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Sheep Blowfly Research V.—Carcasses as Sources of Blowflies.*

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In April 1940 an investigation of certain phases of the sheep blowfly problem was commenced at Onderstepoort by the writer. One of these phases concerned the *rôle* carcasses played in nature as sources of blowflies.

Blowflies possess great powers of reproduction, and an important means of control should be directed against their breeding places. These flies are capable of breeding in carcasses to an enormous extent and also on the living sheep. An effective means of destroying blowfly larvae on the living sheep has been described in article No. VI of this series. The destruction of carcasses has been advised by the Union Department of Agriculture and Forestry for several years.

During the past ten or twelve years much work has been done, especially by Australian investigators, on the ecology of blowflies, and valuable and interesting facts concerning the larval habits of these insects have been obtained. Of the facts brought to light those concerning the phenomenon of succession and competition of the inhabitants of carrion are of fundamental importance. Their experiments in many instances yielded surprising results which revolutionised the ideas held on the relationship of carcasses to the blowfly problem.

The general conclusions of these researches were that the chief factor limiting the numbers of blowflies emerging from a carcass was the competition between the larvae for available food, and that, in summer, larvae of the primary blowfly *Lucilia cuprina* Wied., which began feeding on the carcass during the first day or so after the animal's death, could complete their development. Later arrivals found the carcass overcrowded with secondary and other larvae. They suggested that, for carcass destruction to be successful in reducing the primary blowfly population, it should be done within the first three days after the death of the animal.

In Australia there are at least ten species of flies which are connected with the blowfly problem and which play important *rôles* in the carrion complex.

Although we have fewer species concerned with the problem in South Africa, it was thought that valuable results would be obtained by studying it in the light of Australian experience.

In the Union of South Africa there are several species of blowflies which attack sheep. These are *Lucilia cuprina* Wied., *Lucilia sericata* Meig., *Chrysomyia chloropyga* Wied. and *Chrysomyia albiceps* Wied. A description of these flies is not necessary in an article of this nature, and those interested will find full descriptions in entomological literature.

* See footnote to article I of this series.

Largely as a result of work done in Australia, where the sheep blowfly problem is perhaps a more complex one than in this country, certain blowflies were regarded as primary, others secondary, and some even tertiary. This situation has now come to be recognised in this country. A primary blowfly is one which initiates an attack on a sheep and a secondary is one which follows in the wake of the primary, setting up further infestation.

In the Union of South Africa *Lucilia cuprina* is the more important primary fly and *Chrysomyia chloropyga* the second. *Chrysomyia albiceps* is a secondary fly which, under certain conditions, causes grave injury to sheep. *Lucilia sericata* has been found to cause myiasis but not very commonly. When it is found infesting sheep it is more often in partnership with *L. cuprina* or *Ch. chloropyga*. There have been records of the four species of larvae taken from individual sheep but these are usually the result of neglect of the animals.

The distribution of blowflies and their seasonal incidence in South Africa has been dealt with by other workers, notably by Smit, in various publications. It is only comparatively recently that the two species of *Lucilia cuprina* and *L. sericata* have been separated, so that, in previous publications on blowflies in South Africa, most of the statements confined to *sericata* should be taken to refer to *cuprina*.

During the past three years data on the flies causing strikes have been accumulated. Records were obtained in detail from Onderstepoort and the experiment station at Dohne, C.P. and specimens have been sent by many farmers from all the provinces of the Union. The results showed that *L. cuprina* was responsible for 55 per cent. of the strikes, and 35 per cent. of the strikes were caused by *L. cuprina* in association with the other species. In only 10 per cent. of the cases was *L. cuprina* not implicated (*vide* article I of this series).

Any measures, therefore, designed to control *L. cuprina* would be of considerable importance. Inasmuch as these flies are known to be feeders and breeders in carrion it is reasonable to regard such as important sources of blowflies.

In the past various methods for the disposal or destruction of carrion have been suggested and, in some instances, " carcass " traps designed to lure the flies and to destroy the developing larvae have been utilised.

Besides those species of flies already mentioned certain others, *viz. Chrysomyia marginalis* Wied., *Sarchophaga haemorrhoidalis* Meig., *Calliphora croceipalpis*, various *Musca spp.* and some *Anthomyiaed* flies are attracted to carrion. Of these *Ch. marginalis*, or the large blue bottle fly, is at certain times of the year, particularly in summer, attracted in great numbers to carcasses. This fly is not a sheep blowfly but rare instances of it having caused myiasis in other animals have been known. Its value as a scavenger was shown to be appreciable in the experiments about to be described.

