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Distribution, Host Range and Seasonal Abundance of *Sipha* Sp. (Homoptera: Aphididae) and Their Natural Enemies in Pakistan

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Abstract: Two species *Sipha maydis* and *S. elegans* were recorded from Pakistan. First one seems to be restricted to hilly areas of temperate climate and lesser annual rainfall with host range mainly restricted to Gramineae. The wild growing grasses including *Phacelurus speciosus*, *Polypogon fugax*, *Hordeum murinum* and *Cynodon dactylon* seemed its preferred hosts. In laboratory it did not complete its development on some of the reported hosts like sorghum, maize and *Arundo donax*. *S. elegans* was recorded occasionally in small numbers in mixed population with *S. maydis* on barley, wheat, *P. speciosus*, *H. murinum* and *P. fugax*. It was a first record from Pakistan and seems to be an introduced species. It did not breed well on wheat and barley therefore, it may have some other preferred host not recorded during the present studies. *Lysiphlebus ambiguus* was the only parasitoid recorded from *S. maydis* from Pakistan. It did not complete development in other aphids tried including some reported hosts such as *Aphis gossypii* and *Aphis donacis*. *L. ambiguus* is an aggressive parasitoid and its parasitism in field populations of *S. maydis* exceeded 62%.

Key words: *Sipha maydis*, *Sipha elegans*, *Lysiphlebus ambiguus*, hosts, seasonal abundance, natural enemies

Introduction

Cereal aphids represent a problem of increasing importance resulting from changes in agricultural systems (Vickerman & Wratten, 1979). They gained further economic importance when it was discovered that cereal aphids function as vectors of diseases (Krober & Carl, 1990).

In the past, aphids associated with cereals in Pakistan have remained under natural control (Hamid, 1983). More recently there have been reports of serious damage by aphids in northern Pakistan (Shehzad, 1999). With the introduction of new high yielding varieties especially of wheat, sorghum and maize having low resistance to pests, and increase in area of cultivation the risk of aphid damage has assumed an increasing importance.

Sipha maydis and related species have become serious pests in various parts of the world (Semenov, 1984; Khairova, 1979; Argyriou, 1970). More recently, *S. flava* (Forbes) has become a serious pest of sugarcane and pasture grasses in Australia (Barro *et al.*, 1996).

Survey for *Sipha* sp. and their natural enemies was carried out throughout Pakistan during 1997-98. The information gathered on the occurrence, host range and seasonal abundance of *Sipha* sp. and their natural enemies is reported here.

Materials and Methods

Survey for aphids and their natural enemies were carried out in different ecological zones of Pakistan viz: (i) tropical summer rains with higher rain fall (Islamabad, Taxila) and with lesser rainfall (Vehari, Sahiwal); (ii) tropical summer rains but comparatively hot and arid coastal (Thatta) and sub-coastal areas (Hyderabad, Nawabshah, Sakrand); (iii) sub tropical hot arid (Multan, Bahawalpur, Khanpur); (iv) temperate with lesser rainfall south western hills (Ziarat, Quetta, Pishin, Kalat, Khuzdar) and north western hills (Parachinar) and with higher rainfall northern hills (Murree, Singota, Madyan).

Five fields from each area were examined. From each field 50 tillers at random from 5 different spots were sampled. In laboratory the number of different species in a sample were counted and the mummified aphids were separated out and kept individually in gelatin capsules for parasitoids rearing. Identifications of aphids and parasitoids were obtained from International Institute of Entomology, UK.

Suitability of some of the reported hosts for development of *Sipha maydis* was studied. Ten freshly formed females were released on potted plants (two leafed) of *Hordeum vulgare*, *Arundo donax*,

Sorghum sudanensis, *Zea mays*, *Cynodon dactylon* in three replicates in two sets, one in May and the other in July. The plant *Triticum aestivum* was kept as control with each set. Numbers of surviving aphids were counted in each replicate after 10 days of release of mother. Each plant was checked daily and a fallen tiller (with aphids) was cut and kept on the remaining standing tillers in the same pot for transfer of the surviving aphid individuals to the healthy tillers.

Results

Sipha maydis Passerini

Distribution: It is distributed in Europe, the Mediterranean, the Middle East, Central Asia, India, Pakistan and South Africa (Pers. Comm. G. W.). Hamid (1983) reported that it is distributed almost throughout Pakistan, however, during the present studies it was recorded only from Parachinar in north western hills and Quetta in south western hills.

Hosts: It is polyphagous and seems to be restricted mainly to Gramineae, however, it also attacks some plants of Orobanchaceae. Its known hosts in the world are listed in Table 1.

