

THE INCIDENCE OF HYDATIDOSIS IN THE REPUBLIC OF SOUTH AFRICA

ANNA VERSTER and MARIE COLLINS, Veterinary Research Institute,
Onderstepoort

In a previous survey of hydatidosis in domestic livestock at five large abattoirs the total number of infested livers, together with that of infested lungs, was taken as representing the incidence of hydatidosis in the Republic of South Africa (Verster, 1962).

To obtain a truer reflection of the incidence of hydatidosis the present, more detailed and comprehensive survey was undertaken. An additional 35 abattoirs were included. The assumption was that, because of their widespread sources of supply, the larger centres could be taken to give an indication of the average incidence throughout the country, whilst the smaller centres would reflect, within limits, the incidence in their respective geographical areas.

ORIGIN OF THE DATA

Forty abattoirs submitted monthly returns for periods varying from 8 to 24 months.

Large Centres

Twelve abattoirs slaughter more than 1,000 head of cattle per month, including nine abattoirs which fall under the marketing control of the Livestock and Meat Industries Control Board.

Small centres

These slaughter less than 1,000 head of cattle per month. The stock handled is normally reared locally—except under adverse climatic and other conditions, when it is imported from further afield.

The abattoirs were requested to submit the following information for each species: total number of animals slaughtered, the number slaughtered in the various age groups, the number of animals with hydatid cysts in either the liver or the lungs, the number infested in both the liver and the lungs, the number with hydatid cysts in other organs, and the area of origin of the infested animals.

All the abattoirs submitted data regarding the total number of animals slaughtered, the number infested either in the liver or the lungs, those infested in both the liver and the lungs, and those with infestations in other organs. The nine large abattoirs treated sheep and goats as a unit. All the abattoirs supplied data on the number of calves slaughtered. Eleven abattoirs submitted detailed data regarding the infestation in age groups ranging from calves and lambs to adult animals.

Received for publication on 26 April 1965.—Editor

THE INCIDENCE OF HYDATIDOSIS IN THE REPUBLIC OF SOUTH AFRICA

TABLE 1.—Incidence of hydatidosis at centres in the Western Province

Centre	Period in months	Cattle		Sheep		Goats		Pigs	
		Number Slaughtered	% infested Monthly Range	Number Slaughtered	% infested Monthly Range	Number Slaughtered	% infested Monthly Range	Number Slaughtered	% infested Monthly Range
Malmesbury.....	13	2,185	2.31-10.91	9,960	2.20-21.98	25		3,647	0-9.57
Paarl.....	12	6,006	0.80-3.78	40,034	0-0.38	34		3,825	0-0.44
Worcester.....	20	8,153	2.27-14.00	52,570	1.53-16.76	876		4,227	2.46-47.00
Mean and Total.....		16,344	4.72	102,564	3.55	935		11,699	5.93

GEOGRAPHICAL INCIDENCE

The findings from the twenty-eight small abattoirs were used to determine the incidence of the parasite in their respective geographical regions.

Western Province

Three abattoirs in this area submitted data for periods varying from 12 to 20 months (Table 1).

Discussion: There is little difference in the average incidence among cattle, sheep and pigs in this area, viz 4·72 per cent, 3·55 per cent and 5·93 per cent respectively. The average incidence in cattle and sheep at the three centres is about the same, but at Paarl it is lower than at either of the other two centres. The incidence in pigs differs markedly at the three centres, varying from 0·13 per cent (Paarl) to 13·67 per cent (Worcester).

The cattle and sheep slaughtered at Paarl and Worcester are not locally reared, these two centres being in the fruit-growing area of the Winter Rainfall Region. Those slaughtered at Paarl originate from the North Western and the South Western Cape; those slaughtered at Worcester, on the edge of the Karoo, may be drawn from any part of the Cape Province (Veenstra, 1963). In contrast to this, a fair percentage slaughtered at Malmesbury are locally reared (Veenstra, 1963; Du Toit, 1963).

It is probable that the pigs slaughtered at these three centres are locally reared, since Cape Town, which slaughtered 73,155 pigs during this period, drew 74·5 per cent of its supplies from this area (Livestock and Meat Industries Control Board, 1963). The average incidence in pigs slaughtered at Cape Town (6·44 per cent) approximates that of this region (5·93 per cent). This high incidence may be ascribed to the practice of running the pigs on "free range" (Muller, 1962; Veenstra, 1963).

Karoo

Seven abattoirs collected data for periods ranging from 10 to 24 months (Table 2).

Discussion: The average incidence in sheep is low, only one centre (Middelburg) recording an incidence above 1 per cent. The low incidence is probably due to the fact that these animals are turned out to graze and thus are not in daily contact with farm dogs.

The incidence in cattle is erratic; the first record of a cyst at the Calvinia abattoir was in the seventh month of the survey. Three abattoirs recorded average incidences above 1 per cent in cattle. As this is a sheep-rearing area, cattle are kept for domestic use only and would thus come into close contact with dogs around the homestead, and further they would be slaughtered when they are relatively old. The higher incidence in cattle than in sheep is, therefore, to be expected.

The variation in the incidence in pigs is probably due to the slaughter of batches of animals kept on "free range". These, like the cattle, would be in close contact with the farm dogs.

The incidence in goats is slightly higher than in cattle. Upington, the only abattoir to handle any number (3,421), recorded an average incidence of 1·10 per cent.