The main object of the experiments was to find out what species of flies bred in carcasses under field conditions.

Methods.

The apparatus: In the first experiment a forty-four gallon oil drum was cut in half lengthwise and each half filled with sand to a depth of about six inches. Two sheep were killed and placed on the sand, one in each drum.

These were exposed for three and ten days respectively and then covered with a wire gauze fly screen to exclude further visitors. After a few days the soil was sifted, larvae and puparia removed to the insectary, and the remaining larvae and puparia adhering to the carcasses, were left *in situ* to develop. The resulting flies were trapped as they emerged from the troughs.

This apparatus was not very suitable because the maggots could escape easily; furthermore, as the troughs were on the ground ants, *Pheidole megacephala,* were able to get in and remove the larvae and also destroy the flies in the traps placed on top of the screen covers.

After experiencing these difficulties with the oil drums larger rectangular metal troughs were made with the edges turned inwards and downwards at an angle of 45 degrees and having a " fence " of wire gauze soldered on and lying parallel to the sides of the trough. This was found to prevent to a high degree the escape of the maggots. To obviate the difficulty with the predatory ants these troughs were placed on platforms raised about twelve inches above the ground and the supports were painted with tanglefoot. The corners of the troughs each had a metal tube attached opening into the troughs at the level of the sand on which the carcasses rested. The wandering larvae could escape through these openings and fall down the tubes into tins containing sand. This sand was usually sieved twice a day and the collected larvae removed to insect boxes constructed to exclude parasites.

Owing to wartime economy the platforms and supports were made of old rough timber which, in the extreme heat of summer, were very difficult to be kept effectively treated with tanglefoot as this quickly melted and ran off leaving conditions suitable for the ants to cross. Almost daily applications of tanglefoot were required to prevent access to the troughs by the ants. These difficulties were finally overcome by standing the platforms in concrete pots containing water. For other reasons too, which will be mentioned later, new and larger troughs of the same type were used. These metal troughs are 54 in. long, 36 in. wide and 21 in. deep and the exit holes 1 in. in diameter in each corner. The depth of sand is 8 in. in each trough.

The former mesh screen covers were re-designed. The latest cover consists of a wood and metal lid which fits closely over the top of the trough. A portion 30 in. by 18 in. in the centre is cut out and over this is built a framework 9 in. high whose sides are covered with wire gauze and the top with metal. This top has a circular hole cut out through which emerging flies can escape into a trap placed over it. To induce the flies to leave the trough strips of cardboard are tacked on the gauze of this top screen. The purpose of this top screen is to provide ventilation which is essential when the carcass is overcrowded with maggots. A photograph (Fig. 1) of the apparatus appears on the next page.

The running of an experiment: Two sheep are used in each experiment, one being exposed for a longer period than the other. This was done to ascertain the differences in the final fly populations in the one instance where competition was unchecked and in the other where later ovipositing fly visitors were excluded from the carcass. During the cooler months carcasses were usually exposed for three and ten days respectively, but in summer when decomposition and the growth of the larvae is extremely rapid, exposures of one and three days, sometimes less, were made.

At frequent intervals after the carcasses were exposed observations on the flies visiting and ovipositing were recorded. The larvae which wandered from the carcasses and escaped through the corner tubes were collected twice a day from the sand tins. In winter, some days after the troughs have been closed the sand is sieved and the larvae and pupae removed to a warm room in the laboratory. The remains of the carcasses containing adhering larvae and pupae are left in the troughs and the flies emerging later are trapped. It would have been an advantage to have suitable containers for the carcass remains to be placed in a warm room but these unfortunately were not obtainable.

