A Record of Three Korea Indigenous Species newly developed as Biological control agents for controlling Aphids

Hyun-Jin Shin, **Woo-Yeun** Kim, Tae-Su Kim

SESIL Corporation, Beneficial Insect Research Institute, Republic of Korea
sesil@sesilipm.co.kr

SUMMARY

It is well known 4 parasitoids(*Aphidius colemani*, *Aphidius ervi*, *A. matricariae*, *Aphelinus abdominalis*) and 3 predators(*Aphidoletes aphidimyza*, *Chrysoperla carnea*, and *Harmonia axyridis*) as the major natural enemies of aphids all over the world. In addition to above mentioned natural enemies, novel aphid natural enemies include two parasitoid species (*A. gifuensis, Aphelinus asychis*) and two predator species (*Micromus angulatus*, *H. yedoensis*) which have been developed are used in Korea. Especially, *A. gifuensis, A. asychis, H. yedoensis* are widely used for aphids biological control and were the first commercial native natural enemies developed by SESIL of Korea.

In the biological characteristics, it was confirmed that *A. gifuensis* was similar with *A. colemani, A. matricariae.* But *A. gifuensis* have high adaptability in higher temperatures, it was more available to use these conditions that *A. colemani, A. matricariae.*

In general, aphid parasitoids have an advantage that can be used for effective control of aphids compensating disadvantages such as decrease of activity during high temperatures periods.

The Biological characteristics of *A. asychis* are similar with *A. abdominalis.* However, in the reason that *A. asychis* have high parasitism to *Myzus persicae* and *Aphis gossypii* as well as potato aphid and greenhouse potato aphid, it can more effectively control aphids when aphids density is low and simultaneously occurred different aphid species at the control area.

In *H. yedoensis*, due to the lack of locomotion and relative long period of larval stage, it is possible to remain the control for a long time so that it is expected as next generation aphid control agent along with *H. axyridis.*

The *A. gifuensis, A. asychis* and *H. yedoensis* are native natural enemies developed by SESIL in Korea. We look forward to their use as a biological control agent for aphid control. They have excellent environmental adaptability, a wider host range, and ability for predation compensating for disadvantages in existing aphid parasitoids and predators.

Aphidius gifuensis

Aphelinus asychis

Harmonia yedoensis

RESULTS

Table 1. Commercially available five parasitoids used for controlling four major pest aphid occurring in the field and their host preferences (Hajimu Takada, 2002).

Parasitoids	Host aphids			
	Aphis gossypii	*Myzus persicae*	*Macrosiphum euphorbiae*	*Aulacorthum solani*
Braconidae, Aphidiinae				
Aphidius ervi			○	○
Aphidius gifuensis	○	◎	△	◎
Aphidius colemani	◎	◎		△
Aphelinidae				
Aphelinus abdominalis			◎	◎
Aphelinus asychis	◎	◎	◎	◎

Degree of suitability as host: ◎ high, ○ low, △ very low.

Table 2. Fecundity and longevity of three parasitoids when *Myzus persicae* were supplied as a prey(Giri M.K *et al*.1982; Korolkevich V. I., 2009)

Temperature	Parameter	*A.colemani*	*A.matricariae*	*A.gifuensis*
20℃	Fecundity (eggs/female)	-	280±10.0	529.0±17.7
	Longevity(days)	-	8.2	12.8±0.8
25℃	Fecundity (eggs/female)	261±8.4	272±4.1	536.7±35.3
	Longevity(days)	-	5.1	12.3±0.7

Table 3. Comparison of longevity of female, number of eggs deposited and aphids killed by non-reproductive host killing at *A. asychis* (Cate *et al*. 1973; Bai and Mackauer ,1990; Byeon, 2009)

Host aphid	Temp. ºC	Longevity (days)	No. of Fecundity		No. of aphids killed		Total no. attacked aphid
			daily	total	daily	total	
Schizaphis graminum	26.7	23.4	ca. 10.0	233.0	ca. 1.5	30.4	263.4
Acyrthosiphon pisum	25.0	-	ca. 8.0	-	ca. 1.0	-	-
Aphis gossypii	25.0	21.3	14.9	342.6	3.3	73.9	416.5

Table 4. Distribution and occurrence of Coccinellidae in various landscapes of the Far East (Kuzentsov V. N. *et al*. 2001)

Species	Plant Ecosystem						
	AG	MD	M	BL	CBL	P	MTF
Harmonia axyridis	+++	+	+	+++	+++	++	-
Harmonia yedoensis	-	-	-	-	-	+	-
Adalia bipunctata	-	-	-	++	+	-	+
Coccinella septempunctata	+++	+++	+	++	+	+	+

AG, agricultural ecosystem ; MD, meadow; M, mire; BL, broad-leaved forests; CBL, coniferous-broad-leaved forests; P, pine forests; MTF, mountain tundra and forest tundra. Abundance is indicated by the following symbols: +++, abundant; ++, common; +, rare.

Table 5. Larval developmental period and number of prey consumption of *H. yedoensis* and *H. axyridis* according to each different prey(SESIL, unpublished)

Species	Prey	Developmental period(days)	No. of Prey Consumption
H. yedoensis	*M. persicae*	15±1.0	1,811
	S. avenae	10±0.6	685
	A. craccivora	10±0.9	665
H. axyridis	*M. persicae*	14±1.5	1,217
	S. avenae	8±0.4	452
	A. craccivora	10±0.6	597

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www. sesilipmco.kr 135, Dongsan-Ri, Yeonmu-Eup, Nonsan-Si, Chungcheongnamdo, Korea Tel. +82-41-740-8000