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**THE PLUMOSA GROUP OF HYDROPHORIA IN ASIA
(DIPTERA: ANTHOMYIIDAE)**

By MASAAKI SUWA

Research Trips for Agricultural and Forest Insects in the Subcontinent of India,
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Abstract

SUWA, M. 2002. The *plumosa* group of *Hydrophoria* in Asia (Diptera: Anthomyiidae). *Ins. matsum. n. s.* 59: 109–127, 43 figs.

Three Asian species of the *Hydrophoria plumosa* group are dealt with. *H. rufitibia* Stein, 1907, originally described from Qinghai, China, and *H. megaloba* Li et Deng, 1981, originally from Sichuan, China, are newly recorded and redescribed on the basis of specimens from Nepal and Pakistan and from Nepal, respectively. *H. japonica* sp. nov. is described from Hokkaido and Honshu, Japan. This is the species formerly misidentified by Suwa (1983, 1999) as *H. bavarica* Hennig, 1969, known from Germany. A brief discussion is given on the phylogenetic relationships among the five known species of the group. The present disjunct distribution of the group is supposed to be due to relic.

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INTRODUCTION

The *plumosa* group of *Hydrophoria* here understood is equivalent to the *Hydrophoria plumosa* superspecies in the sense of Griffiths (1998a). To receive three Palaearctic species, *H. rufitibia* Stein, 1907, described from China, *H. megaloba* Li et Deng, 1981, from China, and *H. bavarica* Hennig, 1969, from Germany, Suwa (1983) proposed the *rufitibia* group of *Hydrophoria*. Recently Griffiths (1998a) has revealed that the New World species *H. plumosa* van der Wulp, 1896, is included in the *rufitibia* group, and proposed the superspecies mentioned above for the group.

In the course of the present study, I have examined a lot of specimens of *H. rufitibia* from Nepal and Pakistan and of *H. megaloba* from Nepal. I have also reexamined some Japanese specimens formerly referred to *H. bavarica* by Suwa (1983, 1999), and come to the conclusion that the Japanese form should be described as new to science. Descriptions of these Asian species and a short discussion on the phylogenetic relationships among the group will be given in the following lines.

The Nepalese specimens used in this paper were collected by myself and are preserved in the Laboratory of Systematic Entomology, Hokkaido University. Some will be deposited in an appropriate institution in Nepal.

THE *HYDROPHORIA PLUMOSA* GROUP

This group is composed of species with characteristic modifications on the male terminalia as mentioned below. It is now represented by the following five species:

H. plumosa van de Wulp, 1896, found in North America (U.S.A., Mexico) and South America (Venezuela, Bolivia, Argentina).

H. rufitibia Stein, 1907, in China (Qinghai, Gansu, Shanxi, Liaoning), Nepal and Pakistan.

H. bavarica Hennig, 1969, in Europe (Germany).

H. japonica sp. nov. (= "*bavarica*" sensu Suwa, 1983), in Japan.

H. megaloba Li et Deng, 1981, in China (Sichuan) and Nepal.

Diagnosis. The members of the *plumosa* group are readily distinguished from any other species of *Hydrophoria* by the extraordinarily modified male terminalia: Surstylus much expanded basally in contrast to the rod-like apical part; basal expansion partitioned into a dorsal and a ventral plate; dorsal plate densely covered with microtrichia and the ventral with minute or short setulae; a setose tubercle present near middle dorsally (reduced in *megaloba*); a distinct process present inner-basally (reduced in *megaloba*), bearing a pair of prominent setae (lost in *plumosa*, probably secondarily).

♂. Frons narrower than anterior ocellus; parafrontals contiguous to each other or nearly so; if absent, or vestigial when present. Mesonotum with *pra* shorter than posterior *ntpl*; notopleuron with no ground setulae; hypopleuron bare; scutellum setulose on dorsal surface. Abdomen conical; 5th sternite without a row or group of setae along inner margin or at base of each process; apical rod of surstylus with series of pale-coloured setae basally on inner surface in some rows and shifting apically to dorsal surface in about 2 rows, setae of the inner row on apical half being longer than others; pregonite attenuated; distiphallus more or less lengthened. Fore tibia with 1 small *ad* and 1 strong *pv*, some setulae beyond the *ad* being a little developed and the ordinary *ad* often hardly differentiated from these setulae; *t*₃ with 2 *pd*, the distal one prominently long. Wings

with costal thorns small; *dm-cu* oblique and sinuate.

♀ . Frons wider than one-third head width; a pair of well developed *if*; 3 *ors*. Lower anterior and lower posterior *stpl* much shorter and weaker than the uppers. Ovipositor without any stiff or spine-like setae; 6th to 8th tergites membranous medially and divided into paired lateral plates, which are, however, narrowly connected to each other posteriorly on 8th segment and sometimes also on 7th; 6th and 7th sternites entire; 6th and 7th spiracles situated close together near posterolateral corners of 6th tergite; 2 well developed spermathecae present, third one much smaller or absent. Fore tibia with *ad* well developed.

KEY TO THE KNOWN SPECIES OF THE *PLUMOSA* GROUP (MALES)

1. Thorax with some (rarely 1, usually 3–5) fine setulae on pteropleuron posteriorly. Cercal plate becoming a little wider and flattened dorsoventrally on apical area; surstylus conspicuously expanded ventro-caudally on ventral plate to form a deep notch between the plate and apical rod. Found in China and Nepal. *H. megaloba* Li et Deng
- Thorax without setulae on pteropleuron. Cercal plate narrowing and compressed laterally on apical area; surstylus not so conspicuously expanded on ventral plate to form a deep notch between the plate and apical rod. 2
2. Cercal plate in dorsal view not prolonged apically beyond inner-basal processes of surstyli. Surstylus with no setae on inner-basal process. Found in North and South America.
..... *H. plumosa* van der Wulp
- Cercal plate in dorsal view prolonged apically beyond inner-basal processes of surstyli. Surstylus with a pair of prominent setae on inner-basal process. 3
3. Surstylus more or less right-angled between apical rod and ventral plate both in dorsal and lateral views, without a swelling on apical rod dorsally. Found in Japan. ... *H. japonica* sp. nov.
- Surstylus obtuse-angled between apical rod and basal plate both in dorsal and lateral views, with a swelling on apical rod near base dorsally. 4
4. Surstylus setulose around median tubercle, with ventral plate having ventral margin visible backward in dorsal view. Found in Germany. *H. bavarica* Hennig
- Surstylus not setulose around median tubercle, with ventral plate having ventral margin invisible in dorsal view. Found in China, Nepal and Pakistan. *H. rufitibia* Stein

DESCRIPTIONS

Hydrophoria rufitibia Stein, 1907 (Figs. 1–17)

Hydrophoria rufitibia Stein, 1907: 350; Hennig, 1969: 286; Fan et al., 1988: 113.

Material examined. Pakistan. Natiagali, 2400 m, 10 km north of Murree, 7 ♂, 18.vii.1987 (S. Shinonaga); Lalazar, 2700 m, 16 km west of Naran, 1 ♂, 21.vii.1987 (S. Shinonaga); Babusar, 3000 m, 30 km south of Chilas, 3 ♂, 2 ♀, 5.viii.1987 (S. Shinonaga). Some specimens (2 ♂ from Natiagali, 1 ♂, 1 ♀ from Babusar) are preserved in the Laboratory of Systematic Entomology, Hokkaido University, and the others in the National Science Museum (Natural History), Tokyo.

