The successful capture and restraint of gemsbok, eland and kudu using the potent sedative, Xylazine hydrochloride (Rompun, Bayer) and the new retractable-barbed dart ("drop-out" dart) is described. These species were rapidly immobilized and rendered 100 per cent tractable by Etorphine/Rompun or Fentanyl/Rompun drug combinations. The drop-out dart proved to be invaluable for the capture of timid species as flight distances were greatly reduced and the chances of capture myopathy (overstraining disease) subsequently obviated.

Introduction

During the past decade very successful drug combinations and capture techniques have been developed for the restraint of most African ungulate species. Some of these are described by Harthoorn (1963, 1965 and 1966), King and Carter (1965), Pienaar, Van Niekerk, Young, Van Wyk and Fairall (1966), Pienaar (1968 a and b), Pienaar (1969 and *in press*) and Hanks (1967). In a number of species there are, however, capture problems yet to be overcome or techniques that require improvement. When reviewing the literature it is obvious that most major problems are confined to the nervous and aggressive antelope species.

These species are usually difficult to approach with the capture vehicle (i.e. very timid), inclined to run long distances if the dart remains lodged in their bodies, and difficult to tranquillize.

Considering these problems and using a newly designed retractable-barbed projectile syringe ("drop-out" dart)** together with a drug mixture containing the potent sedative, Rompun (Bayer) in combination with Etorphine hydrochloride (Reckitt) or Fentanyl (Janssen) the following species were successfully captured:

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** (See paper by Van Rooyen and De Beer in this issue – Eds.)

Gemsbok (*Oryx gazella*) – 11 in the Mountain Zebra National Park near Cradock.

Eland (*Taurotragus oryx*) – 7 in the Mountain Zebra National Park near Cradock.

Kudu (*Tragelaphus strepsiceros*) – 4 in the Kruger National Park.

Material and Methods

Drugs used

(i) Etorphine hydrochloride (M.99) (Reckitt). Etorphine is a potent analgesic with a wide safety margin, well tolerated and can be effectively antagonised.

(ii) Fentanyl (R4263-Citrate) (Janssen). Fentanyl has properties similar to those of Etorphine and can also be effectively antagonised.

(iii) Lethidrone (Nalorphine hydrobromide) (Burrough's Wellcome). This antidote was used to antagonise the effect of both Etorphine and Fentanyl.

(iv) Xylazine hydrochloride (Rompun, Bayer) is a sedative, analgesic and muscle relaxant which has been used with a great degree of success on domestic cattle and horses (Clemente, 1970; Fessl, 1970). Its use for the capture and restraint of free ranging wild animals is, however, relatively unknown. Pienaar (*in press*) gives a list of recommended dosages for the use of Rompun as a tranquillizer in a number of South African antelope species.

For the current series of experiments the drug was made up to a standard concentration of 200 mg/ml in sterilised water. Rompun was never used on its own but rather as a tranquillizer and possible synergist with either Etorphine or Fentanyl.

(v) Azaperone (R1929) (Janssen). The tranquillizer Azaperone was used for comparative purposes in the case of one adult male gemsbok. In all the other cases Rompun was used as the tranquillizer.

(vi) Phenergan (Promethazine hydrochloride) (May and Baker). Phenergan, a drug which possesses powerful antihistamine and central sedating properties, was used as an adjuvant in a few of the drug mixtures.

All dart wounds were routinely treated with Terramycin (Pfizer) and a precautionary dose of the penicillin/streptomycin/cortisone compound, Combimycin (Panvet), given.

Since the first few gemsbok received overdoses of Rompun they were additionally treated with the following drugs, where indicated:

(i) Dopram-V (doxapram hydrochloride) (A. H. Robins). This drug is a potent respiratory stimulant which promotes the restoration of normal ventilation and produces early arousal following general anaesthesia. Dopram-V was used intravenously at dosages varying between 60 and 200 mg per gemsbok.