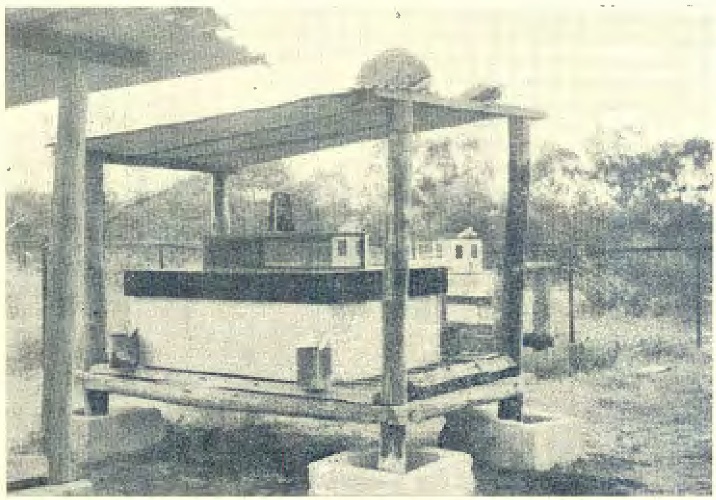

Fig. 1.—*Carcass trough.*—The trough is shown with the lid on. Note the wire gauze screen on the lid and the fly trap above. Migrating larvae escape through the corner tubes and are collected in the tins containing sand. During the exposure of the carcass the lid and corrugated iron roof are removed.

Parasites and predators, except ants, had access to the carcasses. Those larvae which escaped from the troughs into the sand tins were regarded as being successful in avoiding parasites and predators, and were subsequently protected under laboratory conditions.

Under natural conditions larvae migrate considerable distances from a carcass, thereby reducing the chances of parasitism, especially by *Mormoniella vitripennis* Wlk., which oviposits particularly in exposed puparia. In an experiment of this type, therefore, everything should be designed to simulate as closely as possible natural conditions, hence the tubes permitting the escape of wandering maggots. Further, the reason for using large troughs was to have sufficient space between the carcass and the walls of the trough. In smaller troughs the animal just fitted in touching all sides. When a carcass is swarming with maggots this cramping tends to disperse the maggots unduly, thereby introducing an undesirable factor which the larger troughs obviated. The sand on which the carcasses are placed is 9 in. deep, thus allowing a volume great enough to accommodate the pupating larvae. Should the sand be too shallow a great proportion of the larvae would be forced to pupate on the surface thereby being unduly exposed to parasitism.

In some instances the sheep were killed by cutting their throats, but in the majority of the experiments, the animals were shot in the head by means of a humane killer and the wounds plugged immediately with wads of wool taken from the animals. It was felt that the cutting of the throats and the subsequent haemorrhage might have some unusual effect on the process of decomposition and the resulting odours, which may not be normally associated with carcasses of animals dying from natural causes. However, under field conditions there would be deaths from jackal attacks and partly eaten carcasses would be left on the ground. Although death by shooting in the brain would not simulate natural death, bleeding is reduced to a minimum. It has been observed that fresh blood attracts blowflies and that flies are attracted more quickly to a carcass which has been opened to expose the viscera .

Apart from the experiments with sheep carcasses a number of small animals, e.g., rats, snakes, fowls, rabbits, guinea-pigs and cats were killed and their bodies exposed to flies. These small carcasses were placed in suitable containers with sand, and after they were broken down by larvae they were placed in insect boxes and removed to the laboratory. The results obtained from these are shown in Table 3.

Results.

(*a*) *Sheep carcasses:* The results of the experiments at Onderstepoort with whole carcasses are shown in Table 1.

A parallel set of experiments carried out by A. H. de Vries, Entomologist at the Grootfontein College of Agriculture, Cape Province, has been in progress for over a year. Some of these results (to be published more fully later) are shown in Table 2.

In the Onderstepoort experiments the wandering larvae were unable to escape in experiments two, three, and four, as at that time the exit tubes had not been attached to the troughs. In the first experiment where a half oil drum was used many larvae escaped but the numbers are not shown in the table. In the other experiments where migration has been recorded it will be noted what dimensions it assumes.

From Table 1 the most striking results may be stated: *Lucilia* species breed in carcasses during the winter and cooler months but not in summer.

Ch. chloropyga does not breed from carcasses in summer.

Ch. marginalis and *Ch. albiceps* are particularly successful in summer while the former is not bred to any great extent in winter.

In several instances the longer the exposure in summer the greater the percentage of *Ch. albiceps* in the final emerging population.

From Table 2 the results show: An enormous population of *Lucilia* spp. and *Ch. chloropyga* during winter and a decrease of these species as the weather becomes warmer. In midsummer *Ch. marginalis* and *Ch. albiceps* constitute the population obtained from the carcasses. Unlike some of the results obtained at Onderstepoort, the proportion of *Ch. marginalis* is greater than that of *Ch. albiceps* the longer the carcass is exposed.

