

SHORT COMMUNICATION

http://urn:lsid:zoobank.org:pub:112F8E1D-BA4A-460B-98ED-CDAFB840819B

Hao-Yu Liu^{1, 2)}, Yan Li¹⁾ and Yu-Xia Yang¹⁾. DESCRIPTIONS OF THE MALE REPRODUCTIVE ORGANS OF FIVE CRICKET SPECIES (ORTHOPTERA: GRILLIDAE). – *Far Eastern Entomologist*. 2013. N 261: 13-19.

Summary. The male reproductive organs of five cricket species, *Loxoblemmus doenitzi* Stein, 1881, *L. equestris* Saussure, 1877, *Teleogryllus occipitalis* (Serville, 1838), *Oecanthus rufescens* Serville, 1838, and *Dianemobius fascipes nigrofasciatus* (Matsumura, 1904), are described in detail and provided with photos.

Key words: Orthoptera, Gryllidae, *Loxoblemmus*, *Teleogryllus*, *Dianemobius*, *Oecanthus*, male reproductive organs.

Хао-Юй Лю^{1, 2)}, Янь Ли¹⁾, Юй-Ся Ян¹⁾. Описание репродуктивной системы самцов пяти видов сверчков (Orthoptera: Gryllidae) // *Дальневосточный энтомолог*. 2013. N 261. С. 13-19.

Резюме. Впервые приведены фотографии и детальные описания репродуктивной системы самцов 5 видов сверчков: *Loxoblemmus doenitzi* Stein, 1881, *L. equestris* Saussure, 1877, *Teleogryllus occipitalis* (Serville, 1838), *Oecanthus rufescens* Serville, 1838 и *Dianemobius fascipes nigrofasciatus* (Matsumura, 1904).

INTRODUCTION

The structure of the male reproductive organs of Orthoptera in general has been described by Walker (1919), Chopard (1920), Snodgrass (1933, 1935, 1937), and Qadri (1940). Though extensive studies have been done on the reproductive organs among the various orthopterous insects, yet only a few focuses on the reproductive organs of Gryllidae. Spann (1934) has dealt with the reproductive system of *Gryllus assimilis* (Fabricius, 1775). Rakshpal (1961) described the structure and development of the reproductive organs of *Gryllus veletis* (Alexander et Bigelow, 1960) and *G. pennsylvanicus* Burmeister, 1838. Nandchahal (1972) described the reproductive organs of *Gryllodes sigillatus* (Walker, 1869). Wu and Zhao (2002) simply described the structure of the male reproductive system of *Scapsipedus micado* Saussure, 1877 (now placed in the genus *Velarifictorus* Randell, 1964). However, none of the authors described the male reproductive organs in *Loxoblemmus doenitzi* Stein, 1881, *L. equestris* Saussure, 1877, *Teleogryllus occipitalis* (Serville, 1838), *Dianemobius fascipes nigrofasciatus* (Matsumura, 1904) and *Oecanthus rufescens* Serville, 1838, which are common species distributed in the northern China, so this is the primary aim of the present work.

MATERIAL AND METHOD

The insects were collected from Baoding, Mancheng and Jinxian, Hebei Province during September and October 2012.

The alive specimens were killed in 75% alcohol and then immediately submerged with enough 5% saline. The specimens were dissected and measured in less than 10 min. The dissections and measurements of the various organs of the insect were carried out under the

stereoscopic binocular microscope Nikon SMZ 1500. Values are mean ($\pm$ SE) number of 5 specimens, which are analyzed by SPSS 13.0. The photos of the reproductive organs were taken by the automated fluorescence stereomicroscope Leica M205 FA.

The terminology of the reproductive organs follows that of Snodgrass (1937). The abbreviations used in the photos are as follows: testis (T), vas deferens (Vd), seminal vesicle (Sv), accessory gland tubules (Ag), ejaculatory duct (Ej) and genitalia (Ge).

