

Jpn. J. Ent., 60 (1): 85-95. March 25, 1992

The Chalcosiine Moths of *Agalope* (Lepidoptera, Zygaenidae) from Taiwan, with Notes on Allied Genera¹⁾

Mamoru OWADA

Department of Zoology, National Science Museum
Hyakunin-cho 3-23-1, Shinjuku, Tokyo, 169 Japan

Abstract The genus *Agalope* from Taiwan is revised as follows: 1) *Agalope formosana* MATSUMURA, 1927, stat. nov., is a good species comparable to *A. hyalina* (KOLLAR, 1844) from the Himalayas; 2) *Agalope pica* WILEMAN, 1910, and *A. trimacula* MATSUMURA, 1927, are redescribed; 3) *Agalope wangi* OWADA, sp. nov., is described. Relationship between *Agalope* and allied genera, *Achelura* and *Elcysma*, is also discussed.

Key words: Lepidoptera; Zygaenidae; *Agalope*; Taiwan; revision.

The genus *Agalope* WALKER, 1854, is distributed from the Himalayas north-eastwards through western China to Taiwan and southeastwards to New Guinea. BRYK (1936) listed 17 species, including *Achelura* KIRBY, 1892.

From Taiwan four nominal taxa have hitherto been described. MATSUMURA (1911) recorded a Himalayan species, *Agalope hyalina* (KOLLAR, 1844), and later gave it a subspecific name, *formosana* (MATSUMURA, 1927). Then, he described *Agalope trimacula* MATSUMURA, 1927, and *Agalope karenkonis* MATSUMURA, 1931. On the other hand, WILEMAN (1910) described *Chelura pica* from Taiwan. Recently, INOUE (1987) pointed out that *A. pica* was a senior synonym of *A. karenkonis*, though the taxonomic status of the remaining two taxa was not stated.

Through the courtesy of Professor Tosio KUMATA, Hokkaido University, I was able to examine the type specimens of *Agalope*-species described by MATSUMURA, and found that *A. formosana* is not a subspecies of Himalayan *A. hyalina* but a good species, and that *A. trimacula* is also a good species closely related to *A. pica*. Beside these three species, I collected a pair of another different species on the Nanhutashan Mountains in northern Taiwan. In this paper, I will describe the new species, redescribe all the known species from Taiwan, and give some notes on the genus *Agalope* and its allied genera.

Before going further I wish to express my hearty thanks to Mr. H. Y. WANG, Taiwan Museum, Taipei, Mr. Wern-Jyh LIN, Taipei, Mr. Chun-Ling LI, National Taiwan University, Taipei, and Mr. Masaaki TOMOKUNI, National Science Museum, Tokyo, for their kind aid in the field researches of steep high mountains of Taiwan

1) This study is supported by the Grants-in-aid No. 01041099 for Field Research of the Monbusho International Scientific Research Program and No. 02640643 for Scientific Research from the Ministry of Education, Science and Culture, Japan.

in the summer of 1990, and to Prof. Yau-I CHU, and Mr. Chiun-Cheng KO, National Taiwan University, Taipei, for his kind arrangement for our expedition made by the Entomological Laboratory, National Science Museum, Tokyo. I am deeply indebted to Prof. Tosio KUMATA, Entomological Institute of Hokkaido University, Sapporo, for the loan of the type material in the MATSUMURA collection, to Prof. Hiroshi INOUE, Otsu Women's University, Iruma, for giving me valuable advice, and to Dr. Shun-Ichi UENO, National Science Museum, Tokyo, for critical reading of this manuscript. My thanks are also due to the following gentlemen for the material used in this study: Messrs. Shigero SUGI, Yasunori KISHIDA, Hiroshi YOSHIMOTO, Kiyoshi HORIE, Tokyo, Mr. Akira YOKOKURA, Yamagata, Mr. Kazuhiko MORISHITA, Zushi, and Mr. Kôji NAGAMI, Hino.

Agalope formosana MATSUMURA, 1927, stat. nov.

Agalope hyalina: MATSUMURA, 1911, Thousand Insects Japan, (Suppl.), 3: 82, pl. 31, fig. 11; MATSUMURA, 1931, 6000 Illust. Ins. Japan-Empire, p. 983. Nec KOLLAR, 1844.
Agalope hyalina formosana MATSUMURA, 1927, J. Coll. Agric. Hokkaido imp. Univ., 19: 82, pl. 5, fig. 5; BRYK, 1936, Lepid. Cat., (71): 182; INOUE, 1987, Japan Heterocerists' J., (144): 298, 300.

Type series. Holotype (Fig. 1) of *Agalope formosana* MATSUMURA, 1927, male, labeled "Type Matsumura (in red label)/Formosa, Matsumura; IX-23 1906 (on the back side)/*Agalope hyalina* s. *formosana* (hand writing by MATSUMURA)", genitalia slide no. Zgn-17, preserved in Hokkaido University, Sapporo.

Male (Fig. 1). Length of forewing: 18 mm.

