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A Comparison Of Trisodium Phosphate And Decon 90 as Rehydrating Agents for Arachnida And Myriapoda Dry Specimens

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Introduction

The Entomology Department at The Natural History Museum (NHM) has a large main collection of Arachnida and Myriapoda specimens stored in 80% Industrial Methylated Spirit (IMS). There is also dry, pinned material dating back to the early 19th century. Over the last few years, there has been an on-going policy to remove type specimens from the dried collection and to house them in the main spirit collection, in order to make them more accessible. Traditionally, trisodium phosphate (TSP) was used as a rehydrating agent on Arachnida and Myriapoda specimens in the Department. However, I decided to undertake an experiment to compare the effects of trisodium phosphate, with that of Decon 90 (D-90), which is used in the Zoology Department at the NHM.

Aim

To determine the most appropriate chemical out of trisodium phosphate and Decon 90, to use as a rehydrating agent in order to prepare dried Arachnida and Myriapoda material for transfer into the spirit collection.

Methods

Dried specimens (without data) of different orders were selected (i.e. Pill millipedes, millipedes, centipedes, spiders and ticks). Two dilutions (2% and 5%) of both Decon 90 and trisodium phosphate were used on 'comparable' specimens - that is, specimens from the same genus. Where there was a lack of specimens, i.e. large tarantulas, I was only able to test one strength of chemical and chose 5% because of their large size. The specimens were fully immersed in the test chemicals in tubes or small jars and the results recorded after 17 hours. The specimens were then transferred into 80% IMS, and the results recorded after 4 hours and then again after 3 years.

Results

After 17 hours in the test chemicals

Decon 90 rehydrated 17 out of 20 specimens with no real side effects (see Tables 1-4). However, it did cause heavy leaching of colour in 1 specimen out of 20 rehydrated (see Tables 1 & 2), and heavy leaching of colour with bad breakdown of body contents in 2 out of 20 specimens rehydrated (see Tables 1 & 2). Trisodium phosphate rehydrated 13 out of 20 specimens with no real side effects (see Tables 1 – 4). However, although it caused very little leaching of colour, 6 specimens out of 20 showed breakdown of body contents, and 1 specimen out of 20 showed heavy leaching of colour with bad breakdown of body contents (see Tables 1 & 2). All specimens showed good flexibility. At the specimen level, the performances varied greatly depending on the group.

Results with the Pill millipedes varied greatly between the different dilutions of both test chemicals. In Decon 90 (at both dilutions), the results were good overall, although there was some leaching. However, in trisodium phosphate there was a breakdown of body contents (see Plate 1). For the millipedes, body breakdown was also much greater in trisodium phosphate (see Table 1). In both trisodium phosphate and Decon 90, the *Scolopendra* centipedes (see Table 2) were noticeably more badly leached and degraded than any of the other specimens. In Decon 90, only the legs were badly affected (see Plate 2), although in trisodium phosphate the cuticle of the body segments was flaking and there were chemical deposits all over the specimens. All three varieties of spider, i.e. large tarantulas, small tarantulas (*Atrax* sp.) and Sparassidae spp. were generally good in both chemicals at both dilutions, although the Sparrassidae specimens were slightly leached in both dilutions of Decon 90. The ticks were good in all dilutions of both test chemicals.