THE INCIDENCE OF HYDATIDOSIS IN THE REPUBLIC OF SOUTH AFRICA

TABLE 2.—Incidence of hydatidosis in the Karoo

Centre	Period in months	Cattle			Sheep			Goats			Pigs		
		Number Slaughtered	% infested		Number Slaughtered	% infested		Number Slaughtered	% infested		Number Slaughtered	% infested	
			Monthly Range	Mean		Monthly Range	Mean		Monthly Range	Mean		Monthly Range	Mean
Beaufort West.....	13	2,187	1.21-3.05	1.70	25,060	0-0.36	0.07	301	0.8-3.3	2.99	929	0-3.67	1.61
Calvinia.....	20	455	0-8.70	0.77	12,075	0-1.10	0.27	27		0	289	0-30.78	5.54
Carnarvon.....	13	241	0-19.05	2.49	5,222	0-2.80	0.87	2		0	175	0-40.00	5.20
De Aar.....	18	2,301	0-11.94	3.52	22,501	0-4.67	0.51	55		0	765	0-4.66	0.26
Middelburg.....	12	676	0-5.26	0.44	7,531	0-18.31	6.65	0		0	258	0-12.50	1.16
Victoria West.....	10	229	0-4.76	0.87	3,705	0-0.32	0.14	0		0	64		0
Upington.....	24	9,857	0-2.25	0.57	38,282	0.25-1.71	0.74	3,421	0-10.6	1.10	3,419	0-2.04	0.47
Mean and total.....		15,946		1.18	114,376		0.86	3,806		1.21	5,899		0.88

Whereas the animals slaughtered at six of these abattoirs are probably locally reared, it is unlikely that those slaughtered at Upington are drawn from its immediate vicinity. Upington lies in an irrigation area with few sheep and cattle. The cattle probably originate from the cattle-rearing areas to the north and the sheep from the Karoo.

Eastern Province

Data collected at six abattoirs for periods varying from 14 to 21 months, are summarized in Table 3.

Discussion: The highest average incidence recorded in this survey is in cattle, i.e. 13.76 per cent, the average varying from 5.45 per cent (Umtata) to 20.14 per cent (Fort Beaufort) and 22.99 per cent (King William's Town). The lowest monthly incidence is recorded at Grahamstown (0.49 per cent) and the highest at Queenstown (42.13 per cent).

The average incidence in sheep is low and somewhat erratic; four abattoirs recorded average incidences below 1 per cent. As in cattle, the highest averages are recorded at Fort Beaufort (4.50 per cent) and at King William's Town (6.88 per cent).

The average incidence in goats ranges from zero to 15.18 per cent at the different abattoirs. Uitenhage, slaughtering 11,535 goats, shows an incidence of 3.16 per cent; the extremes of zero and 15.18 per cent are recorded at abattoirs slaughtering few goats.

The incidence in pigs, as in sheep, is erratic at the different abattoirs. Three centres record an average incidence below 1 per cent; the highest, 8.38 per cent, is again recorded at King William's Town. At Umtata the average incidence (5.94 per cent) differs but slightly from that recorded in cattle (5.45 per cent).

The vegetation in this region varies and farming practices differ accordingly. In some districts cattle-farming and in others, sheep-farming, predominates. In the sheep-rearing areas both the dog and the jackal populations are controlled, but not so in the cattle-farming areas (Van Aardt, 1963). Thus animals slaughtered at some centres are locally reared, e.g. sheep at Queenstown (Schutte, 1963), while those slaughtered at other centres originate from further afield, e.g. cattle and sheep slaughtered at Umtata come from outside the Transkei (Galpin, 1963). These differing farming practices undoubtedly account for the marked differences in the incidence not only among the four species of stock, but also among the six centres.

Orange Free State

Two centres collected data for periods varying from 9 to 14 months (Table 4).

Discussion: The incidence in both sheep (0.69 per cent) and pigs (0.30 per cent) is low. The rather higher incidence in cattle (2.38 per cent) can probably be ascribed to the fact that the same farming practices obtain as are found in the Karoo.

Highveld

Six abattoirs submitted data for periods varying from 8 to 24 months (Table 5).

TABLE 3.—Incidence of hydatidosis at centres in the Eastern Province

Centre	Period in months	Cattle			Sheep			Goats			Pigs		
		Number Slaughtered	% infested		Number Slaughtered	% infested		Number Slaughtered	% infested		Number Slaughtered	% infested	
			Monthly Range	Mean		Monthly Range	Mean		Monthly Range	Mean		Monthly Range	Mean
Fort Beaufort.....	14	2,572	11.81-29.52	20.14	4,863	0.29-12.88	4.50	73	0-16.66	1.37	494	0-6.9	0.81
Grahamstown.....	21	7,743	0.49-27.90	9.92	25,264	0-4.11	0.89	33		0	4,670	0-1.81	0.34
King Williams Town.....	20	4,298	15.56-38.36	22.99	13,802	2.35-21.73	6.88	79	0-28.57	15.18	2,745	1.77-16.23	8.38
Queenstown.....	21	7,258	5.72-42.13	16.94	30,696	0-1.99	0.52	154	0-25.00	0.65	3,922	0-12.57	1.89
Uitenhage.....	15	6,021	6.67-18.08	11.83	31,394	0-8.55	0.36	11,535	1.71-4.19	3.16	2,592	0-0.69	0.08
Umtata.....	21	4,533	1.53-18.78	5.45	8,733	0-2.02	0.77	0			2,611	0-15.15	5.94
Mean and total.....		32,425		13.76	114,752		1.51	11,874		3.18	17,034		2.82

TABLE 4.—Incidence of hydatidosis in the Orange Free State

Centre	Period in months	Cattle		Sheep		Goats		Pigs		
		Number Slaughtered	% infested Monthly Range	Number Slaughtered	% infested Monthly Range	Number Slaughtered	% infested Monthly Range	Number Slaughtered	% infested Monthly Range	
										Mean
Kroonstad.....	14	7,222	0.38-4.81	26,584	0.06-1.96	0		2,221	0-3.13	0.32
Winburg.....	9	386	0-8.11	1,414	0-0.57	0		156		0
Mean and total.....		7,608		27,998		0		2,377		0.30

