RESEARCH COMMUNICATION

Use of Wild Rodents for Environmental Monitoring - Comparison of Rats in Bangkok and Rural Areas of Thailand

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Abstract

There is a great deal of concern regarding the hazard potential of human exposure to toxic substances and carcinogens as well as infectious agents in the environment. For monitoring purposes fish are well established with regard to aquatic pollution. However, for the human environment, mammalian species might be considered more relevant. As the various types of rats are one of the most common animals sharing human habitants they are natural candidates. In the present study, numbers of such wild rats were trapped in the metropolis of Bangkok and country regions of Thailand for comparison of lesions in the liver and lung which might provide indicators of carcinogens or other hazardous agents in the environment. Glutathione S transferase P form positive foci could be detected in livers, comparable to the laboratory rat case, but without any significant link to site of capture. In contrast, fatty liver and inflammation/cirrhosis were significantly more frequent in animals from the metropolis. Parasite infection also tended to be more prevalent, along with leptospirosis. Inflammatory change was similarly found in the lungs but without any variation between the city and countryside groups. These results suggest that wild rats could be employed as monitors of environmental agents of toxicological significance.

Key Words: wild rats - environmental hazard - liver - lung - inflammation

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Introduction

For monitoring purposes fish are well establishedwith regard to aquatic pollution. However, for the human environment, mammals might be considered better indicators and rodents species are an obvious choice since thay are exposed to many of the same influences as human beings. In the present study, wild rats were therefore trapped for histopathological and immunohistochemical assessment of lesions in the lungs, liver and kidneys. Since the enzyme glutathione-S-transferase P (placental form) (GST-P) is well established as a marker of preneoplastic lesions in the livers of laboratory inbred rats (Moore and Tatematsu, 2001), an assessment of its potential to identify lesions in the wild rat was included.

Materials and Methods

Wild rats, mainly of the strain *Rattus norwegicus* but also of other types, were trapped live and transported to laboratory faciliteis for sacrifice under ether anesthesia. The livers, lungs and kidneys were immediately removed and fixed in 10% buffered formalin, then routinely processed for embedding in paraffin, sectioning and staining with hematoxylin and eosin. In addition, immunohistochemical staining with specific antibodies against GST-P was performed for liver sections with established methods.

Results

Totals of 33 rats from within the Bangkok metropolis and 33 from countryside areas were examined in the present study. A summary of overall findings is given in the Table.

In the livers of the some of the animals, small numbers of GST-P positive foci, including single cells demonstrating strong staining, were observed (see Fig 1). However, their numbers were too low to allow effective quantitation. The

Table. Histopathological Findings for Liver.

Lesion	Bangkok (%)	Provinces (%)
Fatty Change	10/33 (30)	0/33 (0)
Parasites	13/33 (39)	7/33 (21)
Cirrhosis	6/33 (18)	0/33 (0)

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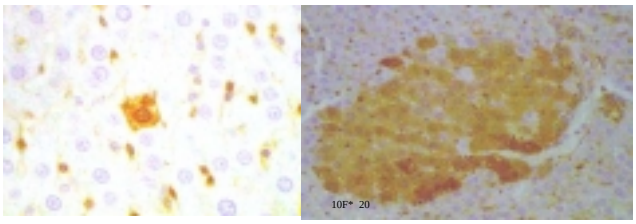

Figure 1. GST-P Positive Foci

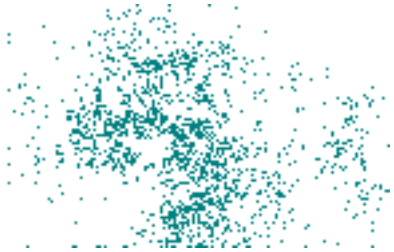

Figure 2. Fattly Change with Inflammation/Cirrhosis.

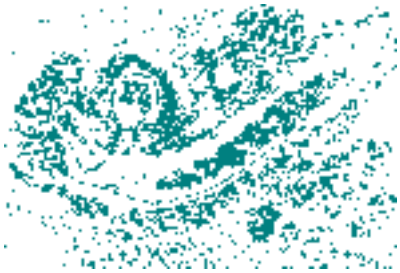

Figure 3. Parasite Involvement in a Liver

incidences of fatty change in livers, in some cases very severe and linked with inflammation/cirrhosis (see Fig 2), was over 30% in the rats from the metropolis, whereas it was totally lacking in the animals from the provinces. Similarly, inflammation was significantly more prevalent in rats trapped in Bangkok, and no cirrhosis was evident in the animals from the countryside. Parasite infection was also more frequent (see Fig 3) but the difference was not significant.

In the lungs, various degrees of inflammation were encountered with goblet cell metaplasia and reactive hyperplasia evident in the bronchioles (see Fig 4). However, no significant difference in frequency was apparent between the Bangkok and the provinces. Leptospirosis in the kidneys, as assessed by direct immunofluorescence, was slightly more prevalent in the metropolis.

Discussion

The present study revealed that wild rats, like their laboratory counterparts, exhibit GST-P positive foci in the liver, including single altered cells, so that they have potential for assessment of low level exposure to hepatocarcinogens in their environment. In addition, the presence of fatty change, along with inflammation and cirrhotic lesions, particularly in those animals captured in the metropolis of Bangkok, suggests advantage for environmental monitoring. This is in line with earlier findings for lead contamination in Italy using wild rats (Ceruti et al., 2002).

Figure 4. Lung Inflammation /Bronchial Metaplasia

Employment of aquatic species as sentinels for assessment of contamination with hazardous agents is well established (Fox, 2001; Mikaelan et al., 2002). Histopathological examination has also been emphasized for detection of liver lesions (Schmalz et al., 2002; Simpson et al., 2002), as well as biochemical indicators (Ventura et al., 2002). The literature is however sparse for mammals as monitors, with occasional exceptions like. for example, organochlorine pesticide, polychlorinated biphenyl and heavy metal concentrations in wolves (Canis lupus L. 1758) from north-west Russia (Shore et al., 2001). Clearly this is an area deserving further exploration.

Acknowledgements

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