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Study on the changes of population of main rodents in Jianchuan area in different years and habitats

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ABSTRACT

In order to investigate influencing factors on the number changes of small rodents in different years and habitats in Jianchuan area, more than 100,000 rat cages were set up in different habitats from 2002 to 2014, and 15338 small mammals were captured. The main small rodents were *Rattus norvegicus*, *Rattus flavipectus*, *Apodemusspeciosus* and *Micromysminutus*. In different habitats, numbers of *Rattus norvegicus* and *Rattus flavipectus* were more in indoor and vegetable garden than that of agricultural land and shrub, while *Apodemusspeciosus* and *Micromysminutus*were major in agricultural land and shrub. In different years, numbers of *Rattus norvegicus* and *Rattus flavipectus* were highest in 2003 and 2013. Numbers of *Apodemusspeciosus* and *Micromysminutus* were highest in 2002, 2005 and 2014. All of the results indicated that climate changes and habitat conditions were the main important factors to affected population changes of small rodents in Jianchuan.

Keywords:*Rodents; Climate changes; Habitat*

1. INTRODUCTION

Rats do great harm to human society, and their influence is basically negative (Dong et al. 2015). Rats not only steal food, bite clothes and quilts, but also damage crop rhizomes, which also carry a variety of pathogenic organisms (Zhang and Li 2005). Since the 1960s, China has made a lot of in-depth studies on the food conditions, habitat conditions and climatic conditions affecting the population changes of rodents. In many surveys, monitoring and analysis, the results show that the number changes of rodents and their populations in farmland are closely related to climatic conditions and habitats (Guo et al. 2001; Dong et al. 2005).

Rattus norvegicus and *Rattus flavipectus* were important Rattus in Yunnan Province. They mainly live indoors and near houses (Pan 2000).. They are harmful to apples during storage. *Apodemusspeciosus* and *Micromysminutus* were wild rodents in China. They mainly live near shrubs and farmland. They do great harm to crops and forestations (Wang and Li 1998). Based on the rodents captured in Jianchuan area of Yunnan Province from 2002 to 2014, this study found that the population of four small rodents, namely *Rattus norvegicus*, *Rattus flavipectus*, *Apodemusspeciosus* and *Micromysminutus*. Therefore, the four small rodents were used as experimental animals in this study, and the quantitative changes in different years and habitats were analyzed and discussed in advance. Rodent control provides some basic materials.

2. MATERIALS AND METHODS

Animals and experimental designs

Jianchuan County, which is located in the central part of Hengduan Mountains, northwest Yunnan Province, with an altitude of 2200-3000m. The average annual temperature is 9.1 C. Jianchuanis located in the high northwest and low southeast of China. Its geomorphological types are complex and diverse, stratified from the vertical zone. There are many rivers in this area. It belongs to the famous “Three Rivers Parallel Current” World Nature Reserve, and the Jianchuan area of Yunnan Province is the main focus of plague in the Longitudinal Valley of Western Yunnan (Zhu et al. 2008a; 2008b). Therefore, it is of great significance to study the change and regularity of the number of small rodents in this area for the prevention of epidemics such as plague and the development of tourism resources (Zhu et al.

2010). In the present study, the number of rodents in different years and habitats (indoors: places for farmers to live and store grain; agricultural lands: grazing and environment for planting maize, soybean, wheat, etc.; shrubs: places where plants flourish; vegetable gardens: areas near farmers' habitats, where vegetable crops are the main crops) were investigated and studied. All animal procedures were licensed under the Animal Care and Use Committee of School of Life Sciences, Yunnan Normal University (Permit No.: 13-0901-011).

Quantitative statistics

Folding cage with steel mesh material of 25 cm long, 13 cm wide and 13 cm high was used as the investigation tool (Yan and Zhong 1984). The cage method was used to distribute cages randomly in four main habitats (vegetable gardens, shrubs, agricultural lands and indoors). Each habitat has no less than 350 cages at one time, and each survey has continuously laid cages for 3 nights (Pan et al. 1996) and harvested at night (Li et al. 1998). Apples and grains were used as bait, and the cage spacing was kept between 3 and 8 m. Each cage is laid at the beginning of the month. In case of bad weather, it will be delayed. The captured samples were counted quantitatively.

Statistical analysis

Data were analyzed using SPSS 15.0 software package. Pictures were made with Sigma plot 8.0.

