Distinction of Two Closely Allied Horse-Fly Species *Tabanus nipponicus* and *T. pallidiventris* with Notes on Their Distribution in Hokkaido

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(With 3 Text-figures and 2 Tables)

Tabanus nipponicus Murdoch et Takahasi is one of the most predominant horse-fly species in Hokkaido, usually occupying the top rank among blood-sucking species collected at pastures and grasslands (Inaoka, 1971). In the course of ecological and biological studies of horse-flies in Hokkaido, however, it has been recognized that another closely similar species, *T. pallidiventris* Olsoufiev, also exist in certain areas and locally even fairly abundant. The taxonomy of this group was clarified by Murdoch and Takahasi (1969), but the separation of two species occasionally fails by a careless application of their diagnoses. Further the distribution pattern of these species is also still insufficiently surveyed. The aim of the present study is first to give some additional observations for the distinction of two species, and secondarily to establish their distribution range within Hokkaido.

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The specimens, all females, were sampled mostly by the following techniques: 1) CO_2 traps, 2) Net collecting on and around cows, 3) Collecting the specimens attracted in and around the car. Although so far not purposively used, the last method proved very effective for collecting various tabanid species. The disparities in the relative abundance due to different techniques were not perceptible. Two species nearly coincide in active season but that of *T. pallidiventris* was somewhat shorter, for instance, appearing 11 days later, disappearing 12 days earlier in Eniwa 1973. The sampling dates in each locality are shown in Table 2. Both species are diurnal and all specimens were collected in the daytime.

Distinction

Two species were distinguished by Murdoch and Takahasi 1969 for each other as follows:

Characters	*nipponicus*	*pallidiventris*
I. Markings of abdominal tergites (cf. Fig. 1)		
A. Median spots	each spot triangular, forming a line with serrated lateral margins	each spot parallel sided, forming continuous and parallel sided longitudinal line
B. Sublateral spots	each spot well-defined, triangular and broad at tergal posterior margin, forming a discontinuous longitudinal line	each spot ill-defined tapering at tergal posterior margin, forming a continuous longitudinal line

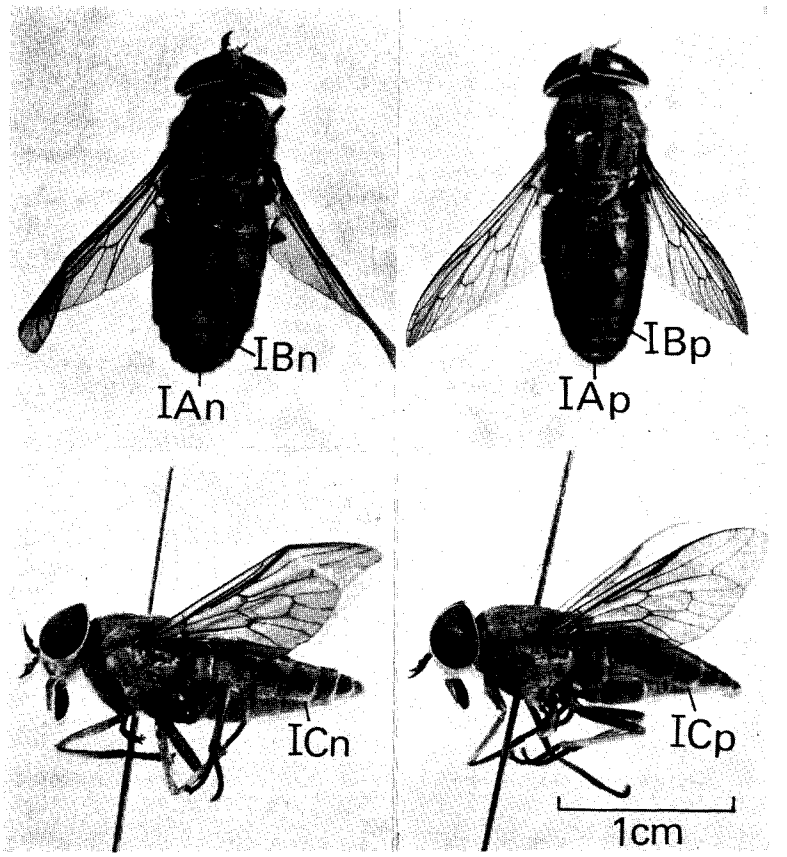

Fig. 1. Differences of abdominal markings between *T. nipponicus* (n) and *T. pallidiventris* (p). I A: Median spots, I B: Sublateral spots, I C: Lateral spots

