THE PARASITOLOGY OF HUMAN SCABIES

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(With 3 Figures in the Text)

Introduction

In human scabies the cuticle is invaded by all stages of the mite *Sarcoptes scabiei* de G. var. *hominis*.* Although there is a considerable literature on the disease there is little precise data on its parasitology. Diagnosis is frequently based not on the discovery of living mites but on general appearance of the patient; this need not lead to errors in diagnosis, but it often gives rise to a misunderstanding of the nature of parasitic infection. It is commonly believed that when a patient possesses numerous stigmata acari are present in immense numbers.

The data presented in this paper are the first approximately accurate figures which have been published on the parasite population of patients with scabies. They show the number of adult female *Sarcoptes* which occurred on 886 cases; all patients were soldiers.

An accurate knowledge of the numbers of adult female *Sarcoptes* on patients may be valuable in two ways: (1) in any statistical study of the epidemiology of scabies; (2) in the treatment aimed at killing all the parasites, which can be more easily achieved if we have more precise knowledge of their number.

Methods

In the 886 cases described here we believe that at least 95% of the adult female *Sarcoptes* have been located and extracted. The procedure is as follows: The patient lies naked on a couch in a good light in a warm room and the surface of the body is inspected, using a watchmaker's eyeglass; the mites are extracted with a mounted needle. With a little experience it is possible to detect the mites in the skin before removal. Each patient is carefully examined at least two, and often more, times, and the accuracy of the results has been ensured by keeping some patients from whom the mites have been removed in this way under observation for periods of weeks, to ensure that none has been missed.

This technique only estimates the adult female population and ignores the other stages (i.e. eggs, larvae, nymphs and adult males). Nevertheless, as the adult females probably bear a fairly definite relation to the whole mite population an estimation of this stage alone will give a good guide to the intensity of parasitic infection. We propose to refer to the number of adult females per patient as the 'parasite rate'.

The parasite rate

9978 mites were removed from 886 patients. Thus the average parasite rate was 11·3. Fig. 1 and Table 1 give some indication of the distribution of the different mite populations among the patients. 52% had under six parasites and only 3·9% had over fifty. Very occasionally large populations were encountered. For instance, one patient had 511 adult female mites.

* The most recent account of *Sarcoptes* has been given by Buxton (1941*a*).

https://doi.org/10.1017/S0031182000016279 Published online by Cambridge University Press

In sarcoptic mange of animals many thousands of mites may occur on a single host. A similar state of affairs appears in man in 'Norwegian' or 'Crusted' scabies. We have not heard of a single case of anything approaching this condition occurring recently in Britain.

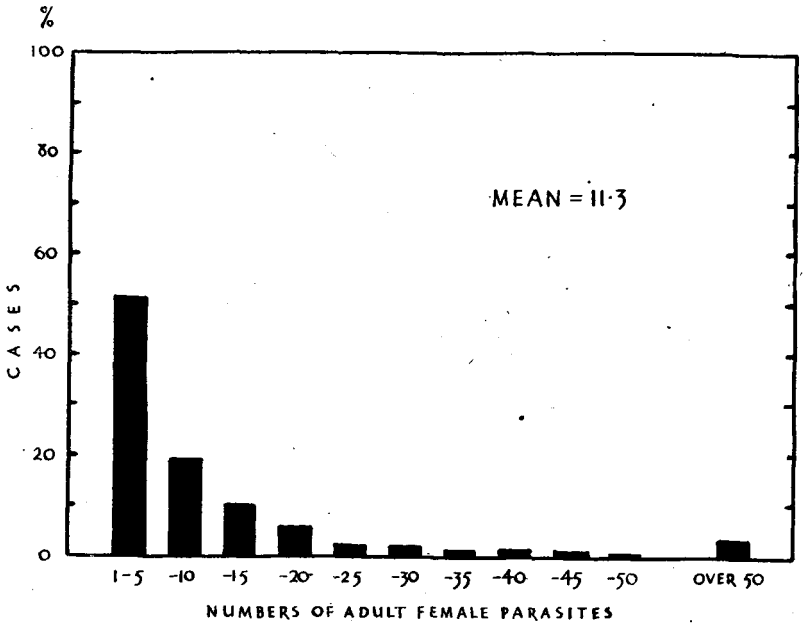

Fig. 1. The number of adult female *Sarcoptes* found on 886 cases of scabies.

