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Myxomatosis. The effect of age upon survival of wild and domestic rabbits (*Oryctolagus cuniculus*) with a degree of genetic resistance and unselected domestic rabbits infected with myxoma virus

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SUMMARY

The response of wild and domestic rabbits with a degree of genetic resistance to myxomatosis has been shown to be markedly affected by the age at which they were infected with a virulent strain of the virus. The response, in terms of mean survival time and percentage survival, fell with increasing age from 10 to 30 weeks with little change thereafter.

INTRODUCTION

Tests of the virulence of strains of myxoma virus and estimations of genetic resistance in populations of wild rabbits and domestic rabbits selected for resistance (Sobey, 1969) have been difficult to standardize owing to a large variation in survival time and case mortality, apparently caused by relatively minor environmental differences. One such source of variation is the age at which rabbits are infected. Fenner (1949) has shown that in mice infected with ectromelia virus, suckling mice and mice about a year old displayed a much higher mortality than young 8-week-old adults. Fenner also mentioned that there are many examples in human medicine where the age at which infection occurs has a marked bearing on the course of a disease. Studies on the effect of age upon the response of non-immune unselected domestic rabbits to infection with myxoma virus are reviewed by Fenner & Ratcliffe (1965). A limited range of ages was covered in these studies, 1–8 weeks and 17 weeks, over which period there was an increase in survival time and recovery rate.

In the present study observations were made on domestic rabbits selected for resistance to myxoma virus, unselected domestic rabbits and wild rabbits with a degree of genetic resistance; they were infected with a virulent myxoma virus, over the age range 10–50 weeks. Two groups of wild rabbits falling into two distinct age groups from other localities were also infected and observed.

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MATERIALS AND METHODS

Viruses

Three highly virulent strains and one moderately attenuated strain of myxoma virus cloned in our laboratory were used. Standard laboratory strain (SS) Strain no. 1, Glenfield (GV) Strain no. 5, Lausanne (Lu) Strain no. 7 and KM 13 Strain 30: strain numbers are according to Fenner & Marshall (1957).

Rabbits

(1) Unselected domestic rabbits were obtained from a randomly bred stock maintained by C.S.I.R.O. Division of Animal Genetics; this stock has never been exposed to myxomatosis. (2) Selected domestic rabbits: rabbits selected for resistance to myxomatosis (Sobey, 1969) with a mean grade of 6·5, equivalent to about six generations of selection, were used. (3) Wild rabbits from Lake Urana in New South Wales where populations have been subject to severe annual outbreaks of myxomatosis since 1951 (Marshall & Douglas, 1961). The rabbits used from this location were bred in Canberra by C.S.I.R.O. Division of Wildlife Research. Adult wild rabbits were caught, ear marked and screened for circulating antibodies to the soluble antigens of myxoma virus using the technique described by Sobey, Conolly & Adams (1966). Six does with and six does without circulating antibodies and four bucks without circulating antibodies were selected as parents. The does were housed in individual field enclosures and the bucks caged. Does were mated when receptive during the breeding season June to November 1968. Kittens were removed from the enclosures at 4 weeks of age, ear marked, flown to Sydney and caged. Eighty-two rabbits from four litter drops were used. (4) Wild rabbits from two localities, Natimuk and Seaspray in Victoria: Seaspray has been subject to annual epizootics since 1951 and Natimuk has failed to have an annual epizootic only during severe drought periods. Rabbits were captured in the field and screened for circulating antibodies as above, only those without antibodies to myxoma soluble antigens being kept for testing. These rabbits fell into two clearly defined age groups, subadult (10–16 weeks) and adult (greater than 25 weeks).

Testing conditions

At appropriate ages for testing the domestic rabbits and the wild rabbits originating from Urana were moved into a room carefully maintained at $75 \pm 2°$ F. Where possible sibs were tested over a range of ages. A dose of 3–10 lesion-forming units (L.F.U.) of SS virus was administered intradermally in the ear base. A large number of ampoules of virus were frozen at $-60°$ C. at the beginning of the experiment and repeated titrations during the course of the work revealed no change in the titre.

