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Warsaw Wild Captive Pisula Stryjek rats (WWCPS) - Establishing a breeding colony of Norway Rat in captivity

*It is believed that the history of laboratory rat dates back to 1820-ies, which is about 300 generations. This relatively short evolutionary distance, drastically different environment and selective breeding could have caused differences in behaviour between the laboratory rat and his wild counterpart - Norway rat (*Rattus norvegicus*). The vast majority of research concerning differences between wild and laboratory rats was conducted over 30 years ago. The knowledge acquired as a result of that research seems far from being complete. Over a quarter of a century could have deepened the described differences. Nowadays the change in experimental approach, in favour of low stress conditions, can give a new insight into this problem. This article describes process of establishing a laboratory line of wild Norway rat, which will take part in a broad series of comparative studies. 16 wild rats were trapped in 5 distant parts of Warsaw. Most of wild rats successfully adapted to captive conditions, mating successfully and producing litters, which have survived to adolescence.*

Keywords: wild rat, wild-type rat, *Rattus norvegicus*, domestication

Introduction

It is believed that the history of laboratory rat dates back to the middle of 19th century, which is about 300 generations. Sławiński (1991) gives a more precise date – 1822. This relatively short evolutionary distance, drastically different environment and selective breeding could have caused differences in behaviour between the laboratory rat and his wild counterpart (Blanchard et al., 1994).

Laboratory rats, contrary to their wild cousins, are to the large extent a product of an artificial environment. There is a considerable risk that if we base our knowledge upon results obtained from laboratory rats it could give false generalization to their wild counterparts. Despite of that, the results are often extrapolated to wild rats. Value of findings concerning domesticated rat is often questionable (Beach 1950; Lockard 1968; Richter, 1959). Lockard (1968) even calls laboratory rat a degenerate remain of what is intact in his wild cousin.

Several comparative studies of both lines have been conducted. The results were not always unambiguous. Lockard (1968) reviews the research over two described

lines from many angles. Anatomical differences are noticeable. Laboratory rats are larger in size, have slighter skeleton, smaller brain, heart, liver, spleen, less developed sense of smell etc. (Keeler, 1947; Lockard, 1968). Wild rats display significantly higher level of aggression and vocalize more often (authors' observation; Tolman, 1958; Lockard, 1968; Barnett et al., 1979; Barnett & Hocking, 1981). Lab rats are much less neophobic (authors' observation; Barnett, 1958; Calhoun, 1962; Cowan, 1977; Mitchell, 1976). Wild females keep their nests cleaner, carrying and removing excrements to distant parts of the cage (authors' observation; Lockard, 1968).

On the other hand Price (1972) states that lab rats are superior to their wild counterparts as far as conditioning of the escape response is concerned. Inhibition process is also faster. Wild rats are more sensitive than their domestic counterparts to the effects of early (post weaning) experience (Huck & Price, 1975).

Another group of experiments seems to emphasize the lack of differences between both lines. Process of domestication did not affect rats' taste preferences (Shumake et al., 1971). Boice (1977) compared systems of

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burrows dug by albino and wild rats both in semi-natural and laboratory conditions. He found no differences in the extension and durability of burrow structures in the two lines. The burrows dug by rats bred in laboratory and semi-natural conditions did not differ either.

In the light of the above findings straight extrapolation of results from lab rat to its wild counterpart seems to be risky. Many interpretations of behaviour refer to its adaptive values. The factor which is adaptive in the wild rat (e.g. high level of aggression, neophobia, fear of people) in laboratory conditions decreases chances for survival and, what is clear, chances for reproduction. This relationship is bilateral – features of lab rats acquired in laboratory conditions (e.g. docility, low level of aggression and fear) in natural conditions are highly maladaptive. So there are two drastically different environments, which within the evolution process generated in their dwellers equally varied adaptive features. Differences in behaviour seem to be obvious – the question concerns only the extent of the differences. Above described research focused on describing the role of domestication of the rat in its behaviour. We should also mention that the vast majority of the data was obtained 30-40 years ago. This period covers about 20-25% of history of laboratory rat and it could have deepened the differences. It underlines the need to replicate some of the projects and could make a perfect field for comparative studies. Nowadays the change in experimental approach, in favour of low stress conditions, can give a new insight into cognitive phenomena related to animal behavior (Pisula, 1998, 2003).