During the present studies in Pakistan, it was recorded from cereal crops wheat (*Triticum aestivum*), barley (*Hordeum vulgare*), *Polypogon fugax*, *Phacelurus speciosus* and *Cynodon dactylon*. Maize and sorghum reported by Hamid (1983) as hosts of *S. maydis* from Pakistan were examined almost in all the areas surveyed but this species was not recorded on these plants.

Seasonal abundance: At Quetta, where sampling was started from May, *S. maydis* was recorded in small numbers on cereal crops like wheat, barley and grasses *Cynodon dactylon*, *Phacelurus speciosus*, *Polypogon fugax* and *Hordeum murinum*. *Phacelurus speciosus* seems to be the main host of this aphid. On this plant *S. maydis* was recorded in May. Its numbers increased on this plant in June and further increased in July when probably it was maximum at this locality. It was abundant on *Polypogon fugax* in May. On this plant its numbers decreased in June probably because the plant matured. It was not recorded in July on this plant (Table 2). Similar trends were observed on *Hordeum murinum* (Table 2).

At Parachinar where observations were started from June, *S. maydis* was recorded only on *P. speciosus*. Its density increased in July and continued increasing through August

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Table 1: Revised world list of hosts of *Sipha maydis*

Host Plant	Country	Reference
<i>Cynodon dactylon</i>	Israel	Bodenheimer & Swirski (1957)
	Himachal Pradesh (India)	Shujauddin (1978)
	Pakistan*	Present Recd. (1997)
<i>Triticum aestivum</i>	Tadzhikistan	Khairova (1979)
	Pakistan	Hamid (1983)
	Russia	Semenov (1984)
<i>T. durum</i>	Turkey	Bodenheimer & Swirski (1957)
<i>Avena</i> sp.	Tadzhikistan	Khairova (1979)
<i>A. sterilis</i>	Madrid (Iberian Peninsula)	Castanera & Santiago (1983)
<i>Avena</i> sp.	Russia	Semenov (1984)
	Israel	Bodenheimer & Swirski (1957)
<i>Hordeum vulgare</i>	Pakistan	Hamid (1983)
	Tadzhikistan	Khairova (1979)
	Morocco	El Yamani & Hill (1990)
	Russia	Semenov (1984)
<i>H. murinum</i>	Pakistan*	Present Recd. (1997)
<i>H. sativum</i>	Israel	Bodenheimer & Swirski (1957)
<i>Phleum pratense</i>	Lithuanian SSR	Yuronis (1984)
<i>Dactylis glomerata</i>	Lithuanian SSR	Yuronis (1984)
<i>Arundo donax</i>	Israel	Mescheloff & Rosen (1990)
<i>Zea mays</i>	Pakistan	Hamid (1983)
	Cordoba (Iberian Peninsula)	Castanera & Santiago (1983)
	Lebanon	Bodenheimer & Swirski (1957)
Broom rape	Turkey	Bodenheimer & Swirski (1957)
<i>Sorghum halepense</i>	India	Puzzilli (1983)
<i>Bromus villosus</i>	Pakistan	Hamid (1983)
<i>Bromus</i> sp.	Israel	Bodenheimer & Swirski (1957)
<i>Aegilops longissima</i>	Israel	Boenheimer & Swirski (1957)
<i>Koeleria phleoides</i>	Israel	Bodenheimer & Swirski (1957)
<i>Lolium rigidum</i>	Israel	Bodenheimer & Swirski (1957)
<i>L. temulentum</i>	Israel	Bodenheimer & Swirski (1957)
<i>Lolium</i> sp.	Israel	Bodenheimer & Swirski (1957)
<i>Secale cereale</i>	Israel	Boenheimer & Swirski (1957)
	Russia	Semenov (1984)
<i>Trisetum koelerioides</i>	Israel	Bodenheimer & Swirski (1957)
<i>T. vulgare</i>	Israel	Bodenheimer & Swirski (1957)
<i>Utrisetum</i> sp.	Israel	Bodenheimer & Swirski (1957)
<i>Polypogon fugax</i>	Pakistan*	Present Recd. (1997)
<i>Phacelurus speciosus</i>	Pakistan*	Present Recd. (1997)

* = New additions from Pakistan

Table 2: Numbers of *Sipha maydis* recorded on 50 tillers of different plants at Quetta and Parachinar

Month	Locality			
	Quetta		Parachinar	
	No. of aphids on different plants			No. of aphids on
	<i>Phacelurus speciosus</i>	<i>Hordeum murinum</i>	<i>Polypogon fugax</i>	<i>Phacelurus speciosus</i>
May	180	210	380	-
June	240	100	190	410
July	590	0	0	530
August	-	-	-	580
September	-	-	-	400
October	-	-	-	350

- No observation

Table 3: Survival and multiplication of *Sipha maydis* on different plants per ten females released on a plant species for 10 days.