The wild rabbits from Natimuk and Seaspray were caged in a room maintained at $70 \pm 3°$ F. A number of animals from each age group from each locality was infected with either of three strains of virulent virus, SS, GV or Lu. Infection was made via the eye with virus dried on to an abrasive powder (D.E.P.), described by Sobey, Conolly & Adams (1967).

All rabbits were given a score equivalent to the number of days they survived after infection. Those rabbits which survived beyond 30 days were classed as recoveries and given a score of 30.

A pelleted food ration and water were supplied *ad. lib.*

RESULTS

Unselected domestic rabbits

The responses of animals infected with SS between the ages of 10 and 50 weeks, recorded separately for sex, are shown in Table 1. The mean survival times ($\bar{x}$ S.T.S) for both sexes are shown in Fig. 1A. There is no evidence of any difference in

Table 1. *The survival times, in days, of unselected domestic rabbits*

(Rabbits were inoculated intradermally in the ear base with 3–10 L.F.U. of SS strain of myxoma virus at ages between 10 and 50 weeks.)

Age tested in weeks	Males	Females	No.	$\bar{x}$ S.T.	%S
10	10, 11, N.R., N.R., N.R.*	11, 12, 13, N.R.			
11	10, 12, 14	11, 12			
12	11, 13, 14, 15	12, 12, 13			
13	16	13	19	12·4	—
14	11, 13	11, 12, 12			
15	—	—			
16	11, 13	11, 12, 12	10	11·8	—
17	—	—			
18	10, 11, 11, 11, 13, 13, 14	11, 11, 12, 12, 13, 13	13	11·9	—
19	—	—			
20	12, 12, 12	12, 13			
21	11	12, 12	8	12·0	—
22	11, 12, 12, 16, S†, N.R.	10, 11, 12, 12, 12, 12, 13, 16, S			
23	—	—	14	15·0	14
24	11, 12, N.R.	11, 12			
25	—	—	4	11·5	—
26	12, 13, N.R.	12, 13, 13			
27	—	—			
28	—	—			
30	10, 11, 12, 14, 15	11, 12, 13, 16, N.R.	14	12·7	—
31–40	14, 14, N.R.	11, 12, 12			
41–50	11, 12, 12	10, 13	10	12·1	—
Total			92	12·6	2

* N.R.: no reaction at site of injection, animal failed to contract myxomatosis.

† S: animal survived beyond 30 days after infection.

response between males and females. There is little evidence of an age effect except at about 22–23 weeks of age where two animals survived. The overall $\bar{x}$ S.T. of 12·6 days was higher than the 10·8 days found by Fenner & Marshall (1957) for SS, although the dose of virus administered was similar. Several minor differences in the method of testing may bear on this discrepancy in $\bar{x}$ S.T.; Fenner & Marshall inoculated in the shaved flank and held their rabbits at 70 ± 2° F., whereas

in the above work rabbits were inoculated in the ear base and held at $75 \pm 2°$ F. Further, their unselected domestic rabbits and ours were from different stocks and may therefore have had some slight genetic divergence. In cloning the virus in our laboratory it is possible we may have emerged with a slightly different strain.