Antenna dark brown; bipectinate, each pecten long. Forewing greyish white, slightly tinged with brown, somewhat hyaline, veins dark brown, conspicuous; basal orange mark bright, edged with dark shade at costa and dorsum; medial band in discoidal cell blackish brown, broad, linked with a dull slender line which starts obliquely from the base of CuA_2 and then bends downwards to dorsum; terminal half pale greyish brown, forming whitish marks in discoidal cell, cells M_3 and CuA_1 ; a small whitish mark in cell R_4 . Hindwing greyish white, slightly tinged with brown, somewhat hyaline, costal and anal portions darker.

Male genitalia (Fig. 11). Eighth abdominal tergite simply rectangular, sternite somewhat sclerotized. Uncus broad, short, with round apex. Gnathos simple, as long as uncus, with round apex. Tegumen broad. Vinculum short, wide U-shaped. Valva markedly curved, apex acutely pointed; basal part of valvae tightly fused; sacculus developed. Juxta Y-shaped, rather broad. Aedeagus slightly angled at 1/3, broadened towards base.

Notes. The holotype is a very worn specimen shown in Fig. 1, and I have been unable to examine other material. Although MATSUMURA described it as a new subspecies in 1927, he did not refer to it in his book (MATSUMURA, 1931).

In *Lepidopterorum Catalogus*, BRYK (1936) enumerated synonyms of *Agalope hyalina* KOLLAR, 1844, and treated *formosana* MATSUMURA as a Taiwanese subspecies. INOUE (1987) referred to *A. hyalina formosana* under the heading of *Agalope*

pica (WILEMAN), mentioning that the status was still uncertain for him.

This species is superficially very similar to the dark form of *A. hyalina* (Fig. 7), but can be distinguished from it by the following characters: the pectines of antennae are markedly longer; the ground colour is greyish white instead of creamy white in *hyalina*. The hindwing of ordinary pale form of *hyalina* (Fig. 6) is creamy white with blackish cilia, and the veins are not stained with dark brown, so that it may be easily separated from *formosana*.

In the genitalic characters *A. formosana* is more easily distinguished from *A. hyalina*. In *hyalina* (Fig. 10) the eighth tergite is distally furcate and the eighth sternite is membranous and clothed with short rough setae; the uncus and gnathos are slenderer and terminate more acutely; the apex of valva is not so acute as in *formosana* and clothed with many short spines.

Although the females of *A. formosana* have not yet been found, I will show the female genitalia of *A. hyalina* (Fig. 17) for comparison in the future.

Agalope trimacula MATSUMURA, 1927

Agalope trimacula MATSUMURA, 1927, J. Coll. Agric. Hokkaido imp. Univ., 19: 82, pl. 4, fig. 4; MATSUMURA, 1931, 6000 Illust. Ins. Japan-Empire, p. 983; INOUE, 1987, Japan Heterocerists' J., (144): 298, 300.

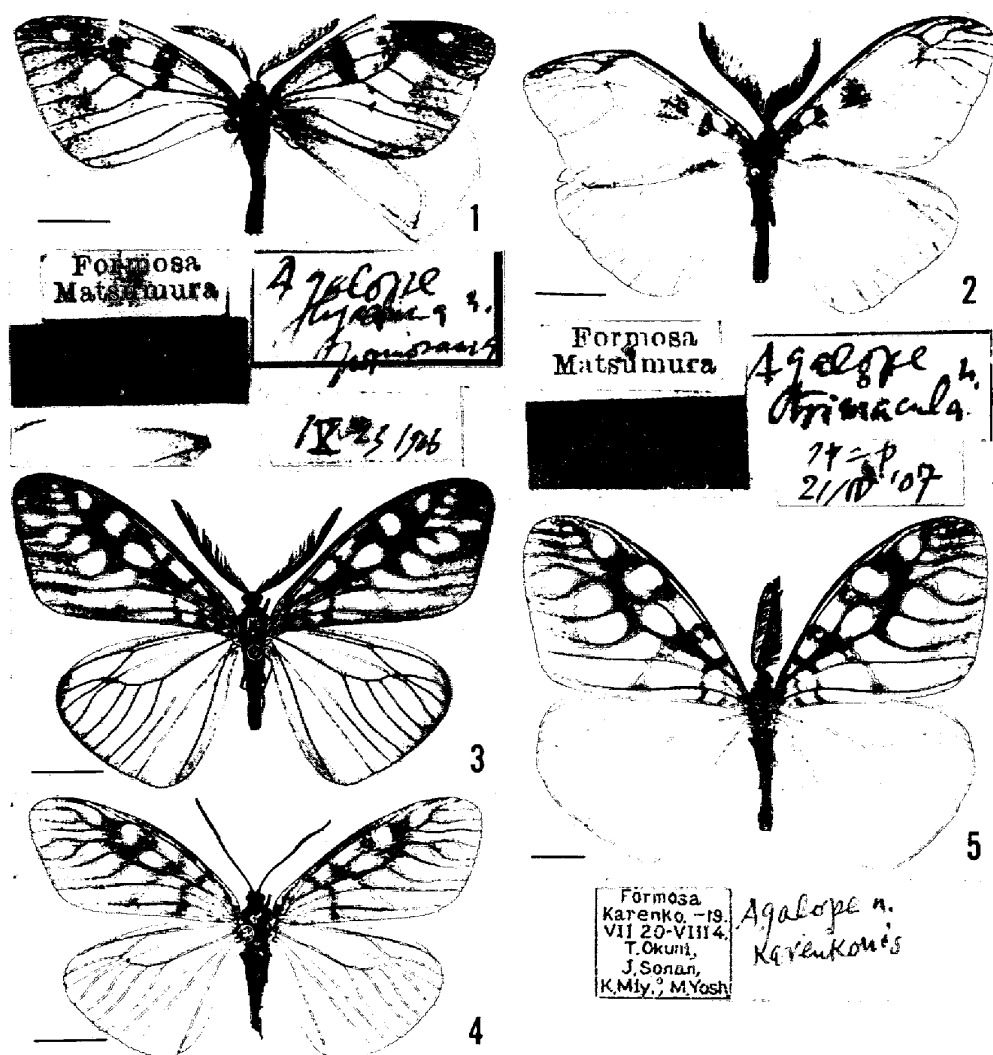
Type series. Holotype (Fig. 2) of *Agalope trimacula* MATSUMURA, 1927, male, labeled "Type Matsumura (in red label)/Formosa, Matsumura; クヤニテ [Kuyania (in Japanese letter), Chiayi Pref.], 21/IV '07 (on the back side)/*Agalope trimacula* n. (in hand writing by MATSUMURA)", genitalia slide no. Zgn-16, preserved in Hokkaido University, Sapporo.