THE INCIDENCE OF HYDATIDOSIS IN THE REPUBLIC OF SOUTH AFRICA

TABLE 5.—Incidence of hydatidosis in the Highveld

Centre	Period in months	Cattle			Sheep			Goats			Pigs		
		Number Slaughtered	Monthly Range	% infested Mean	Number Slaughtered	Monthly Range	% infested Mean	Number Slaughtered	Monthly Range	% infested Mean	Number Slaughtered	Monthly Range	% infested Mean
Bethal.....	23	12,246	0.18-2.72	1.39	9,267	0.4-6.2	0.92	0			1,791	0.2-8.9	0.28
Bethlehem.....	23	11,039	0.2-1.3	0.95	25,489	0.19-2.52	0.91	0			4,914	0.1-7.8	0.49
Ermelo.....	24	4,788	0.88-9.89	3.45	6,756	0.36-5.20	1.79	0			1,192	0.2-9.4	0.42
Harrismith.....	12	1,593	0.80-3.33	2.26	3,964	1.47-8.70	5.75	0			688	0.1-6.4	0.15
Volkstrust.....	13	1,665	0.3-4.2	0.84	4,320	0.0-5.4	0.07	1			537	0.4-7.6	0.37
Vryheid.....	8	1,815	0.1-4.2	0.66	2,580		0	0			457	0.1-5.0	0.22
Mean and total.....		33,146		1.52	52,376		1.27	1			9,579		0.40

Discussion: The incidence in this region is similar to that in the Orange Free State except that the incidence in cattle (1·52 per cent as against 2·38 per cent) is slightly lower and that in sheep (1·27 per cent as against 0·69 per cent) slightly higher.

Transvaal Bushveld

Three abattoirs in this region submitted data for periods varying from 13 to 21 months (Table 6).

Discussion: The average incidence in cattle in this region is the second highest recorded in this survey. The cattle slaughtered at Pietersburg and Potgietersrus were probably drawn from their respective immediate vicinities. In the Tzaneen district where livestock are rare, the cattle probably originate from the ranching districts to the east and west of this centre.

Very few sheep are kept in this region and it is probable that the sheep slaughtered at these three centres come from the sheep-farming areas further south; those slaughtered at Tzaneen were obtained from the Highveld.

The average incidence in pigs was just below 1 per cent though Potgietersrus recorded an incidence of 9·94 per cent; this incidence is second only to that recorded at Worcester (Western Province). The high incidence at Potgietersrus is partly due to the practice of allowing these animals out on "free range" on the peanut lands (Loveday, 1963).

It is probable that the parasite is disseminated not only by domestic dogs, but also by wild carnivores; the Cape hunting dog (*Lycan pictus*) and lion (*Panthera leo*) as well as the more widely distributed carnivores, such as black-backed jackal (*Canis mesomelas*), occur in this region. Because *Echinococcus* spp. have been recorded from them, one can assume that they undoubtedly play a part in the dissemination of the parasite (Ortlepp, 1934; 1937; Viljoen, 1937).

Natal Coastal Belt

Only one centre, viz. Stanger, submitted data. During 24 months, 2,497 cattle were slaughtered, the incidence varying from 0·76 per cent to 8·82 per cent (average 3·28 per cent). In the same period 6,302 sheep and 2,595 goats were slaughtered, the incidence in sheep varying from 0 to 3·57 per cent (average 0·22 per cent) and that in goats from 0 to 2·80 per cent (average 0·85 per cent). During this period only 54 pigs were slaughtered; none of these was infested.

As this is a sugar-cane growing area it is unlikely that the sheep are reared locally. The cattle may be locally reared, as dairy cattle are the only livestock kept in any number.

LARGE CONSUMER CENTRES

Twelve abattoirs submitted data for periods varying from 11 to 24 months (Table 7). Nine of these are under the marketing control of the Livestock and Meat Industries Control Board. The remaining three centres, Vryburg, Welkom and Witbank, are not controlled by this Board, but are considered here as they also slaughter large numbers of animals.

TABLE 6.—*Incidence of hydatidosis in the Transvaal Bushveld*

Centre	Period in months	Cattle			Sheep			Goats			Pigs		
		Number Slaughtered	% infested		Number Slaughtered	% infested		Number Slaughtered	% infested		Number Slaughtered	% infested	
			Monthly Range	Mean		Monthly Range	Mean		Monthly Range	Mean		Monthly Range	Mean
Pietersburg.....	21	13,364	1·81-13·60	5·83	14,059	0·7-17	1·00	700	0·5-26	0·31	19,425	0·3-52	0·50
Potgietersrus.....	13	2,486	7·14-28·02	16·17	3,371	0·35-71	4·33	1		0	865	0·59-25	9·94
Tzaneen.....	14	2,890	8·33-23·23	12·60	1,884	0·69-14·69	7·01	174	0·50-0	2·87	788	0-13·1	3·30
Mean and total.....		18,740		8·24	19,314		2·17	829		0·84	21,078		0·99