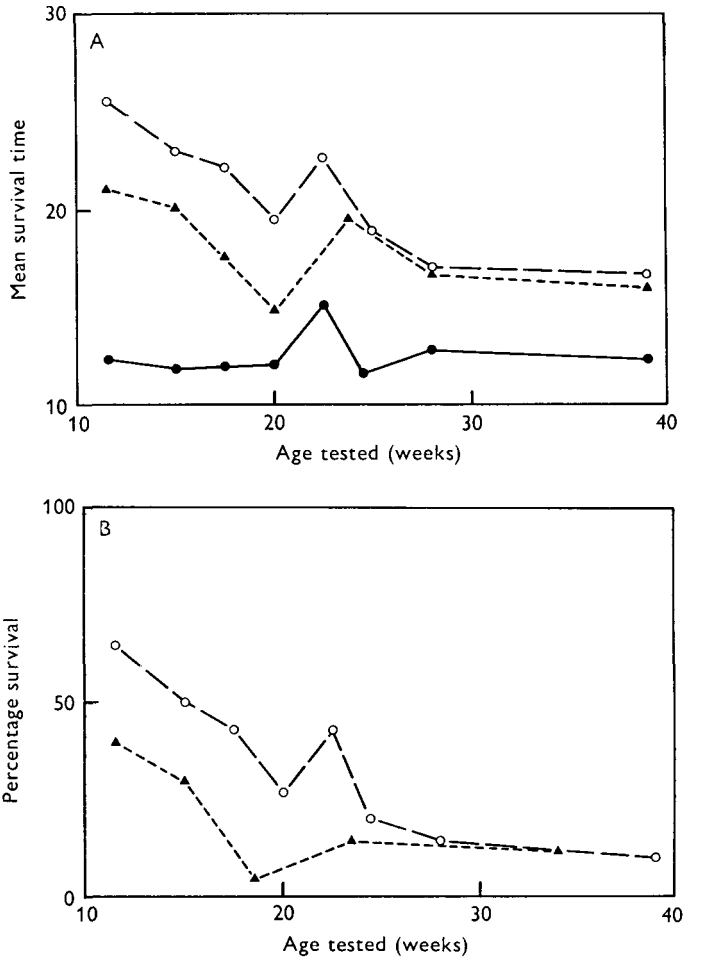

Fig. 1 (A). The mean survival times of groups of unselected and selected domestic rabbits and wild rabbits from Urana tested at different ages between 10 and 42 weeks. (B). The percentage survival of groups of selected domestic rabbits and wild rabbits from Urana tested at different ages between 10 and 42 weeks. ○——○, selected domestic; ▲- - -▲, wild Urana; ●— —●, unselected domestic.

Domestic rabbits selected for resistance to myxomatosis

The responses of animals infected with SS between the ages of 10 and 50 weeks whose dams had not been exposed to myxomatosis are shown in Table 2; and the responses of rabbits whose dams had survived the disease are shown in Table 3. The survival times of these two groups are plotted against age at testing in Fig. 2. When compared over the whole age range from 10 to 50 weeks at testing there is

no significant difference between the two groups in survival time. With respect to percentage survival however, there is a significant difference between the two groups in the age range 15 and 20 weeks ($\chi^2_{(1)}$ 4·5 $P < 0{\cdot}05$) suggesting that the fall in percentage surivival, with age at testing, was more rapid in animals whose dams

Table 2. *The survival times in days of domestic rabbits selected for resistance to myxomatosis for about six generations born to does which were not challenged with virus*

(Rabbits were inoculated intradermally in the ear base with 3–10 L.F.U. of SS strain of myxoma virus at ages between 10 and 50 weeks.)

Age tested in weeks	Male	Female	No.	$\bar{x}$ S.T.	%S
10	15, 18, S, S†	14, 21, S			
11	S	12, S, S			
12	14, S, S, S	S, S			
13	—	—	17	25	65
14	12, S, S, S	17, S, S, S, N.R.			
15	—	—			
16	11, 18, 25, S	12, 18, 22, S, S, S, S	19	24·5	58
17	14, 14, 17, S	14, S, S, S			
18	14, 14, 16, S, S, S, S	12, 13, 17, 21, 25, S, S, S, S	24	23·0	50
19	10, 12, 13	15, 17, S			
20	16, 29, S, S, S	14, 16, 18, 21			
21	13, 14, 14, S, S	16, S	22	20·4	32
22	10, 15, 16, 16, 17, 17, S, S, S	17, 20, 20, 24, S, S, N.R.			
23	14, 16, S, N.R., N.R.*	15, 19, 21, S, S	23	21·6	35
24	13, 16, 19, N.R.	13, 14, 20, S, S, S			
25	13, 13, 20, 28	15, 15, 20, S	17	20·0	24
26	19, 24	14, 16			
27	—	16			
28	12	11, 13			
30	13, 13, 16	S, N.R.	12	16·4	8
31–40	11, 14	12, 14			
41–50	13	N.R.	5	12·8	—
Total			139	19·2	39