Other material examined. Taoyuan Pref., Lalashan, 1 ♀, 30. IV. 1987, C. C. Lo leg.; Hualien Pref., Tenhsiang, 1 ♂ 1 ♀, 11, 13. VII. 1987, C. C. Lo leg., genitalia slide no. NSMT 2185 ♀; Nantou Pref., Yuishiu, 1 ♂ 1 ♀, 10. VI. 1987, C. C. Lo leg.; Nantou Pref., Howangshan, 1 ♂, 16. V. 1987, genitalia slide no. NSMT 2184 ♂, 1 ♀, 1. VI. 1986, 1 ♂, 24. VII. 1987, C. C. Lo leg.; Nantou Pref., Sungkang, 1 ♀, 15. V. 1976, M. KUBOKI leg.

Male (Fig. 2). Length of forewing: 19–23 mm.

Antennae black, long bipectinate, pecten markedly longer than that of *formosana*. Forewing white, slightly tinged with grey, somewhat hyaline, edged with blackish brown shade; veins stained with blackish brown; basal orange mark rather broad; three blackish brown markings present in discoidal cell, the basal mark bordering the orange mark, the next one broader than the basal one, and the last one at the centre of the cell, very large, sometimes fusing with the second mark and dorsal shade; outer portion of the cell shaded with blackish brown, forming whitish marks with terminal shade. Hindwing as in forewing, edged with blackish brown shade except for the base of anal portion.

Female (Fig. 8). Length of forewing: 23–27 mm.

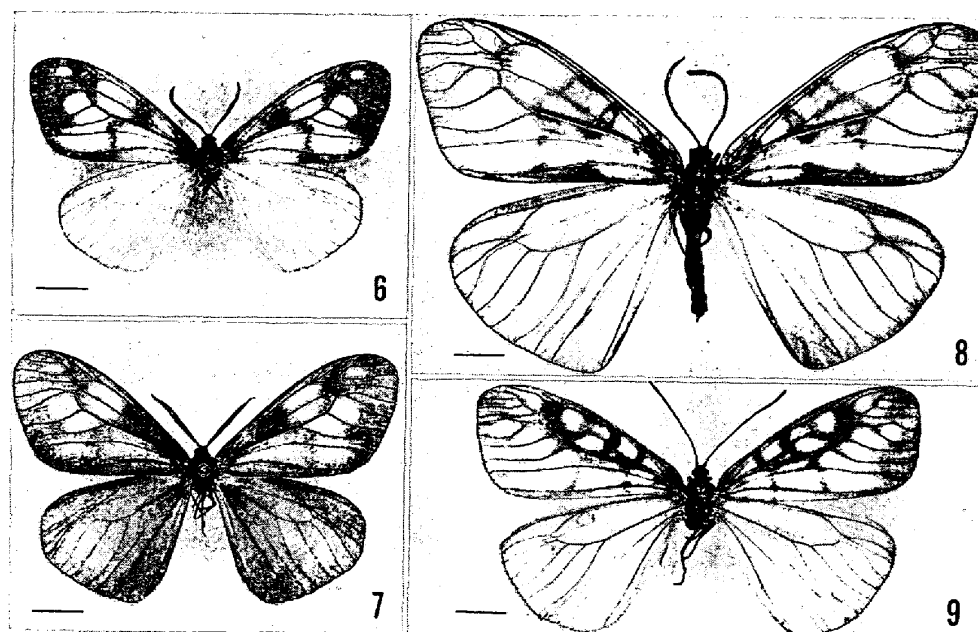


Figs. 1-5. Type specimens of *Agalope* from Taiwan. — 1, Holotype of *A. formosana* MATSUMURA, ♂. — 2, Holotype of *A. trimacula* MATSUMURA, ♂. — 3, Holotype of *A. wangi* OWADA, sp. nov., ♂. — 4, Paratype of *A. wangi*, ♀. — 5, Lectotype of *A. karenkonis* MATSUMURA ♂, = *A. pica* (WILEMAN). Scale: 5 mm.