- (ii) Ritalin (Ciba). This analeptic drug was injected in one dose of 40 mg with the hope that it would shorten the recovery period.
- (iii) Guronsan or glucuronic acid (Chugai Pharmaceutical Co.). This drug is a powerful detoxicating agent and invigorator of liver function and body metabolism. Administration was intramuscular at a rate of 1000 mg per animal.
- (iv) Cortensor (Heptaminol) (Wander). This cardiovascular stimulant and tonic of the heart muscle was used in the case of one gemsbok and one eland, where an overdose of Rompun reduced heart rate. Intramuscular dosages of 500 mg were used.
- (v) Two eland that were chased for a long way before capture (due to the immobilizing drugs being injected into the abdomen), received 150 mg of Deltacortril (Pfizer). The anti-inflammatory and glucose mobilizing activity of the drug indicated this precaution. The first five gemsbok were also routinely treated with the drug.

Capture equipment and methods of approach

In all cases initial delivery of the immobilizing drugs was by dart-syringes propelled either by the Van Rooyen crossbow or the Van Rooyen modified 20 gauge shotgun. A major feature of the dart-syringe was that some of the needles were fitted with a recently designed retractable barb, specially designed in the Kruger National Park for the sole purpose of reducing and possibly obviating the fleeing response of a darted animal and thus also minimising the chances of prolonged muscular exertion and finally overstraining disease (capture myopathy). For comparative purposes a few specimens were also darted with dart-syringes fitted with the ordinary non-retractable barbs.

In the case of the kudu darting was effected from a stationary vehicle. In the eland and gemsbok, however, flight distances which varied between 100 and 150 metres occurred and these had to be darted from suitable hides situated near paths frequented by the two species. In most of these cases three or four men on horseback were used to slowly herd the animals past the hidden marksman. Once an animal had been darted the horsemen immediately turned away, and so left the animals as undisturbed as possible.

The gemsbok and eland were transported in their immobilized state on the back of a Land Rover truck and then off-loaded into suitable enclosures where the antidote was injected. The kudu, on the other hand, were marked with "Sterkolite" collars and released near the site of capture.

Results

Although all the animals were captured for purposes of translocation or study, the use of the new "drop-out" dart syringes and Rompun resulted in an interesting experiment. Therefore, the dosage rates, reaction times and distances moved by each darted animal are discussed in some detail in Table 1.

Table 1
 Dosage rates and reaction times for gemsbok, eland and kudu captured with Rompun/Etorphine and Rompun/Fentanyl combinations

Species and Number	Sex	Age est. years	Mass est. (kg)	Individual Dosages (mg)			Dart site	Immobilization time	Distance moved after being darted (metres)	Time elapsed before adminstr. of antidote	Time elapsed before animal was fully recovered (after admin. of antidote)	Rectal temp. and time after being darted	Type of dart used	Comments
				Narcotic E = Etorphine F = Fentanyl	Neuroleptic R = Rompun A = Azaperone	Antagonist L = Lethidrone								
Gemsbok 1	♀	4-7	170	4 E	300 R	120 L	Shoulder	± 1000	75 min.	13 hours	—	drop-out	Chased for 3 km before being darted.	
Gemsbok 2	♂	5-8	180	5 E	400 R	140 L	Hip	± 600	45 min.	14 hours	38.5°C-20 min. 38.1°C-60 min.	drop-out	Walked quite undisturbed after being darted.	
Gemsbok 3	♀	6-8	165	3 E	200 R	120 L	Shoulder	10	60 min.	19 hours	—	drop-out	Did not see the dart or the marksman.	
Gemsbok 4	♂	5-7	190	4 E + 1 E after 25 min.	400 A + 100 A after 25 min.	0 - died	Shoulder	± 600	—	—	—	ordinary type	Ran strongly and died suddenly after 42 minutes.	
Gemsbok 5	♀	± 8 mths	80	Captured by hand	20 R	—	—	—	—	—	42.2°C-30 min. 41.1°C-50 min.	—	Run down by horsemen.	
Gemsbok 6	♀	4-7	155	3 E	100 R + 75 Phenergan	120 L	Shoulder	60	42 min.	9 hours	38.3°C-15 min. 37.8°C-40 min.	drop-out	Ran a short way and then walked.	
Gemsbok 7	♂	4-7	175	3 E	80 R + 50 Phenergan	120 L	Shoulder	200	42 min.	10 hours	39.7°C-30 min. 39.7°C-40 min.	drop-out	Walked quite undisturbed after being darted.	
Gemsbok 8	♂	4-7	170	3 E	60 R + 50 Phenergan	120 L	Thorax	300	25 min.	7½ hours	—	drop-out	Remained relatively calm after being darted.	
Gemsbok 9	♀	4-7	160	3 E + 1 E after 2 hrs.	60 R + 50 Phenergan + 40 R after 2 hours	120 L	Abdomen	3000	210 min.	7 hours	39.7°C-4 hr.	ordinary type	Darted in abdomen.	
Gemsbok 10	♂	5-9	180	3 E	40 R	120 L	Shoulder	1500	100 min.	2½ hours	41.8°C-1 hr. 40 min.	ordinary type	Ran until the dart fell out on its own.	
Gemsbok 11	♀	5-8	160	3 E	40 R	120 L	Hip	800	40 min.	3 hours	—	ordinary type	Ran for about 600 m and then walked.	
Eland 1	♀	4-6	410	3 E	150 R + 50 Phenergan	120 L	Shoulder	1500	38 min.	1½ hours	40.0°C-60 min.	ordinary type	Followed fleeing herd.	
Eland 2	♀	± 1½	180	3 E	60 R + 50 Phenergan + 55 R after 3½ hours	80 L	Abdomen	4000	4 hrs.	1 hour	41.1°C-4 hrs.	ordinary type	Remained with herd for two hours (roped).	