Contemporary studies concerning wild rats focus mainly on epidemiological and medical issues (van de Brandt et al., 2000; Ceruti et al., 2001; Hilton et al., 2002), whereas there is a huge gap in the studies concerning behaviour. In this situation a return to comparative studies of behaviour is necessary and relevant. To answer this need a breeding colony of Norway Rat in captivity has been successfully established. The whole breeding took place in the Laboratory of Comparative and Evolutionary Psychology of Warsaw School of Social Sciences and Humanities.

Collection technique¹

Commercially available live-traps were used (fig. 1). They were set in basements, barns and cowsheds. As a bait preparation Wabiwax, smoked bacon cheese and paper towels (potential nesting material) were placed inside traps.

¹ Trapping wild rodents, such as domestic mice and Norway rats is not legally restricted, and may be performed without special permission in Poland. Maintaining and breeding rats does not fulfill criteria of conducting experiments, and therefore does not require permission of local ethic committee for animal experimentation.

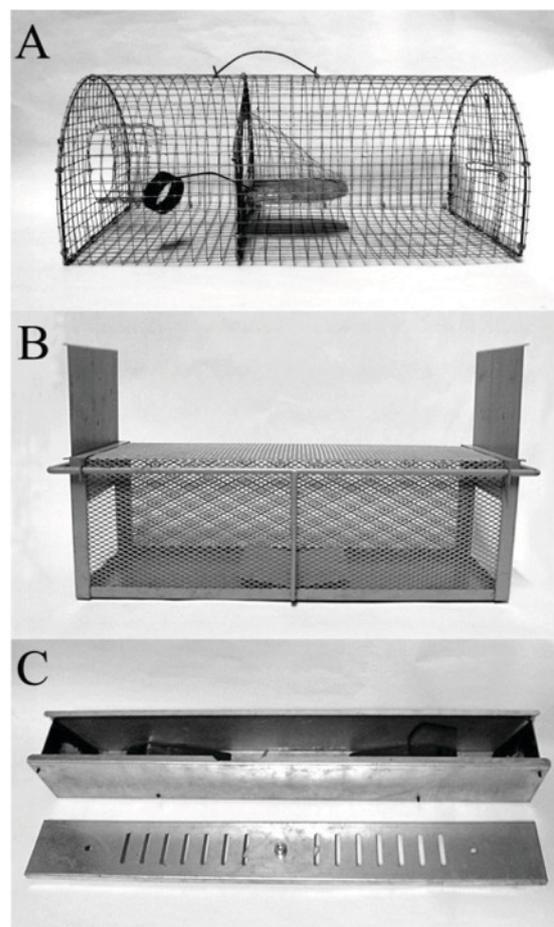


Figure 1. Types of live-traps used in the project (A - Chwytaacz gryzoni 110, B – Chwytaacz gryzoni 201, C – EKES-DER-21).

To diversify the pool of genes trapping took place in 5 distant (at least 5 km) places in Warsaw and its surroundings: the center, Wilanów, Mokotów, Białołęka and Nieporęt. Project started in January 2006. The genetic variation is planned to be maintained by adding individuals from two new sources every five generations.

Characteristics of trapped rats

Sixteen rats have been trapped (5 males and 11 females). Calhoun (1962) observed contrary sex ratio – males entered traps much more frequently than did females. This difference may be circumstantial and may result from the small number of rats captured in our project.

The age of the vast majority of caught animals was between 3-8 weeks. Young rats start to leave their nests by the age of 18-23 days (Calhoun, 1962). It is likely that some of the trapped rats left the nest for the first time in their lives. Therefore placed traps were not the only novelty and did not evoke neophobic avoidance reaction, which is common among adult wild rats that are familiar with an environment (Boice, 1971).