Table 1. Variability of antenna and second palpal segment in *Tabanus nipponicus* (n) and by percentage ratios (*nipponicus* shown in Gothic). Code numbers

Locality (code no.)	Number of specimens examined		Coloration of basal portion			
			Reddish to dark brown apically darker		Orange apically darker	
	n	p	n	p	n	p
Shakotan (15)	**14**	4	**35.7%**	—	**57.1**	50.0
Azuma (19)	**10**	10	**20.0**	30.0	**60.0**	50.0
Sapporo II (22)	**20**	8	**35.0**	12.5	**45.0**	50.0
Ishikari (23)	**50**	50	**40.0**	8.0	**48.0**	52.0
Eniwa (24)	**25**	25	**56.0**	36.0	**36.0**	36.0
Takikawa (33)	**10**	10	**50.0**	30.0	**50.0**	60.0
Fûren (43)	**10**	10	**40.0**	30.0	**40.0**	20.0
Kenbuchi (44)	**4**	15	**75.0**	40.0	**25.0**	46.7
Monbetsu (49)	**16**	3	**43.8**	—	**43.8**	33.3
Total	**159**	135	**42.1**	21.5	**46.0**	45.9

C. Lateral spots	each spot not covering full length of tergite	each spot covering full length of tergite
II. Coloration of basal portion of flagella (cf. Fig. 2)	reddish brown, apically black	entirely yellow to orange
III. Pilosity of second palpal segment (cf. Fig. 2)	dense and complete	sparse and partial

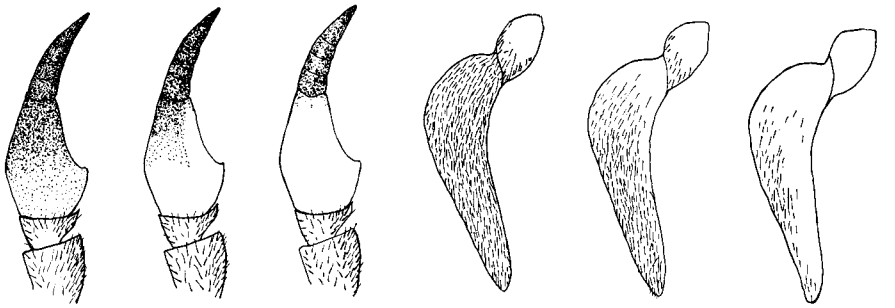

Fig. 2. Variations of antennal coloration (II) and pilosity of second palpal segment (III).
IIa: Reddish to dark brown apically darker, IIb: Orange apically darker, IIc: Entirely orange
IIIa: Dense and complete, IIIb: Intermediate, IIIc: Sparse and partial

T. pallidiventris (p) based upon the specimens collected at 9 localities in Hokkaido shown given parenthetically correspond to those of Fig. 2.

of flagella		Pilosity of second palpal segment					
Entirely orange		Dense and complete		Intermediate		Sparse and partial	
n	p	n	p	n	p	n	p
7.1	50.0	64.3	—	35.7	—	—	100.0
20.0	20.0	100.0	—	—	20.0	—	80.0
20.0	37.5	55.0	—	40.0	12.5	5.0	78.5
12.0	40.0	68.0	—	16.0	22.0	16.0	78.0
5.0	35.0	88.0	—	8.0	32.0	4.0	68.0
—	10.0	60.0	—	20.0	40.0	20.0	60.0
20.0	50.0	100.0	—	—	50.0	—	50.0
—	13.3	100.0	—	—	46.7	—	53.3
12.5	66.7	81.3	—	12.5	33.3	6.2	66.7
11.9	32.6	74.8	—	17.0	28.9	8.2	71.1

Among these characters, II is quite variable, being invalid for distinction. Separation by this character is virtually impossible. Character III also exhibits occasionally considerable variations with intermediate conditions. Characters I A-C are fairly constant but the distinction is sometimes difficult in aged individuals in which the abdominal hairs are lost. The variability of characters II and III in two species were analyzed using the specimens collected at nine localities in Hokkaido after separating the species by character I. As shown in Table 1, two tendencies are recognized. Coloration of antenna tends to paler in *T. pallidiventris* than in *T. nipponicus*. Hairs on second palpal segment are dense and complete in most specimens of *T. nipponicus* while sparse and partial in most of *T. pallidiventris*. The separation is thus not always possible by characters II and III, though the specimens with second palpal segment densely and completely covered with short black hairs could be identified to *T. nipponicus*. Most specimens listed in Table 2 were identified mainly by character I, but in subtle cases with aged individuals, other characters, especially III, facilitate the sorting. In most specimens the separation was not difficult, but about 1.1% of total specimens, mostly aged ones, were impossible to identify.