Antenna very short bipectinate, the pectines rather long in distal portion. Markings a little paler than and almost same pattern as in male.

Male genitalia (Fig. 12). Eighth tergite nearly rectangular, distal margin rounded; 8th sternite short, broad. Uncus triangular, elongated in apical portion. Gnathos short, broad, roundly protruded at middle, clothed with minute granules. Tegumen stout, well sclerotized, pedunculus long. Vinculum wide U-shaped. Valva slender, smoothly curved; pointed clasper well developed. Juxta long, distal margin V-shaped. Aedeagus rather short, straight.

Female genitalia (Fig. 19). Papillae anales and inter-segmental membrane slender; eighth abdominal segment rather wide and short, well sclerotized. Bursa



Figs. 6-9. *Agalope* species. — 6, *A. hyalina* (KOLLAR), ♂, typical form, Ghughuti 2,600 m, Jumura, W. Nepal.—7, Ditto, ♂, dark form.—8, *A. trimacula* MATSUMURA, ♀.—9, *A. pica* (WILEMAN), ♀. Scale: 5 mm.

copulatrix membranous, ovate; a pair of signa large, round, with a central ridge.

Notes. The holotype is rather worn as shown in Fig. 2. This species is rather similar to the preceding species, *A. formosana*, in the size when small specimens are compared, greyish white ground colour and rather simple wing maculation, but can be separated from it by the following characters: the pectines of male antennae are markedly longer; the basal orange mark is paler; three blackish marks are present in the discoidal cell of the forewing; the marginal shades of wings are narrower.

The male genitalia are markedly different from those of *formosana* and *hyalina* in the shape of uncus, gnathos, tegumen, valva and juxta. The female genitalia are similar to those of *hyalina*, but the papillae anales, eighth abdominal segment and apophyses are slenderer, and the bristles arising from papillae anales and posterior margin of eighth abdominal segment are weaker.

Agalope pica (WILEMAN, 1910)

Chelura pica WILEMAN, 1910, Entomologist, 43: 193.

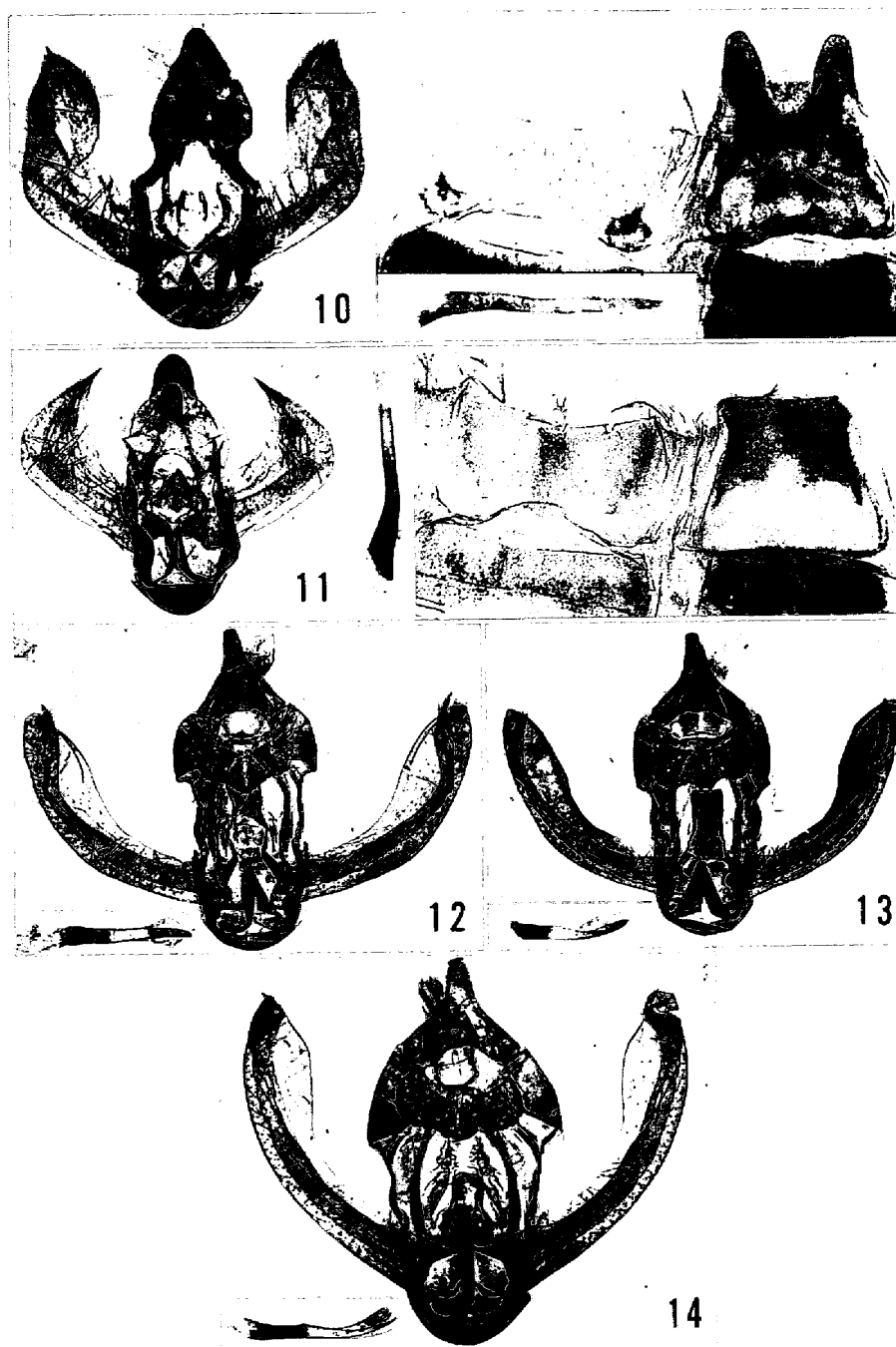
Agalope karenkonis MATSUMURA, 1931, 6000 Illust. Ins. Japan-Empire, p. 983; INOUE, 1987, Japan Heterocerists' J., (144): 297, synonymy.