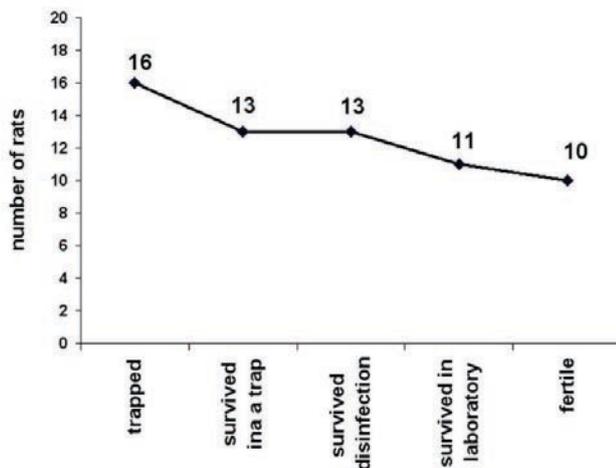


Figure 2. Number of rats in different stages of a breeding process.

In order to avoid trapping low social status rats, all individuals with scar markings (2 cases) were let free. It was observed (Boice & Boice, 1968; Boice 1971) that low status wild rats significantly more frequently than low rank lab rats show problems with adapting to a novel environment and tend to abandon their litters.

Only 2 (1 male and 1 female) out of 13 rats did not manage to survive in laboratory conditions (see fig. 2).

Disinfection procedure

Before being taken out of the traps, all the rats were disinfected externally with 10% solution of ethyl alcohol. Then they were moved to their laboratory cages while stunned due to the alcohol. After the animals dried out, they had a 1% solution of ivermectin (2 drops for rats lighter than 100g, 3 drops for heavier ones) which was applied externally.

Living conditions

Wild rats were bred in standard laboratory conditions (plexiglass cage, wood turnings, standard laboratory fodder – Labofeed H). As a diet supplement a smoked bacon and carrot were used. For the first month the cages were additionally equipped with open water containers attached to the bottom of the cage.

To make the process of adaptation to a novel environment easier for the wild rats, the laboratory rats were introduced into their cages (individually 16-month-old males). Old non-aggressive lab rats were chosen on purpose. They surpassed wild rats at least 3 times as far as their weight was concerned, so the wild rats' aggression was successfully inhibited. All trapped rats started to display affiliative behaviour toward the "intruder" within 4-5 hours after his introduction (fig. 3).



Figure 3. A young, wild rat (right) following old, laboratory male.

While establishing the colony several helpful devices and techniques of wild rats' maintenance were developed and used (Stryjek, 2008).

Health

Virusological, bacteriological and parasitological examination was done over acquired rats. No parasites were found in the breeding stock. Blood test showed existence of *Mycoplasma pulmonis* (Broderson et al., 1976). The over a year long observation did not detect any signs of problems with the respiratory system, what seems to support the hypothesis that trapped rats are only carriers of *Mycoplasma pulmonis*. All animals have thick, shining, healthy looking fur. They are vigorous and briskly react to changes in their environment which are good signs of health.

Breeding

The trapped rats displayed the high level of stress. Despite that, among 11 rats that successfully adapted to laboratory conditions only 1 female did not reproduce. Total of 26 pairings were conducted. Over half of them (15) was unsuccessful (9 did not result in pregnancy, 6 had to be cancelled due to overt fighting). To avoid resident-intruder aggression all pairings were conducted in neutral territory (a clean cage with a new bedding). The highest level of aggression was observed in females and was usually directed towards younger (smaller) males. 11 pairings were effective (only 1 female, after first birth, abandoned her litter). Average litter size was 7,45 (min=2, max=11, SD=2,54). In the first generation of wild rats bred in the laboratory 100% of pairings proved to be effective and no abandonment of litters was observed.

Preliminary observations

Preliminary observations show that wild-caught animals are more aggressive towards other rats and experimenters, show higher locomotor activity and also differ from their laboratory counterparts in hygiene of nests - (wild mothers removed droppings more frequently). They freeze significantly more often in presence of people. They are also significantly more neophobic – especially towards unfamiliar kinds of food.

WWCPS

The breeding line was named WWCPS (WARSAW WILD CAPTIVE PISULA STRYJEK). In 2007 the name was registered in Polish Patent Office under number Z – 320033.

WWCPS line is proposed to be used in psychopharmacological, behavioural and neurobiological research. As far as comparative cognitive psychology is concerned the line seems to be perfectly useful in the context of studies over emotions and evolution of cognitive processes.

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