Nepal. Bagmati: Ghora Tabela, 3000 m, Langtang Valley, 3 ♂, 2 ♀, 20.v.1988; Ghora Tabela–Langtang, 3000–3400 m, Langtang Valley, 1 ♀, 15.v.1988, 27 ♂, 10 ♀, 19.v.1988, 1 ♀,

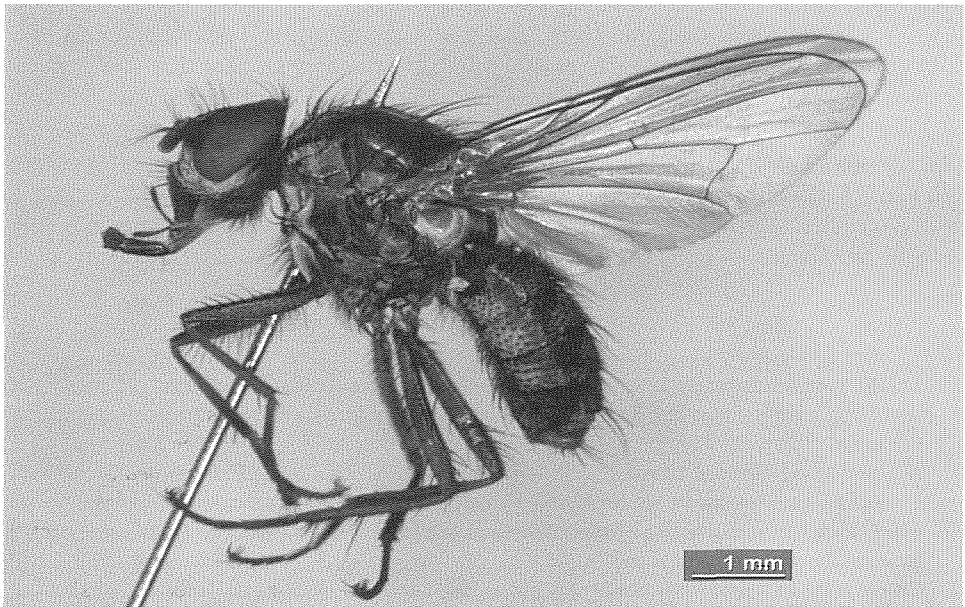
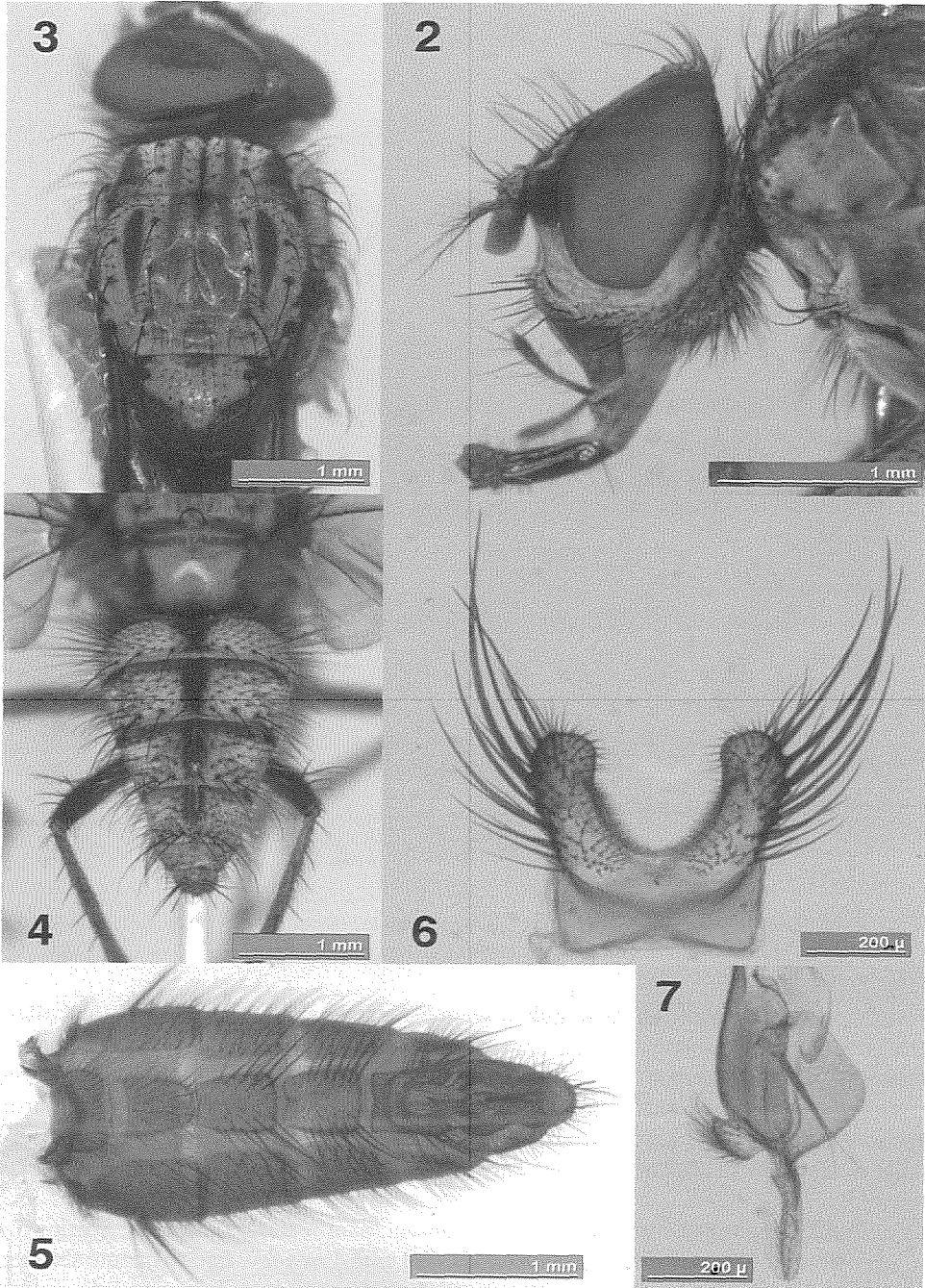


Fig. 1. *Hydrophoria rufitibia* Stein, ♂. Manang.

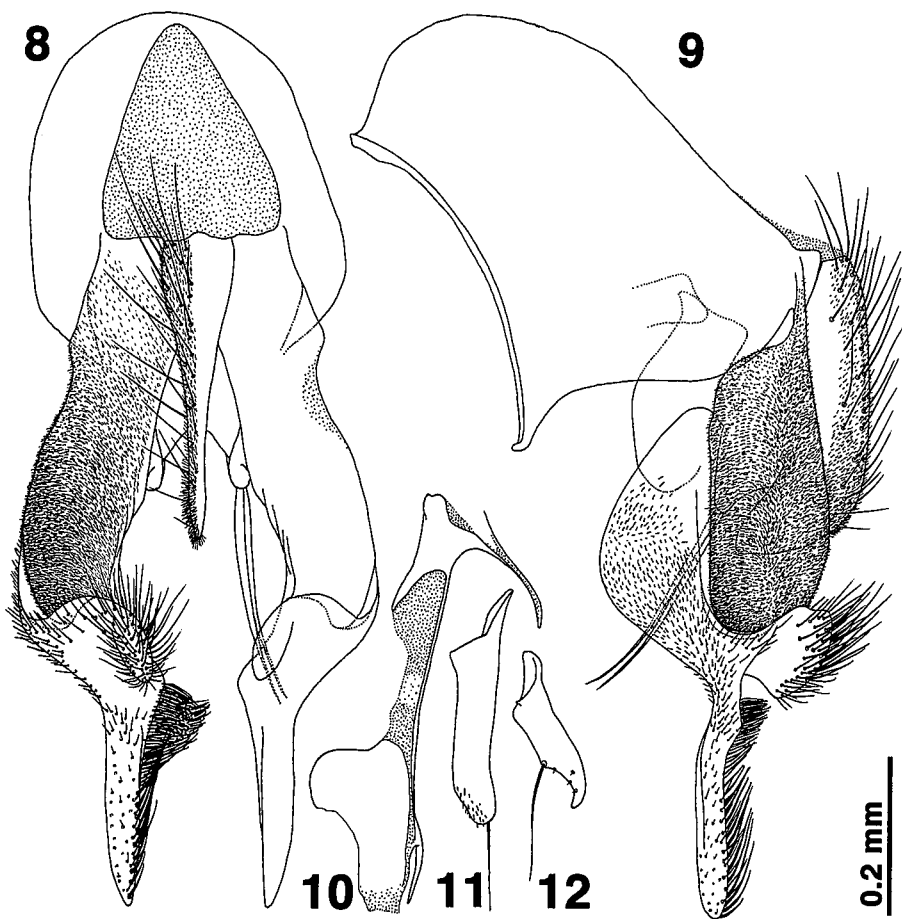
12.ix.1983; Langtang-Kyanjing, 3400–3800 m, Langtang Valley, 1 ♀, 14–18.ix.1983; Kyanjing, 3800 m, Langtang Valley, 1 ♀, 14–15.ix.1983. Gandaki: Latamarang, 2400–2500 m, Marsyandi Valley, 1 ♂, 21.vi.1988; Latamarang–Chame, 2400–2700 m, Marsyandi Valley, 2 ♀, 20.vi.1988; Chame, 2600–2700 m, Marsyandi Valley, 22 ♂, 20 ♀, 19.vi.1988; Chame–Bratang, 2700–3000 m, Marsyandi Valley, 14 ♂, 5 ♀, 11.vi.1988; Chame–Bratang, 2700–2900 m, Marsyandi Valley, 27 ♂, 3 ♀, 18.vi.1988; Bratang, 2800–3000 m, Marsyandi Valley, 1 ♂, 4 ♀, 18.vi.1988; Bratang–Pisang, 3000–3200 m, Marsyandi Valley, 16 ♂, 4 ♀, 11.vi.1988; Bratang–Pisang, 2800–3200 m, Marsyandi Valley, 15 ♂, 6 ♀, 17.vi.1988; Pisang, 3100 m, Marsyandi Valley, 2 ♀, 16.vi.1988; Pisang–Hunde, 3100–3350 m, Marsyandi Valley, 88 ♂, 20 ♀, 12.vi.1988, 1 ♀, 16.vi.1988; Hunde–Manang, 3300–3500 m, Marsyandi Valley, 13 ♂, 13.vi.1988; Manang, 3500 m, Marsyandi Valley, 41 ♂, 14.vi.1988.