DESCRIPTIONS OF MALE REPRODUCTIVE ORGANS

The male reproductive organs of crickets possess the following characteristic features. Paired testes are laying dorsolaterad to the alimentary canal, each is a tuft of multiple spermatid tubules and enveloped in a peritoneal membrane, which has many tracheae ramifying over it. Each testis with a slender vas deferens leads to a large mass of accessory gland tubules. The distal portion of the vas deferens is swollen as seminal vesicle, which serves as a storage organ for the mature spermatozoa. The seminal vesicles of either side are surrounded by a membranous or sclerotized sheath or not sheathed and terminates into the ejaculatory duct. The accessory gland tubules are well-developed and attached on apical portion of the ejaculatory duct, they can be distinguished as 3 types in general according to the coloration and length: the type I are longest, transparent tubules, attached on lateral sides; the type II are moderately long, milky white tubules, placed between the type I and III; the type III are shortest, milky white tubules, placed in the middle. The ejaculatory duct is a small thick-walled tube, which is mostly hidden in the rosette of the accessory gland tubules, and opens into an internal chamber known as the endophallic cavity of genitalia, sometimes bears a pair of small ductless ejaculatory vesicles. Five species of crickets are described and differentiated in the above mentioned organs.

***Loxoblemmus doenitzi* Stein, 1881**

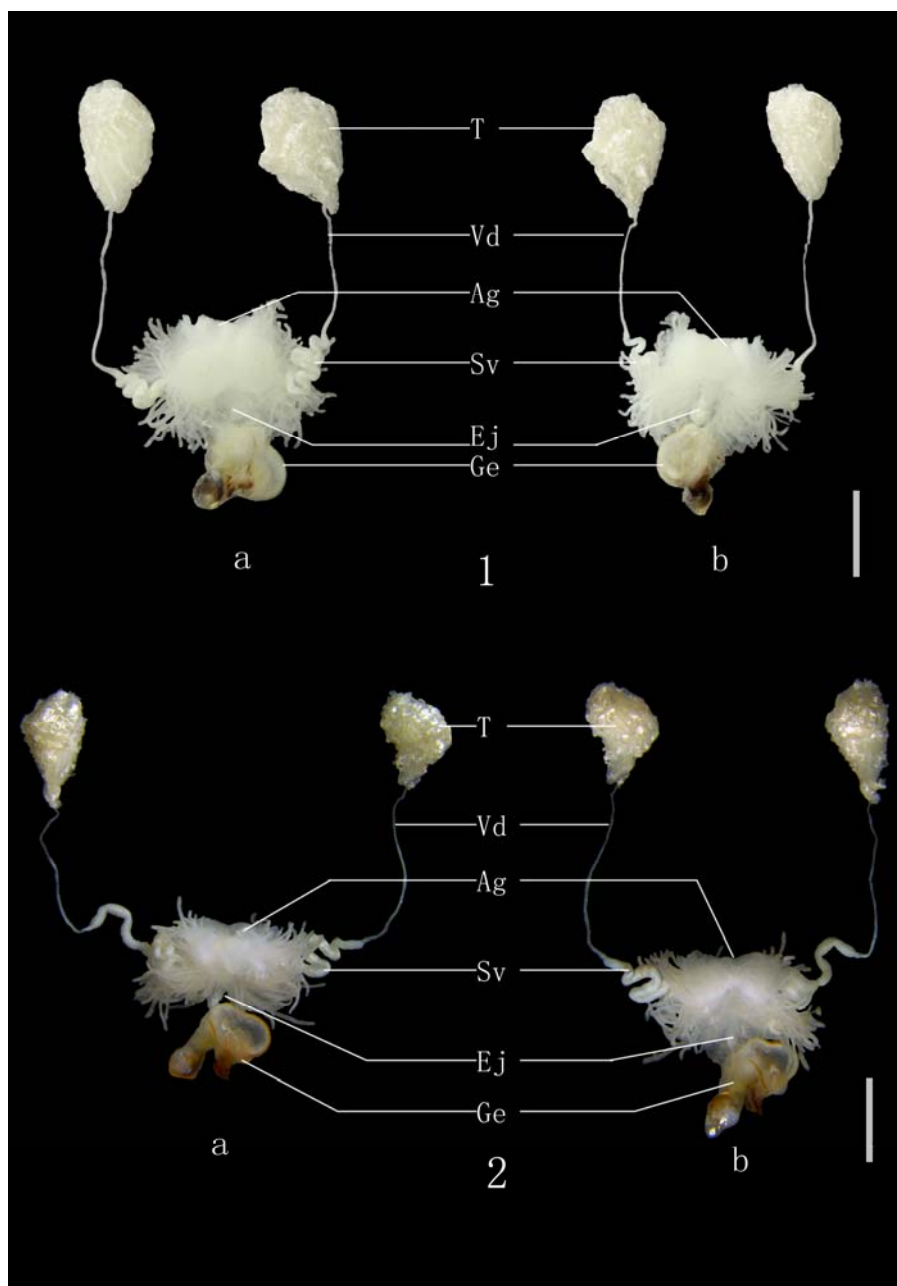
Fig. 1

The testes are milky white, inverted pear-like organs, pointed at base and subrounded at apex, each testis measures 3.07 ± 0.03 mm in length and 1.93 ± 0.08 mm in breadth. Vasa deferens are milky white, each vas deferens measures 3.77 ± 0.15 mm in length and 0.14 ± 0.01 mm in breadth when straightened. The vas deferens is abruptly enlarged and convoluted forming the seminal vesicle. The seminal vesicle is milky white, surrounded with a transparent membranous sheath, placed at base of the accessory gland tubules and on either side of ejaculatory duct, measures 5.19 ± 0.53 mm in length and 0.27 ± 0.01 mm in breadth. The accessory gland tubules are moderately developed, the tubules of the type I vary from 1.23 mm to 1.62 mm in length, 0.13 mm to 0.14 mm in breadth; the type II from 0.82 mm to 0.94 mm in length, 0.11 mm to 0.12 mm in breadth; the type III from 0.35 mm to 0.45 mm in length, 0.08 mm to 0.09 mm in breadth. The ejaculatory duct is milky white, ejaculatory vesicles are absent.