It would appear from a comparison of the results from the two tables that *L. cuprina*, *L. sericata* and *Ch. chloropyga* may be bred from carcasses for a greater portion of the year at Middelburg in the Karroo than at Onderstepoort which is sub-tropical in climate. In this respect it is interesting to compare these results with those obtained in Australia. In that country it was noted that *Chrysomyia* spp. flies bred more successfully in the warmer climate of Queensland than in the cooler climate of New South Wales, and that in the far northern territory *Chrysomyia* spp. and *Sarcophagids* constituted the dominant species of the population emerging from carrion.

(*b*) *Small animal carcasses:* Unfortunately there were not enough exposures of these carcasses in the summer but this was unavoidable due to the writer's absence from the institution for three months at that time. The few summer exposures show an absence of *Lucilia* spp. and *Ch. chloropyga*, while, during the winter, these species bred successfully in small carcasses. *Ch. marginalis* and *Ch. albiceps* constitute the dominant species in the summer populations from these carcasses.

From the available records, therefore, it seems reasonable to suppose that fly populations from small and big carcasses are very similar in composition.

It is interesting to note what enormous numbers of flies relative to the available food supply are produced. From a small *Otomys* rat barely four inches long 730 *L. sericata* were obtained, and from a small cat containing 640 gm. of available food 7,933 blowflies were bred.

In Australia Fuller noted that different kinds of animal carcasses yielded different species of larvae, e.g., "a cat always has many more *Chrysomyia* spp. larvae present than a guinea-pig, whilst the guinea-pig may contain only a few dozen hairy (*Chrysomyia*) maggots and be crowded with those of *Lucilia* spp. . . . ." She also notes that pieces of beef seldom contain "hairy" maggots.

Our records are not complete enough to draw conclusions on this aspect. In order to obtain significant results it would be necessary to expose simultaneously about six carcasses of each kind of animal and to repeat the experiment at different times of the year.

The available records of populations from small carcasses show great variation in the same kinds of animals. The explanation is not obvious and it is suggested that it is largely a matter of chance. For example, two cats of the same variety were exposed about thirty feet apart; from the one over 1000 *L. sericata*, 6000 *Ch. chloropyga* and no *Ch. marginalis* were bred, and from the other no *L. sericata*, very few *Ch. chloropyga*, but nearly 2000 *Ch. albiceps* and 100 *Ch. marginalis*. The latter carcass began to attract flies to oviposit about five days after the former.

A salient point to be noted from these records is that small carcasses can produce many blowflies and, most important, many primary flies, e.g., 344 *L. cuprina* from a small *Otomys* rat.

In all these experiments the phenomenon of succession already referred to was noted. In summer the first flies to arrive, sometimes in less than an hour after the death of the animal, were *L. cuprina* and *L. sericata* followed almost immediately by *Ch. marginalis*. The next to come is *Ch. chloropyga* and then *Ch. albiceps*. *Musca* spp. usually arrive when the carcass has been broken down and are presumably mainly attracted by the exposed contents of the digestive organs. Sarcophagid species also arrive in the later stages of decomposition. There is an overlapping in the succession and in winter succession does not operate. The fact that *Ch. marginalis* is a very early visitor to carcasses is important for this fly lays prodigious masses of eggs at about the same time as the Lucilias.

Competition amongst the maggots is extremely keen though from these experiments a complete picture of the different stages cannot be obtained. Larvae of *Ch. marginalis* are large and very active, and in summer they swarm over the carcasses in great numbers. They possibly prey on other larvae and probably account for the destruction of the larvae of Lucilias and *Ch. chloropyga* during summer. Holdaway (1930), working in France on the insects inhabiting carrion, states that the greatest reduction in summer in the numbers of *L. sericata* is brought about by *Ch. albiceps*. He gives an example, a rabbit (1 Kg. of available meat) exposed during summer and having an initial population of 60,350 *L. sericata* and 2,850 *L. caesar* yielded a final population of 30 Lucilia and 2,611 Chrysomyia.