Distribution. China (Liaoning; Shanxi; Gansu; Qinghai); Nepal; Pakistan. New to Nepal and Pakistan.

♂. Wing-length 4.5–6.4 mm. Body blackish in ground colour, and whitish grey and more or less bluish in pollinosity, scarcely (in the Pakistani form) or scarcely to rather distinctly (in the Nepalese form) tinged with brown or brownish yellow in the pollinosity especially on dorsal surface. Antennae blackish; palpi blackish or dark brown, often slightly paler basally; haustellar mentum blackish or dark brown, more or less roughened on main part and shining, with pollinosity indiscernible. Mesonotum rather obscurely (most in Pakistani form) or rather sharply (in Nepalese form) vittate in caudal view (Fig. 3); median vitta narrow and sharp, often restricted around transverse suture; paramedian vittae narrow and opaque; sublateral vittae not connected with postsutural lateral patches. Abdomen in caudal view with median vitta sharp (Fig. 4), slightly narrower to a little wider than hind-tibial diameter on 3rd tergite and narrowing



Figs. 2-7. *Hydrophoria rufitibia* Stein, ♂. 2, head, lateral view; 3, thorax, dorsocaudal view; 4, abdomen, dorsocaudal view; 5, ditto, ventral view; 6, 5th sternite; 7, left surstylus, inside view. Manang (Fig. 2; 5), Pisang-Hunde (Fig. 3; 7), Hunde-Manang (Fig. 4) and Chame (Fig. 6).



Figs. 8–12. *Hydrophoria rufitibia* Stein, ♂. 8, hypopygium, dorsal view; 9, ditto, lateral view; 10, basiphallus and distiphallus; 11, pregonite; 12, postgonite. Chame.

caudad; fore-marginal bands obscurely discernible at high angle in caudal view and often indiscernible at low angle, if discernible narrower than median vitta. Legs almost wholly blackish, only brownish at apical extremes of femora and at bases of tibiae especially on fore legs (in Nepalese form), or a little more broadly brownish, with t_2 and t_3 brownish yellow to brown near base and ventrally, darker apically (in Pakistani form). Wings slightly tinged with brownish yellow; calyptae tinged with yellow; halteres yellowish at knob.

Frons narrower than anterior ocellus; *if* absent; parafrontals contiguous, bearing 5–8 strong and 1–2 rather weak *ori*, usually mingled with 1 or a few fine or minute setulae; A_3 about twice as long as wide; orbits at parafrontal angle as wide as or a little wider than A_3 ; genae rather distinctly higher than A_3 -width, with genal setae in 1 or 2 rows; epistoma situated behind tip of parafrontal angle.

Mesonotum with 3 or sometimes 4 pairs of *pre-acr*, and setulose (in more or less 2 rows) between the rows of *pre-acr*, which are separated from each other by a distance

about as long as that to the adjacent *dc*-row; posterior *ph* well differentiated from adjacent setulae though weaker than the anterior; mesopleuron with 1 or a few (rarely no) differentiated anterior *mpl*, 1 or 2 of them usually strong; 1 strong and 1 weaker *pstg*, associated with some (2–7 in Pakistani form; 5–13 in Nepalese) finer setulae; *stpl* 2:2, lower anterior shorter than the upper, a differentiated setula usually discernible below the posteriors and sometimes well developed though much weaker than the uppers; pteropleuron with no setulae.

Abdomen conical, 1.7–1.9 times as long as wide; terminalia as in Figs. 5–12; cercal plate prolonged apically to exceed much beyond inner-basal processes of surstyli and compressed laterally; surstylus unsetulose around median tubercle, with apical rod making an obtuse-angle to ventral plate both in dorsal and lateral views, and with a swelling on apical rod near base dorsally; postgonite more or less angled at setal base.

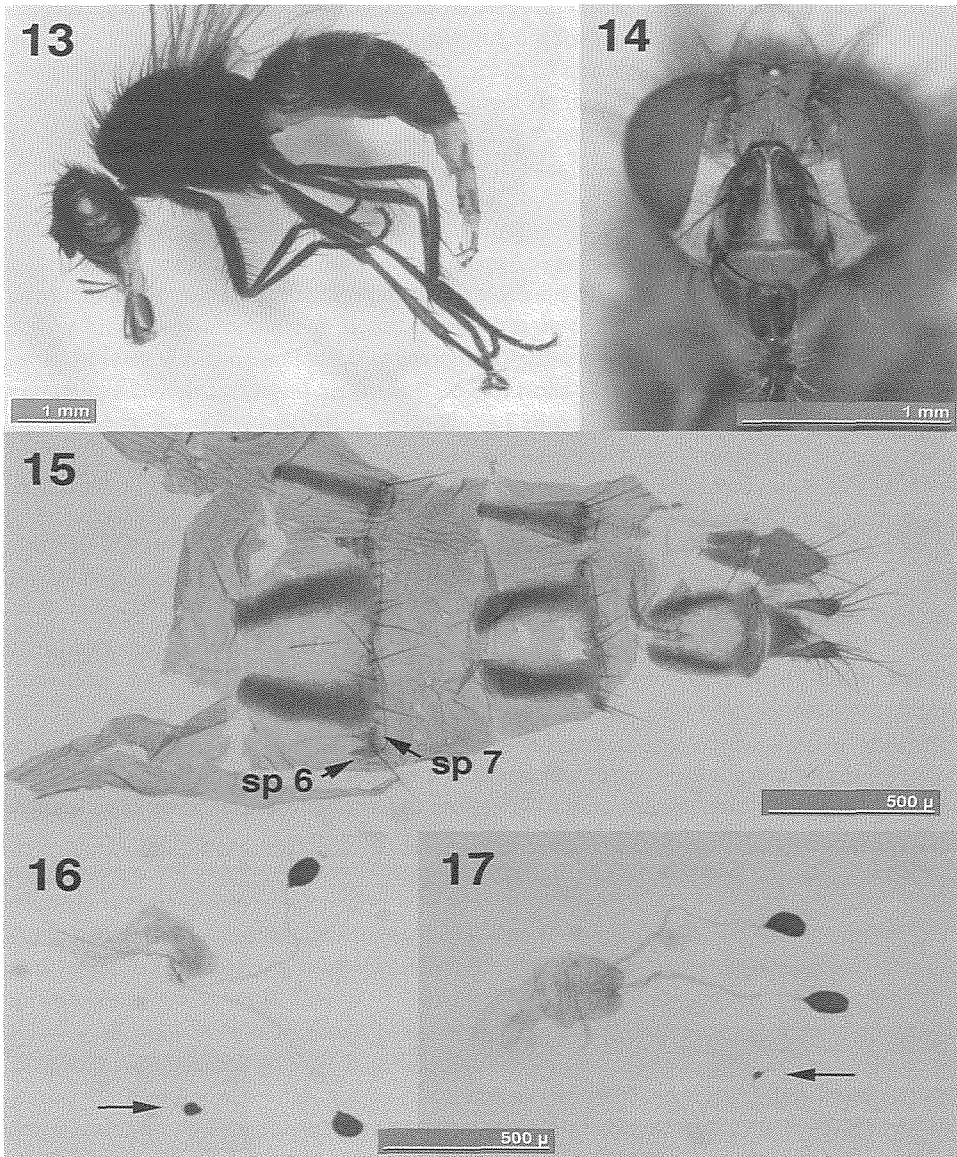
Mid femur with 2–4 (rarely 1) short and distinct *av* on basal fourth and 4–5 (rarely 6) long *pv* on basal half; f_3 with a row of 7 to about 10 *av*, and with 1 small *pv* near base, 1 very strong and sometimes 1 (rarely 2) weaker *pv* around basal third, and 1 *pv* near apex; t_2 with 1 or rarely 2 *ad*, 1 *pd*, 1 or sometimes 2 *p/pd*, 1 *p/pv* and 1 *pv*; t_3 with 2 or sometimes 3 *av*, 5–6 (sometimes 4) *ad*, 2 or rarely 3 *pd* and no distinct *pv*, and in apical chaetotaxy with a few long *pd* and a few or some slightly developed *pv* discernible, the longest apical *pd* distinctly longer than v of hind tarsomere 1. Wings with costal thorns small though stronger than costal spinules.