***Loxoblemmus equestris* Saussure, 1877**

Fig. 2

The testes are milky white, inverted pear-like organs, pointed at base and subrounded at apex, each testis measures 2.27 ± 0.30 mm in length and 1.52 ± 0.06 mm in breadth. Vasa deferens are milky white, each vas deferens measures 3.67 ± 0.26 mm in length and 0.11 ± 0.02 mm in breadth when straightened. The vas deferens is abruptly enlarged and convoluted forming



Figs. 1-2. Male reproductive organs. 1 – *Loxoblemmus doenitzi* Stein, 1881; 2 – *L. equestris* Saussure, 1877. (1a, 2a – dorsal view; 1b, 2b – ventral view). Scale bars: 2.0 mm.

the seminal vesicle. The seminal vesicle is milky white, surrounded with a transparent membranous sheath, placed at base of the accessory gland tubules and on either side of ejaculatory duct, measures 6.72 ± 0.29 mm in length and 0.35 ± 0.04 mm in breadth. The accessory gland tubules are moderately developed, the tubules of the type I vary from 1.53 mm to 2.14 mm in length, 0.11 mm to 0.12 mm in breadth; the type II from 1.29 mm to 1.72 mm in length, 0.09 mm to 0.10 mm in breadth; the type III from 0.39 mm to 0.58 mm in length, 0.06 mm to 0.07 mm in breadth. The ejaculatory duct is milky white, ejaculatory vesicles are absent.

***Teleogryllus occipitalis* (Serville, 1838)**

Fig. 3

The testes are milky white, fusiform organs, widest nearly in middle, each testis measures 3.74 ± 0.27 mm in length and 2.24 ± 0.18 mm in breadth. Vasa deferens are milky white, each vas deferens measures 6.16 ± 1.64 mm in length and 0.15 ± 0.17 mm in breadth when straightened. The vas deferens is abruptly enlarged and convoluted forming the seminal vesicle. The seminal vesicle is milky white, surrounded with a transparent membranous sheath, placed at base of the accessory gland tubules and on either side of ejaculatory duct, measures 12.11 ± 0.31 mm in length and 0.42 ± 0.01 mm in breadth. The accessory gland tubules are strongly developed, the tubules of the type I vary from 4.19 mm to 5.05 mm in length, 0.18 mm to 0.19 mm in breadth; the type II from 2.22 mm to 3.77 mm in length, 0.14 mm to 0.15 mm in breadth; the type III from 0.89 mm to 1.15 mm in length, 0.11 mm to 0.12 mm in breadth. The ejaculatory duct is milky white, ejaculatory vesicles are absent.