Agalope pica: INOUE, 1987, Japan Heterocerists' J., (144): 298, fig. 8 (8C, holotype of *Chelura pica* WILEMAN).

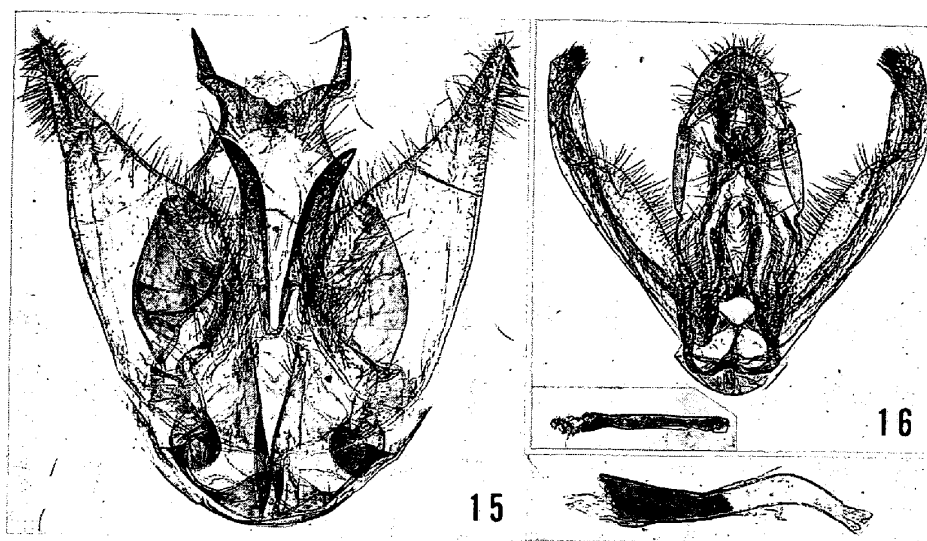
Type series. Lectotype (Fig. 5) of *Agalope karenkonis* MATSUMURA, 1931, male, designated herein, labeled "Formosa, Karenko, -19. VII 20-VIII 4., T. Okuni, J.

Sonan, K. Miy., M. Yosh./*Agalope karenkonis* n. (in hand writing by MATSUMURA)", genitalia slide no. Zgn-15, preserved in Hokkaido University, Sapporo.

Other material examined. Nantou Pref., Tsuifeng, 1 ♂, 22. VI. 1988, K.



Figs. 10-14. Male genitalia of *Agalope*. — 10, *A. hyalina* KOLLAR, Ghughuti 2,600 m, Jumra, W. Nepal.—11, *A. formosana* MATSUMURA, holotype.—12, *A. trimacula* MATSUMURA, holotype.—13, *A. wangi* OWADA, sp. nov., holotype.—14, *A. pica* (WILEMAN), lectotype of *A. karenkonis* MATSUMURA.



Figs. 15–16. Male genitalia.—15, *Acherula bifasciata* (HOPE), Kathmandu, Nepal.—16, *Elcysma westwoodii* (VOLLENHOVEN), Osaka, Japan.

MORISHITA leg., genitalia slide no. NSMT 2164 ♂, 1 ♀, 25. VI. 1982, A. YOKOKURA leg., genitalia slide no. NSMT 2165 ♀; Chiayi Pref., Alishan, 1 ♂, 21. VI. 1982, K. NAGAMI leg., genitalia slide no. NSMT 2182 ♂.

Male (Fig. 5). Length of forewing: 23–27 mm.

Antenna bipectinate, pectines a little longer than those of *trimacula*. Forewing white, slightly tinged with grey, somewhat hyaline; veins stained with blackish brown; basal orange mark pale, minute, only traceable at costa; three blackish brown lines running from base to centre of discoidal cell, broad in the cell and narrow or disappearing to dorsum; outer half of forewing blackish brown, with white marks in the distal portion of discoidal cell and between veins; dorsum white, not shaded with black. Hindwing white, somewhat hyaline, edged with blackish brown shade in some specimens; veins slightly stained with greyish brown.