In Australia, Fuller records Chrysomyia larvae driving off and overwhelming larvae of *Lucilia* spp. and *Calliphora* spp. The larvae of *Sarcophagidae* and *Musca* spp. play a very minor *rôle* in competition and for all practical considerations may be ignored. Various beetles, mostly *Dermestes vulpinus* and several species of *Histeridae* are attracted to carcasses, feeding to a small degree on larvae and puparia but not appreciably affecting the final results. Parasitism by *Mormoniella vitripennis*, Wlk., occurs more particularly on *Ch. albiceps* and *Ch. chloropyga*. Lucilia larvae which are the first to migrate are more successful in escaping from this parasite. Where Lucilias have been obtained from sheep carcasses the great majority have been reared from larvae which have migrated. This migration occurs in the early stages of the experiments. In summer, when no Lucilias are obtained, it seems reasonable to suppose that larvae of *Ch. marginalis*, which are present soon after the death of the animal, devour the former or else render the pabulum otherwise unsuitable to them.*

Practical considerations from the above indicate that measures should be adopted to dispose of carcasses particularly when they breed Lucilias and *Ch. chloropyga*. During the period of the year when *Ch. marginalis* is most abundant and Lucilias are not successful in carrion the destruction of carcasses is not so important, except in cases of infectious disease. On the other hand *Ch. albiceps*, a secondary sheep blowfly, is a highly successful breeder in summer carcasses particularly in those left exposed for three days or longer. It would be desirable, therefore, to design methods to foster *Ch. marginalis*. This might be accomplished in summer by burying carcasses three days after the death of the animal. During this time any Lucilia and *Ch. chloroypga* larvae present would be eliminated by the active *Ch. marginalis*, while, in most instances, the later arriving *Ch. albiceps* would, therefore, be excluded.

It is interesting to note the effect of burying carcasses containing maggots. Smit has shown how successful are *Ch. chloropyga* and Lucilia maggots in burrowing upwards through six feet of soil. Fuller has shown that burial has a deleterious effect on larvae of *Ch. ruficacies* and this would probably apply to *Ch. albiceps*, a closely related fly and almost identical in appearance. The effect of burial on larvae of *Ch. marginalis* has not been determined. The simple burial of a carcass favours the primary species. This was strikingly demonstrated by Fuller. Burial must be combined

* Since this work was done tentative experiments conducted by Dr. Ulyett at the Entomological Parasite Laboratory, Pretoria, have failed to demonstrate any preying on larvae of *Lucilia* spp. by those of *Chrysomyia marginalis*. Larvae of *Ch. albiceps*, on the other hand, were shown to prey very actively on *Lucilia* larvae. Sufficient data to enable conclusions to be drawn have not yet been obtained.

with the poisoning of carcasses to control the emergence of primary flies at such times of the year when these flies are usually successful breeders in carrion.

Experiments on similar lines to these have been commenced in a coastal district of the Cape Western Province. The climate is different from that of the rest of the Union and a comparison of blowfly populations from carcasses there and from other parts of the country will be interesting.

Conclusions.

1. The object of the investigation was to determine what species of flies bred in carcasses exposed under field conditions.

2. The technique of exposing sheep carcasses in specially constructed troughs and the collection of migrating larvae and the trapping of emerging flies are described.

3. Fly populations from small animal carcasses were bred at various times of the year.

4. The phenomenon of succession and competition of the inhabitants of carrion was demonstrated.

5. *Lucilia cuprina, Lucilia sericata* and *Chrysomyia chloropyga* mainly constituted the populations of flies bred during the cool time of the year, while *Chrysomyia marginalis* and *Chrysomyia albiceps* constituted the populations during mid-summer.

6. When *Ch. marginalis* is abundant it is attracted to carcasses in the first stage of decomposition. *L. cuprina* and *L. sericata* are usually the first visitors to fresh carcasses followed almost immediately by *Ch. marginalis*.

7. Certain suggestions are made for the treatment of carcasses as a means of controlling blowflies.

PUBLICATIONS CONSULTED.

FULLER, MARY E. (1932). The blowfly problem—Notes on the effect of carcass burial. *J. Coun. Sci. Indust. Res.*, Vol. 5 pp. 162-164.

FULLER, MARY E. (1934). The insect inhabitants of carrion: A study in animal ecology. *Coun. Sci. Indust. Res.* Bull. 82.

HOBSON, R. P. (1938). Sheep blowfly investigations. Observations on the development of eggs and oviposition in the sheep blowfly, *Lucilia sericata* Mg. *Ann. Appl. Biol.*, Vol. 25. pp. 573-582.

HOLDAWAY, F. G. (1930). Field populations and natural control of *Lucilia sericata*. *Nature*, Vol. 126, pp. 648-649.