* N.R.: no reaction at site of injection, animal failed to contract myxomatosis.
† S: Animal survived beyond 30 days after infection.

had recovered from myxomatosis than in the animals whose dams had not been exposed. The $\bar{x}$ S.T. and percentage survival for the combined data from both types of dam are plotted against time in Fig. 1A, B respectively. Clearly there was a fall in the $\bar{x}$ S.T. and percentage survival over the whole age range from 10 to 40 weeks. Except for the elevated response at 22 to 23 weeks, which does not test statistically significant, the fall appears to be linear from 10 to about 30 weeks, after which it tends to plateau although the number of animals tested over the later age range was not large. It is interesting that the elevated resistance at 22–23 weeks corresponded to that found in the unselected domestic rabbits.

Unselected domestic rabbits seldom survive longer than 15 days after infection with SS. The percentage of animals which die before 15 days is inversely proportional to the percentage which survive infection, therefore, either estimate can be used as an index of the resistance of a group or class of animals to the disease. This is illustrated in Fig. 3 where an age effect in terms of percentage survival is mirrored by the percentage of animals which died before 15 days.

Table 3. *The survival times in days of domestic rabbits selected for resistance to myxomatosis for about six generations born to does which had recovered from the disease*

(Rabbits were inoculated intradermally in the ear base with 3–10 L.F.U. of SS strain of myxoma virus at ages between 10 and 50 weeks.)

Age tested in weeks	Male	Female	No.	$\bar{x}$ S.T.	%S
10	S†, N.R.*	S			
11	18, 26	13			
12	S, S	S			
13	—	—	8	27·1	63
14	13, 14, 20	13, 14, 17			
15	—	—			
16	14, 15, S, S	S, S, S, N.R.	13	20·8	39
17	S, S	22			
18	13, 14, 14, 16, 24	15	9	19·8	22
19	13, 16	S			
20	15, 16	14			
21	14, 15	14, 14, S	11	17·4	18
22	14, 15, S, N.R.	S, S			
23	23, S, S, N.R.	19, S	10	25·1	60
24	16, 17	14			
25	11, N.R.	—	4	14·5	—
26	—	12, 20			
27	—	—			
28	11, 13, 18, S	15, 16			
30	S	12	10	17·7	20
31–40	16, S	—			
41–50	—	17, 22	4	21·3	25
Total			69	20·4	33

* N.R.: no reaction at site of injection, animal failed to contract myxomatosis.
† S: animal survived beyond 30 days after infection.

Wild rabbits from Urana

The responses of the 82 animals infected with SS between the ages of 10 and 43 weeks are shown in Table 4 and plotted in Fig. 1 A, B. There was a fall in survival time between 10 and 20 weeks similar to that found in the selected domestic rabbits. Only two animals were tested in the 22–23 weeks age group but the elevated resistance between 22 and 25 weeks corresponded approximately with that found for both the selected and unselected domestic rabbits. No male rabbits older than 16 weeks survived the disease. When the data were grouped into two