Eland 3	Very old	360	3 E + 2 E after 20 min.	200 R + 100 R after 20 min.	140 L	Shoulder	24 min.	100	72 min.	1 hour	37,6°C-60 min.	drop-out	Relatively undisturbed by darting procedure.
Eland 4	♀ 4-5	410	4 E	300 R	120 L	Thorax	12 min.	600	32 min.	1½ hours	—	drop-out	Ran off with rest of herd.
Eland 5	♂ ±1	110	60 F	150 R	120 L	Shoulder	3 min.	200	55 min.	3 hours	—	drop-out	Chased by vehicle and then darted.
Eland 6	♀ 4-6	410	70 F + 60 F after 45 min.	150 R + 500 R after 50 min.	200 L	Abdomen	35 min.	2000	2 hrs.	3 hours	40,7°C-55 min.	ordinary type	Underdose of drugs and abdominal injection (roped)
Eland 7	♀ Very old	360	70 F	100 R + 200 R after 22 min.	140 L	Shoulder	31 min.	65	32 min.	?	—	ordinary type	Initial underdose of drugs.
Kudu 1	♀ 4-6	160	50 F	350 R	120 L	Thorax	35 min.	300	85 min.	3½ hours	39,2°C-40 min.	drop-out	Ran ± 5 metres and then walked off undisturbed.
Kudu 2	♀ 4-6	160	50 F	200 R	120 L	Neck	23 min.	200	55 min.	2 hours	39,1°C-30 min.	drop-out	Ran a short way and then started feeding.
Kudu 3	♂ 5-7	290	75 F	330 R	160 L	Abdomen	17 min.	100	100 min.	2 hours	39,7°C-28 min. 40,3°C-1 hr. 25 min.	drop-out	Undisturbed by darting.
Kudu 4	♂ 5-7	290	80 F	360 R	160 L	Shoulder	6 min.	100	105 min.	3 hours	39,8°C-40 min.	drop-out	Undisturbed by darting.



Fig. 1 A semi-tractable eland cow (No. 7) (still slightly aggressive) darted with 70 mg of Fentanyl and 100 mg of Rompun. Although the first dart contained a sub-anaesthetic threshold dose of Rompun the animal could still be approached. The wound caused by the "drop-out" dart is visible in the right-hand shoulder.

The immobilization time referred to in Table 1 is the time interval that elapsed between injection of the drugs and recumbency. Animals darted with the Rompun/Etorphine or Rompun/Fentanyl mixtures, and allowed to go into recumbency without disturbance, were either tractable as soon as they lay down, or one or two minutes later. The only animals that had to be pulled down manually were those that received sub-anaesthetic threshold doses of the drugs (eland No. 3 and No. 7) (Fig. 1) and individuals which were darted in the abdomen, where proper absorption of the drugs was impeded (gemsbok No. 9 and eland No. 2 and No. 6).