♀. Wing-length 4.5–6.1 mm. Interfrontalia brown or brownish grey pollinose on upper half, brownish grey or pale grey on lower; parafrontals brownish pollinose along inner margin on upper half or more, in frontal view of head becoming dark, but not entirely blackened (Fig. 14); parafacials often brownish pollinose along facial ridge. Mesonotum in caudal view more narrowly and obscurely vittate than in male. Legs paler than in male; trochanters brownish yellow to dark brown, darker on hind legs; in Nepalese form t_1 brownish yellow near base, t_2 and t_3 brownish yellow to dark brown, darker apically and dorsally; in Pakistani form tibiae paler, t_1 brownish yellow near base and ventrally, darker apically, t_2 and t_3 largely yellow or brownish yellow, darker apically.

Parafrontals with 2–4 (usually 3) *ori*; orbits at parafrontal angle 1.2–1.5 times as wide as A_3 ; genal setae usually in 1 row. Mesonotum with posterior *ph* more or less differentiated from adjacent setulae though much weaker than in male; lower posterior *stpl* sometimes fine though more or less differentiated from adjacent setulae. Ovipositor more than half as long as main part of abdomen (Fig. 13); 2 developed spermathecae present, third one small (Fig. 16) or vestigial (Fig. 17).

Mid femur with 1 or rarely 2 *av* near base and 2–4 (usually 3) *pv* on basal third, the *pv* being much weaker than in male; f_3 with 1 or sometimes 2 *av* in basal half and 3–5 *av* on apical half, and with no *pv* except for basal and preapical ones; t_2 with 1 *ad*, 1 or rarely 2 *pd*, 1 *p/pd*, 1 *p/pv* and 1 *pv*; t_3 with 2 (rarely 1) *av*; 3–7 (usually 4–6) *ad* and 2 *pd*, and in apical chaetotaxy with *pd* shorter than in male, at most as long as v of hind tarsomere 1.

Remarks. In the original description of this species based on two males and a lot of females collected in eastern Tsaidam, Qinghai, China, the male is given a note “die Vorderknie und die Mittel- und Hinterschienen sind rotgelb.” Having examined the syntypes preserved in Zoologischen Institute der Academie der Wissenschaften, Leningrad, and in Zoologischen Museum Berlin, Hennig (1969) states, “p [legs] schwarz, f [femora] grau bestäubt, t [tibiae] rötlich aufgehellt” for the male and “t noch stärker



Figs. 13–17. *Hydrophoria rufitibia* Stein, ♀. 13, general features; 14, head, frontal view; 15, ovipositor, sp 6: 6th spiracle, sp 7: 7th spiracle; 16–17, spermathecae, arrows indicating small or vestigial one. Pişang–Hunde (Fig. 13; 15–16), Chame–Bratang (Fig. 14) and Latamarang–Chame (Fig. 17).

aufgehellt als beim ♂ ” for the female. Fan et al. (1988) recorded the species from a wide range in China, and described the male as “[tibiae more or less tinged with orange colour.]” In the present specimens examined the tibiae are dark in the Nepalese form and paler in the Pakistani. This species may be geographically variable in the tibial colour.

The male terminalia figured from a syntype of *H. rufitibia* by Hennig (1969) clearly

show that the surstylus is obtuse-angled between the apical rod and ventral plate both in dorsal and lateral views, has a prominent median tubercle situated inward in dorsal view, and is not setulose around the tubercle. The Nepalese and Pakistani specimens at hand agree well with the aspects mentioned above, and are referred to the species.

A closely related species, *H. bavarica* Hennig, 1969, was described from a single male specimen collected in the Bavarian Alps, Germany. This species is different from *H. rufitibia* in the surstylus (cf. Figs. 261, 262, Hennig, 1969) which is setulose around the median tubercle and has the ventral plate with its ventral margin visible backward in dorsal view.

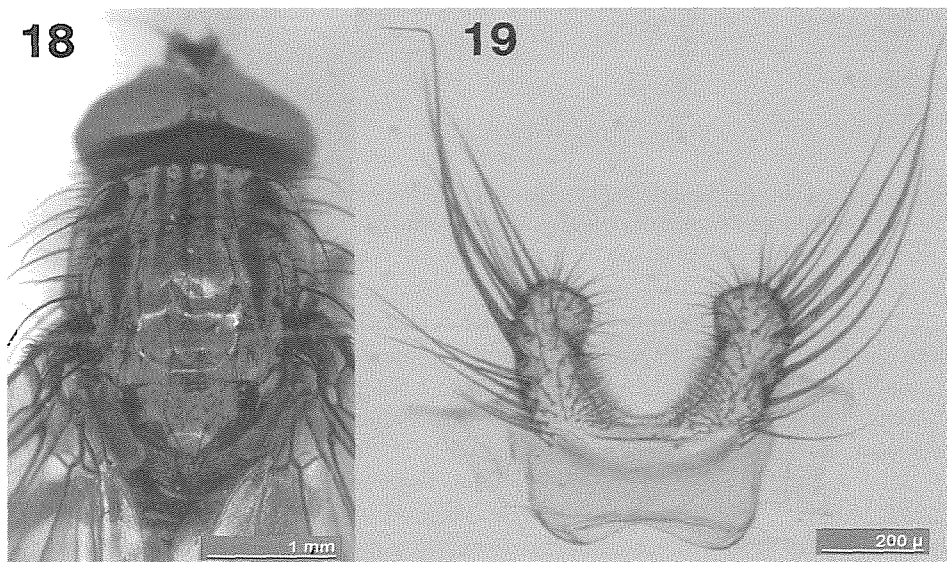
Hydrophoria japonica sp. nov.
(Figs. 18–25)

“*Hydrophoria bavarica* Hennig, 1969”: Suwa, 1983: 9; Suwa, 1999: 226.