TABLE 7.—*Incidence of hydatidosis at large consumer centres*

Centre	Period in Months	Cattle			Sheep and goats			Pigs		
		Number slaughtered	% infested		Number slaughtered	% infested		Number slaughtered	% infested	
			Monthly range	Mean		Monthly range	Mean		Monthly range	Mean
Bloemfontein.....	23	44,481	0.38-3.37	1.82	164,730	0.06-4.83	1.25	22,956	0-0.79	0.26
Cape Town.....	18	246,134	0.04-2.90	0.32	1,052,084	0.13-1.45	0.63	73,155	2.16-14.45	6.44
Durban.....	20	186,927	0.32-1.59	0.73	867,457	0.01-0.21	0.07	97,701	0-0.44	0.10
Germiston.....	13	43,255	0-1.00	0.33	103,087	0.21-1.12	0.27	7,757		0
Johannesburg.....	24	766,631	0.08-50	0.22	2,087,685	0.05-2.08	0.61	320,521	0-0.90	0.04
Kimberley.....	15	17,743	0.07-3.84	1.77	82,102	0.52-9.29	2.74	2,334	0-2.79	1.24
Krugerdsorp.....	24	66,830	0-2.28	0.43	102,052	0-2.22	0.57	20,059	0-1.27	0.04
Pietermaritzburg.....	11	19,723	1.34-3.92	2.15	62,075	0-0.24	0.08	5,170	0-0.53	0.10
Port Elizabeth.....	22	93,817	0.8-4.75	2.60	469,326	0.05-0.88	0.35	39,035	0-0.19	0.03
Vryburg.....	11	14,867	1.02-6.50	3.53	5,019	5.58-21.24	12.45	462	0-2.22	0.43
Welkom.....	24	56,949	0-49.6	1.39	110,326	7.50-29.99	14.50	12,774	0-3.48	0.16
Witbank.....	21	24,854	1.76-12.43	4.6	16,456	0-1.88	0.15	5,172	0-1.91	0.53
Mean and total.....		1,582,211		0.68	5,122,399		0.85	607,096		0.84

THE INCIDENCE OF HYDATIDOSIS IN THE REPUBLIC OF SOUTH AFRICA

Cape Town was the only centre to submit data regarding the incidence in horses. A total of 10,845 was slaughtered, the monthly incidence varying from zero to 3.30 per cent (mean 1.93 per cent).

Discussion: An analysis of the information supplied by the Livestock and Meat Industries Control Board shows that during the period 1960 to 1962, 57.25 per cent of the cattle, 95.91 per cent of the calves, 84.92 per cent of the sheep and goats and 88.41 per cent of the pigs, originated from the seven geographical areas discussed above. The figures at the large consumer centres can, therefore, be taken to give a reasonable indication of the incidence in the country as a whole.

In the present survey the average incidence in cattle and pigs is slightly higher than that recorded by Verster (1962); in sheep, however, it is slightly lower, having dropped to 0.85 per cent from 1.798 per cent.

In the previous survey the incidence was based on the numbers of livers and lungs infested, while in the present survey a distinction is being made between animals infested only in either the liver or in the lung and those with dual infestations. Dual infestations occurred in 19.04 per cent of the cattle and 16.01 per cent of the sheep and goats. The two sets of returns for Port Elizabeth are interesting in that for both surveys dual infestations were taken into consideration, yet the present survey shows a decrease in both cattle, and sheep and goats.

The average incidence in swine, for the present survey, is higher than in the previous one in which only two centres submitted data. The increase in the average from 0.35 per cent to 0.84 per cent is due to the high average incidence at the Cape Town abattoir (Table 7), where an average incidence of 6.44 per cent was recorded, while the other eleven centres gave an average of only 0.07 per cent. The relatively high incidence in Cape Town is probably due to the fact that 74.5 per cent of the pigs slaughtered here originate from the Western Province (Table 1).

An exceptionally high incidence (14.50 per cent) was recorded in sheep slaughtered at Welkom. These originated from within a radius of 100 miles of this centre. It is possible, and also probable, that some of these animals originated from various more distant parts of the country before being sold at Welkom by speculators (Nyschens, 1963). The sheep slaughtered at Vryburg, showing an incidence of 12.45 per cent, came from its immediate vicinity. Vryburg is a cattle-ranching area and only small flocks of up to 300 sheep are kept on the farms. Jackals are a serious problem, consequently the sheep are kraaled, i.e. confined to pens, at night. This custom, as well as the use of a number of sheep dogs, brings about a close contact between the sheep and the farm dogs, and may account for the high incidence (Van Heerden, 1963).

COMPARISON OF INCIDENCE AT LARGE AND SMALL CENTRES

The average combined incidence of both large and small centres compared with those from the large centres alone, shows but slight difference in the four species (Table 8).

TABLE 8.—Average incidence (%) of hydatidosis: large consumer centres compared with that of all the centres

Species	Large centres		All centres	
	No. slaughtered	% infested	No. slaughtered	% infested
Cattle.....	1,582,211	0·68	1,706,420	1·08
Sheep and goats.....	5,122,399	0·85	5,571,224	0·92
Pigs.....	607,096	0·84	674,762	0·98

AGE INCIDENCE

All the centres submitted data regarding the incidence in calves; the majority of the centres also submitted separate data for lambs and kids. The large consumer centres under the marketing control of the Livestock and Meat Industries Control Board, combined the data pertaining to lambs and kids. Only eleven centres were able to break down the data of all the cattle and sheep and goats slaughtered into age groups, i.e. Beaufort West, Bethlehem, Ermelo, Fort Beaufort, Queenstown, Potgietersrus, Tzaneen, Volksrust, Welkom, Winburg and Witbank. These data are summarized in Table 9.

TABLE 9.—Incidence of hydatidosis in various age groups

Age group	Cattle		Sheep	
	No. slaughtered	% infested	No. slaughtered	% infested
Calves and lambs.....	3,673	0	38,269	4·81
2 tooth.....	5,656	1·11	19,010	8·26
4 tooth.....	17,493	1·18	22,304	10·26
6 tooth.....	30,470	2·25	41,960	6·24
8 tooth.....	63,193	5·85	112,085	8·05

The incidence in cattle shows a steady rise from zero in calves to 5·85 per cent in adult animals, whereas in sheep it is erratic.

When calves are excluded from the total number of cattle slaughtered at all the centres, the average incidence in 1,496,868 head of cattle is 1·23 per cent, i.e. an increase of 0·15 per cent.

Discussion: This survey confirms the findings of Pullar & Marshall (1958) in Australia, of Froyd (1960) in Kenya and of Gemmell (1961) in New Zealand, viz. that the incidence of hydatidosis in cattle increases with age.

The high incidence recorded in cattle at some centres is probably partly due to the predominance of adult animals in the slaughter stock. Thus at Grahamstown, which recorded an average incidence of 9·92 per cent, 73·6 per cent of the cattle slaughtered are six and eight tooth animals; at Queenstown, with an average incidence of 16·94 per cent, 93·9 per cent of the cattle fall into this age group.