The distance which animals moved after they were darted (see Table 1) was important to help gauge the effect of the "drop-out" dart. In the case of some of the gemsbok and eland this distance did not, however, always give a true reflection of the animals' reaction since they often continued to move simply because they were, or had been, herded by the horses. Animals that were chased by vehicles could similarly not serve as suitable examples, because they remained nervous after the chase was terminated. In addition to these, specimens that received sub-anaesthetic threshold doses of the drugs, or those that were darted in the abdomen, also produced abnormally long fleeing distances even though they may have walked calmly after being struck by the dart.

The time that elapsed before the antidote was administered (Table 1) depended on how far from the boma the animal was captured, the type of terrain, or, in the case of the kudu, how long the marking procedure took.

In the case of the gemsbok and the eland it was possible to observe the animals' recovery from Rompun tranquillization very accurately, since they were kept in an enclosure. This recovery time (after administration of the antidote) is also given in Table 1 and refers to the time taken by each individual to regain 100 per cent control of its postural and other observable reflexes.

Of the 22 animals captured, three died (gemsbok No. 1 and No. 4 and eland No. 3). In none of these cases could death be ascribed to the use of Rompun (see below).

Discussion

Considering the nervous and aggressive antelope species, capture problems may be summarised as follows:

- (i) Difficult to approach – i.e. flight distances in excess of 80 metres make certain species difficult to approach on the ground. This problem has largely been overcome by using a helicopter while the recently improved Van Rooyen modified shotgun is accurate and effective up to 100 metres.

Although the helicopter may be a very effective means of approaching and darting timid species, the tremendous disturbance may cause the animals to overstrain themselves, e.g. tsessebe (*Damaliscus lunatus*) captured in the Kruger National Park (Young and Whyte, *in press*).

- (ii) Disturbance caused by the sight of the projectile syringe dangling from some part of the animal's anatomy. Many of the larger ungulates, e.g. elephant (*Loxodonta africana*) and giraffe (*Giraffa camelopardalis*) pay little attention to a dangling dart, but species such as zebra (*Equus burchelli*), wildebeest (*Connochaetes taurinus*), sable antelope (*Hippotragus niger*), roan antelope (*Hippotragus equinus*), kudu, gemsbok and often eland will flee for long distances if a dart remains lodged in their bodies. The foreign shape, irritation and possibly the smell of the dart must be regarded as the major causes of the disturbance. Should the dart drop out soon after the animal has been hit, or should it be lodged in such a position as to be out of the animal's angle of vision, fleeing distances are very much reduced.
- (iii) Incomplete tranquillization. Although it is today possible to immobilize all African ungulates with various drug mixtures, some of these "cocktails" remain relatively unsuitable because although the animal can be restrained, it is not completely tractable, and could injure its captors or itself. Species such as eland (Keep and Keep, 1968) and kudu (Pienaar, *in press*) remain ambulatory,

displaying a persistent trotting gait, and often have to be roped and pulled to the ground. Gemsbok, on the other hand, are relatively easy to immobilize but are less tractable than the previous two species and resist handling to a considerable degree. Ebedes (1969) who captured 64 gemsbok with various Etorphine mixtures, found that loud noises had to be avoided when handling an immobilized specimen.

From the series of animals captured using Rompun, in combination with either Etorphine or Fentanyl, it has become abundantly clear that this drug shows distinct advantages in certain species. The drug combinations used and described in Table 1 clearly indicate that Rompun has an excellent potentiating effect on both the analgesics. Immobilization was rapid and thorough, and no animal that received the requisite dose of the drug combinations had to be roped or pulled down.