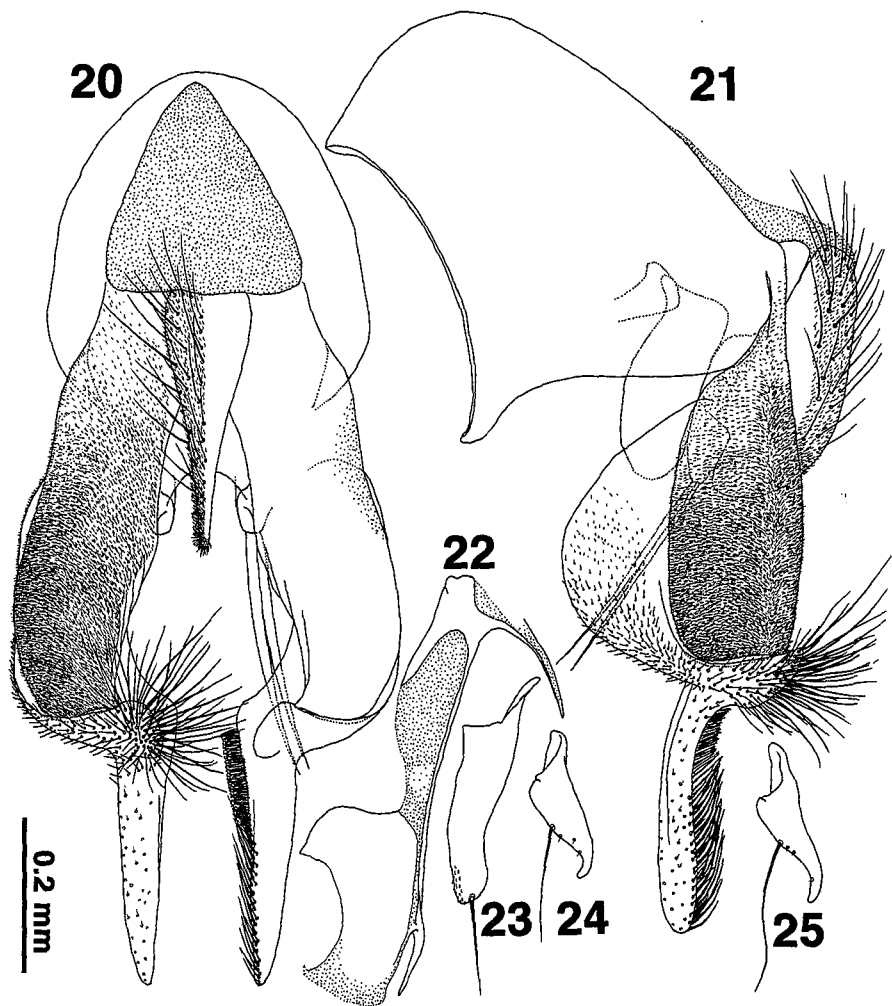
Type series. Japan. Hokkaido: Mt. Soranuma, 500–900 m, near Sapporo, 2 ♂ (one the holotype), 7.vi.1985 (M. Suwa). Honshu: Sando-goya, Mt. Nasu, Tochigi-ken, 1 ♂, 27.vii.1976 (H. Kurahashi); Mt. Asama, Nagano-ken, 2 ♂, 24.vii.1972 (H. Kurahashi). The specimens are preserved in the Laboratory of Systematic Entomology, Hokkaido University, except for the paratypes from Mt. Asama in the National Institute of Infectious Diseases, Tokyo.

Distribution. Japan.

♂. Wing-length 5.5–6.1 mm. Body blackish in ground colour, and whitish or bluish grey pollinose, scarcely or slightly tinged with brown or brownish yellow in the pollinosity though distinctly brownish on and near dark markings on dorsal surface. Interfrontalia and orbits largely orange brown in ground colour in a paratype from Hokkaido (probably due to its teneral condition); antennae blackish; palpi blackish or



Figs. 18–19. *Hydrophoria japonica* sp. nov., ♂. 18, thorax, dorsocaudal view; 19, 5th sternite. Mt. Soranuma (Fig. 18) and Mt. Nasu (Fig. 19).



Figs. 20–25. *Hydrophoria japonica* sp. nov., ♂. 20, hypopygium, dorsal view; 21, ditto, lateral view; 22, basiphallus and distiphallus; 23, pregonite; 24–25, postgonite. Mt. Soranuma (Figs. 20–24) and Mt. Nasu (Fig. 25).

dark brown; haustellar mentum blackish or dark brown, more or less roughened on main part and shining, with pollinosity indiscernible. Mesonotum rather sharply vittate in caudal view (Fig. 18); median vitta narrow and sharp, continuous posteriorly beyond transverse suture; paramedian vittae narrow and opaque; sublateral vittae not connected with postsutural lateral patches. Abdomen with median vitta broader than hind-tibial diameter and dark brownish pollinose at high angle in caudal view, becoming sharp, narrow and black at low angle; fore-marginal bands black on 2nd tergite, dark brownish pollinose on 3rd to 5th tergites, rather broad on 3rd and 4th tergites and narrow on the 5th at high angle, becoming sharp and paler at low angle. Legs dark brownish or blackish, at most very slightly brownish at apical extremes of femora especially on fore legs. Wings

more or less tinged with brown or brownish yellow; calyptrae whitish, slightly tinged with yellow; halteres yellowish at knob.

Frons narrower than anterior ocellus; a single or paired minute *if* discernible, or any *if* indiscernible; parafrontals contiguous or nearly so, bearing 5–8 strong or distinct *ori*, mingled with 1 or a few fine or minute setulae; A_3 1.8–2.1 times as long as wide; orbits at parafrontal angle a little wider than A_3 ; genae rather distinctly higher than A_3 -width, with genal setae in 2 rows; epistoma situated behind tip of parafrontal angle.

Mesonotum with 3 pairs of *pre-acr*, setulose (in more or less 2 rows) between the rows of *pre-acr*, which are separated from each other by a distance about as long as that to the adjacent *dc*-row; posterior *ph* a little to well differentiated from adjacent setulae though weaker than the anterior; mesopleuron with a few anterior *mpl* differentiated; 1 strong and 1 weaker *pstg*, associated with some (4–8) finer setulae; *stpl* 2:2, lower anterior shorter than the upper, a distinct setula discernible below the posteriors (in 4 specimens) though much weaker than the uppers; pteropleuron with no setulae.

Abdomen conical, 1.7–1.9 times as long as wide; terminalia as in Figs. 19–25; cercal plate with apical prolongation only a little exceeding beyond inner-basal processes of surstyli; surstylus without unsetulose area around median tubercle, with apical rod making a more or less right angle to ventral plate both in dorsal and lateral views, and without a swelling on apical rod dorsally; postgonite scarcely angled at setal base.

Mid femur with 1–4 (3–4 in 3 paratypes from Honshu) short *av* on basal fourth (those on left f_2 weakly differentiated in holotype) and 5–7 long *pv* on basal half; f_3 with a row of 7–9 *av*, and with 3–4 (5 on left leg in 1 specimen from Mt. Asama) *pv* on basal third or half (distal 1 or 2 well developed) and 1 *pv* near apex; t_2 with 1 *ad*, 1 *pd*, 1 *p/pd*, 1 or occasionally 2 *p/pv* and 1 *pv*; t_3 with 2 *av*, 4–6 *ad*, 2 or occasionally 3 *pd* and no *pv*, and in apical chaetotaxy with a few long *pd* and a few or some slightly developed *pv* discernible (cf. Fig. 26, Suwa, 1983), the longest apical *pd* being distinctly longer than *v* of hind tarsomere 1. Wings with costal thorns small though stronger than costal spinules.

♀ . Unknown.

Remarks. This species was formerly referred to *H. bavarica* by Suwa (1983, 1999). It is, however, clearly different from the latter in the surstylus which is nearly right-angled between the apical rod and ventral plate both in dorsal and lateral views and does not have a swelling on the apical rod dorsally. By the same characters it is also distinguished from *H. rufitibia*.

Hydrophoria megaloba Li et Deng, 1981
(Figs. 26–42)

Hydrophoria megaloba Li et Deng, 1981: 125; Fan et al., 1988: 105.