THE INCIDENCE OF HYDATIDOSIS IN THE REPUBLIC OF SOUTH AFRICA

ORGAN INCIDENCE

The incidence of hydatid cysts in different organs is summarized in Table 10 where it is expressed as a percentage of the total number of infested animals.

TABLE 10.—*Organ incidence (expressed as a % of the total infestation)*

	Liver only	Lung only	Liver and lung	Other
Cattle.....	21·53	55·65	19·04	3·78
Sheep and goats.....	59·04	22·5	16·01	2·45
Pigs.....	59·91	31·17	7·31	1·61

Discussion: In Kenya, Froyd (1960) found that of 1,000 head of cattle 255 were infested; 43 (16·86 per cent) with dual infestations; 122 (47·84 per cent) in the liver only and 87 (34·12 per cent) in the lung only. His observations were confirmed in the number of dual infestations (19·04 per cent), but the majority of the cattle with infestations in a single organ were infested in the lung (55·65 per cent). The organ incidence in other animals with infestations in either the liver or the lung, differs from that in cattle. The majority of sheep, goats and pigs had liver infestations.

Gemmell (1961), in New Zealand, found that the majority of both cattle and sheep had dual infestations and concluded that there was no significant difference in the percentage of animals with infestations in either the liver or the lung.

HOST SPECIES INCIDENCE

When the centres are grouped according to the incidence of hydatidosis in each species, they show definite differences in the degree to which each individual species is parasitized (Fig. 1).

In sheep and pigs the incidence is negligible (below 1 per cent) at the majority of the centres; two centres recorded incidences above 10 per cent in sheep and one centre in the case of pigs. In contrast to this, in cattle only 30 per cent (12 centres) had an incidence below 1 per cent, while 15 per cent (6 centres) recorded an incidence above 10 per cent.

The incidence in goats could not be analysed as only 20 centres slaughtered goats; of these only seven slaughtered more than 100 during the whole period.

An analysis of the data recorded at the small centres shows that this parasite occurs to a greater or lesser extent in all the regions covered by this survey (Fig. 2 to 4), and that in a given region the different species of livestock are not parasitized to the same degree.