Table 1. *Parasite rate in* 886 *cases of scabies*

Parasite rate (i.e. ♀ mites per patient)	No. of cases	%
1	137	15·5
2	123	13·9
3	74	8·4
4	68	7·7
5	54	6·1
1– 5	456	51·5
6– 10	170	19·2
11– 15	91	10·2
16– 20	48	5·4
21– 25	24	2·7
26– 30	21	2·4
31– 35	14	1·7
36– 40	13	1·5
41– 45	9	1·0
46– 50	7	0·7
51–100	28	3·2
Over 100 (i.e. 116, 166, 254, 280, 320, 511)	6	0·7

Sites of election

It is well known that certain sites on the body more frequently harbour mites than others, and this point, which has been specially investigated, is shown in Table 2 and Fig. 2. It will be seen that the majority, i.e. 63%, were found on the hands and wrists. The next most favoured site was the extensor aspect of the elbow, where 10·9% of the mites occurred.

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These results may be expressed in a different way. If a patient is examined rapidly it may not be possible to search all the sites of election, and therefore it is valuable to know what proportion of cases can be diagnosed by examining certain areas only. The results expressed in Fig. 3 indicate what proportion of the total 886 cases had some mites

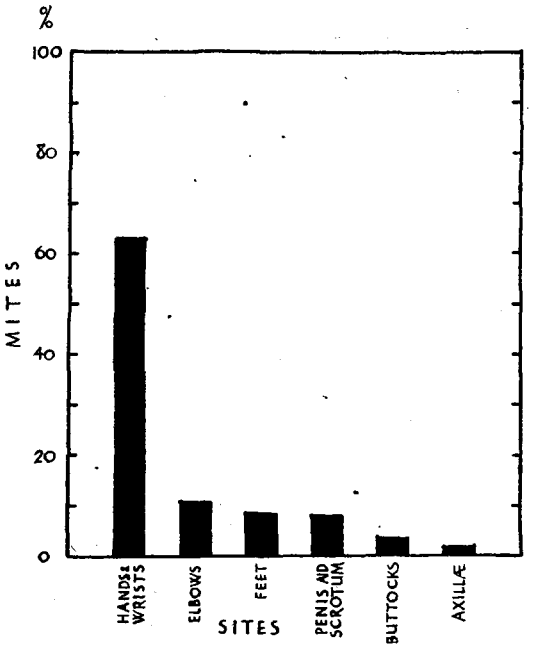

Fig. 2. Distribution of mites among the principal sites of election.

Table 2. *Sites of election: Number of adult female* Sarcoptes *extracted from the various sites. Total mites*, 9978. *Also frequency with which the different sites were affected. Total cases*, 886

Sites	Mites	%	Cases	%
Hands and wrists	6294	63·1	751	84·8
Elbows (extensor aspect)	1090	10·9	359	40·5
Feet and ankles	918	9·2	328	37·0
Penis and scrotum	842	8·4	319	36·0
Buttocks	398	4·0	140	15·8
Axillae	239	2·4	130	14·7
Knee	73	0·7	57	6·4
Navel	35	0·4	27	3·0
Hip	29	0·3	22	2·5
Thigh	22	0·2	19	2·2
Belly	18	0·2	13	1·5
Arm	13	0·1	7	0·8
Chest	10	0·1	10	1·1
Nipples	9	0·1	8	0·9
Back	3	—	2	0·2
Neck	3	—	2	0·2

on any particular site. Thus it will be seen that 85% had one or more parasites on the hands and wrists (mostly in addition to some parasites on other sites also). This means that at least nine out of ten of these cases of scabies could have been diagnosed by finding the causative organism if only the hands, wrists and elbows of the patient had been examined. This point may be of some importance when large groups of both sexes

have to be examined rapidly, though whenever possible the whole skin surface should be inspected.

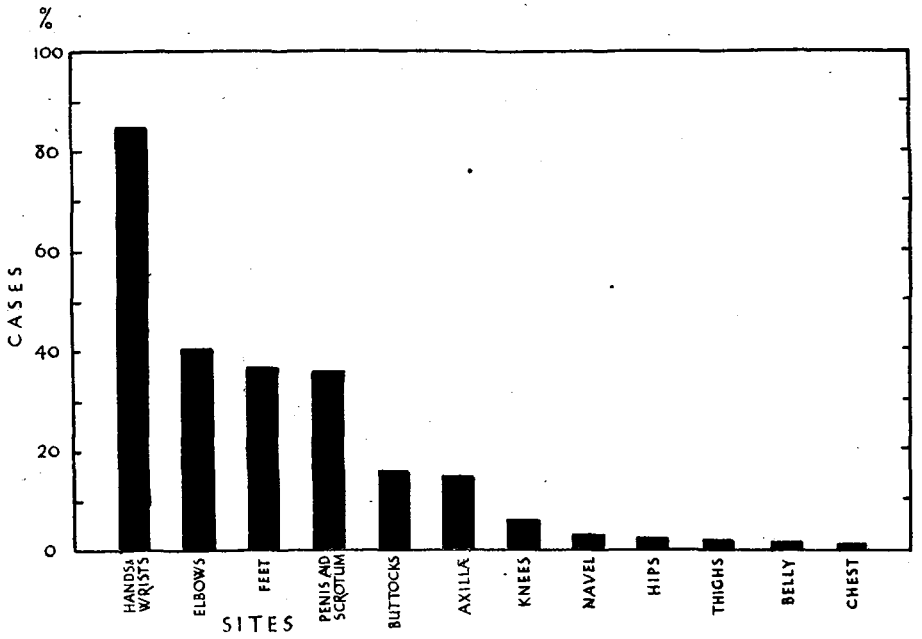

Fig. 3. The frequency with which various sites are infested with *Sarcoptes*.