Material examined. Nepal. Bagmati: Phulchok, 2500–2700 m, Kathmandu Valley, 1 ♂, 27.vii.1983; Chiuling–Kutumsang, 2200–2500 m, Helambu, 17 ♂, 1 ♀, 29.v.1988; Kutumsang–Magen Gotha, 2500–3000 m, Helambu, 48 ♂, 3 ♀, 28.v.1988; Kutumsang–Magen Gotha, 3000–3200 m, Helambu, 33 ♂, 10 ♀, 28.v.1988; Magen Gotha–Thare Pati, 3200–3600 m, Helambu, 1 ♂, 27.v.1988; Dhunche–Syabru, 1800–2300 m, Gosainkund Lekh, 8 ♂, 1 ♀, 13.v.1988. Gandaki: Dharapani–Latamarang, 1900–2400 m, Marsyandi Valley, 1 ♂, 1 ♀, 9.vi.1988; Chame–Bratang, 2700–3000 m, Marsyandi Valley, 1 ♂, 1 ♀, 11.vi.1988; Chame–Bratang, 2700–2900 m, Marsyandi Valley, 4 ♂, 18.vi.1988; Bratang, 2800–3000 m, Marsyandi Valley, 1 ♂, 18.vi.1988;

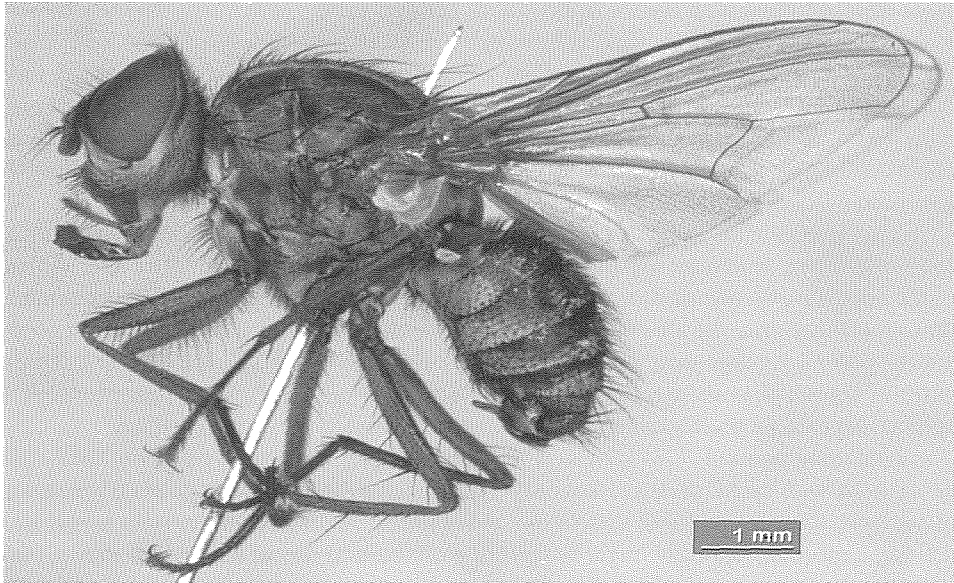


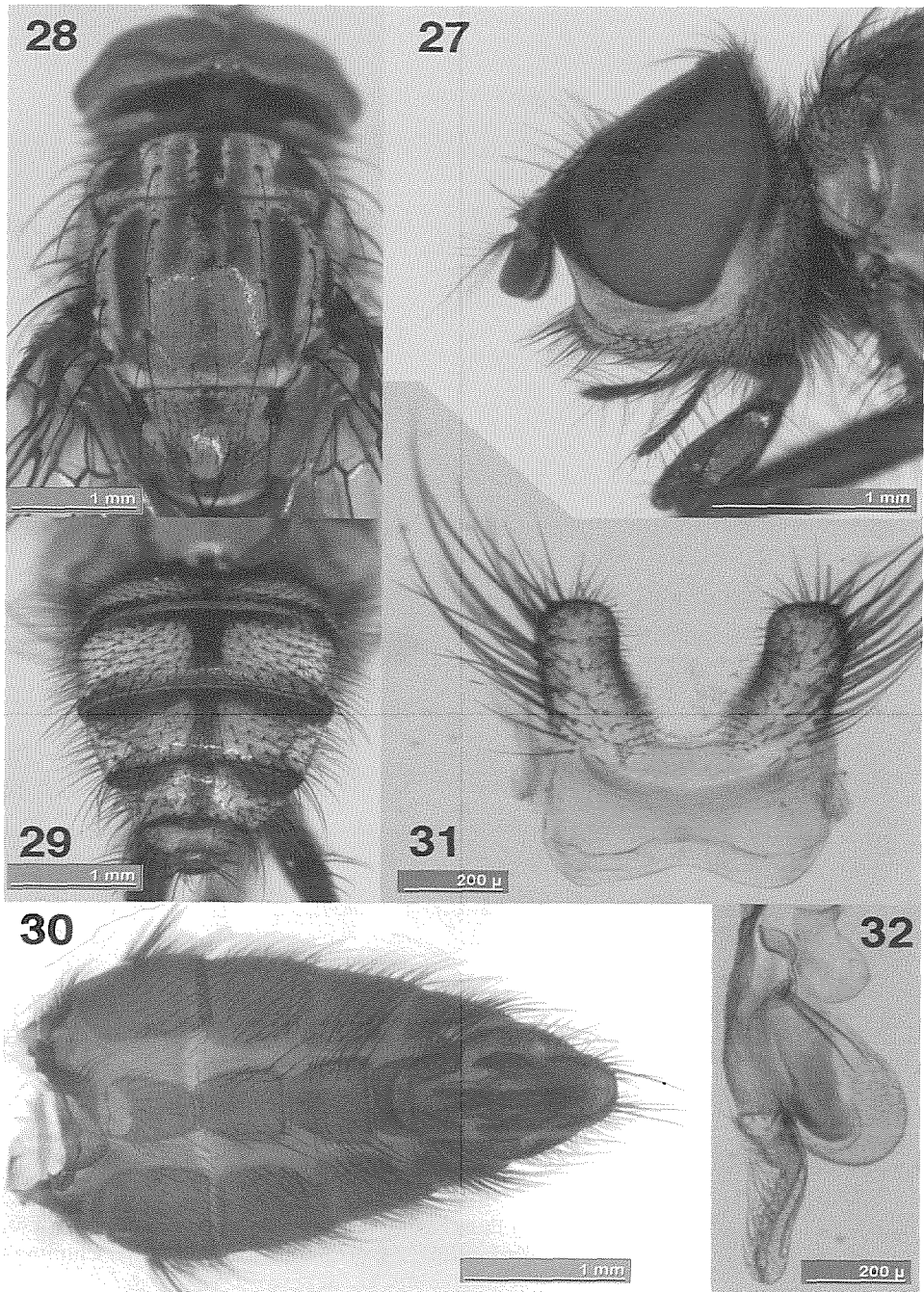
Fig. 26. *Hydrophoria megaloba* Li et Deng, ♂. Chipling-Kutumsang.

Bratang-Pisang, 2800–3200 m, Marsyandi Valley, 1 ♂, 17.vi.1988.