Distribution

During 1972 and 1973, in total 2,386 specimens of both species were captured from various localities in Hokkaido. In Fig. 3, each locality is shown with the numeral given in Table 2 within the municipal division. The number of specimens from each locality is given approximately by the size of pie graph accompanied and the relative abundance of both species by black (*pallidiventris*) and

white (*nipponicus*) sectors. Although many municipal divisions still remain unexplored, *T. nipponicus* seems to occur throughout Hokkaido and prevailing in most areas. On the contrary, the distribution of *T. pallidiventris* is, within the limit of present knowledge, confined to central Hokkaido, so far not collected from Oshima peninsula, southernmost part of Hokkaido, and from easternmost part of Hokkaido. In the areas of coexistance, at 16 out 25 localities, it is mostly less abundant, equal to or outnumbering *T. nipponicus* only at nine, Azuma, Ishikari, Naganuma, Urausu, Takikawa, Hamatonbetsu, Fûren, Kenbuchi and Rubeshibe I. The distribution pattern suggests, at the present, no clear geographical segregation between two species. Further both species behave similarly in habitat selection, preferring openlands, pastures, rural and suburban areas whereas diminishing in or near woodlands, replaced by other species, especially *Haematopota tristis*.

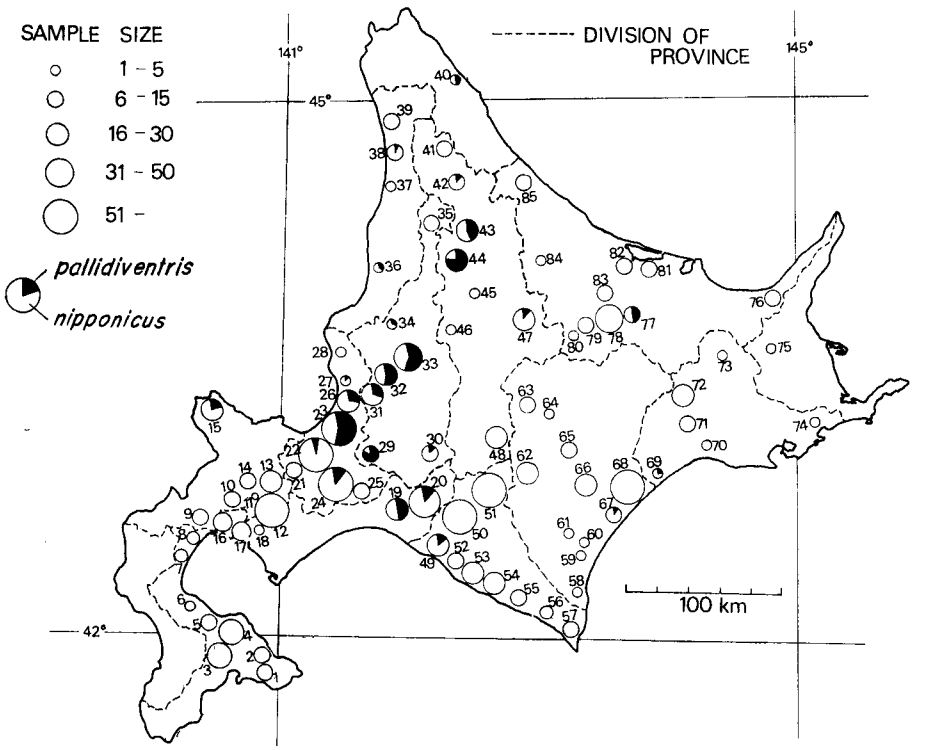

Fig. 3. Distribution of *T. nipponicus* and *T. pallidiventris* in Hokkaido.