HOLDAWAY, F. G. (1932). Fly strike of sheep. A natural phenomenon. *J. Coun. Sci. Indust. Res.*, Vol. 5, pp. 205-211.

JOINT BLOWFLY COMMITTEE (1933). The sheep blowfly problem in Australia. Report No. 1. *Counc. Sci. Indust. Res.* Pamphlet 37. *N.S.W. Dept. Agric.* Sci., Bull. 40.

JOINT BLOWFLY COMMITTEE (1940). The prevention and treatment of blowfly strike in sheep. Report No. 2. *Coun. Sci. Indust. Res.*, Pamphlet 98.

SALT, G. (1930). Natural control of *Lucilia sericata*. *Nature*, Vol. 125, p. 203.

SMIT, B. (1931). A study of the sheep blowflies of South Africa. *17th Report of Dir. Vet. Services and Animal Industry.* Union of South Africa. Part 1, pp. 299-421.

TABLE 1. *Blowflies Bred in Sheep Carcasses at Onderstepoort.*

Experiment Number.	Date when Experiment Commenced.	No. of Days Carcass Exposed.	FLIES OBTAINED. *Lucilia cuprina.*	*Lucilia sericata.*	*Chrysomyia chloropyga.*	*Chrysomyia albiceps.*	*Chrysomyia marginalis.*	Other Species.	Total Number of Flies.	REMARKS.
1	5/ 6/40	3	460	238	22,358	1,359	43	—	24,458	Carcasses exposed in half oil drums.
		10	13	43	17,253	14,054	2,044	—	33,407	Large number of *Lucilia spp.* probably lost.
2	15/11/40	3	—	—	—	5	19,836	541	20,382	On the third day the carcasses were almost totally destroyed.
		7	—	—	—	16,477	6,435	226	23,138	
3	3/ 2/41	1 day 5 hrs.	3	4	—	1,337	16,039	283	17,666	Abdomens opened to expose contents.
		2 days	—	—	—	7,960	14,249	699	22,908	
4	2/ 6/41	3	475	—	24,951	2,861	4,203	720	33,210	
		7	—	—	4,635	4,350	36	69	9,090	
5	20/ 8/41	3	174	447	9,016	77	150	—	9,864	Flies from larvae which had migrated.
			—	—	6,467	659	62	53	7,241	Flies emerged in carcass trough.
		TOTAL.....	174	447	15,483	736	212	53	17,105	
		13	405	834	12,813	4	361	—	14,417	Migrated.
			6	4	2,652	978	41	194	3,875	From trough.
		TOTAL.....	411	838	15,465	982	402	194	18,292	
6	30/ 9/41	2	—	—	—	13,062	6,237	—	19,299	Migrated.
			—	—	—	6,273	2,707	6	8,986	From trough.
		TOTAL.....	—	—	—	19,335	8,944	6	28,285	
		7	—	—	—	9,230	30,727	—	39,957	Migrated.
			—	—	—	166	505	12	683	From trough.
		TOTAL.....	—	—	—	9,396	31,232	12	40,640	

TABLE 1.—(*continued*).

Experiment Number.	Date when Experiment Commenced.	No. of Days Carcass Exposed.	Flies Obtained.							Remarks.
			Lucilia cuprina.	*Lucilia sericata.*	*Chrysomyia chloropyga.*	*Chrysomyia albiceps.*	*Chrysomyia marginalis.*	Other Species.	Total Number of Flies.	
7	31/10/41	1	—	—	—	10,245	424	—	10,669	Migrated.
			—	—	—	3,989	166	—	4,155	From trough.
		TOTAL.....	—	—	—	14,234	590	—	14,824	
		7	—	—	—	6,485	4,050	—	10,535	Migrated.
			—	—	—	2,506	870	—	3,376	From trough.
		TOTAL.....	—	—	—	8,991	4,920	—	13,911	
8	3/12/41	1	—	—	—	6,294	9,395	—	15,689	Lamb's carcass.*
			—	—	203	1,918	7,821	—	9,942	Lamb's carcass. Eggs and larvae removed and bred on meat kept in insect boxes.
		3	—	—	—	1,427	1,488	—	2,915	Lamb's carcass.
9	17/ 3/42	1	33	—	—	—	12,445	—	12,478	Migrated.
			24	5	98	7,284	6,964	112	14,487	From trough.
		TOTAL.....	57	5	98	7,284	19,409	112	26,965	
		5	—	—	1	2,724	10,209	—	12,934	Migrated.
			—	1	3	11,912	3,560	101	15,577	From trough.
		TOTAL.....	—	1	4	14,636	13,769	101	28,511	