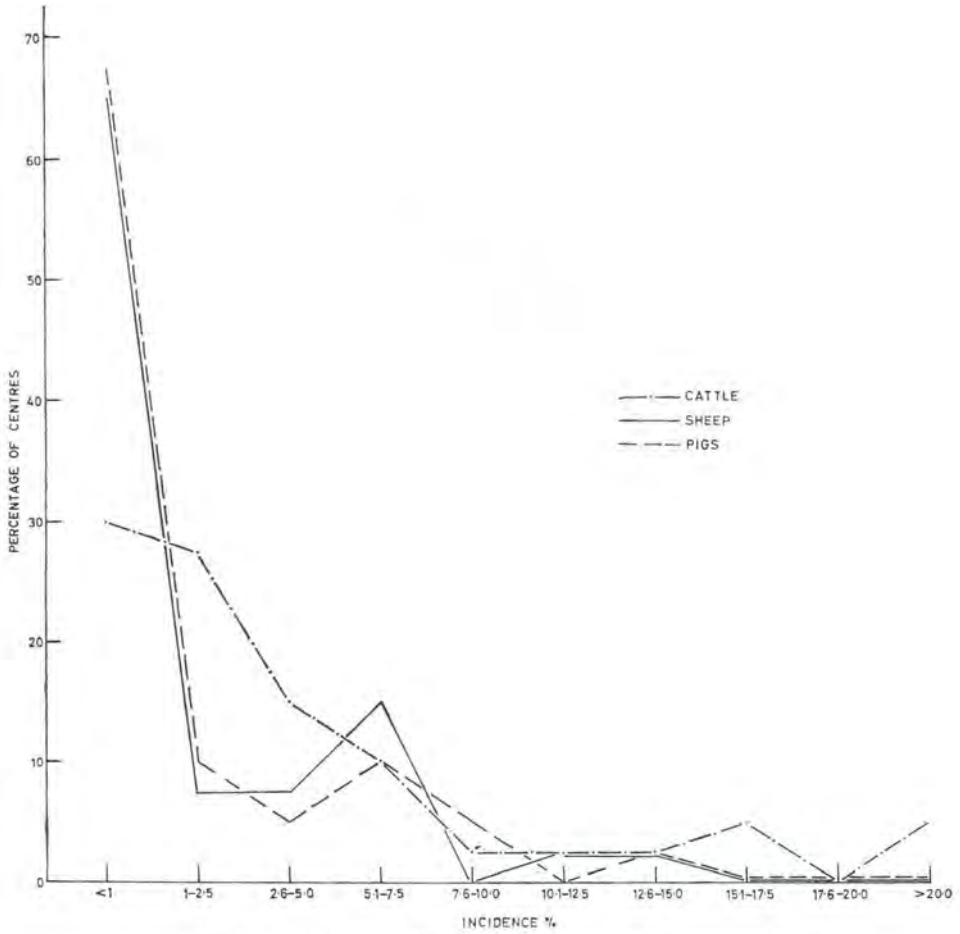


FIG. 1.—Percentage incidence of hydatidosis in cattle, sheep and pigs

THE INCIDENCE OF HYDATIDOSIS IN THE REPUBLIC OF SOUTH AFRICA



Fig. 2.—Incidence of hydatidosis in cattle

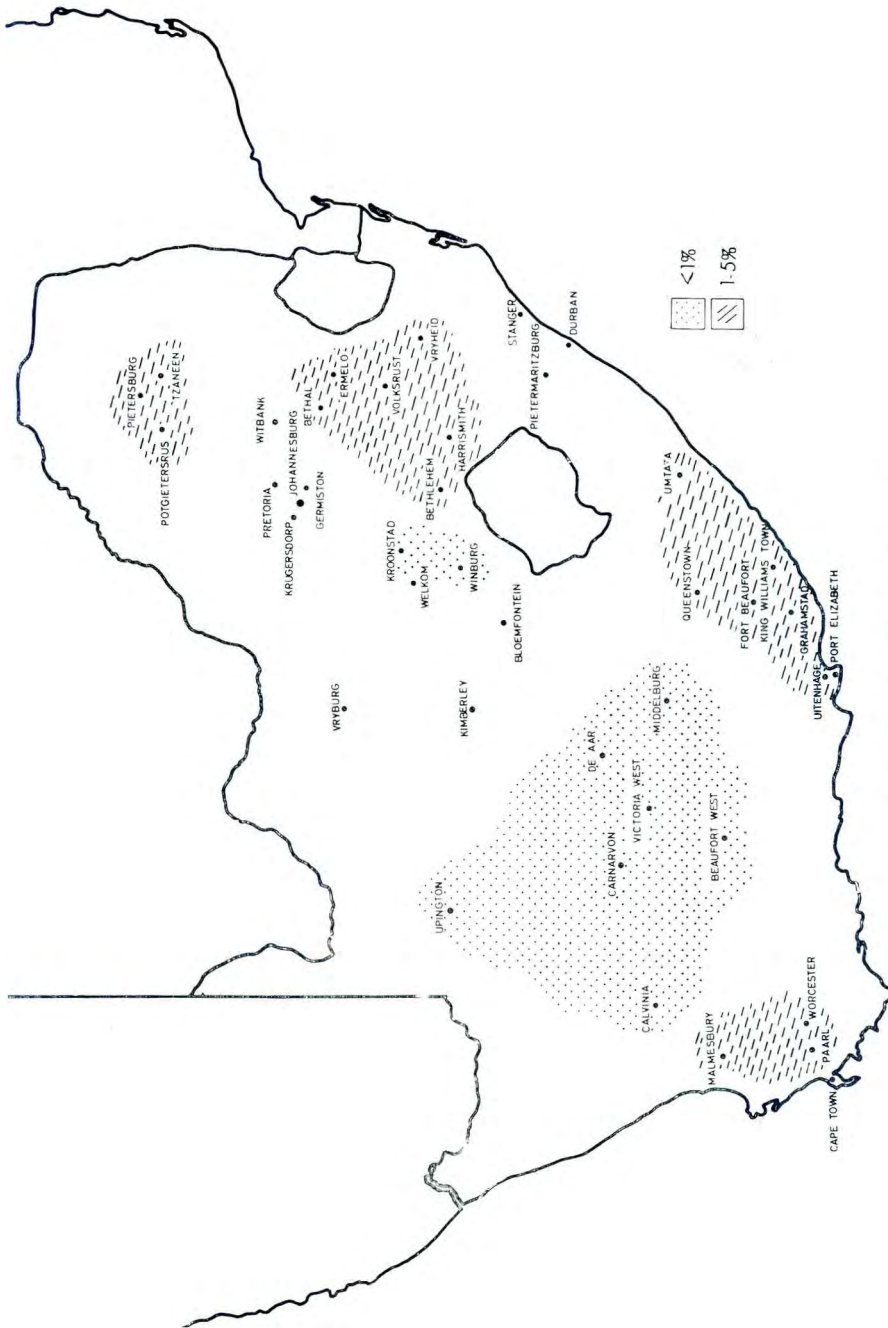


FIG. 3.—Incidence of hydatidosis in sheep

FACTORS INFLUENCING THE INCIDENCE OF HYDATIDOSIS

The prevalence or otherwise of the parasite is primarily dependent on the availability of infestive material to both the definitive and the intermediate host. While a single hydatid cyst is capable of infesting a great number of dogs or other definitive hosts, the sexual stage in carnivores is capable of disseminating the parasite to a greater number of intermediate hosts and over a long period. It is, therefore, to be expected that, should there be definitive hosts in a region, all species of domestic livestock may become infested. This survey has shown that, although all species of domestic livestock are infested in all the regions covered by it, the different species are not necessarily parasitized to the same degree. Thus, another limiting factor is undoubtedly the farming practices obtaining in any given region.

Definitive hosts

The domestic dog is undoubtedly a major source of infestation; but *Echinococcus granulosus* sub-species have also been recorded from a number of wild carnivores (Verster, 1965).

At present the only information available on the incidence in the domestic dog is that reported by Ortlepp (1934) who found five of 25 dogs from the vicinity of Pretoria to be infested with *E. granulosus*. This figure may incriminate the domestic dog to a greater extent than is actually the case. Unlike countries such as Australia and New Zealand, the use of sheep dogs for herding purpose is not common in South Africa. They are at present used to a limited extent in certain areas, e.g. Northern Cape and parts of the Karoo, but are by no means common to all the farms in any of these areas. It is however, desirable that the incidence in domestic dogs be determined, especially in those areas with a high incidence of hydatidosis.

The importance of wild carnivores as disseminators is shown by the recovery of echinococci from them (Table 11).

The material recovered from the black-backed jackal and the silver fox was unsuitable for determination of the sub-species; that from the other wild carnivores was: *Echinococcus granulosus felidis* from the lion, *E. g. lycaontis* from the Cape hunting dog, and *E. g. africanus* from the Cape wild cat (Verster, 1965).

