The chromosomes of some species of moths

Kazuo SAITOH

Biological Institute, Hirosaki University, Hirosaki

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The present paper deals with the chromosomes of eleven species of moths, including three species of the Geometridae, one species of the Eupterotidae, one species of the Notodontidae, three species of the Noctuidae, one species of the Arctiidae and two species of the Sphingidae. So far as the literature shows (Makino 1956), the chromosomes of these families have not yet been studied for any Japanese species.

Materials and Methods : The testes taken from mature larvae or very young pupae which were prepared entirely by the squash method with acetic dahlia furnished the material for study. A complicated polychromatism of the larval body coloration is commonly known to occur in many species of sphingid moths. For details of the larval color-forms, one should refer to the papers of Yamamoto (1949 a, b, c, d, 1952 a, b). In the present study, larvae of two color-forms (type-I and-II) were observed in *Psilogramma menephron increta*, while in *Theretra japonica* larvae of type-II alone were employed as material.

Results and Remarks

1) *Agathia carissima* Butler (Chizumon-aoshaku) (Figs. 1, 2)

This is a member of the family Geometridae. The testes taken from very young pupae were used for the study. Haploid chromosomes numbering 31 were clearly observed in both primary and secondary spermatocytes.

2) *Ascotis selenaria cretacea* Butler (Yomogi-edashaku) (Figs. 3, 4)

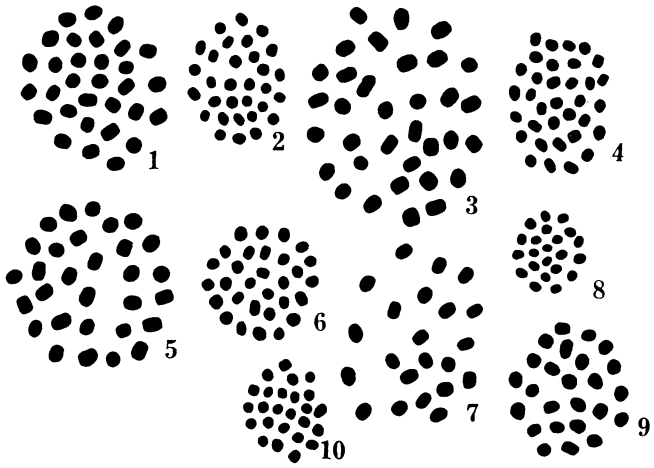
This is also a species of the Geometridae. The haploid chromosomes were studied in prepupal testes and 34 chromosomes were observed in the haploid complex. It is noticeable that the present species has the largest number of chromsomes among the moths dealt with in the present study.

3) *Cusiala stipitaria karuizawensis* Bryk (Sebuto-edashaku) (Figs. 5, 6)

This species belongs also to the Geometridae. Prepupal and young pupal testes furnished the material for study. The primary and secondary spermatocytes showed at metaphase 30 haploid chromosomes without exception.

4) *Apha tychoona* Butler (Obi-ga) (Figs. 7, 8)

The genus *Apha* (Eupterotidae) seems to be new to cytology. Testes from the mature larvae comprised the present material. The number of chromosomes was found to be 22 in haploid. This is the smallest among the chromosome numbers of the moths here under study.



Figs. 1–10. Haploid chromosomes, × ca. 1800. 1, 3, 5, 7, 9; Primary spermatocytes. 2, 4, 6, 8, 10; Secondary spermatocytes. 1, 2. *Agathia carissima, n,* 31. 3, 4. *Ascotis selenaria cretacea, n,* 34. 5, 6. *Cusiala stipitaria karuizawensis, n,* 30. 7, 8. *Apha tychoona, n,* 22. 9,10. *Clostera anastomosis tristis, n,* 25.

5) *Clostera anastomosis tristis* Staudinger (Seguro-shachihoko) (Figs. 9, 10)

This is a member of the Notodontidae. Previously, Kawaguchi (1933a, b) reported the association between the heteropycnotic chromosome and the nucleolus in this species. The present observations based on materials from mature larvae revealed that the haploid number of chromosomes was 25.

6) *Autographa nigrisigna* Walker (Tamana-gin-uwaba) (Figs. 11, 12)

7) *Arcte coerulea* (Guénée) (Fukura-suzume) (Figs. 13, 14)