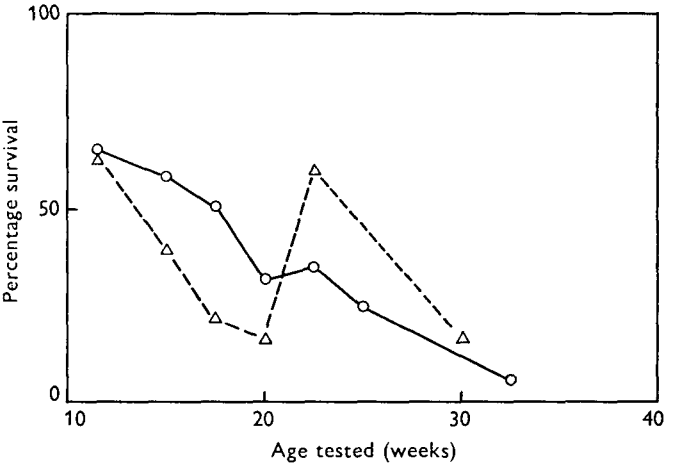

Fig. 2. The percentage survival of groups of rabbits born to does which had no contact with (unchallenged) and does which had recovered from (recovery) myxomatosis, tested at different ages between 10 and 42 weeks. ○——○, offspring from unchallenged does; △ - - - △, offspring from recovered does.

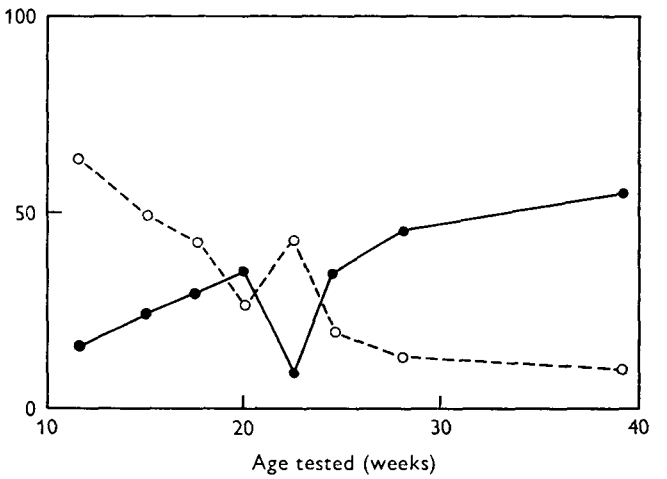

Fig. 3. The effect of age on the resistance of selected domestic rabbits as measured by the percentage which died before 15 days. ○- - -○, Percentage survival; ●——●, percentage surviving < 15 days.

age groups 10–19, and 20–42 weeks, as shown in Table 5, a partition of chi-square (Claringbold, 1961) showed a significant interaction between survival and age, there being more survivors in the 10–19 week group than in the 20–42 week age group, $\chi^2_{(1)} = 5{\cdot}01$ ($P < 0{\cdot}05$). The interaction of these factors with sex was highly significant $\chi^2_{(1)} = 7{\cdot}06$ ($P < 0{\cdot}01$) with a high male and low female survival in the 10–19 week age group and a low male and higher female survival in the 20–42 week age group. The resistance of animals from dams which had not been exposed to myxomatosis was not significantly different from that for animals whose dams had recovered from the disease although, as with the selected domestic rabbits, the

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resistance of the latter was consistently lower than that of the former. Thus there is no suggestion that maternal antibodies confer any protective effect beyond 10 weeks of age to rabbits infected with SS virus.

Table 4. *The survival times in days of Urana wild rabbits born in enclosures to does which had recovered from myxomatosis and does which had never been infected*

(Rabbits were inoculated intradermally in the ear base with 3–10 L.F.U. of SS strain of myxoma virus at ages between 10 and 43 weeks.)