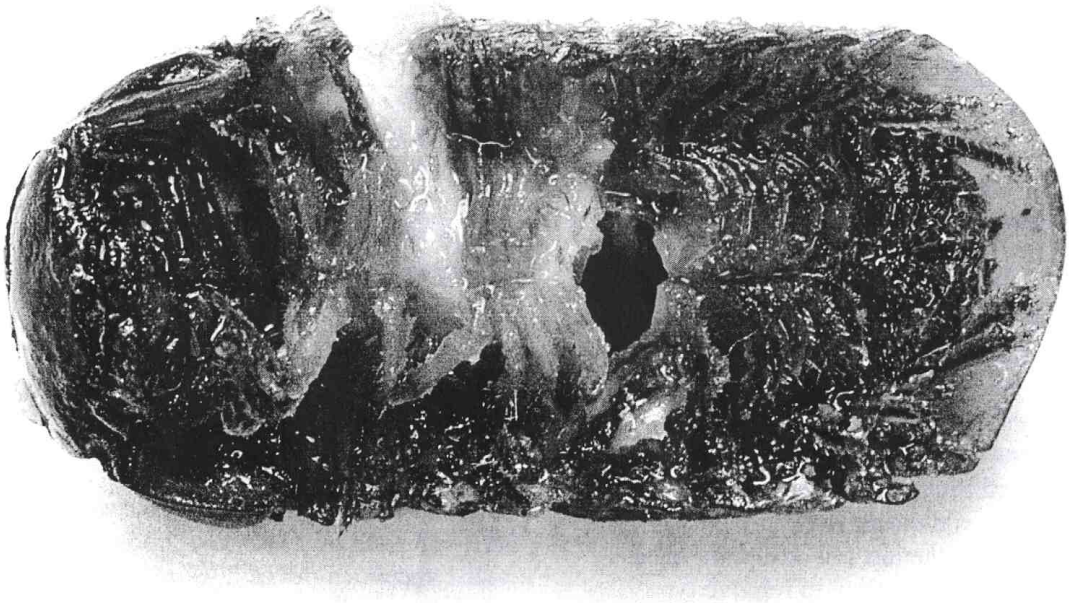

Plate 1

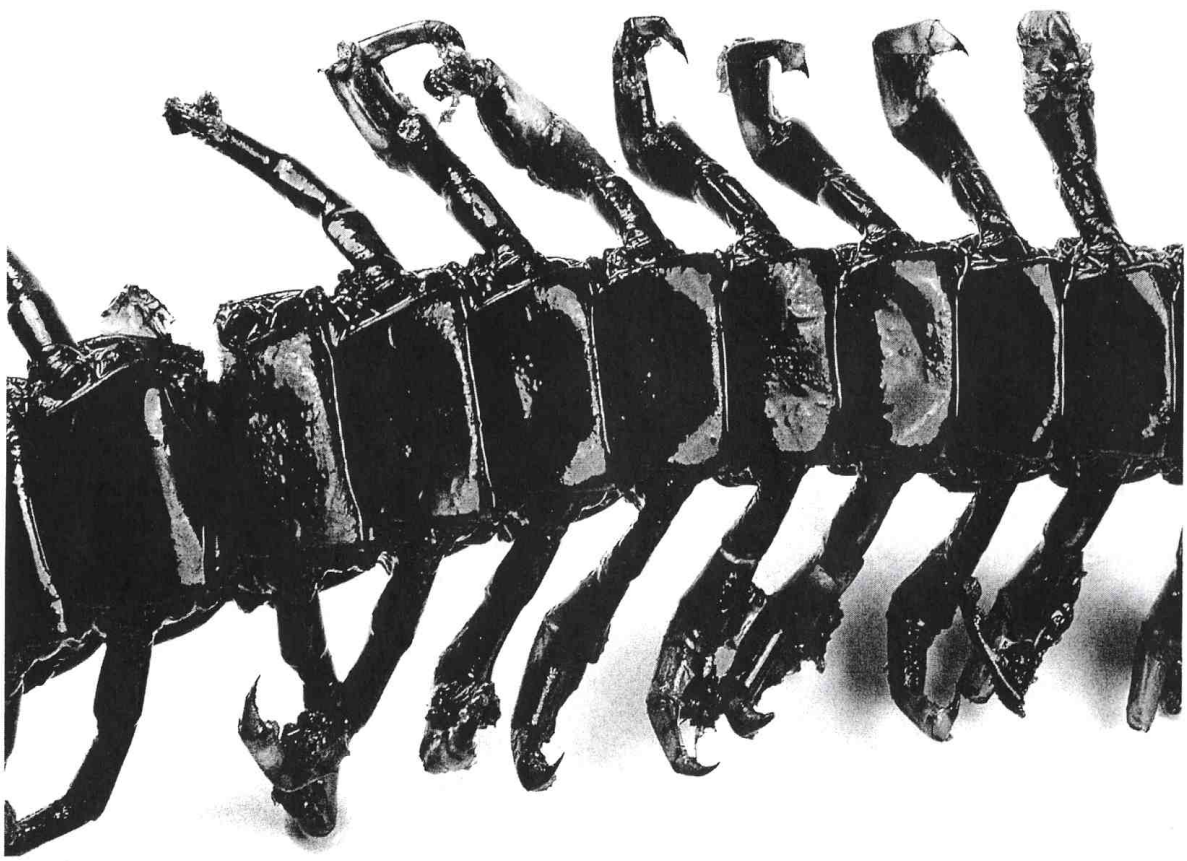

Plate 2

TABLE 1 - Millipede Results

Tube no.	Specimen	Chemical	Dilution	Results after 17 hours in test chemical	Results after 4 hours in 80% IMS	Results after 3 years
1	Pill millipede – large (*Arthrosphaera* sp.)	D – 90	2%	Slight leaching of colour, otherwise good	No further wetting req'd	Dried out
2	Pill millipede – large (*Arthrosphaera* sp.)	D – 90	5%	Quite heavy leaching of colour, otherwise good	No further wetting req'd	Dried out
3	Pill millipede – large (*Zephronia* sp.)	TSP	2%	Bad breakdown of body contents	Further wetting req'd	No further change
4	Pill millipede - large (*Zephronia* sp.)	TSP	5%	Start of breakdown of body contents	No further wetting req'd	No further change
19	Pill millipede - small (*Arthrosphaera* sp.)	D – 90	2%	Slight leaching of colour, otherwise good	Further wetting req'd	Some breakdown of body contents and fatty droplets in IMS
20	Pill millipede - small (*Arthrosphaera* sp.)	D – 90	5%	Slight leaching of colour, otherwise good	Further wetting req'd	IMS slightly cloudy
21	Pill millipede - small (*Arthrosphaera* sp.)	TSP	2%	Slight leaching of colour, otherwise good	Further wetting req'd	No further change
22	Pill millipede - small (*Arthrosphaera* sp.)	TSP	5%	Very bad breakdown of body contents	Further wetting req'd	Fatty droplets in IMS and on specimen

TABLE 1 - Millipede Results (continued)

Tube no.	Specimen	Chemical	Dilution	Results after 17 hours in test chemical	Results after 4 hours in 80% IMS	Results after 3 years
16	Millipede – large (*Spirobolus* sp.)	D – 90	2%	Slight leaching and breakdown of body contents	Further wetting req'd	IMS cloudy
15	Millipede – large (*Spirobolus* sp.)	D – 90	5%	Very bad leaching and breakdown of body contents	No further wetting req'd	No further change
17	Millipede – large (*Spirobolus* sp.)	TSP	2%	Slight leaching and quite bad breakdown of body contents	No further wetting req'd	Fatty deposits on specimen