Set No.	Month	Host Plant	Temperature of the rearing room		Number of aphids surviving up to 10 days of release	
			Mean Minimum	Mean Maximum	Mean	Standard deviation
I	May	<i>Arundo donax</i>	19.4	24.2	0	0
		<i>Sorghum sudanensis</i>	"	"	0	0
		<i>Zea mays</i>	"	"	0	0
		<i>Triticum aestivum</i>	"	"	51.3	7.58
II	July	<i>Zea mays</i>	22.4	26.1		
		<i>Hordeum vulgare</i>	"	"	60.3	2.49
		<i>Cynodon dactylon</i>	"	"	20.3	3.85
		<i>Triticum aestivum</i>	"	"	44.6	7.58

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Table 4: Revised world list of hosts of *Sipha elegans*

Host Plant	Country	Reference
<i>Triticum aestivum</i>	Czechoslovakia	Honeka (1985)
	Germany	Zimmermann & Basedow (1980)
	Pakistan*	Present. Recd.(1997)
	Turkey	Elmali (1997)
<i>Hordeum vulgare</i>	Germany	Zimmermann & Basedow (1980)
	Czechoslovakia	Honeka (1985)
	Pakistan*	Present Recd. (1997)
<i>H. murinum</i>	Pakistan*	Present Recd. (1997)
<i>H. jubatum</i>	Manitoba	Robinson & Hsu (1963)
<i>Festuca arundinacea</i>	Washington, USA	Clement <i>et al.</i> (1990)
<i>F. pratensis</i>	Manitoba	Robinson & Hsu (1963)
<i>Agropyron desertorum</i>	Manitoba	Robinson & Hsu (1963)
<i>Polypogon fugax</i>	Pakistan*	Present Recd. (1997)
<i>Phacelurus speciosus</i>	Pakistan*	Present Recd.(1997)
<i>Aegilops</i> sp.	Manitoba	Robinson & Hsu (1963)
<i>Aegilops</i> sp.	Czechoslovakia	Havlickora <i>et al.</i> (1996)
<i>Agropyron cristatum</i>	Manitoba	Robinson & Hsu (1963)
<i>A. repens</i>	"	Robinson & Hsu (1963)
<i>A. trachycaulum</i>	"	Robinson & Hsu (1963)
<i>A. trichophorum</i>	"	Robinson & Hsu (1963)
<i>Agrostis stolonifera</i>	"	Robinson & Hsu (1963)
<i>Bromus inermis</i>	"	Robinson & Hsu (1963)
<i>Phleum pratense</i>	"	Robinson & Hsu (1963)
<i>Setaria italica</i>	"	Robinson & Hsu (1963)
<i>Sorghum sudanense</i>	"	Robinson & Hsu (1963)

* = New records

Table 5: Parasitism of *Lysiphlebus ambiguus* on *Sipha maydis* on different plants at Quetta and Parachinar during 1997.

Month	Host Plant	No. of aphids in a sample	Parasitism (%)
At Quetta			
May	<i>Phacelurus speciosus</i>	67	22.3
	<i>Hordeum murinum</i>	225	20.4
	<i>Polypogon fugax</i>	368	17.3
	<i>Triticum aestivum</i>	40	5
	<i>H. vulgare</i>	37	5.4
June	<i>P. speciosus</i>	225	6.6
	<i>H. murinum</i>	92	19.5
	<i>P. fugax</i>	165	3.0
July	<i>P. speciosus</i>	567	0.7
At Parachinar			
June	<i>P. speciosus</i>	412	0
July	<i>P. speciosus</i>	453	14.9
August	<i>P. speciosus</i>	580	40.0
September	<i>P. speciosus</i>	400	52.0
October	<i>P. speciosus</i>	350	62.5

when it was maximum (Table 2). After this month the population started decreasing and this trend continued through October.

Host suitability: Suitability of some of the reported host plants for multiplication of *S. maydis* was studied. The results are presented in Table 3. The aphid did not establish on *A. donax*, *S. sudanensis* and *Z. mays*. Its survival was the highest on *H. vulgare* followed by *T. aestivum* and *C. dactylon* (Table 3).

***Sipha elegans* del Guercio**

Distribution: It is distributed in Europe, Central Asia and introduced into North America (Blackman & Eastop, 1994). This is a first record from Pakistan (Pers. Comm. R.L.).

Hosts: The reported hosts of *S. elegans* in the world are given in Table 4. From Pakistan it was recorded in mixed population with *S. maydis* in small numbers on wheat, barley, *Polypogon fugax*, *Phacelurus speciosus* and *Hordeum murinum* at Quetta in May and on *P. speciosus* at Parachinar in August - September. As it was recorded occasionally in small numbers from the plants sampled for *S. maydis* and no parasitoids were reared from the

aphid individuals collected in samples, therefore, it appears that this species has some other preferred hosts not recorded during present studies.