The importance of wild carnivores as disseminators varies in the different regions. Their rôle is primarily limited by their distribution. Thus the lion and the Cape hunting dog at present have a restricted distribution and are, therefore, only of importance in restricted localities. Other potential hosts such as the black-backed jackal and silver fox occur throughout the country. Their rôle is limited by the availability of infestive material, which in turn, is determined by the farming practices prevalent in a given area. Thus, the black-backed jackal is a source of infestation in the Western Transvaal where 11 of 84, and in the Eastern Province where 10 of 71, proved to be infested. No echinococci were recovered from 38 black-backed jackal originating from the Northern Transvaal. Sheep-farming is common in the Western Transvaal and in the Eastern Province; the black-backed jackal, therefore, has a readily available source of infestive material. The Northern Transvaal, however, is primarily a cattle-ranching area with but few sheep; hydatid cysts are, therefore, not easily available to this jackal.

THE INCIDENCE OF HYDATIDOSIS IN THE REPUBLIC OF SOUTH AFRICA

TABLE 11.—*Carnivores examined for adult Echinococcus granulosus sub-species*

Species	Common name	Number examined	Number infested
Canidae			
<i>Canis mesomelas</i>	Black-backed jackal.....	215	21
<i>Lycan pictus</i>	Cape hunting dog.....	1	1
<i>Otocyon megalotis</i>	Bat-eared fox.....	15	0
<i>Vulpes chama</i>	Cape silver fox.....	24	1
Mustelidae			
<i>Ictonyx striatus</i>	Striped polecat.....	7	0
<i>Poecilogale albinucha</i>	White-naped weasel.....	1	0
Viverridae			
<i>Cynictis penicillata</i>	Yellow mongoose.....	36	0
<i>Genetta genetta</i>	Small-spotted genet.....	6	0
<i>Genetta rubiginosa</i>	Rusty-spotted genet.....	3	0
<i>Genetta tigrina</i>	Large-spotted genet.....	2	0
<i>Genetta</i> spp.....		8	0
<i>Helogale parvula</i>	Dwarf mongoose.....	1	0
<i>Herpestes</i> spp.....		5	0
<i>Ichneumia albicauda</i>	White-tailed mongoose.....	2	0
<i>Mungos mungo</i>	Banded mongoose.....	5	0
<i>Suricata suricatta</i>	Suricate.....	12	0
<i>Viverra civetta</i>	African civet.....	5	0
Protelidae			
<i>Proteles cristatus</i>	Aardwolf.....	17	0
Hyaenidae			
<i>Crocuta crocuta</i>	Spotted hyaena.....	8	0
<i>Hyaena brunnea</i>	Brown hyaena.....	7	0
Felidae			
<i>Acinonyx jubatus</i>	Cheetah.....	3	0
<i>Felis caracal</i>	Caracal lynx.....	4	0
<i>Felis lybica</i>	African wild cat.....	15	1
<i>Felis nigripes</i>	Blackfooted cat.....	5	0
<i>Felis serval</i>	Serval.....	2	0
<i>Panthera leo</i>	Lion.....	7	5
<i>Panthera pardus</i>	Leopard.....	6	0

Farming practices

By and large the farming practices in this country are geared to protect the domestic livestock from wild carnivores. The means by which the livestock are protected varies in different parts of the country, being dependent on the type of livestock kept and the type of predator prevalent. In areas where large carnivores are common, it is usual to kraal the livestock at night; whereas in areas where the ubiquitous black-backed jackal is a threat to smaller livestock such as sheep, the animals are protected by kraaling, or the jackal population is controlled by hunting and jackal-proof fencing.

The practice of kraaling animals at night is common to many parts of the country. Under these conditions the livestock are exposed to pastures and water sources possibly contaminated with the excreta of wild carnivores by day. Furthermore twice daily on the way to and from the kraal, they are brought into close contact with the dogs at the homestead. The practice of kraaling cattle at night is probably partly responsible for the high incidence of hydatidosis in the Bushveld (Table 6). Similarly, the incidence in sheep at Vryburg (Table 7) is probably aggravated by the practice of kraaling these animals to protect them from black-backed jackal, and also by the use of sheep dogs for herding purposes.

In sheep-rearing areas such as the Karoo, black-backed jackal and Cape silver fox are the only wild carnivores that prey on sheep, and their numbers are constantly being reduced by a combination of jackal-proof fencing and hunting. As a result of this strict control of the jackal population, it is not necessary to kraal the sheep, and they are, therefore, only rarely brought into contact with the dogs at the homestead. As would be expected, the incidence in sheep in this area is low (Table 2). The cattle kept in this region are dairy animals for domestic use and as such have more contact with dogs at the homestead. The incidence in cattle (1·18 per cent) is slightly higher than in sheep (0·86 per cent).

Climatic conditions

Gemmell (1958), working in New South Wales, Australia, concluded that a low incidence of the parasite may be expected if climatic conditions are unfavourable. He described as unfavourable temperatures exceeding 80° F (based on air temperatures), or alternatively less than one inch of rain per month for six consecutive months. In the parts of New South Wales from which he appears to draw his conclusions, the rainfall is evenly distributed throughout the year. It would seem that Gemmell, in drawing these conclusions, did not take into consideration the effect of local farming practices, such as watering places for the animals, and of the local microclimate. Sweatman & Williams (1963) investigated the survival of *E. granulosus* ova under natural conditions in New Zealand. They showed that high rainfall is a limiting factor in that the ova are leached into the soil. In their study in which they measured soil surface temperatures, they found that under natural conditions the ova of *E. granulosus* "survive conditions of wide extremes and temperatures well above 70° and 80° F even when conditions are meteorologically dry".

The present survey was not planned to test the effect of climatic conditions on the incidence of the parasite. It is not possible to assess the effect of climatic conditions on the prevalence of the parasite in the Republic as the very dry parts of the country were not covered. The data available seem to indicate that farming practices are of more importance than climatic conditions, as the prevalence of the parasite in different species of livestock varies in the same region (Fig. 2, 3, 4).

CONTROL

The presence in this country of both sylvatic and urban cycles makes the control of the parasite more difficult than would have been the case had there been an urban cycle only. From the public health point of view, the sylvatic cycle is negligible, but not so the urban one. This survey has shown that the parasite is present to a greater or lesser extent throughout the country. Due to its public health significance, it is desirable that efforts should be made to control it, not only in the regions with a high incidence, but also in those with a low incidence.