Age tested in weeks	Offspring from unchallenged does		Offspring from recovered does		No.	$\bar{x}$ S.T.	%S
	Male	Female	Male	Female			
10	S†	13, S	14, 14, 17	14, 16, 17			
11	—	—	—	—			
12	15, S, S	17	S, S, S	15, 16, N.R.			
13	—	—	—	—	18	21·0	39
14	15, 15, S	17, 17, 21	14, 16, S, S	15			
15	—	—	—	—			
16	S, S, N.R.*	12, N.R.	15, 20, S	13, 16, 16	20	20·1	30
17	—	—	—	—			
18	15, 16	14, S	13, 17, 21	12, 14, 25	10	17·7	
19	—	—	—	—			5
20	14, 20	15, 15	12, 16	17			
21	—	—	12, 14	13	10	14·8	
22	—	—	21	18			
23	—	—	—	—	2	19·5	14
24	—	—	—	20, S, N.R.			
25	11	—	13	23	5	19·4	
26	—	S	11	S			
27	13	13	—	—			
28	—	—	—	—			
30	—	15	13	11, 13	9	16·6	12
31–40	13	—	13, 13	14, 15, 16			
41–50	—	—	—	20, 22	8	15·8	
Total					82	18·5	21

* N.R. no reaction at site of injection, animal failed to contract myxomatosis.
† *S: animal survived beyond 30 days after infection.*

Table 5. *The percentage survival and mean survival times of male and female wild rabbits from Urana in the two age groups* 10–19 *and* 20–42 *weeks*

Sex	Age in weeks: 10–19			20–42		
	No.	$\bar{x}$ S.T.	%S	No.	$\bar{x}$ S.T.	%S
Male	27	22·2	45	15	13·9	—
Female	21	17·2	9	19	18·5	16
Male and Female	48	20·0	29	34	16·5	9

%S: percentage survival. $\bar{x}$ S.T: Mean survival time in days.

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Animals which showed no reaction at the site of injection and failed to contract myxomatosis (N.R.)

The three groups of animals described above, unselected domestic, selected domestic and wild rabbits from Urana were all tested under the same conditions and inoculated with the same stored batch of virus. A dose of ± 5 L.F.U. was selected to give the minimum dose that would ensure that of the order of 99 % of the inoculated animals would become infected (i.e. 1 % N.R.). The observed frequencies of % N.R. in the unselected domestic, selected domestic and wild Urana rabbits were 10, 6 and 5 % respectively, with no statistically significant difference between them. The mean % N.R. over the three groups was 6 % and although not significantly outside the expected range for the estimated 5 L.F.U. used, was higher

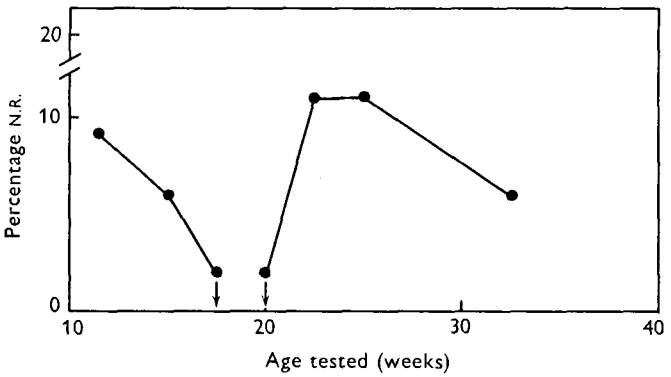

Fig. 4. The distribution, as a percentage, of rabbits which failed to show a reaction at the site of injection or to contract myxomatosis from the unselected and selected domestic rabbits and the wild rabbits from Urana tested at different ages between 10 and 42 weeks.

than expected. The distribution of N.R. over the age range 10–50 weeks was not random and is plotted for different age groups in Fig. 4. There appears to be a correlation between the % N.R. and $\bar{x}$ S.T. over the age groups studied, with a fall from 10 weeks to a trough at 18–20 weeks, a sharp rise during 22–25 weeks and a subsequent falling off with increased age of testing.

Selected domestic rabbits infected with KM 13

During the early stages selection was based on animals which survived infection with attenuated viruses of field origin (Sobey, 1969). Most animals were inoculated with virus between 16 and 20 weeks of age, but because of batch testing a number of animals were tested outside of these age limits. A summary of the percentage survival of animals after two generations of selection, in different age groups, infected with KM 13 is given in Table 6. There are two interesting aspects to these data; the elevated response at 22–23 weeks and the absence of any fall-off in response between 14 and 21 weeks of age.