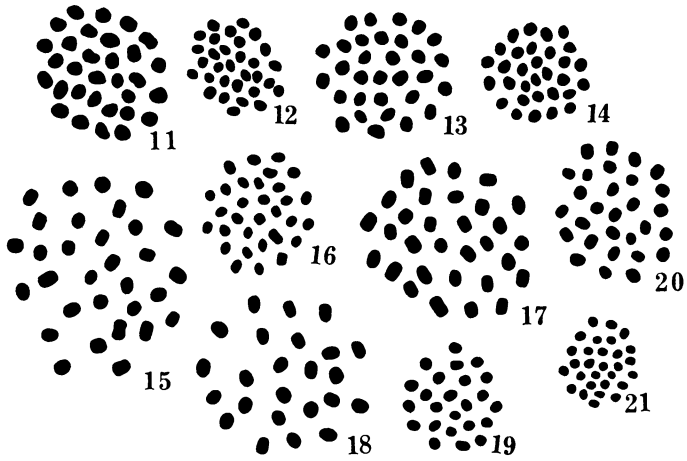
8) *Mamestra brassicae* (L.) (Yotô-ga) (Figs. 15, 16)

These three species belong to the Noctuidae. The chromosome study was available with the testicular material from the mature larvae in *Mamestra brassicae,* while in the other two species the testes of very young pupae proved suitable material for investigation. In every species here studied 31 haploid chromosomes were observable in the meiotic divisions. Beliajeff (1930) reported the same number of chromosomes in the Russian specimens of *M. persicariae.*

9) *Spilarctis* (*Spilosoma*) *imparilis* Butler (Kuwa-gomadara-hitori) (Fig. 17)

This is a member of the Arctiidae. Primary spermatocytes studied in the testes of mature larvae showed 31 chromosomes in the first metaphase. The chromosomes of three species of *Spilosoma* have hitherto been studied (Makino 1956). The haploid number, *n,* 31, was reported for *S. lubricipeda* by Beliajeff (1930), and for *S. mendica* by Kernewitz (1915), while *S. menthastri* was found to have 30 haploid chromosomes (Beliajeff 1930).

10) *Psilogramma menephron increta* Walker (Shimofuri-suzume) (Figs 18. 19)



Figs. 11-21. *Haploid chromosomes*, ×ca. 1800. 11, 13, 15, 17, 18, 20; Primary spermatocytes. 12, 14, 16, 19, 21; Secondary spermatocytes. 11, 12. *Autographa nigrisigna*, *n*, 31. 13, 14. *Arcte coerulea*, *n*, 31. 15, 16. *Mamestra brassicae*, *n*. 31. 17. *Spilarctis imparilis*. *n*, 31. 18, 19. *Psilogramma menephron increta*, *n*, 24. 20, 21. *Theretra japonica*, *n*, 29.

This is a member of the Sphingidae together with the next one. The mature larvae of two color-forms (type -I and -II) were chosen for the chromosome study. The chromosomes of the haploid group were found to be 24 in number in all larvae studied and there was no remarkable difference in the morphology of chromosomes between these two forms.

11) *Theretra japonica* de l'Orza (Ko-suzume) (Figs. 20, 21)

The chromosomes were studied in material from mature larvae belonging to type-II of the colour-form. The haploid chromosomes numbering *n*, 29, were clearly

Table 1. Chromosome numbers of 11 species of moths established in this study

Species	*n*
Geometridae	
Agathia carissima	*n*, 31 ♂ (I, II)
Ascotis selenaria cretacea	*n*, 34 ♂ (I, II)
Cusiala stipitaria karuizawensis	*n*, 30 ♂ (I, II)
Eupterotidae	
Apha tychoona	*n*, 22 ♂ (I, II)
Notodontidae	
Clostera anastomosis tristis	*n*, 25 ♂ (I, II)
Noctuidae	
Autographa nigrisigna	*n*, 31 ♂ (I, II)
Arcte coerulea	*n*, 31 ♂ (I, II)
Mamestra brassicae	*n*, 31 ♂ (I, II)
Arctiidae	
Spilarctis imparilis	*n*, 31 ♂ (I)
Sphingidae	
Psilogramma menephron increta	*n*, 24 ♂ (I, II)
Theretra japonica	*n*, 29 ♂ (I, II)

(I): Primary spermatocyte. (II): Secondary spermatocyte.

observed in both first and second metaphases.

Summary

The chromosomes of the haploid group in 11 species of moths from 6 families were investigated in squash material prepared with the application of acetic dahlia. The species under study and the chromosome numbers established are listed in Table 1.

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References

Beliajeff, N. K. 1930. Z.I.A.V. **54** : 369-399.
Kawaguchi, E. 1933a. Zool. Mag. Tôkyô **45** : 69-71.
———— 1933b. Cytologia **4** : 339-354.
Kernewitz, B. 1915. Arch. Naturg. **81** A : 1-34.
Makino, S. 1956. A review of the chromosome numbers in animals. 2nd Ed. Hokuryûkan, Tôkyô.
Yamamoto, Y. 1949a. Shin Konchû **2** : 39-41.
———— 1949b. *Ibid.* **2** : 69-71.
———— 1949c. *Ibid.* **2** : 112-114.
———— 1949d. *Ibid.* **2** : 162-164.
———— 1952a. Ins. Ecol. **4** : 13-22.
———— 1952b. Hyogo Biol. **2**(1) : 1-4.