Concluding remarks

A brief note is given as to the distribution of both species, especially out of Hokkaido. In earlier papers, *T. nipponicus* has been cited as *T. amaenus* with

Table 2. Capture records of *Tabanus nipponicus* and *T. pallidiventris* from Hokkaido. Code numbers for each locality correspond to those in Fig. 2. Asterisked localities were surveyed in 1973, all others in 1972.

Province	Locality	Number of specimens examined		Sampling date
	Name (code no.)	*nipponicus*	*pallidiventris*	
Oshima	Hakodate (1)	14	0	Jul. 31
	Minamikayabe (2)	13	0	Jul. 31
		2	0	Aug. 31
	Ôno (3)	38	0	Jul. 31
	Mori, I (4)	37	0	Jul. 30
		4	0	Aug. 31
	Mori, II (5)	9	0	Jul. 30
	Yakumo (6)	5	0	Aug. 1
	Oshamanbe, I (7)	13	0	Jul. 30
	Oshamanbe, II (8)	10	0	Aug. 1
Shiribeshi	Kuromatsunai (9)	7	0	Aug. 31
	Niseko (10)*	1	0	Jul. 27
	Makkari (11)*	14	0	Jul. 27
	Rusutsu (12)	70	0	Jul. 29
		5	0	Aug. 31
	Rusutsu (12)*	11	0	Jul. 27
	Kimobetsu (13)	9	0	Jul. 29
	Kimobetsu (13)*	7	0	Jul. 27
	Kutchan (14)*	7	0	Jul. 27
	Shakotan (15)*	12	4	Aug. 2
Iburi	Toyoura, I (16)	30	0	Jul. 30
	Toyoura, II (17)	28	0	Jul. 30
	Tôya (18)	2	0	Jul. 30
	Azuma (19)*	8	8	Aug. 12
	Hobetsu (20)	117	11	Jul. 19
		5	5	Aug. 11
Ishikari	Sapporo, I (21)	15	0	Jul. 13
	Sapporo, II (22)	94	3	Jul. 27
		18	3	Aug. 4
		21	0	Aug. 14
		22	1	Aug. 20
	Ishikari (23)	12	20	Jul. 12
		31	57	Jul. 26
		7	21	Aug. 3
		53	87	Aug. 12
		52	84	Aug. 13
		52	7	Sept. 9
	Eniwa (24)*	21	0	Jul. 1–10
		116	7	Jul. 12–16
		64	16	Jul. 22–28
		4	7	Aug. 8
		1	1	Aug. 14
		1	0	Aug. 26

Table 2 (Continued)

Province	Locality	Number of specimens examined		Sampling date
	Name (code no.)	*nipponicus*	*pallidiventris*	
	Chitose (25)	6	0	Jul. 14
	Tôbetsu (26)*	21	9	Jul. 23
	Atsuta (27)*	5	1	Aug. 16
	Hamamasu (28)*	4	0	Aug. 16
Sorachi	Naganuma (29)*	1	5	Aug. 15
	Yûbari (30)*	9	2	Aug. 15
	Tsukigata (31)*	14	9	Jul. 23
	Urausu (32)*	8	9	Jul. 23
	Takikawa (33)	19	22	?
	Hokuryu (34)	2	1	Aug. 16
	Horokanai (35)*	9	0	Jul. 25
Rumoi	Obira (36)*	2	1	Aug. 16
	Shosanbetsu (37)*	4	0	Aug. 17
	Enbetsu (38)*	10	1	Aug. 17
	Teshio (39)*	11	0	Aug. 17
Sôya	Hamatonbetsu (40)	1	1	Aug. 18
Kamikawa	Otoineppu (41)	6	0	Aug. 18
	Bifuka (42)*	11	2	Jul. 25
	Fûren (43)*	14	12	Jul. 25
	Kenbuchi (44)*	4	15	Jul. 25
	Pippu (45)*	1	0	Jul. 25
	Asahikawa (46)*	1	0	Jul. 25
	Kamikawa (47)	16	3	Jul. 24
	Kamikawa (47)*	5	0	Jul. 25
	Minamifurano (48)*	17	0	Aug. 13
Hidaka	Monbetsu (49)*	23	5	Aug. 12
	Biratori (50)	156	0	Jul. 20
		16	0	Aug. 11
	Hidaka (51)	98	0	Jul. 20
		1	0	Aug. 12
	Niikappu (52)*	10	0	Aug. 12
	Shizunai (53)*	27	0	Aug. 12
	Mitsuishi (54)*	17	0	Aug. 12
	Urakawa (55)*	9	0	Aug. 12
	Samani (56)*	10	0	Aug. 12
	Erimo (57)*	10	0	Aug. 13
Tokachi	Hiro-o (58)*	4	0	Aug. 13
	Taiki (59)*	2	0	Aug. 13
	Chûrui (60)*	3	0	Aug. 13
	Sarabetsu (61)*	4	0	Aug. 13
	Shimizu (62)	10	0	Jul. 21
		10	0	Aug. 12