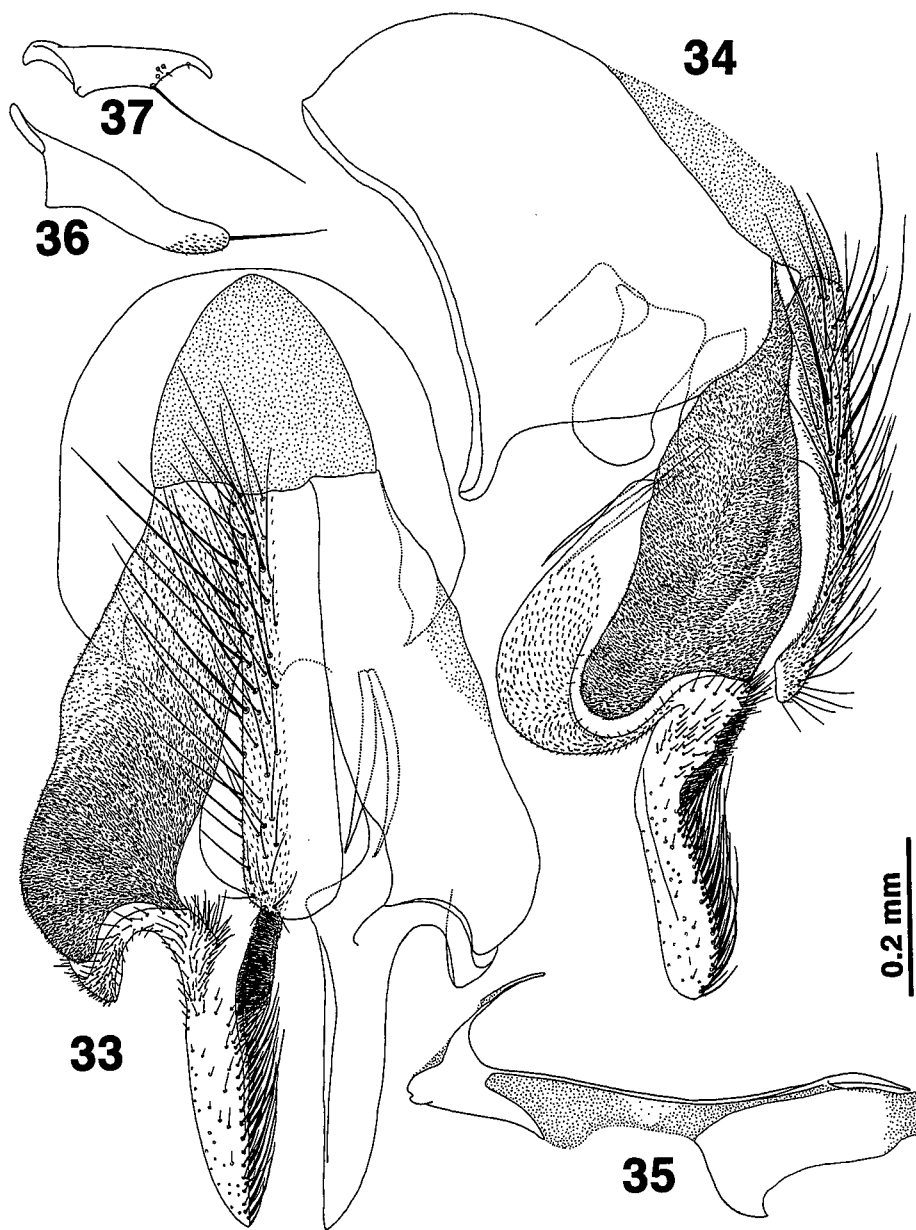
Distribution. China (Sichuan); Nepal. New to Nepal.

♂. Wing-length 5.1–7.2 mm. Body blackish in ground colour, and pale grey or whitish grey pollinose, faintly or slightly tinged with brown or brownish yellow in pollinosity. Antennae blackish; palpi blackish or dark brown, paler basally; haustellar mentum blackish or dark brown, shining in some lights though rather distinctly roughened on main part, with pollinosity hardly discernible. Mesonotum usually rather distinctly tinged with brown in pollinosity, in frontal view with a brownish pollinose median vitta obscurely or distinctly discernible; in caudal view (Fig. 28) with median vitta broad (sometimes narrow) and rather sharp before suture and rather narrow and obscure behind suture, paramedian vittae opaque and rather narrow to rather broad, presutural lateral patches large, sublateral vittae rather broad, and postsutural lateral patches restricted around pre-alar and supra-alar setae; these markings visible also in frontal view except for black median vitta. Abdomen in caudal view with median vitta sharply visible (Fig. 29), a little to rather distinctly wider than hind-tibial diameter on 3rd tergite and narrowing caudad; fore-marginal bands discernible, on 4th and 5th tergites more or less expanded caudad on each lateral sector; hind-marginal bands discernible at low angle of view. Legs almost wholly blackish; trochanters dark brown or blackish, partly paler; fore legs sometimes narrowly brown at apical extremes of femora and at bases of tibiae. Wings slightly tinged with brown or brownish yellow; calyptae whitish, slightly tinged with yellow or brownish yellow; halteres yellowish at knob.

Frons much narrower than anterior ocellus; *if* absent; parafrontals broadly contiguous, bearing 7–14 distinct or strong *ori*, mingled with a few or some minute setulae; A_3 2–2.4 times as long as wide; orbits at parafrontal angle about as wide as A_3 ; genae distinctly higher than A_3 -width, with genal setae in 2–4 (usually 3) rows; epistoma



Figs. 27–32. *Hydrophoria megaloba* Li et Deng, ♂. 27, head, lateral view; 28, thorax, dorsocaudal view; 29, abdomen, dorsocaudal view; 30, ditto, ventral view; 31, 5th sternite; 32, left surstylus, inside view. Kutumsang–Magen Gotha (Fig. 27; 28), Dunche–Syabru (Fig. 29), Chipling–Kutumsang (Fig. 30; 31) and Chame–Bratang (Fig. 32).



Figs. 33–37. *Hydrophoria megaloba* Li et Deng, ♂. 33, hypopygium, dorsal view; 34, ditto, lateral view; 35, basiphallus and distiphallus; 36, pregonite; 37, postgonite. Chipling-Kutumsang.

situated behind tip of parafrontal angle.

Mesonotum relatively short setose and setulose, for example with 2nd *pre-de* shorter than scutellum and with ground setulae mostly shorter than greater ampulla; 3–4 pairs of *pre-acr*, densely setulose (in about 3 or 4 rows) between the rows of *pre-acr*,

which are separated from each other by a distance usually a little longer than that to the adjacent *dc*-row; posterior *ph* scarcely or sometimes rather distinctly differentiated from adjacent setulae; mesopleuron with 1 or sometimes 2 anterior *mpl* weakly or distinctly differentiated, though often indiscernible; 1 strong and 1 weaker *pstg*, associated with some (5–14) finer setulae; *stpl* 2:2, lower anterior shorter than the upper, a differentiated setula often discernible below the posteriors and sometimes rather well developed though much weaker than the uppers; pteropleuron with some (1–7, usually 3–5) fine setulae on posterior half.

Abdomen conical and stubby, 1.4–1.6 times as long as wide; marginal setae on 2nd tergite weak and even the longest one being shorter than apparent length of 3rd tergite in dried specimens; terminalia as in Figs. 30–37; cercal plate much prolonged, flattened and becoming a little wider apically; surstylus much expanded on ventral plate, short setulose on weakly developed median tubercle, with inner-basal process scarcely protruded caudad, inner-basal setae being shifted to the inside base of the process; apical rod of surstylus distinctly crooked upward, with a rather weak or distinct swelling discernible dorsally between the rod base and the crook; postgonite more or less angled at setal base.