In the past, kudu (Pienaar, *in press*) and eland (Keep and Keep, 1968) have been difficult to immobilize with Fentanyl combinations, i.e. the animals remained on their feet although they could be handled. Similar results were obtained with Etorphine, Acetylpromazine (Boots) and Scopolamine (Hyoscine hydrobromide) mixtures in the case of kudu (Pienaar, *et al.*, 1966; Harthoorn and Bligh, 1965). In the present small series of eland captured, there appeared to be no difference between the reactions of those captured with Etorphine and Rompun and those captured with Fentanyl and Rompun. The kudu similarly all went into recumbency

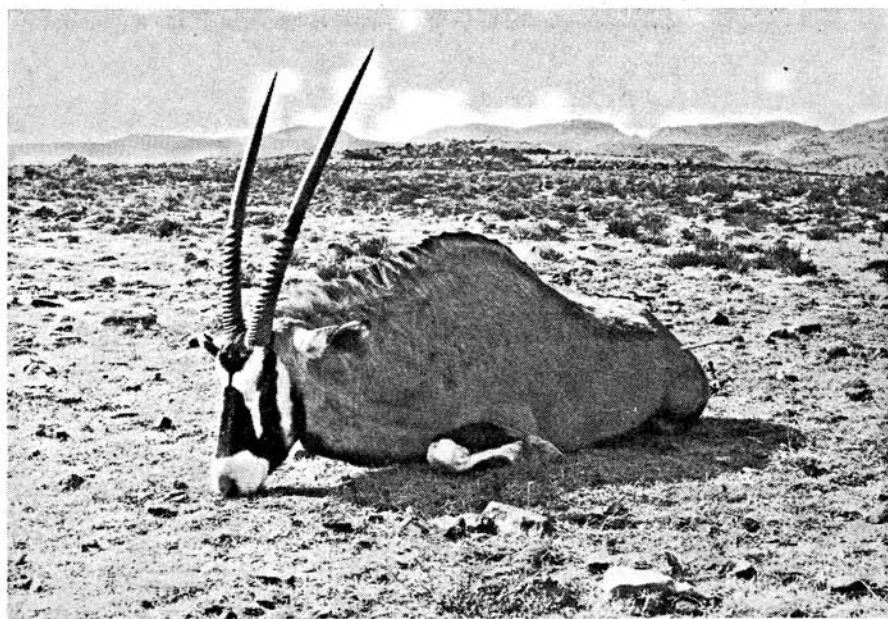


Fig. 2 A semi-narcotised gemsbok bull just after going down. Notice the sleepy look in the eyes, the chin resting on the ground, the relaxed ears and the non-retractable barbed dart still lodged in the rump.



Fig. 3 An adult kudu bull darted with 75 mg of Fentanyl and 330 mg of Rompun. All animals had to have their heads supported. Note the profound state of relaxation of the skeletal musculature including the ears and the tongue.

on their own, displaying a perfect reaction, i.e. no sign of excitation during or after the initial stages of induction.

In all the species the typical reaction before recumbency could be described as:

- (i) a slow swaying gait with the head sagging lower and lower. In

the kudu cows the head was dropped backwards, at times even touching the withers;

- (ii) the animals then stopped or walked in a tight circle until the degree of narcosis inhibited the control of postural reflexes.

Most specimens went down in a position of sternal recumbency with their chins resting on the ground (Fig. 2). As narcosis proceeded they rolled over onto their sides and had to have their heads supported (Fig. 3). In this respect the most profound state of narcosis was observed in the first group of gemsbok. These animals took between seven and 19 hours to recover completely from the effects of the Rompun and had to be supported against bales of lucern while their heads rested on suitable pillows. During this period they were in a deep sleep which lasted for three to eight hours. Salivation was copious, the tongue was paralysed and the eyes were closed.



Fig. 4 The relaxed tongue and copious salivation was very characteristic of all the kudu immobilized with Etorphine and Rompun combinations. Paralysis of the tongue was not obvious in any of the eland.

These animals could be roused by making a noise and slapping them on the ears. This stimulation caused them to jump up and run off (quite normally) for a few yards. If then left undisturbed they stood in one position with their legs apart, the head gradually sagging and the legs eventually again buckling beneath them. If now handled carefully and noiselessly they could again be propped up or supported manually.

While immobilized, none of the animals captured with Rompun

mixtures resisted handling or showed any signs of aggressiveness. This contrasted markedly with the single gemsbok captured with 4 mg Etorphine and 400 mg of Azaperone. Although this specimen was recumbent, it could not be handled and had to receive a booster dose of Etorphine and Azaperone. The aggressive nature of the gemsbok was very difficult to suppress (see also Ebedes, 1969).