* In this experiment a third carcass was included in order to obtain eggs and newly emerging larvae for rearing in an environment when larval competition was greatly reduced. In this way it was hoped to determine what species of larvae were present in the first twenty-four hours of exposure without resorting to the method of examining first instars individually. Furthermore, there is no satisfactory way of distinguishing between the early instars of *L. cuprina* and *L. sericata*. It is interesting to note that *Ch. chloropyga* were recovered only from the eggs and larvae which were removed before intense competition set in. Carcasses of lambs were used to reduce the labour entailed in working with large carcasses.

TABLE 1.—(*continued*).

Experiment Number.	Date when Experiment Commenced.	No. of Days Carcass Exposed.	Flies Obtained. *Lucilia cuprina.*	*Lucilia sericata.*	*Chrysomyia chloropyga.*	*Chrysomyia albiceps.*	*Chrysomyia marginalis.*	Other Species.	Total Number of Flies.		Remarks.
10	23/ 4/42	2	196	39	3,035	49	432	1	3,752	Migrated.	*Ch. marginalis* and *Ch. albiceps* visited carcasses in first day; on second day *Ch. marginalis*, *Ch. albiceps*, *L. cuprina*, *L. sericata* and *Ch. chloropyga*.
			28	29	1,175	8,769	7,885	119	18,005	From trough.	
		Total.....	224	68	4,210	8,818	8,317	120	21,757		
		6	6	1	—	63	972	—	1,042	Migrated.	
			—	—	—	15,587	2,980	1	18,568	From trough.	
		Total.....	6	1	—	15,650	3,952	1	19,610		
11	23/ 6/42	4	1,516	1,025	—	—	—	—	2,541	Migrated.	Very cold weather during first five days. Blowflies began to arrive on the second day.
			272	1,313	500	1	—	18	2,104	From trough.	
		Total.....	1,788	2,338	500	1	—	18	4,645		
		14	124	10,293	473	—	—	125	11,015	Migrated.	
			125	2,235	22,505	62	2	93	25,022	From trough.	
		Total.....	249	12,528	22,978	62	2	218	36,037		

TABLE 1.—(continued).

Experiment Number.	Date when Experiment Commenced.	No. of Days Carcass Exposed.	Flies Obtained.							Remarks.
			Lucilia cuprina.	*Lucilia sericata.*	*Chrysomyia chloropyga.*	*Chrysomyia albiceps.*	*Chrysomyia marginalis.*	Other Species.	Total Number of Flies.	
12	5/ 8/42	3	87	310	13,755	95	2,233	—	16,480	Migrated.
			12	30	32,380	3,770	9,295	—	45,487	From trough.
		TOTAL.....	99	340	46,135	3,865	11,528	—	61,967	
		12	376	2,825	12,094	4	147	—	15,446	Migrated.
			15	140	28,150*	2,934*	2,247*	40	33,526	From trough.
		TOTAL.....	391	3,965	40,244	2,938	2,394	40	48,972	
13	25/ 9/42	3	—	—	1,580	11,541	6,810	6	19,937	Migrated.
			—	—	10	1,752	1,476	55	3,293	From trough.
		TOTAL.....	—	—	1,590	13,293	8,286	61	23,230	
		7	—	—	2	1,133	15,420	1	16,556	Migrated.
			—	—	—	7,130	1,270	—	8,400	From trough.
		TOTAL.....	—	—	2	8,263	16,690	1	24,956	

* Many of these species had escaped from trough.

TABLE 2. *Blowflies Bred in Sheep Carcasses at Grootfontein College of Agriculture: Middelburg, C.P.*