***Dianemobius fascipes nigrofasciatus* (Matsumura, 1904)**

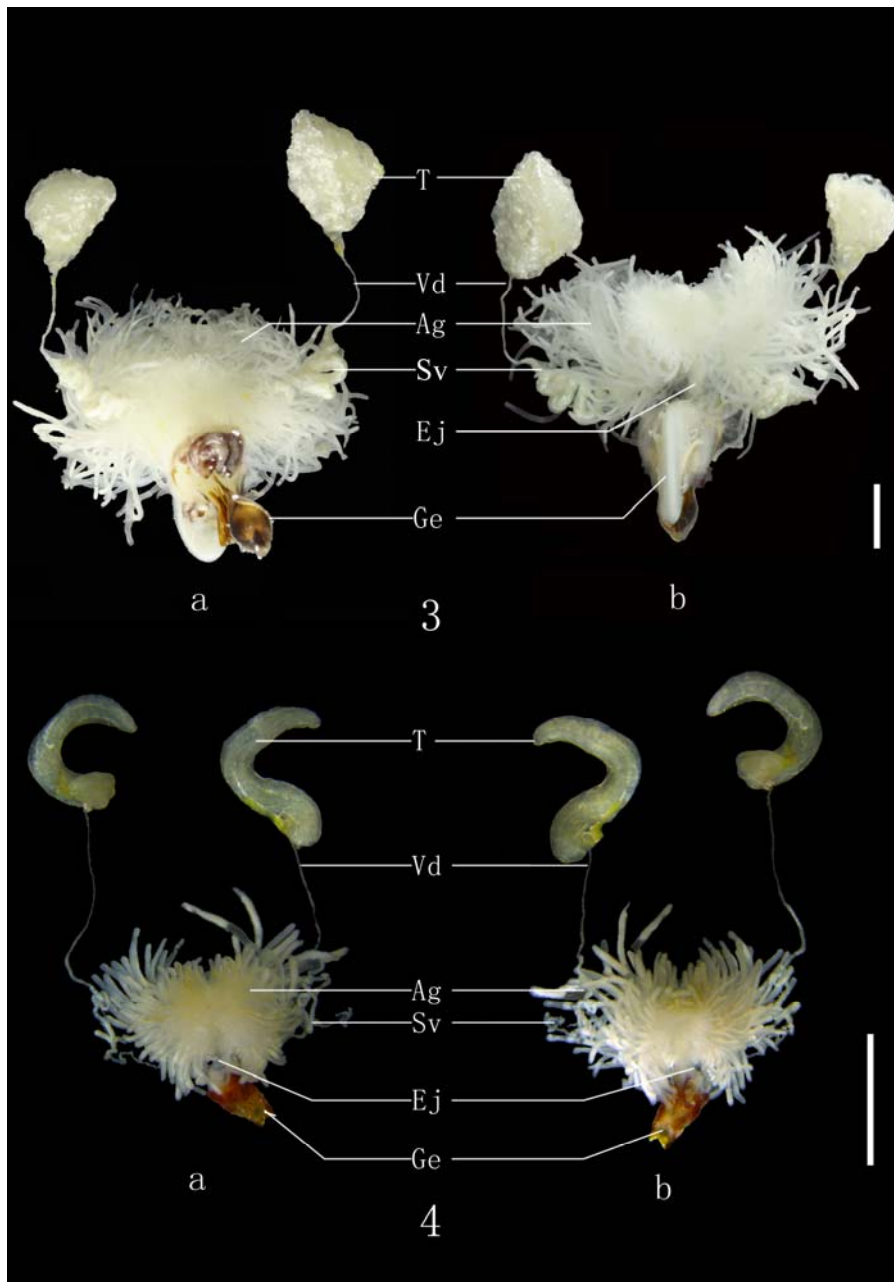
Fig. 4

The testes are milky white, slightly yellow at base, crescent-shaped organs, truncate at base and pointed at apex, each testis measures 3.47 ± 0.07 mm in length and 0.47 ± 0.02 mm in breadth. Vasa deferens are milky white, each vas deferens measures 2.29 ± 0.14 mm in length and 0.06 ± 0.17 mm in breadth when straightened. The vas deferens is slightly enlarged and convoluted forming the seminal vesicle. The seminal vesicle is milky white, has a branch tubule, concealed in the midst of accessory gland tubules, measures 3.70 ± 0.13 mm in length and 0.10 ± 0.02 mm in breadth. The accessory gland tubules are moderately developed, the tubules of the type I vary from 1.70 mm to 2.15 mm in length, from 0.13 mm to 0.14 mm in breadth; the type II from 0.83 mm to 1.08 mm in length, from 0.07 to 0.08 mm in breadth; the type III from 0.30 mm to 0.53 mm in length, from 0.07 mm to 0.08 mm in breadth. The ejaculatory duct is milky white, bears a pair of small ductless ejaculatory vesicles.

***Oecanthus rufescens* Serville, 1838**

Fig. 5

The testes are orange, subfusiform organs, beak-like at base and obtuse-angled at apex, each testis measures 2.48 ± 0.10 mm in length and 1.54 ± 0.06 mm in breadth. Vasa deferentia are milky white, sometimes filled