The life cycle of the parasite can only be controlled by breaking the link between the intermediate and definitive hosts. This may be done by treating the dogs with an effective taenicide, but as reinfestation can occur, this in itself will not be completely effective. The only effective method of control is the prevention of infestation of dogs by discontinuing the feeding of raw offal. The practice of feeding raw offal is common throughout the country as is evident from the high incidence of *Taenia hydatigena* in dogs (Verster, 1965b).

THE INCIDENCE OF HYDATIDOSIS IN THE REPUBLIC OF SOUTH AFRICA

A decrease in the incidence of echinococcosis in dogs would result in a decrease in the incidence of hydatidosis in domestic livestock. The latter will only be evident over a period of years when the older, more heavily infested, animals have been slaughtered out.

A decrease in the incidence of hydatidosis in domestic livestock will decrease the incidence of echinococcosis in the wild carnivores that prey on them. This decrease in echinococcosis of wild carnivores will only occur with respect to those sub-species of *E. granulosus* in which only domestic livestock act as intermediate hosts (Verster, 1965a).

Control measures cannot be instituted against those subspecies which are host specific to wild carnivores, i.e. *E. g. lycaontis* and *E. g. felidis*. *E.g. lycaontis*, which is host specific to the Cape hunting dog, is known to utilize sheep as intermediate hosts. It is possible that this parasite may utilize other herbivores as intermediate hosts, but this has not yet been proved. The life cycle of *E. g. felidis* of the lion is unknown. As both the Cape hunting dog and the lion have a restricted distribution, the sylvatic cycles of their parasites can affect domestic livestock in restricted areas only.

SUMMARY

Hydatidosis occurs in all the areas of the Republic that were covered by this survey. In the country as a whole the average incidence is approximately 1 per cent in all species of slaughter stock.

The incidence varies in the different regions and in different species of livestock in the same region. In cattle it is high in the Eastern Province and the Transvaal Bushveld, in sheep at Welkom and Vryburg, in pigs in the Western Province and at Potgietersrus.

The incidence in cattle increases with the age of the animals.

The majority of the centres recorded an incidence of below 1 per cent in both sheep and pigs, but only 30 per cent of the centres recorded a similar low incidence in cattle.

The domestic dog is an important disseminator of hydatidosis but wild carnivores, particularly the black-backed jackal, are also sources of infestation in certain areas.

Farming practices tending to increase contact between the domestic dog and livestock, tend to increase the incidence of hydatidosis.

ACKNOWLEDGEMENTS

The authors would like to express their sincere appreciation to the authorities of the various abattoirs who recorded the necessary data, and to the State Veterinarians who also assisted with the collection of data. Thanks are also due to the many interested persons, ranging from farmers and State Veterinarians to Houndmasters of the various jackal hunting clubs and the various Nature Conservation authorities, who assisted by collecting specimens from wild carnivores. The assistance of Dr. Gertrud Theiler and Dr. R. K. Reinecke in reading the manuscript is gratefully acknowledged.

REFERENCES

- DU TOIT, D. F., 1963. Personal communication.
- FROYD, G., 1960. Cysticercosis and hydatid disease of cattle in Kenya. *J. Parasit.*, 46, 491-496.
- GALPIN, W. E., 1963. Personal communication.
- GEMMELL, M. A., 1958. Hydatid disease in Australia. III. Observations on the incidence and geographical distribution of hydatidiasis in sheep in New South Wales. *Aust. Vet. J.* 34, 269-280.
- GEMMELL, M. A., 1961. An analysis of the incidence of hydatid cysts (*Echinococcus granulosus*) in domestic food animals in New Zealand. *N.Z. Vet. J.*, 9, 29-37.
- LIVESTOCK & MEAT INDUSTRIES CONTROL BOARD, 1963. Personal communication.
- LOVEDAY, R. K., 1963. Personal communication.
- MULLER, G. L., 1961. In Hobbs, W. B.; Rossiter, L. W.; Reinecke, R. K.; Muller, G. L.; Anna Verster; Van der Walt, K.; Tustin, R. C. Symposium Helminth Research in South Africa. *J. S. Afr. Vet. Med. Ass.* 32, 477-479.
- NYSCHENS, A. L., 1963. Personal communication.
- ORTLEPP, R. J., 1934. *Echinococcus* in dogs from Pretoria and vicinity. *Onderstepoort J. Vet. Sci.*, 3, 97-108.
- ORTLEPP, R. J., 1937. South African helminths. Part I. *Onderstepoort J. Vet. Sci.*, 9, 311-366.
- PULLAR, E. M. & MARSHALL, W. K., 1958. The incidence of hydatids in Victorian cattle. *Aust. Vet. J.*, 34, 193-201.
- SCHUTTE, J. A., 1963. Personal communication.
- SWEATMAN, G. K. & WILLIAMS, R. J., 1963. Survival of *Echinococcus granulosus* and *Taenia hydatigena* eggs in two extreme climatic regions of New Zealand. *Res. Vet. Sci.*, 4, 199-216.
- VAN AARDT, W. P., 1963. Personal communication.
- VAN HEERDEN, A., 1963. Personal communication.
- VEENSTRA, T., 1963. Personal communication.
- VERSTER, ANNA, 1962. Hydatidosis in the Republic of South Africa. *S. Afr. J. Sci.* 58, 71-74.
- VERSTER, ANNA J. M., 1965 (a). Review of *Echinococcus* species in South Africa. *Onderstepoort J. Vet. Res.*, 32, 7-118.
- VERSTER, ANNA, 1965 (b). Unpublished data.
- VILJOEN, N. F., 1937. Cysticercosis in swine and bovines with special reference to South African conditions. *Onderstepoort J. Vet. Sci.*, 9, 337-570.