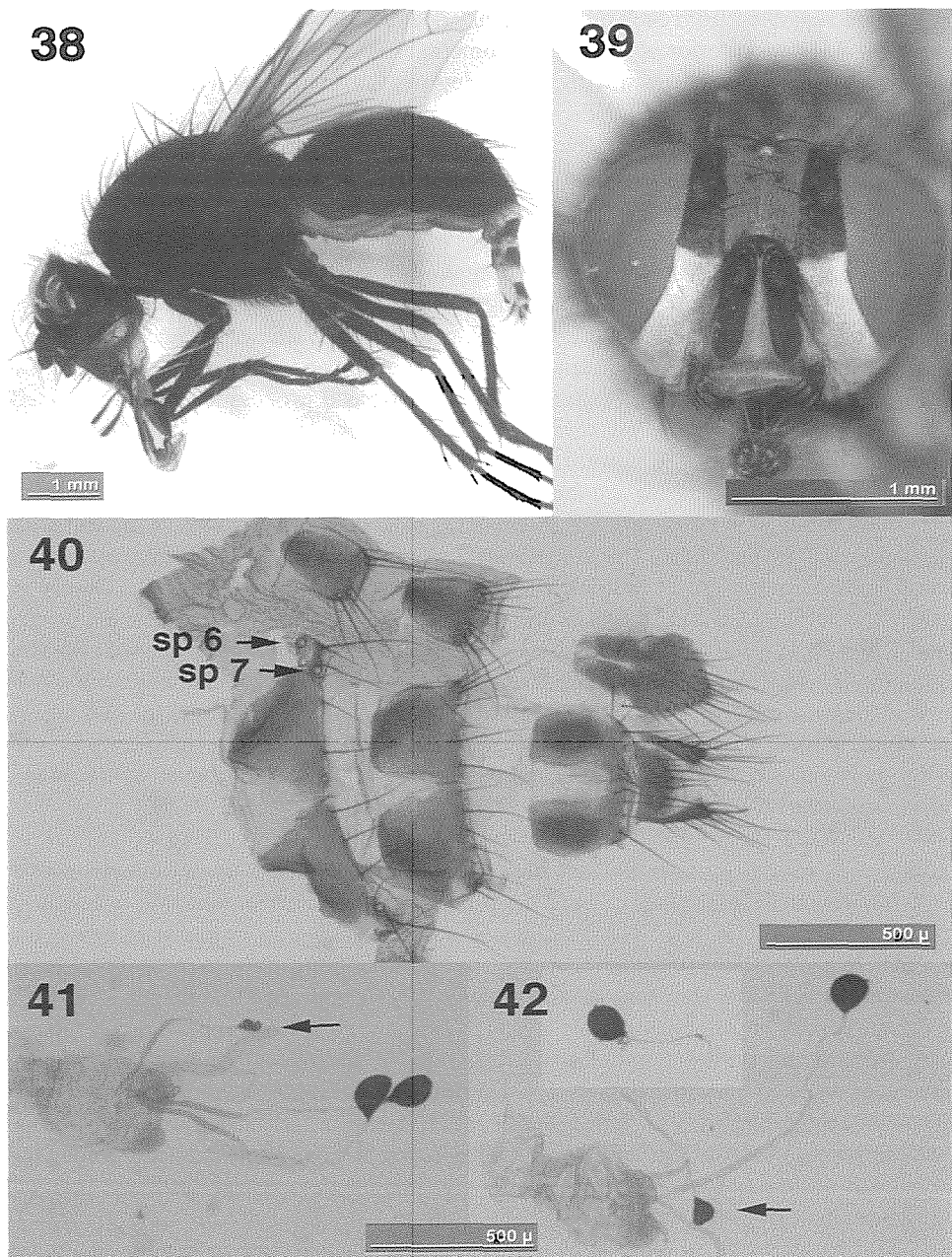
Mid femur with no *av* and 4–6 *pv* on basal half; f_3 with a row of 6–9 *av*, and with 1 rather weak *pv* near base, 1 or sometimes 2 strong and rarely 1 additional *pv* around basal third or middle, and 1 rather strong *pv* near apex; t_2 with 1 *ad*, 1 *pd*, 1–2 (rarely 3) *pd/pv* (namely, 1 *p/pd* and 1 *p/pv*, or more frequently 0 *p/pd* and 1–2 *p/pv*, rarely 0 *p/pd* and 3 *p/pv*) and 1 *pv*; t_3 with 2 *av*, 5–6 (sometimes 4) *ad*, 2 *pd* and no *pv*, near middle sometimes with 1 or a few *p/pv* barely discernible, and in apical chaetotaxy with a few rather long *pd* and a few or some slightly developed *pv* discernible, the longest apical *pd* being at most a little longer than *v* of hind tarsomere 1, and usually as long as or a little shorter than the *v*. Wings with costal thorns very small though slightly stronger than costal spinules.

♀ . Wing-length 5.8–7 mm. Interfrontalia brown or brownish grey pollinose, sometimes pale grey near lunule; parafrontals brownish pollinose except along eye-margin, in frontal view of head becoming wholly black in contrast to brightly pollinose parafacials (Fig. 39); parafacials and genae slightly tinged with brownish yellow in pollinosity; palpi dark brown to brownish yellow on basal third or half. Mesonotum in caudal view with median vitta usually narrow on whole length. Legs with trochanters dark brown, paler on mid legs and sometimes brownish yellow.

Parafrontals with 3–5 *ori*; 3 *ors*, occasionally 1 additional proclinate present on one side; orbits at parafrontal angle 1.4–1.6 times as wide as A_3 ; genal setae usually in 2 rows. Mesonotum with posterior *ph* fine, at most only a little stronger than adjacent setulae; lower posterior *stpl* often fine; pteropleuron with 1–4 fine setulae. Ovipositor about half as long as main part of abdomen (Fig. 38); 2 developed spermathecae present, third one small (Fig. 42), vestigial (Fig. 41) or absent.

Mid femur with 1 or rarely 2 *av* near base and 3 or often 4 *pv* on basal third, the *pv* much weaker than in male; f_3 with 1–2 *av* in basal half and 3–5 *av* on apical half, and with no *pv* except for basal and preapical ones; t_2 with 1 *ad*, 1 *pd*, 1 or sometimes 2 *p/pd*, 1 *p/pv* and 1 *pv*; t_3 with 2 *av*, 4–6 (3 on right leg in 1 specimen) *ad* and 2 (rarely 3) *pd*, and in apical chaetotaxy with *pd* less developed than in male, and always shorter than *v* of hind tarsomere 1.

Remarks. This species much differs from any other known species of the group in having the surstylus which is conspicuously expanded ventro-caudally on ventral plate



Figs. 38–42. *Hydrophoria megaloba* Li et Deng, ♀. 38, general features; 39, head, frontal view; 40, ovipositor, sp 6: 6th spiracle, sp 7: 7th spiracle; 41–42, spermathecae, arrows indicating vestigial or small one. Kutumsang–Magen Gotha (Fig. 38; 40, 42; 41) and Chipling–Kutumsang (Fig. 39).

to form a deep notch between the ventral plate and apical rod, and in having the cercal plate which is much prolonged and flattened apically. The short ovipositor may also be peculiar to the present species although the females are unknown for *H. bavarica* and *H. japonica*.

DISCUSSION

The genus *Hydrophoria* is provisionally subdivided into four groups, namely, the *lancifer*, *ruralis*, *albiceps* and *plumosa* groups (as superspecies) by Griffiths (1998a). As discussed by Griffiths (1991), it may be appropriate to include the genus in the *Delia* group. Simple and blade-like surstyli such as those of the *lancifer* group may be a groundplan structure of the *Delia* group. The surstyli of the *albiceps* group are, however, more derivative in having a tendency to expand ventrally and attenuate apically (cf. figs. 2058–2059, 2072–2073, Griffiths, 1998a). The aedeagus of the *albiceps* group is also similar to that of the *plumosa* group in having attenuated pregonites and lengthened distiphallus (cf. figs. 2060–2061, 2074–2075, Griffiths, 1998a). These may indicate a close relationship between the *albiceps* and the *plumosa* group.

Among the family Anthomyiidae the surstyli are often armed with some distinct setae on ventral surfaces, and this applies also to some species of the *albiceps* group, e.g. *H. albiceps* (Meigen, 1826) and *H. cinerascens* Stein, 1907. The prominent inner-basal setae of surstylus in the *plumosa* group may be derived from such ventral setae existed in the ancestral species of the group, and the inner-basal process of surstylus may have been developed to support those prominent setae. If this is the case, the absence of prominent setae on the inner-basal process of surstylus in *H. plumosa* is understood as secondary, and the less protruded inner-basal process in *H. megaloba* is due to reduction of the formerly well protruded one.

The five known species of the *plumosa* group are tentatively placed as in a cladogram given in Fig. 43. The characters corresponding to the numbers in the cladogram are explained as follows:

1. Surstylus gained a tendency to expand ventrally and attenuate apically. Pregonite attenuated; distiphallus lengthened.

2. Male 5th sternite with a group of short setae developed at base of each process. Ovipositor, so far as known, with 6th and 7th sternites each divided into anterior and posterior fragments.

3. Surstylus much expanded basally in contrast to the rod-like apical part; basal expansion partitioned into a dorsal plate densely covered with microtrichia and a ventral plate with minute or short setulae; a setose tubercle developed near middle dorsally; a distinct process with a pair of prominent setae developed inner-basally.

4. Surstylus with prominent setae on inner-basal process lost.

5. Surstylus with basal expansion further developed. Cercal plate gained a tendency to prolongation.

6. Any synapomorphic characters not yet found.

7. Surstylus conspicuously expanded ventro-caudally on ventral plate to form a deep notch between the plate and apical rod, with median tubercle reduced, and with setae on the tubercle much weakened; inner-basal process of surstylus reduced, with prominent setae shifted to the inside base of the process. Cercal plate much prolonged and flattened to become a little wider apically.

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