Discussion

There appears to be little direct correlation between the general appearance of a scabies patient and the parasite rate. What is usually spoken of as a 'severe case', covered with follicular pustules and boils, will often have far fewer parasites than a patient with practically no clinical symptoms. Few of our cases had sufficient secondary infection of the skin to necessitate prolonged hospital treatment; it seems that at the present, in the army, scabies is being diagnosed before serious secondary complications occur (far worse complications are being regularly discovered in civilians, particularly children, among hospital out-patients). Of the 886 cases considered here, only forty had at all widespread secondary infection, and among these men the parasite rate was 12. Here the parasites were usually discovered on those parts of the body which were *not* secondarily infected, for the formation of pus appears to kill mites with which it comes in contact. Incidentally, the worst secondary infection was observed in men who had had scabies but had since been overtreated at other centres with sulphur (usually by the 'thiosulphate-HCl' method).

Of the 886 patients, 585 (66%) had detected symptoms which had caused the men to report sick, whereas 301 (34%) had been diagnosed at routine medical inspections. There was no significant difference in the parasite rate in these two groups. Some of the patients stated that even when sent for treatment they had no unpleasant itchy symptoms, whereas others reported that itching had been felt for periods of up to 12 weeks. There was no significant difference in the parasite rate of patients who had noticed itching for 1, 2, 3, 4 weeks, or for longer periods.

Those familiar with clinical scabies may be surprised at the results given in Table 2 and Fig. 2, which state that 63% of the mites occur on the hands, whereas only 8% are found on the genitals and a mere 4% on the buttocks. They will be inclined to state that far more obvious stigmata are found on the genitals and buttocks than on the hands. This is true also of the patients considered here, but careful observation showed that on many softer parts of the body, although very obvious old burrows could be found, these were seldom occupied by mites. It appears that in the genitals, buttocks and axillary region the skin gives a severe reaction to the parasites, and this reaction causes the patient to scratch and so the mite may be removed. Even after its removal the site of the old burrow may remain irritant for a considerable period; thus though only 37% had live mites on the genitals nearly 100% showed the remains of old burrows in this region. On the hands, however, the reaction is often comparatively slight even when the mites are numerous. If the hands are kept clean, little secondary infection may occur, and as ordinary washing has little effect on the infestation (Mellanby, 1942*a*) a fairly large population of mites may remain there.

The results given here refer to the parasites found on cases of scabies at the time of treatment. Results describing the development of the population of *Sarcoptes* and the symptoms of scabies will be published shortly, and at the moment it need merely be stated that the numbers of parasites by no means always show a steady increase as the disease proceeds, for rapid falls in population are very frequent. From the point of view of the epidemiology, the patients with large numbers of parasites will probably have the greatest importance, and the 3·6% with over fifty parasites may well be a greater danger to the community than the 52% with light infestations of under six adult females.

This investigation has been made on adult male patients only. A smaller number of females and children with scabies has been examined, and no striking differences in parasitology have been observed.

It is interesting to compare the populations of *Sarcoptes* on man with that of other human parasites. Both head and body lice (see Buxton, 1941*b*; MacLeod & Craufurd-Benson, 1941; Mellanby, 1942*b*) usually occur in small numbers, not unlike those described for *Sarcoptes* in this paper, with occasionally much larger populations on particular individuals.

SUMMARY

1. An analysis has been made of the numbers and location of adult female *Sarcoptes scabiei* found on 886 men suffering from scabies.

2. The average number of mites per man was 11·3. 52% of the cases had under six mites and only 3·6% over fifty.

3. 63% of the mites were found on the hands and wrists, 10·9% on the elbows, 9·2% on the feet, 8·4% on the genitals and 4% on the buttocks.

4. So-called 'severe' cases of scabies, showing widespread clinical symptoms, may have very few parasites, whereas cases with few symptoms may have large mite populations.

To obtain the results given above necessitated many hours of tedious work. The greater part of this was done by Mr W. C. Bartley, Corporal G. A. Burns, R.A.M.C., and by volunteers of the Sorby Research Institute. Part of the expenses were paid by grants from the Ministry of Health and the Medical Research Council.

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(*MS. received for publication* 9. VI. 1942.—Ed.)