Female (Fig. 9). Length of forewing: 21 mm.

Antenna minutely bipectinate, the pectines rather long in distal portion. Markings paler than and almost same pattern as in male.

Male genitalia (Fig. 14). Very similar to those of *trimacula*, but differ from them by the following characters: the latero-caudal margin of gnathos more protruded; the clasper shorter; the distal margin of juxta flat.

Female genitalia (Fig. 18). Very similar to those of *trimacula*, but the papillae anales and eighth abdominal segment are slenderer and the signa are smaller.

Notes. The holotype of *Chelura pica* WILEMAN was illustrated by INOUE (1987), who synonymized *Agalope karenkonis* MATSUMURA. This species is easily distinguished from *A. trimacula* by the wing maculation especially in the pattern of discoidal cell of the forewing, though the genitalic characters of the two species are very similar. Taiwanese *Agalope* species seem to be very rare, and I have been able to examine only 19 specimens, including the three pictures illustrated by INOUE

(1987). However, no specimen having intermediate wing maculation between *trimacula* and *pica* is found in this material, so that it can be concluded that they are different species, flying sympatrically. The male specimen of *pica* collected at Alishan bears a brief note of the collecting site as "flying over a crown of evergreen broad-leaved oak forest."

Agalope wangi sp. nov.

Type series. Holotype (Fig. 3), male, Taiwan, Taichung Pref., Mts. Nanhutashan, Chiling Lintao 2,250 m, 1. VIII. 1990, M. OWADA leg., genitalia slide no. NSMT 2166 ♂, preserved in National Science Museum, Tokyo. Paratype: 1 ♀ (Fig. 4), same locality as holotype, 10. VIII. 1990, M. TOMOKUNI leg., genitalia slide no. NSMT 2167 ♀.

Male (Fig. 3). Length of forewing: 18 mm.

Antenna bipectinate, pectines somewhat shorter than those of *pica*. Forewing greyish white, tinged with brown, a little hyaline; veins stained with blackish brown; basal orange mark well developed, broadest in cell CuA_2 ; markings almost of the same pattern as in *pica*, but the three transverse lines are prominent and slenderer in discoidal cell, the outer blackish part is more developed, and the dorsum is filled in with blackish shade. Hindwing greyish white, tinged strongly with brown, veins markedly stained with blackish brown.

Female (Fig. 4). Length of forewing: 16 mm.

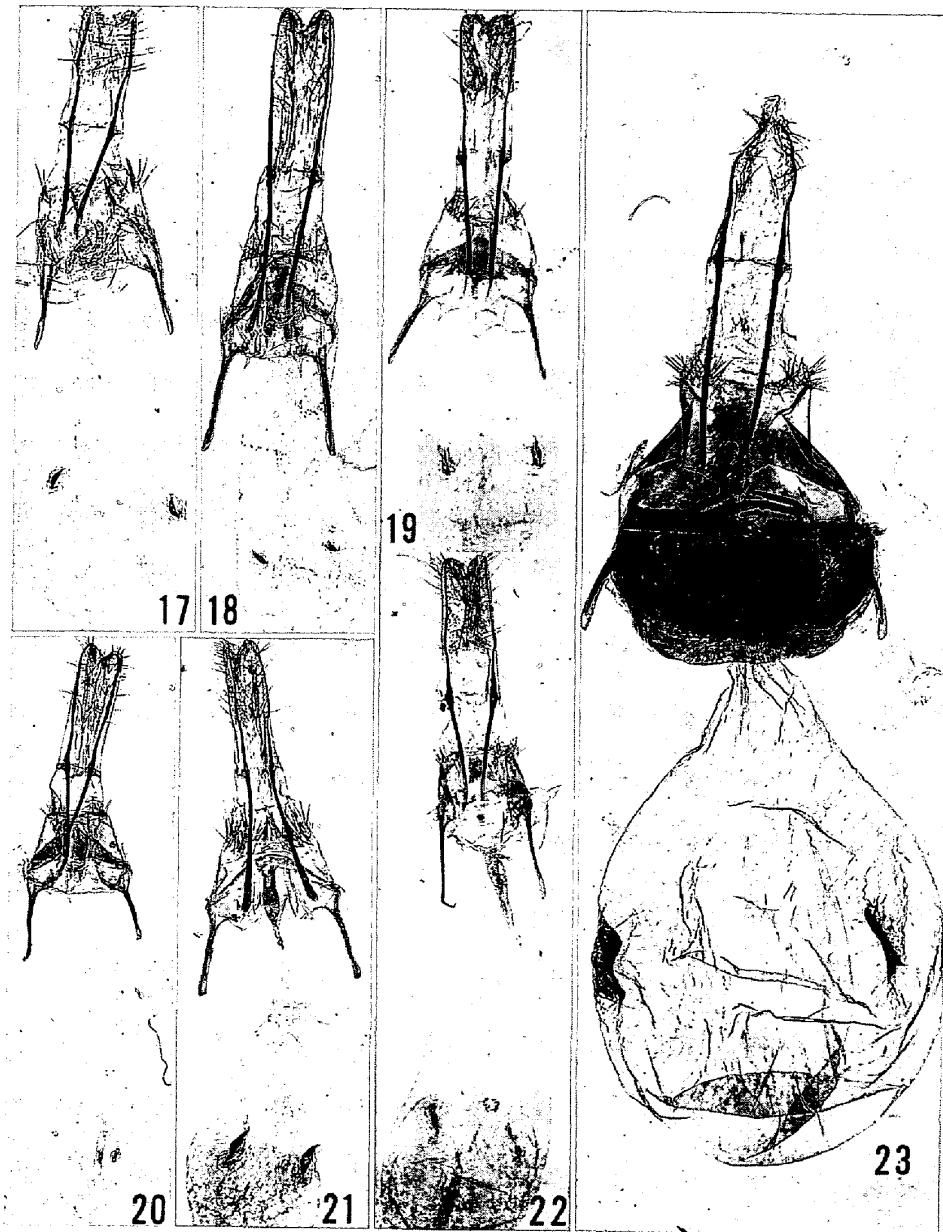
Antenna minutely bipectinate, the pectines rather long in distal portion. Ground colour paler than in male, though the markings are almost of the same pattern.