with red fluid, each vas deferens measures 3.45 ± 0.24 mm in length and 0.09 ± 0.22 mm in breadth when straightened. The vas deferens is subequal in breadth before leading to an orange, ellipsoid, sclerotized sheath surrounding the seminal vesicle. The sheath measures 1.14 ± 0.06 mm in length and 0.63 ± 0.04 mm in breadth, is placed at base of the accessory gland tubules and on either side of the ejaculatory duct in dorso-ventral view. When the sheath is striped off, the seminal vesicle appears red, measures 4.11 ± 0.20 mm



Figs. 3-4. Male reproductive organs. 3 – *Teleogryllus occipitalis* (Serville, 1838); 4 – *Dianemobius fascipes nigrofasciatus* (Matsumura, 1904). (3a, 4a – dorsal view; 3b, 4b – ventral view). Scale bars: 2.0 mm.

in length and 0.09 ± 0.02 mm in breadth. The accessory gland tubules are moderately developed, the tubules of the type I vary from 1.08 mm to 1.22 mm in length, 0.12 mm to 0.13 mm in breadth; the type II from 0.81 mm to 1.13 mm in length, 0.11 mm to 0.12 mm in breadth; the type III from 0.44 mm to 0.60 mm in length, 0.09 mm to 0.10 mm in breadth. The ejaculatory duct is milky white, ejaculatory vesicles are absent.

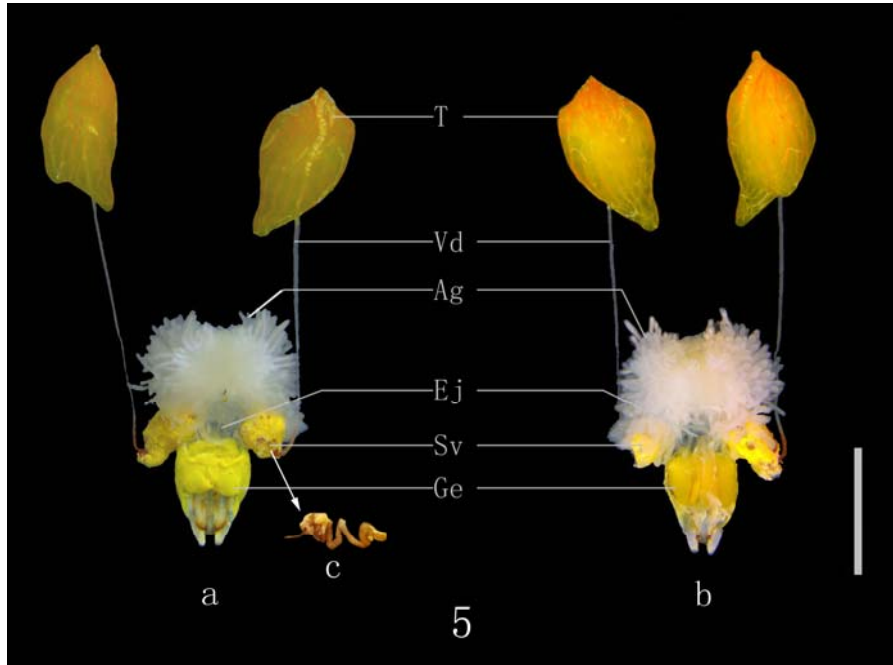


Fig. 5. Male reproductive organs of *Oecanthus rufescens* Serville, 1838. (5a – dorsal view; 5b – ventral view; 5c – seminal vesicle). Scale bar: 2.0 mm.