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Wild rabbits from Natimuk and Seaspray

The data for the subadult and adult groups of rabbits from these two localities are shown in Table 7. With all three strains of virus used the subadult rabbits had a higher $\bar{x}$ S.T. than the adults. The immune state of the parents of these animals was unknown. However, it seems unlikely that maternal antibodies were respon-

Table 6. *The percentage survival of domestic rabbits selected for resistance to myxomatosis for about two generations*

(Rabbits were infected intradermally in the ear base with *ca.* 500 L.F.U. KM13 strain of myxoma virus at ages between 14 and 28 weeks.)

Age tested in weeks	No.	%S*
14–17	293	10
18–21	328	11
22–23	137	28
24–28	45	13

* Animal survived beyond 60 days after infection.

Table 7. *The mean survival times of wild rabbits from Natimuk and Seaspray and unselected domestic rabbits infected with three virulent strains of virus GV, SS and Lu*

	Temperature during test	Method of infection	GV (strain 5)				SS (Strain 1)				LU (Strain 7		
			Subadult		Adult		Subadult		Adult		Subadult		Ad
Source of rabbits	(°F.)		No.	$\bar{x}$ S.T.	No.	$\bar{x}$ S.T.	No.	$\bar{x}$ S.T.	No.	$\bar{x}$ S.T.	No.	$\bar{x}$ S.T.	No.
Wild rabbits from Natimuk	70 ± 3	D.E.P.	6	11·0	14	9·8	10	14·0	15	11·1	5	13·6	13
Wild rabbits from Seaspray	70 ± 3	D.E.P.	6	11·0	16	9·8	9	11·4	16	10·3	3	15·4	7
Unselected domestic	70 ± 2	5 I.D.*	—	—	5	10·2	—	—	43	10·8	—	—	5
Unselected domestic	72 ± 3	D.E.P.	—	—	21	10·2	—	—	—	—	—	—	—

* Five infection doses (I.D.) given intradermally in the shaved flank (data from Fenner & Marshall, 1957). D.E.P., dried eye powder virus inoculated via the eye.

sible for the higher S.T.s of the subadult groups in view of the results given above where dams which had recovered from the disease did not confer any advantage on offspring 10 weeks or older; the most likely cause for the subadults having a higher $\bar{x}$ S.T. than the adults appears to be the difference in age. It is interesting that the $\bar{x}$ S.T.s of the adult groups were very similar to those found by Fenner & Marshall (1957) for unselected domestic rabbits for all three virus strains. Further the $\bar{x}$ S.T. of unselected rabbits infected with eye powder virus was the same as that for rabbits infected intradermally with a low dose of virus where GV was used, suggesting that the method of infection was not responsible for lowering the $\bar{x}$ S.T. of the wild rabbits.

DISCUSSION

In wild and domestic rabbits with a degree of genetic resistance, the age at which they were infected with the virulent SS strain of myxoma virus was found to influence the course of the disease. There was a fall in $\bar{x}$S.T. and percentage survival at between 10 and 30 weeks of age, after which age there appeared to be little change. Although not significant in any one group of rabbits there was a consistent elevation in survival at about 22–23 weeks of age. The percentage of animals which failed to become infected after inoculation also fell with age at infection with a rise in number at about 22–25 weeks of age. The domestic rabbits with only two generations of selection for resistance tested with KM13 did not show a fall in resistance over the age range 14–28 weeks, but they did show a rise in terms of percentage survival at 22–23 weeks.