Male genitalia (Fig. 13). Very similar to those of *pica*, but differ from them in the following characters: smaller in size; the valva is slenderer and the clasper markedly shorter.

Female genitalia (Fig. 20). Very similar to those of *pica*, but smaller in size; the papillae anales and eighth abdominal segment are slenderer and the signa are smaller.

Notes. This species is closely related to the preceding two species, *A. trimacula* and *A. pica*, but can be separated from them by the smaller size and darker ground colour of both wings. At the first glance this moth may be considered to be a melanic and miniaturized form of *pica* due to the similarity in the wing maculation. However, judging from the following facts, I came to the conclusion that they should be separated as good species: 1) a pair of moths were collected at the same place; 2) the holotype of *karenkonis* (typical form of *pica*) was collected in "Karenko" (=Hualien), in the same season, which is very near to the type locality of *wangi*; *A. pica* seems not so variable in the size and ground colour (based on 7 specimens); 3) beside the size, several differences are found in the genitalic characters.

Agalope wangi has been collected in a secondary forest of evergreen oak and conifer trees. The collecting site is a rather open place covered with *Miscanthus*



Figs. 17-23. Female genitalia.—17, *Agalope hyalina* (KOLLAR), Mt. Phulcoki 2,700 m, nr. Kathmandu, Nepal.—18, *A. pica* (WILEMAN).—19, *A. trimacula* MATSUMURA.—20, *A. wangi* OWADA, sp. nov.—21, *Achelura glacialis* (MOORE), Naudanda 1,470 m, nr. Pokhala, C. Nepal.—22, *Elcysma westwoodii* (VOLLENHOVEN), Hiroshima, Japan.—23, *Achelura bifasciata* (HOPE), Kathmandu, Nepal.

grasses and sprouting bushes of broadleaved trees. The male flew slowly over grasses on a level of about 3-4 m from the ground. At a glance I considered that this small dark zygaenid moth could have been *Campylotes maculosus* WILEMAN, but, to my surprise, the moth caught in my net proved to be an *Agalope*-species. Nine days later, a second moth was collected by sweeping on flowers of *Polygonum*-

species (Polygonaceae) exactly at the same place where the first one had been collected.

This species is dedicated to Mr. H. Y. WANG, the curator of Lepidoptera, Taiwan Museum, and an excellent photographer of insects, for his kind cooperation in our researches on high mountains of Taiwan.

Notes on the Genus *Agalope* and Allied Genera

The moths of the genus *Agalope* are medium-sized with broad whitish hyaline wings. Though HAMPSON (1892) restricted this genus to *A. hyalina*, the genus *Achelura* KIRBY, 1892 (= *Chelura* HOPE, 1841, nec PHILIPPI, 1839) was synonymized with *Agalope* by JORDAN (1907, 1908), HERING (1922), BRYK (1936) and ALBERTI (1954). Recently, INOUE (1987) pointed out that *Achelura* is different from *Agalope* in genitalic characters without showing actual differences.

In the course of this study I have examined the genitalia of *Achelura bifasciata* (HOPE, 1841) (Figs. 15, 23) and found that the male and female genitalia are very large and quite different in shape from those of the *Agalope hyalina*- and *pica*-groups. Most remarkable feature of the male genitalia is the presence of a large bifurcate transtilla instead of gnathos. ALBERTI (1954) illustrated male genitalia of *Agalope*-species, *hyalina* KOLLAR, *dauidi* OBERTHÜR, *hemileuca* ssp. *ceramensis* JORDAN et TALBOT, *glacialis* MOORE, and *bifasciata* HOPE, noting that they are rather heterogeneous. From the illustrations given by ALBERTI (1954), it can be pointed out that the transtilla of *Achelura hemileuca ceramensis* JORDAN, comb. nov., is of the same status as that of *Achelura bifasciata*.

Besides, I have examined the female genitalia of *Achelura glacialis* (MOORE, 1872) (Fig. 21), originally described under the genus *Chelura*, and clarified that the genitalia are quite similar to those of *A. hyalina*, *A. pica* and the allies. Its male genitalia illustrated by ALBERTI (1954) call my attention to the genus *Elcysma*.