Like the gemsbok the immobilized kudu (Fig. 4) and eland also salivated copiously but paralysis of the tongue was only witnessed in the kudu. None of these reactions persisted or had noticeable detrimental effects on any of the three species.

One of the major advantages of Rompun is its high therapeutic index (wide clinical margin of safety). None of the three mortalities recorded could be ascribed to this drug:

- (i) Gemsbok No. 1 was destroyed after seven days for humane purposes as it had developed a posterior paralysis. Post mortem examination showed that the animal had overstrained itself during the chase before it was darted and that the resultant haemorrhages and lesions in the skeletal musculature would eventually have caused its death.
- (ii) Gemsbok No. 4 which was captured with Etorphine and Azaperone developed severe haemorrhages in the lungs and a large one midway down the trachea. The lungs were also oedematous and the bronchioli plugged with particles of grass which the animal had ingested while immobilized. The animal struggled tremendously during the loading procedure and while being transported.
- (iii) Eland No. 3 recovered excellently from the drugs, but slipped on the back of the seven ton transport truck and had to be destroyed the following day.

Heart and respiratory rates were not measured, but respiration was closely observed in all specimens. In the first seven overdosed gemsbok respiration was shallow and irregular. In these specimens the use of the respiratory stimulant Dopram-V gave good results. In all the other specimens respiration appeared to be good.

Rectal temperatures were taken at intervals after the animals became recumbent and varied between 37,6°C and 42,2°C. The mean rectal temperatures for each species was as follows:

Gemsbok	39,7°C (n = 6)
Eland	39,7°C (n = 4)
Kudu	39,4°C (n = 4)

In all cases high rectal temperatures could be correlated with muscular exertion, i.e. animals that had run long distances, or animals that lay immobilized in the sun for a long time. The mean rectal temperature for the gemsbok was considerably lower than that reported by Ebedes (1969) where a mean of 41,5°C was obtained for 64 specimens captured with a variety of drug mixtures. A Rompun dose of 0,8–1,0 mg/kg in the horse

and 0,05–0,1 mg/kg in the ox elevated temperature by 0,5–1,6°C (Fessl, 1970).

In addition to the minimal effect on temperature regulation, Rompun is well tolerated at high dosages (see Table 1). This was especially obvious in the case of the gemsbok, where the dosage rate was eventually reduced by a factor of 10 (i.e. from 400 mg to 40 mg/animal). One eland cow (No. 6) was accidentally given an intravenous injection of 500 mg of Rompun. Except for a few minor convulsive seizures immediately after the injection, there were no side effects and she recovered well about two hours later.

In the case of gemsbok, Rompun appears to have one disadvantage, i.e. animals which received an overdosage of the drug took a long time to recover from its narcotic effects (Table 1). When released after the antidote had been administered, they ran off apparently quite normal, but soon lay down again, eventually flopping over onto their sides and bloating considerably. This is of great importance when tranquillized animals are released into the veld where they could either fall prey to carnivores or where bloat could result in a pressure reflux of stomach contents and eventual aspiration of food particles. These animals should be penned or attended until they have recovered completely.

Although the long recovery from Rompun narcosis and sedation experienced by the gemsbok may be a disadvantage in certain instances, it could also be used to great advantage. Here one thinks primarily of the capture and restraint of other aggressive and nervous antelope species such as roan antelope and sable antelope. A high Rompun dosage in combination with Etorphine would effectively keep the animals sleeping for many hours, allowing them to be transported (by road or air) in an immobilized state.

The retractable-barbed needles which make up the so-called "drop-out" dart can be used in any type of projectile syringe. This dart only remains lodged in the animal until the drug contents have been completely injected, whence it immediately falls out – the time interval being no more than a fraction of a second. In most cases the darted animal only hears the report of the rifle (or click of the crossbow) and feels the impact of the dart. After this initial disturbance the situation returns to normal with the animal quite unaware of what has happened.