When the data from the wild rabbits from Seaspray and Natimuk were collected it was difficult to explain why the $\bar{x}$S.T. of the subadult group was higher than that of the adult group. An advantage conferred by maternal antibodies could not be ruled out in view of the findings of Fenner & Marshall (1954) that the offspring from immune dams still had an advantage over the offspring from non-immune dams at 7–8 weeks of age when infected with SS. Further, the animals in these localities had been subjected to repeated epizootics over the years and selection for extended protection by maternal antibodies could be not ruled out. The findings described above show no advantage being conferred on the subadult group by maternal antibodies and suggest very strongly their extended $\bar{x}$S.T. was a result of their age *per se*.

The wild rabbits from Urana and the domestic rabbits with about six generations of selection for resistance were, on the average, very similar in their response over the whole range of ages tested. They differed, however, with regard to the responses of the two sexes. In the selected domestic rabbits there was no suggestion of a sex difference, whereas in the wild Urana rabbits males between the ages of 10 and 19 weeks had a better chance of survival than females of the same age, and the reverse was found with animals tested older than 20 weeks. If this interaction is indeed real then aberrant sex-ratios might be expected in the field depending on the age structure of the susceptible rabbits at the time of a myxomatosis epizootic.

The genetic resistance acquired by some wild rabbits since the introduction of myxoma virus into Australia in 1950 is shown by the high survival rate of the rabbits from Urana to SS; when first released standard strain had a case mortality of the order of 99·8% (Fenner, 1959). Similar findings have been reported by Marshall & Fenner (1958) and Marshall & Douglas (1961) for rabbits from this locality. The rabbits from Seaspray and Natimuk in Victoria showed an elevated $\bar{x}$S.T. in the subadult groups compared with unselected domestic rabbits; the numbers tested were too small to give an idea of the case mortality. Comparing wild rabbits with an unselected 'domestic baseline' is open to question. Vaughan & Vaughan (1968) found that wild rabbits from Skokholm Island with no history of exposure to myxomatosis had a higher 'baseline' in terms of $\bar{x}$S.T. and percentage survival than domestic New Zealand White rabbits. Wild rabbits without a history

of exposure to myxomatosis are no longer available on the Australian continent and the only 'wild baseline' available is that given by Fenner & Marshall (1957) who showed wild rabbits to have only a slightly larger $\bar{x}$S.T. where viruses of high, moderate and low virulence were used. The parents of the wild rabbits used by Fenner & Marshall may have been exposed to some selection and it is quite possible that original Australian wild rabbits were very little different from unselected domestic rabbits in their response to myxomatosis.

The wild rabbits at Urana have been exposed to annual epizootics of myxomatosis since 1951 (K. Myers, personal communication). It is interesting that the degree of resistance achieved during this period appears lower than that achieved in domestic rabbits in six generation equivalents of selection. There is no *a priori* reason for believing that the heritability of resistance is different in wild and domestic rabbits, and the slower rate of genetic gain in the wild rabbit can be attributed to a lower selection differential. Selection in the wild rabbits has been based almost entirely on attenuated strains of virus whereas the selected domestic rabbits were exposed to three generations of selection based on the virulent SS virus. Myxomatosis epizootics occur at Urana in the late spring or early summer with elevated temperatures which would contribute to a greater survival expectancy than the caged domestic rabbits with a degree of temperature control (Marshall, 1959). Further, non-infected wild rabbits in any one year would contribute to the breeding in the following year, reducing the selection differential as compared with the selected domestic rabbits where the grading system (Sobey, 1969) compensated for any non-infected dams and where only recovered sires were used. The consequences of the immune status of the sire have not yet been determined and in this regard it should be noted that the wild rabbits from Urana in the above study were all sired by bucks which had never been infected, whereas all the selected domestic rabbits had sires which had recovered from myxomatosis.

Before the epidemiological consequences of the age effect can be evaluated it will be necessary to show that it occurs where more attenuated virus strains are used, since infection in the field at present is largely by strains of Grade III virulence (Fenner & Chapple, 1965). However, since selection in wild rabbits with attenuated strains of virus and in domestic rabbits with more virulent strains have both resulted in a similar age effect to SS it seems likely that this age effect will be expressed for virus strains other than SS.

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