Experiment Number.	Date when Experiment Commenced.	No. of Days Carcass Exposed.	FLIES OBTAINED									REMARKS.
			Lucilia cuprina.	*Lucilia sericata.*	*Chrysomyia chloropyga.*	*Chrysomyia albiceps.*	*Chrysomyia marginalis.*	*Calliphora croceipalpis.*	*Sarcophaga* spp.	Other Species.	Total Number of Flies.	
1	4/ 7/41	3	6,502	8,128	759	—	—	107	22	—	15,518	
		10	15,371	25,948	23,925	28	—	162	24	—	65,458	
2	6/ 8/41	3	17,183	17,004	510	—	—	—	7	64	34,768	
		10	25,767	20,589	47,228	—	—	30	—	—	93,614	
3	11/ 9/41	3	12,180	9,214	37,724	—	—	—	11	—	59,139	
		10	896	633	38,226	97	—	—	—	—	39,852	
4	10/10/41	3	863	1,676	52,916	—	—	—	22	—	55,477	
		10	977	899	21,234	438	—	—	—	—	23,548	
5	10/11/41	3	—	8	8,954	2,130	—	—	—	573	11,665	
		10	14	—	17,343	7,213	—	—	4	—	24,574	
6	13/12/41	3	—	—	—	16,140	12,839	—	—	—	28,979	
		10	—	—	—	12,080	27,397	—	—	—	39,477	
7	14/ 1/42	3	—	—	4	16,084	6,232	—	—	—	22,320	
		10	—	—	—	11,811	37,829	—	—	—	49,640	
8	12/ 2/42	3	—	—	11	10,521	20,153	—	—	—	30,685	
		10	—	—	50	7,923	25,650	—	—	1,698	35,321	
9	14/ 3/42	3	—	—	—	7,949	24,090	—	—	—	32,039	
		10	—	—	9	2,419	4,544	—	—	63	7,035	Parasitism was marked.
10	9/ 4/42	3	—	—	40	620	592	—	—	11	1,263	Many larvae escaped from insect boxes.
		10	—	—	—	5,656	11,226	—	—	16	16,898	
11.	15/ 5/42	3	10,142	2,659	5,995	766	361	23	23	225	20,194	
		10	2,886	1,368	15,133	4,038	2,119	—	—	17	25,561	
12	18/ 6/42	3	24,795	5,182	7,408	38	—	77	115	690	38,305	
		10	23,283	6,224	15,089	89	—	45	45	1,522	46,297	

TABLE 3.

Flies Bred from Small Carcasses.

Carcass.	Period Exposed.	Flies Bred.	
Rabbit	17/11/41–22/11/41	*Ch. albiceps*	2,971
		Ch. marginalis	448
Mouse	29/10/41– 2/11/41	*Sarcophaga haemorrhoidalis*	33
Guinea-pig	29/10/41– 5/11/41	*Ch. albiceps*	300
Guinea-pig	21/ 8/41– 2/ 9/41	*L. cuprina*	13
		L. sericata	35
Lamb (at birth)	23/ 8/41–10/ 9/41	*L. cuprina*	14
		L. sericata	1,013
		Ch. chloropyga	1,693
		Ch. albiceps	2,172
		Ch. marginalis	12
Otomys rat	29/ 3/41– 1/ 4/41	*L. sericata*	735
Otomys rat	2/ 4/41– 8/ 4/41	*L. cuprina*	3
		L. sericata	185
		Sarcophaga spp	124
		Musca spp	5
Otomys rat	4/ 4/41–15/ 4/41	*L. cuprina*	6
		Sarcophaga spp	7
Otomys rat	3/ 4/41–10/ 4/41	*L. cuprina*	344
		L. sericata	187
Rat	10/ 4/41–18/ 4/41	*L. sericata*	2,353
		Ch. albiceps	13
Rat	10/ 4/41–15/ 4/41	*L. cuprina*	4
		L. sericata	247
		Ch. albiceps	8
		Sarcophaga spp	60
Rat	10/ 4/41–16/ 4/41	*L. sericata*	383
Rat	10/ 4/41–21/ 4/41	*L. sericata*	378
Rat	11/ 4/41–17/ 4/41	*L. sericata*	50
		Ch. albiceps	341
Rat	10/ 4/41–19/ 4/41	*L. cuprina*	50
		L. sericata	571
Snake	18/ 4/41– 2/ 5/41	*Ch. chloropyga*	341
		Ch. albiceps	1,458
		Ch. marginalis	161
Fowl	19/ 4/41– 2/ 5/41	*L. cuprina*	188
		L. sericata	26
		Ch. chloropyga	11
		Ch. marginalis	2,986
Cat	11/ 5/42–25/ 5/42	*Ch. chloropyga*	28
		Ch. albiceps	1,906
		Ch. marginalis	104
Cat	11/ 5/42–30/ 5/42	*L. sericata*	1,367
		Ch. chloropyga	6,410
		Ch. albiceps	156