Table 2 continued

Province	Locality	Number of specimens examined		Sampling date
	Name (code no.)	*nipponicus*	*pallidiventris*	
	Shintoku (63)*	11	0	Aug. 13
	Shikaoi (64)*	3	0	Aug. 13
	Otofuke (65)*	12	0	Aug. 13
	Makubetsu (66)*	20	0	Jul. 1
	Toyokoro (67)	1	3	Jul. 21
		4	0	Aug. 12
	Urahoro (68)	63	0	Jul. 21
		4	0	Aug. 12
Kushiro	Onbetsu (69)	3	1	Aug. 12
	Kushiro City (70)	2	0	Jul. 22
	Akan, I (71)	11	0	Jul. 22
		8	0	Aug. 13
	Akan, II (72)	10	0	Jul. 22
		11	0	Aug. 13
	Teshikaga (73)	2	0	Aug. 13
	Hamanaka (74)	3	0	Aug. 15
Nemuro	Nakashibetsu (75)	1	0	Aug. 16
Abashiri	Shari (76)	7	0	Aug. 16
	Rubeshibe, I (77)	5	5	Jul. 23
	Rubeshibe, II (78)	33	0	Jul. 24
	Rubeshibe, III (79)	8	0	Jul. 24
	Rubeshibe, IV (80)	5	0	Jul. 24
	Saroma (81)	11	0	Aug. 16
	Yûbetsu (82)	10	0	Aug. 17
	Ikutahara (83)	6	0	Aug. 5
	Takinoue (84)	1	0	Aug. 5
	Ômu (85)	10	0	Aug. 16
Total		1938	448	

an enormous distribution covering Japan, Taiwan and continental eastern Asia. The distinction of three species was made by Murdoch and Takahasi 1969, who gave the distribution range of the three species as follows:

T. nipponicus: Hokkaido, Honshu, Shikoku, Kyushu, Okinawa

T. pallidiventris: Hokkaido, Honshu, Shikoku, Korea, Manchuria, Ussuri, China

T. amaenus: Korea, Manchuria, China, Okinawa, Taiwan

If this conclusion is correct, three species seem to form a ring of partial overlap in eastern Asia, and further clarification of their geographical distribution offers an interesting problem. According to previous studies, *T. amaenus* (earlier than 1969) and *T. nipponicus* are abundant and ubiquitous while *T. pallidiventris* is rather sporadic in northern Honshu (Hasegawa et al. 1970, Kato et al. 1965, etc.). By the results given above, it is inferred that the distribution records of *T. amaenus*

in Japan earlier than 1969 could be regarded as that of *T. nipponicus* but they cannot be authentically used unless the specimens studied are reexamined. Further the distinction of *T. nipponicus* and *T. pallidiventris* was not well established even after 1969, so that those records in the studies cited above were not referred to in the present paper. Recent tabanid surveys made in southern Honshu did not record the both species (Sasakawa *et al.* 1968, Institute of Hygiene and Medical Micro Biology, Toyama 1973). Although further accumulation of information is required, both species must become rare in southern Japan, probably replaced by *T. amaenus.*

Summary

Distinctive characters of two closely allied horsefly species, *Tabanus nipponicus* Murdoch et Takahasi and *T. pallidiventris* Olsoufiev were studied. Among the characters studied, abdominal color pattern is useful by its stable species-specificity, though rarely useless in some aged individuals. The other two characters, antennal coloration and palpal pilosity, especially the latter, also have some specific trends, but so variable that effective only as auxiliary distinctive characters.

In Hokkaido, *T. nipponicus* is distributed throughout and the top ranked horse-fly species at openland habitat in most localities, whereas *T. pallidiventris* is so far known in central region of Hokkaido, where distributed rather sporadically and usually less abundant.

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