3. RESULTS

Number change pattern of *Rattus norvegicus*, *Rattus flavipectus*, *Apodemusspeciosus* and *Micromysminutus*: The population change pattern of *Rattus norvegicus* and *Rattus flavipectus*were the growth period (2002-2003), the decline period (2003-2005), the decline period (2005-2012), the growth period (2012-2013), the decline period (2013-2014), in which the number of Rattus norvegicus and Rattus flavipectus in 2003 and 2013 reached the simlar level. By the peak period, especially in 2013, the number reached its highest level, while between 2005 and 2012, the number was close to zero. The change pattern of population of *Apodemusspeciosus* and *Micromysminutus*were descending period (2002-2004), increasing period (2004-2005), stationary period (2005-2013) and increasing period (2013-2014). Among them, the population of *Apodemusspeciosus* and *Micromysminutus* reached the peak in 2002, 2005 and 2014, and reached the lowest in 2004. In conclusion, there is a positive correlation between the number of *Rattus norvegicus* and *Rattus flavipectus*, and between *Apodemusspeciosus* and *Micromysminutus* (Fig. 1).Jianchuan area, located in the central part of Hengduan Mountains in Northwest Yunnan, is the main focus of plague of longitudinal valley type in Western Yunnan. In the course of 13 years' continuous investigation, the results showed that there were great differences in the number of small and medium rodent mammals in different years and habitats. Among them, in different habitats, the number of wild rodents (*Apodemusspeciosus* and *Micromysminutus*) were in the order of shrub > farmland > vegetable garden > indoor, which was related to the degree of influence of habitat environment and human disturbance, the influence degree of human disturbance were indoor > vegetable garden > farmland > shrub was negatively correlated. Therefore, a certain amount of rodenticides can be used in different habitats according to their habitats, which can effectively control the number of wild rodents and domestic rodents, thus preventing the outbreak of rodents and plague (Zhu et al. 2016).

The quantitative relationship between *Rattus norvegicus* and *Rattus flavipectus*, and between *Apodemusspeciosus* and *Micromysminutus* in vegetable gardens, agricultural lands, shrubs and indoorswere as blow: among which the quantitative relationship among four wild rodents in vegetable garden were not obvious. In indoor habitats, *Rattus norvegicus* and *Rattus flavipectus* were the most abundant, while Apodemusagrarius and Nest Rat were zero. Among farmland and shrub habitats, *Apodemusspeciosus* and *Micromysminutus* were the most abundant, while *Rattus norvegicus* and *Rattus flavipectus* were least. Therefore, the suitable habitat for wild rats (*Apodemusspeciosus* and *Micromysminutus*) were farmland and shrub habitat, while the suitable habitat for house rats (*Rattus norvegicus* and *Rattus flavipectus*) were indoor and vegetable garden habitat.In addition, the differences in the number of small rodent mammals in different years may be related to the changes in climatic conditions and habitat environment. As can be seen from Fig. 1, although the number of wild rats (*Apodemusspeciosus* and *Micromysminutus*) fluctuated slightly from 2002 to 2014, the number remained stable, which may be related to their habitats. The best habitat for wild rodents is shrub. Because the shrub has little human disturbance and is insensitive to climate changes, the number of wild rodents fluctuates little. However, the number of *Rattus norvegicus* and *Rattus flavipectus* changed strongly from 2002 to 2014, especially from 2005 to 2012. This may be related to the local living conditions and the severe drought in 2008. Because of the bad climate conditions, the crops were not harvested and the rats lost their food sources, which led to a sharp decrease in the number of Rats in 2005-2012. Therefore, when carrying out rodent control operations, attention should be paid to the prevention of various habitats, especially shrubs, vegetable gardens and farmland (Dong et al. 2013).

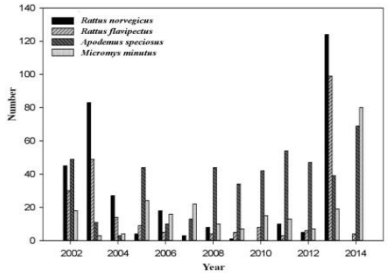

Figure 1. changes in the number of small rodents over different years

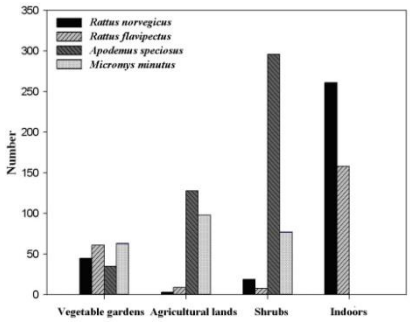

Figure 2. changes in the number of small and medium-sized rodents in different habitats

4. CONCLUSIONS

In conclusion, In different habitats, numbers of *Rattus norvegicus* and *Rattus flavipectus* were more in indoor and vegetable garden than that of agricultural land and shrub, while *Apodemusspeciosus* and *Micromysminutus*were major in agricultural land and shrub, and less in vegetable garden, but none animals of these two rodents were captured in indoor. In different years, numbers of *Rattus norvegicus* and *Rattus flavipectus* were highest in 2003 and 2013, and were stable in other years. Numbers of *Apodemusspeciosus* and *Micromysminutus* were highest in 2002, 2005 and 2014, which were lowest in 2004. Therefore, a certain amount of rodenticides can be used in different habitats according to their habitats, which can effectively control the number of wild rodents and domestic rodents, thus preventing the outbreak of rodents and plague. The quantitative changes of four small rodent mammals, *Rattus norvegicus*, *Rattus flavipectus*, *Apodemusspeciosus* and *Micromysminutus* were affected by many factors, among which climate and habitat conditions were the most important factors.

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