18	Millipede – large (*Spirobolus* sp.)	TSP	5%	Very bad breakdown of body contents	Further wetting req'd	IMS quite clear, but fatty 'tide mark' on specimen
31	Millipede – small (*Paraiulus* sp.)	D – 90	2%	Good	No further wetting req'd	Fatty droplets in IMS and on specimen
34	Millipede – small (*Paraiulus* sp.)	D – 90	5%	Very slight breakdown of body contents, otherwise good	No further wetting req'd	Fatty droplets in IMS
33	Millipede – small (*Paraiulus* sp.)	TSP	2%	Very bad breakdown of body contents	Further wetting req'd	Fatty droplets in IMS and bad deposits on specimen
32	Millipede – small (*Paraiulus* sp.)	TSP	5%	Good	Further wetting req'd	Fatty droplets in IMS and on specimen

TABLE 2 - Centipede Results

Tube no.	Specimen	Chemical	Dilution	Results after 17 hours in test chemical	Results after 4 hours in 80% IMS	Observations after 3 years
39	Centipede - large	D – 90	2%	Slight breakdown of body contents, otherwise good	No further wetting req'd	No further change
9	Centipede – large (*Scolopendra* sp.)	D – 90	5%	Heavy leaching and bad breakdown of legs	No further wetting req'd	No further change
40	Centipede - large	TSP	2%	Very slight breakdown of body contents, otherwise good	No further wetting req'd	Very bad fatty droplets on specimen, IMS brown
10	Centipede – large (*Scolopendra* sp.)	TSP	5%	Quite heavy leaching and flaking away of cuticle on segments	No further wetting req'd	Alcohol brown due to leaching
24	Centipede – small (*Lithobius variegatus*)	D – 90	2%	Slight leaching and breakdown of body contents	No further wetting req'd	Fatty droplets in IMS and on specimen
23	Centipede – small (*Lithobius variegatus*)	D – 90	5%	Good	Further wetting req'd	IMS slightly cloudy
26	Centipede – small (*Lithobius variegatus*)	TSP	2%	Tips of legs beginning to breakdown	No further wetting req'd	Fatty droplets in IMS
25	Centipede – small (*Lithobius variegatus*)	TSP	5%	Slight leaching and breakdown of body contents	No further wetting req'd	Fatty droplets in IMS and on specimen