DISCUSSION

The results show that the form and structure of male reproductive organs of these five crickets are similar to each other, but they differ in the shape of testes, the length of vasa deferens, seminal vesicles and accessory gland tubules. Besides, the seminal vesicles of *Loxoblemmus doenitzi*, *L. equestris* and *Teleogryllus occipitalis* are surrounded by membranous sheaths and *Oecanthus rufescens* by sclerotized sheaths, while are not sheathed in *Dianemobius fascipes nigrofasciatus*, each of however has a branch tubule. Additionally, the ejaculatory vesicles are present in *D. fascipes nigrofasciatus*, while absent in other studied species.

ACKNOWLEDGEMENTS

We are grateful to Prof. Fu-Ming Shi (College of Life Sciences, Hebei University) for his suggestions in the study. Also, we thank Mr. Xun Bian for his help in photographing. This study was supported by the National Natural Science Foundation of China (No. 31201731), Training Program on College Students's Innovation and Entrepreneurship of Hebei University (No. 2012073) and Research and Development Program of Technology & Science of Baoding (No. 12ZN011).

REFERENCES

- Chopard, L. 1920. *Recherches sur la conformation et le developpement des derniers segments abdominaux chez les Orthoperes*. Thèse, Rennes: 352 pp.
- Nandchahal, N. 1972. Reproductive organs of *Grylloides sigillatus* (Walker) (Orthoptera: Gryllidae). *Journal of Natural History*, 6(2): 125–131.
- Qadri, M.A.H. 1940. Development of the genitalia and their ducts of Orthopteroid insects. *Transactions of the Royal Entomological Society of London*, 90(6): 121–175.
- Rakshpal, R. 1961. Structure and development of the reproductive organs of *Gryllus veletis* and *Gryllus pennsylvanicus* (Orthoptera: Gryllidae). *Indian Journal of Entomology*, 23: 23–39.
- Snodgrass, R.E. 1933. Morphology of the insect abdomen. II. The genital ducts and the ovipositor. *Smithsonian Miscellaneous Collections*, 89(8): 1–148.
- Snodgrass, R.E. 1935. *Principles of Insect Morphology*. McGraw-Hill, New York. 667 pp.
- Snodgrass, R.E. 1937. The male genitalia of orthopteroid insects. *Smithsonian Miscellaneous Collections*, 96(5): 1–107.
- Spann, L. 1934. Studies on the reproductive systems of *Gryllus assimilis* Fabr. *Transactions of the Kansas Academy of Science*, 37: 299–340.
- Walker, E.M. 1919. The terminal abdominal structures of Orthopteroid insects, a phylogenetic study Pt. 1. *Annales of the Entomological Society of America*, 12: 267–316.
- Wu, W. & Zhao, Y.L. 2002. The structure of the male reproductive system and the genesis of the generative cells in *Scapsipedus micado* Saussure. *Journal of Shanghai Teachers University (N.S.)*, 31(2): 74–78. (In Chinese)

Author's addresses:

- 1) College of Life Sciences, Hebei University,
Baoding 071002, Hebei Province, China.
- 2) Museum, Hebei University, Baoding 071002,
Hebei Province, China. Corresponding author
E-mail: hhyliu@hotmail.com

© **Far Eastern entomologist (Far East. entomol.)** Journal published since October 1994.
Editor-in-Chief: S.Yu. Storozhenko
Editorial Board: A.S. Lelej, N.V. Kurzenko, M.G. Ponomarenko, E.A. Beljaev, V.A. Mutin,
E.A. Makarchenko, T.M. Tiunova, P.G. Nemkov, M.Yu. Proshchalykin, S.A. Shabalin
Address: Institute of Biology and Soil Science, Far East Branch of Russian Academy of
Sciences, 690022, Vladivostok-22, Russia.
E-mail: entomol@ibss.dvo.ru web-site: <http://www.biosoil.ru/fee>