In certain instances it was possible to dart gemsbok and eland from a hide without them even knowing where the disturbance came from. In these cases the value of the drop-out dart was proved when the darted animal moved no more than a few hundred metres before going down. In one case a gemsbok cow went down 10 metres from where she had been darted, with the rest of the herd milling about her in a confused state. In a few cases there was sufficient time to dart two animals.

In the case of the kudu, excellent results were obtained. These timid animals which usually flee for great distances into thick bush after being

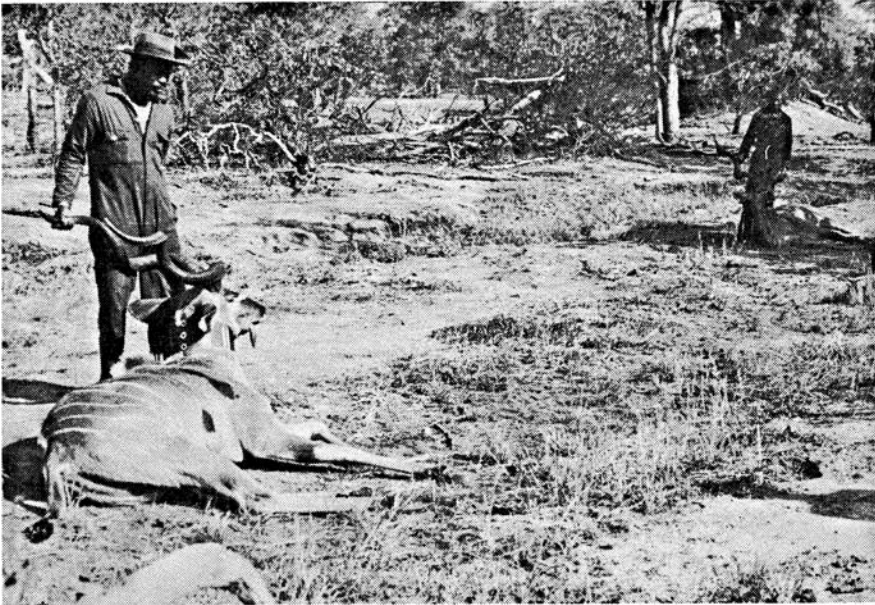


Fig. 5 Two adult kudu bulls (No. 3 and 4) immobilized with Fentanyl and Rompun. Using retractable-barbed darts and the crossbow, they were darted 30 metres from each other and eventually lay immobilized a mere 22 metres apart.

darted, merely gave a jump, ran a short way and then started to walk. The first cow darted moved about five metres and then stood in one position for eight minutes, snorting and looking intently at her captors.

The minimal disturbance created by the "drop-out" dart and the crossbow was well demonstrated when two adult kudu bulls were darted successively, the capture vehicle moving a mere 20 metres before the second shot was fired. These two animals eventually lay completely immobilized 22 metres apart (Fig. 5).

Conclusions

The successful series of field trials undertaken with Rompun and the new retractable-barbed dart leave no doubt as to their practical advantages. The rapid reaction times and excellent tranquilization obtained with Rompun, together with the reduced disturbance factor created by using the "drop-out" dart, must be regarded as being invaluable for reducing the incidence of capture myopathy.

Based on the 22 animals captured, the following dosage rates are recommended for adult animals of each species:

- Gemsbok (♂♂ and ♀♀) - 3 mg Etorphine + 50 mg Rompun.
- Eland (♀♀) - 4 mg Etorphine (or 70 mg Fentanyl) + 400 mg Rompun.
- Eland (♂♂) - 6 mg Etorphine + 500-600 mg Rompun.
- Kudu (♀♀) - 3 mg Etorphine (or 60 mg Fentanyl) + 200 mg Rompun.
- Kudu (♂♂) - 4 mg Etorphine (or 80 mg Fentanyl) + 300 mg Rompun.

It is interesting to note that in the case of kudu and eland the recommended Rompun dosage rates work out at roughly 1 mg/kg of body mass, while in the gemsbok it is considerably reduced to almost 0,35 mg/kg. Although the gemsbok captured were not in prime physical condition the dosage rates support the fact that certain species are more sensitive to the effects of the drug than others (see also Young and Whyte, *in press*).

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