TABLE 3 - Spider Results

Tube no.	Specimen	Chemical	Dilution	Results after 17 hours in test chemical	Results after 4 hours in 80% IMS	Observations after 3 years
5	Tarantula - large	D – 90	5%	Good	Further wetting req'd	No further change
6	Tarantula - large	TSP	5%	Good	Further wetting req'd	IMS very cloudy with precipitate
7	Tarantula – small (*Atrax* sp.)	D – 90	5%	Good	Further wetting req'd	No further change
8	Tarantula – small (*Atrax* sp.)	TSP	5%	Good	Further wetting req'd	No further change
13	Spider (Sparassidae sp.)	D – 90	2%	Slight leaching – otherwise good	Further wetting req'd	No further change
12	Spider (Sparassidae sp.)	D - 90	5%	Leaching – otherwise good	Further wetting req'd	No further change
11	Spider (Sparassidae sp.)	TSP	2%	Good	Further wetting req'd	No further change
14	Spider (Sparassidae sp.)	TSP	5%	Good	Further wetting req'd	No further change

TABLE 4 - Tick Results

Tube no.	Specimen	Chemical	Dilution	Results after 17 hours in test chemical	Results after 4 hours in 80% IMS	Observations after 3 years
30	Tick – large (*Amblyomma variegatum*)	D – 90	2%	Good	Further wetting req'd	IMS cloudy with fatty droplets
29	Tick – large (*Amblyomma variegatum*)	D – 90	5%	Good	Further wetting req'd	IMS slightly cloudy
27	Tick – large (*Amblyomma variegatum*)	TSP	2%	Good	Further wetting req'd	IMS cloudy with fatty droplets
28	Tick – large (*Amblyomma variegatum*)	TSP	5%	Good	Further wetting req'd	IMS cloudy with fatty droplets
36	Tick – small (*Amblyomma variegatum*)	D – 90	2%	Good	No further wetting req'd	Fatty droplets in IMS and on specimen
38	Tick – small (*Amblyomma variegatum*)	D – 90	5%	Good	No further wetting req'd	IMS slightly cloudy
37	Tick – small (*Amblyomma variegatum*)	TSP	2%	Good	No further wetting req'd	IMS cloudy with fatty droplets
35	Tick – small (*Amblyomma variegatum*)	TSP	5%	Good	No further wetting req'd	IMS slightly cloudy

Plate 3

After 4 hours in 80% IMS
The specimens were studied four hours after immersion in 80% IMS, to see whether they needed further rehydration. All the spiders required further rehydrating because they still floated, along with three other specimens – a Pill millipede (tube number 3 – see Table 1), and two large millipedes (tube numbers 16 & 18 – see Table 2). All of the other specimens were sufficiently rehydrated to immerse fully in alcohol without floating.

Results after 3 years
There was clearly visible change - e.g. fatty droplets in the IMS, in 25 out of the total 40 specimens (see Tables 1 – 4).

Discussion
Due to the lack of availability of suitable material for experimentation, the sample size was too small to statistically analyse. However, I feel it is still possible to draw useful conclusions from those data collected. It is evident that in general, *both* chemicals are a compromise. Both chemicals affected specimens at both dilutions (2% & 5%). This therefore emphasises the need to question the motives behind rehydrating specimens in the first place.

I consider body contents or structure (i.e. legs and cuticle) breakdown to be a greater problem than colour leaching, so where there is a choice of preventing either one or the other by using a particular rehydrating agent, then I would choose to prevent body breakdown. I would therefore use Decon 90 in preference to trisodium phosphate, as more specimens - 17 out of 20, were relatively unaffected, compared to 13 out of 20 (see Tables 1 – 4). However, ideally I would use a combination of the two rehydrating agents (see 'Recommendations' section below).

After 17 hours in the test chemicals
It is evident that the condition of the specimen has an effect on the speed of rehydration. For example, those specimens that were broken into sections (i.e. all the millipedes) showed a quicker breakdown of body contents than the Pill millipedes. This is due to their body contents being openly exposed (see Plate 3), thus allowing more of the test chemical to enter the body cavity.

After 3 years
The fact that there was change even in those rehydrated specimens that were unaffected after 4 hours in 80% IMS (i.e. small tick, tube 37 - see Table 4), infers that the rehydrating agent may still have been working. This may have been due to insufficient washing after removal from the rehydrating agent, before being placed in the IMS.

Recommendations
Where there is an option for selectively using both rehydrating agents, I would recommend the following:

<u>2% Decon 90</u>
Pill millipedes (small & large) – although slight leaching, no body breakdown
Millipedes (small & large) – although slight leaching, no body breakdown
Centipedes (small & large) – Decon 90 at 2% appears least damaging to the specimens overall
Ticks (small & large) – good in anything, but 2% Decon 90 appears to be least damaging

<u>2% Trisodium phosphate</u>
Spiders (including small & large tarantulas) – no leaching

Further Work
The above data highlight the need for further, extensive tests on a greater number of specimens, using a greater selection of rehydrating agents and different immersion times. Specimens should then be studied at the tissue structure level for any possible effects.