Natural enemies

Parasitoids

***Lysiphlebus ambiguus* (Haliday)**

Synonymy, hosts and distribution: It has been mostly known under the name of its synonym *Lysiphlebus* or *Adialytus arvicola*. From Pakistan Hamid (1983) reported *L. arvicola* on *Myzus obtusirostris* from northern hills and on *Rhopalosiphum maidis* from western and northern hills. During the present studies it was reared from *S. maydis* from south western hills and north western hills of Pakistan.

Seasonal distribution: At Quetta its incidence was maximum in May on *S. maydis* on *P. speciosus* followed by *H. murinum*, *P. fugax*, *H. vulgare* and *T. aestivum* (Table 5). In June probably because of attack of hyper parasitoids the overall incidence of *L. ambiguus* decreased on all plants except *H. murinum*. Its parasitism further decreased in July possibly because of warming of weather (Table 5).

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At Parachinar, the parasitism on *S. maydis* was negligible in June whereas *L. ambiguus* population started developing in July reaching to its peak in October (Table 5). No observations were taken from November onwards in the area.

Hyper parasitoids: Two species *Syrphophagus aphidivorus* Mayr and *Pachyneuron aphidis* (Bouche) were reared from field collected mummies of *S. maydis* from Quetta and Parachinar. The percent parasitism of two hypers on *L. ambiguus* was 14.2 on *H. murinum* and 19.1 on *P. speciosus* in June at Quetta. Their percent parasitism on *L. ambiguus* on *P. speciosus* at Parachinar was 15.5 in July, 10.0 in August, and 7.0 in September. No hyper parasitoids were reared in October.

Predators: *Syrphus balteatus* (De Geer) was recorded on *Sipha maydis* on *Phacelurus speciosus* in May at Quetta and in June and July at Parachinar.

Discussion

Sipha maydis distribution in Pakistan remained under scrutiny throughout the survey period in 1997. Hamid (1983) indicated that it is widely distributed in Pakistan. During present studies aphid samples were taken from all the host plants of *S. maydis* reported by Hamid (1983) in all the areas surveyed from high hills (3,000 m) to low lands (7 m) (including plains, semi deserts, coastal and sub-coastal areas). The aphid *S. maydis* was recorded only from altitudes between 1,662 - 1,720 m in the north western and south western hills. Thus it seems to be restricted to hilly areas with temperate climate and comparatively lesser annual rainfall (< 250 mm).

Host range of *S. maydis* was found to be mainly restricted to Gramineae. The wild growing grasses including *Phacelurus speciosus*, *Polypogon fugax*, *Hordeum murinum* and *Cynodon dactylon* seemed its preferred hosts though it also attacked cereal crops like wheat and barley. In laboratory, it did not complete its development on some of the reported hosts like sorghum, maize and *Arundo donax*. Therefore, *S. maydis* recorded during the present survey from hills of Pakistan may be a different strain or subspecies to the one reported by Hamid (1983).

Sipha elegans was recorded occasionally in small numbers in mixed population with *S. maydis* on barley, wheat, *P. speciosus*, *H. murinum*, and *P. fugax*. It did not breed well on wheat and barley though tried repeatedly in the laboratory and soon the colonies were lost, therefore it seems to have some other preferred hosts not recorded during present studies. It was a first record from Pakistan and seems to be an introduced species as it was not recorded in previous surveys conducted by CABI Bioscience in 1970s and 1980s.

Several hosts of *Lysiphlebus ambiguus* have been reported from the world. However, in Pakistan it was reared only from *S. maydis* during the present studies. It did not complete development in other aphids tried, including some reported hosts such as *Aphis gossypii* and *Aphis donacis* (Shehzad, 1999). This indicated that a complex of subspecies and/or strains exists in *L. ambiguus*, and the Pakistan strain is probably specific to genus *Sipha*.

Pimental (1963) and Carl (1982) indicated that several native pests in the world have been controlled by introduced natural enemies of related genera and species, therefore, it is hoped that the recent efforts by Department of Agriculture, State of Hawaii, USA to introduce *L. ambiguus* from *S. maydis* against *S. flava* will be successful. *L. ambiguus* is an aggressive parasitoid and its parasitism in field populations of *S. maydis*, as observed in the present studies, exceeded 62% indicating its potential usefulness in controlling *S. flava*.

The host range and distribution of *Sipha* sp. and their natural enemies in Pakistan has been cleared. *S. elegans* is a new entrant in Pakistan and at present it could not build up high populations probably because of competition with other aphid species having common host range. *L. ambiguus* is an aggressive parasitoid and has not let *S. maydis* to develop into outbreak proportions. Regular monitoring of *Sipha* sp. on cereal crops in Pakistan is necessary as they have been reported from other countries causing considerable reduction in yield of crops because of their feeding and also they act as disease vector (El-Yamani and Hill, 1990).

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