The genitalia of *Elcysma westwoodii* (VOLLENHOVEN, 1863) (Figs. 16, 22) are also similar to those of *Agalope*-species. The 'gnathos+transtilla' is weakly sclerotized and hairy with two pairs of lateral sclerites arising from the basal parts of uncus and valvae, and this character may be similar to that of *Achelura glacialis* (ALBERTI, 1954, pl. 10, fig. 8). This suggests an intermediate status of *Elcysma* between *Agalope* and *Achelura glacialis*. It is very interesting that the female genitalia of *Achelura glacialis* and *Elcysma westwoodii* are closely similar to those of *Agalope*.

In *Achelura bifasciata*, however, the female 8th abdominal segment is well sclerotized and bears short apophyses, and the intersegmental membrane between the 7th and 8th tergites is markedly sclerotized and forms a large hollow with 8th tergite (Fig. 23). Though I have not examined the other species of the *Achelura bifasciata*-group, those peculiar genitalic characters seem to indicate its generic independency. On the other hand, some authors also suggested close relationship between *Agalope* (s. lat.) and *Elcysma* (JORDAN, 1908; ALBERTI, 1954), though the

hindwing of *Elcysma* is remarkably elongated as in *Histia flabellicornis* (FABRICIUS, 1775).

On 25th September, 1979, I was able to observe occurrence of *Achelura bifasciata* on roadside cherry trees, *Prunus* sp. (Rosaceae), at Kathmandu in Nepal. Many adults were flying along the road, and I also collected many cocoons fastened to several leaves of *Prunus*, in which were found not only pupae but also prepupae. The larvae of *Elcysma westwoodii* are well known as a *Prunus*-feeder. The eggs are laid in the autumn, larvae soon hatch and hibernate under fallen leaves, then begin to grow in the next spring, and become mature in late June. The larvae make a hard cocoon under a leaf, and the prepupal period may extend to about 50 days (HATTORI, 1973). The food plant and life cycle of *A. bifasciata* and *E. westwoodii* are quite similar to each other. It is doubtless that *Achelura*, *Elcysma* and *Agalope* are closely related, but a careful revision is needed to clarify their true taxonomic status.

References

- ALBERTI, B., 1954. Über die stammesgeschichtliche Gliederung der Zygaenidae nebst Revision einiger Gruppen (Insecta, Lepidoptera). *Mitt. zool. Mus. Berl.*, **30**: 115–480, 63 pls.
- BRYK, F., 1936. Zygaenidae II. In STRAND, E. (ed.), *Lepid. Cat.*, (71): 1–332.
- HAMPSON, G. F., 1892. The Fauna of British India, including Ceylon and Burma. Moths, vol. 1, xxiii+527 pp. Taylor & Francis, London.
- HATTORI, I., 1973. Zygaenidae. In ISSIKI, S. (ed.), *Early Stages of Japanese Moths in Colour*, **2**: 57–61, pls. 28–30. Hoikusha, Osaka. (In Japanese.)
- HERING, M., 1922. Revision der orientalischen Chalcosiinen. *Arch. Naturg.*, (A), **88** (11): 1–93, pl. 1.
- HOPE, F. W., 1841. Descriptions of some new insects collected in Assam by W. GRIFFITH. *Trans. Linn. Soc. Lond.*, **18**: 435–446, 587–600, 3 pls.
- INOUE, H., 1987. Notes on the Zygaenidae from Taiwan 1. *Japan Heterocerists' J.*, (144): 293–301. (In Japanese with English summary.)
- JORDAN, K., [1907]. Zygaenidae. In SEITZ, A. (ed.), *Gross-Schmett. Erde*, **2**: 3–18, pls. 1–3.
- 1908, 1911. Zygaenidae. In SEITZ, A. (ed.), *Ibid.*, **10**: 5–52 (1908), 53–56 (1911), pls. 1–8.
- KIRBY, W. F., 1892. Synonymic Catalogue of Lepidoptera Heterocera (Moths), **1**. xii+951 pp.
- KOLLAR, V., 1842–1848. In HÜGEL, F. C. von, *Kaschmir und das Reich der Siek*, **4**: 865, [6] pp., 27 pls.
- MATSUMURA, S., 1911. Thousand Insects of Japan. Supplement, **3**. 147pp., pls. 30–41. Tokyo. (In Japanese.)
- 1927. New species and subspecies of moths from the Japanese Empire. *J. Coll. Agric. Hokkaido imp. Univ.*, **19**: 1–91, pls. 1–5.
- 1931. 6000 Illustrated Insects of the Japan-Empire. **2**, **2**, **3**, **23**, 1497, 191 pp., 10 pls. Toko Shoin, Tokyo. (In Japanese.)
- MOORE, F., 1872. Descriptions of new Indian Lepidoptera. *Proc. zool. Soc. Lond.*, **1872**: 555–583, pls. 32–34.
- WILEMAN, A. E., 1910. Some new Lepidoptera-Heterocera from Formosa. *Entomologist*, **43**: 189–193.

(Received October 19, 1991; Accepted December 2, 1991)