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Study on the instars of soybean aphid, *Aphis glycines* Matsumura in Jilin province

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Abstract: The number of instar of soybean aphid and the major morphological characteristics of each instar were reported.

Key Words: soybean aphid (*Aphis glycines* Matsumura), instars

Soybean aphid is one of the major pests in soybean production areas of China. In order to provide scientific basic for integrated control and prediction of soybean aphid, we researched its number of stadium and simple morphological characteristics each instar during 1986-1987.

1. Materials and Methods

soybean aphids collected from soybean field were inoculated on pot-cultured soybean. These pots were put in house with natural temperature and isolated each other. There were two treatments in experiment. Treatment 1, Place only one aphid on each pot. When the aphid begin to propagate, remove the mature aphid and all but one nymph by brush pen. Observe and collect the exuviums after each time moulting until the aphid begin to propagate. immerse the collected exuviums and mature aphids in 70% alcohol immediately, set water bath in 60°C and store it in Hydroxybenzene Aldehyde liquid. Treatment 2, Place several aphids of different size on each pot and observe them. Each aphid just in moulting and its exuvium which is not completely separated from body, is collected altogether. Preserve them in one tube with the method as treatment 1. Repeat this several times. At the same time, collect the aphid on the top, middle and bottom leaves of soybean in the field, treat and preserve them with the above-mentioned method.

2. Results and Analyses

There were 76 tubes in treatment 1, one generation was in one tube. There were 120 tubes in treatment 2, one aphid and its exuvium were in one tube. 1707 aphids were collected in different instars from soybean field.

2.1 Number of instar of soybean aphid.

In the 76 tubes, 72 tubes' aphids moulted 3 times and 4 tubes' moulted 2 times. So soybean aphid moultes 2-3 times, has 3-4 instars in one generation. And most of them

moult 3 times, have 4 instars.

2.2 Morphological characteristics of each instar

2.2.1 Change of antennular segment number

The result of observing 72 aphids was: For the aphids which moulted 3 times, its antennular segment number were 4, 5, 6 respectively, and mature aphid was 6. But the aphids of fourth generation moult only 2 times, its antennular segment number were 4, 5 respectively, and mature aphid was also 6 segments. The result from 120 aphids indicated that with exuviums of 4-antennular-segment, aphid just after moulting had 4 antennular segments, with exuviums of 5-antennular-segment, aphid just after moulting also had 5 antennular segments and with exuviums of 6-antennular-segment, aphid just after moulting had 6 antennular segments too, i.e., number of antennular segment of aphid just after moulting is the same as that of its exuvium, but the antenna of aphid after moulting is longer than that of the exuvium, and its segment 3 become longer obviously. Both side near the middle of segment 3 has undercutting which looks like a trace of segment but is not real intersegmentum. Developing-well nymphs anatomized from abdomen of mature aphid had the same 4 antennular segment as that of just natal aphid. Analyzing from above-mentioned situation, increase of antennular segment got along with the increase of instar, increase of antennular segment took place between 2 moultings. Thus, the aphids of 2 and 3 instars have two types of aphid with different number antennular segment i.e. n and $n-1$ antennular segment. For each instar, duration of $n-1$ is shorter, but it is existent at all. And there was an obvious characteristics in the third segments aphid of $(n-1)$ antennular segments. The rule of the antennular segment number changing in different instar is: instar 1 nymphs' antenna have 4 segments, instar 2 have 4-5 segments, instar 3 have 5-6 segments, and instar 4 have 6 segments.

2.2.2 Changing of the characteristics of cauda, siphunculus,

With the increase of instar, length, cauda, siphunculus and feet of aphid became obviously longer. Number of hair and shape of cauda also changed. Shape of different instar aphids' cauda, relative length of cauda and siphunculus were shown in Table 1.

Aphids of instar 3 and 4 had 6-segment antenna and mature aphid also had 6 segments. Then, we can distinguish them from the shape of cauda, relative length of siphunculus, and cauda and existence of medithorax paranal folk.

Cauda of instar 4 aphid just after moulting was ligulate and had not medithorax paranal folk. With time passing by, cauda became coniform, near the middle was constricting and medithorax paranal folk developed completely. The shape of siphunculus, cauda and antenna of all instar of soybean aphid were shown in figure 1.

Winged nymphae appear after moulting two times. i.e. Wing bud became visible in instar 3 aphids and the aphid has 5 or 6 antennular segments. After moulting, winged nymphae became mature and can reproduce after short time development.

Table1 Characteristics of male aphid in different instars

		Antenna		cauda		siphunculus		Medithorax paranal folk
		Number of segment	Times of the length of 3-segmented over 4-segmented	Shape	Length (mm)	Length (mm)	Times of the length of Cauda over Siphunculus	
Instar 1		4		Not developed		0.05		
Instar 2		5		Ligulate	0.08	0.15		
Instar 3		6	1.4	Ligulate	0.12	0.21	0.5	None
Instar 4	Pre-Prognancy	6	1.8	Ligulate	0.14~0.18	0.26	0.5~0.7	None
	Prognancy state			Long-conic				

2.2.3 Deformed paedogenesis

Among the aphids collected from field, a few nymphs had obviously 5-segment antenna, the young aphid whose cauda was ligulate already had nymph embryo in abdomen. These nymphs which had nymph embryo was only 14.5% in all the instar 2 aphids collected from field. This can prove that soybean aphid have the phenomenon of deformed paedogenesis. However, whether the aphids of nymph pregnancy and mature pregnancy have the same number of instar in one generation need research further.

3. Conclusions

3.1 A generation development of soybean aphid has 4 instars.

3.2 Number of antennal segment, shape of cauda, relative length of siphunculus, cauda and existence of medithorax paranal folk in apterous aphid are recognized easy morphological characteristics to distinguish different instar aphids.

3.3 Winged nymph appears in 3rd instar aphid.

3.4 Soybean aphid has phenomenon of deformed paedogenesis

Reference

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