

STUDIES ON THE DIAPAUSE OF THE BLOTCH  
LEAF-MINER OF WHEAT, *AGROMYZA NIGRIPES*  
(MEIGEN) AND ITS BRACONID PARASITOID,  
*DACNUSA NIPPONICA* TAKADA IN EGYPT

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**Abstract**

The diapause of the blister leafminer *Agromyza nigripes* was studied together with its parasitization by *Dacnusa nipponica*. It was found that (99%) of puparia went into diapause by the end of wheat growing season. Flies emerged in two successive seasons (1993-1995), (1994-1996) and (1995-1997) and the majority (92.9%) emerged in the first diapause season. The emergent period was prolonged from late November until late March with two peaks; by the third week of December and the first week of March. The parasitoid *D. nipponica* was found to follow the same pattern of the host emergence. It increased progressively with a distinct peak by the second week of February. This correlation of emergence is highly important for biological control. Parasitism of live puparia was generally higher on diapause puparia than active ones. The highest value of actual total parasitism was 82.9% on the puparia collected in the third week of March.

**INTRODUCTION**

The blotch or blister leafminer, *Agromyza nigripes* (Meigen) attacks wheat and barley in Egypt. The braconid parasite *Dacnusa nipponica* Takada has been found to attack the puparia of this pest (El-Serwy, 1994a). Larvae usually pupate in the soil and plant debris during the wheat growing season. Some adults of host and parasitoid emerged from the active puparia, while the remained ones go into diapause. Few authors contributed to the incidence of parasitism and synchronization between the emergence times of host and parasitoid on diapaused puparia of other agromyzid species (Oatman, 1960; El-Serwy and Al-Azawi, 1991; El-Serwy, 1993 and 1994b). The present study aims to have a detailed knowledge of the diapause and parasitism by *D. nipponica* on *A. nigripes* puparia.

**MATERIALS AND METHODS**

Infested leaves of untreated wheat (Gemmeiza 1 variety) were collected at

weekly intervals from 10 March until 7 April at El-Gemmeiza Agric. Res. Sta., Gambia Governorate, during 1992-1995 wheat growing seasons. On each collection date, the vegetative leaves were taken on a paper sheet to the laboratory. Puparia were collected daily and placed into a glass container. Emerged adults of host and parasitoid from active puparia were collected, counted and excluded. The puparia that did not give rise to adults after a month of pupation were considered in diapause. They were collected, counted and placed into a new glass container. Daily inspection was made and the emerged adults of host and parasitoid were collected, identified and recorded during 1993-1997 diapause seasons.

## RESULTS AND DISCUSSION

**1. Rate of diapause:** In each season, rate of diapause is calculated by dividing the total number of diapause puparia by the total number of collected puparia, multiplied by 100.

Data in Tables 1,2 and 3 show that the total number of diapause puparia were 2344, 5893 and 3375 which accounted for 98.9,99.1 and 98.7% of the total number of collected puparia during the wheat growing seasons 1992-1993, 1993-1994 and 1994-1995. General rate of diapause was about 99%.

**2. Duration of diapause:** It will be seen from Tables 1,2 and 3 that the total number of live diapause puparia; represented by emerged adults of *A.nigripes* and *D.nipponica*; were 296, 635 and 691 which accounted for 12.6, 10.7 and 20.5% of the total number of diapause puparia in 1993, 1994 and 1995, respectively. Flies emerged in two successive seasons and the majorities 98, 86.9 and 97.9% emerged in the first diapause seasons 1993-1994, 1994-1995 and 1995-1996, respectively. Wasps of parasitoid followed the same pattern of emergence, with values in respective 89.9, 94 and 98.1%. The general rate was (92.9%) for host and was (95.3%) for braconid wasp.

**3. Distribution of numbers of host and parasitoid adults during:**

**3.1. The first diapause seasons:** Data in Tables 1,2 and 3 indicate that the total number of emerged adults was 1537, with percentages of 22% and 78% for host and parasitoid in the first diapause seasons 1993-1996. Distribution of these numbers are histographically illustrated in Fig. 1a and b.

Flies emerged in two cyclic periods separated with a latent period and the ma-

jority (88.2%) emerged in the first ones, Fig. 1a. In the first cycle, it began by early December 1993 and 1994 and continued until the third and first weeks of January 1994 and 1995, with a distinct peak by the third week of December in both years. In 1995-1996 season, it emerged and peaked earlier a week than two first diapause seasons which the emergent period lasted by late December. Adults resumed its emergence again, after a latent period ranged between 4-7 weeks, by late February and peaked by early March 1994, 1995 and 1996. The emergence period prolonged until late March in the two first diapause seasons.

Synchronization was found between the emergence times of host and parasitoid at the beginning of the first emergent periods, Fig. 1b.

Adults of parasitoid increased progressively and continued until late March 1994 and 1995 and mid-March, 1996. A distinct peak was found by the first week of March, the fourth week of February and the second week of February, respectively. The highest numbers were 102,332 and 456 in February which accounted for 58.5, 76.6 and 78% of the total number of emerged adults during 1993-1994, 1994-1995 and 1995-1996 seasons, respectively.

**3.2 The second diapause seasons:** It is evident from the data obtained in Tables 1,2 and 3 and illustrated in Fig. 2a and b that adults of host and parasitoid emerged in individual numbers even synchronization between its emergence times was hardly to be observed in the second diapause seasons 1994-1997. The total numbers of emerged adults of host flies and parasitoid wasps were 26 and 59 with percentages of 30.6 and 69.4%, respectively. The highest numbers were in respective 19 and 38 in February.

**4. Parasitism:** The actual percentage of parasitism on puparia; represented by emerged adults of host and parasitoid, is calculated by dividing the number of emerged parasitoids by the total number of emerged adults of host and parasitoids, multiplied by 100.

Data in Tables 1,2 and 3 show that parasitism was generally higher on diapause puparia than active ones, with general rate of 77.5 and 13.4%, respectively. The actual total parasitism were 63.5, 68.9 and 81% among puparia collected during the wheat growing seasons 1992-1993, 1993-1994 and 1994-1995, respectively. General rate was 73.1%. The highest rates were in respective 84.4, 71.4 and 85% in the third week of March, with general rate of 82.9%.

These results lead to the conclusion that 99% of puparia went into diapause by the end of wheat growing season. Adults emerged from diapause puparia was somewhat lower (3.1%) for host and (10.8%) for parasitoid. It emerged in two successive seasons and the majorities 92.9 and 95.3% of host and parasitoid emerged in the first diapause season. Flies emerged in two periods from late November until the third week of January and from late February until late March with two peaks; by the third week of December and the first week of March. The majority (88.2%) emerged in the first ones. The parasitoid followed the same pattern of emergence. It increased progressively with a distinct peak by the third week of February. However, both adults emerged in a few number in the second diapause season. The highest value was (73.1%) for host and was (64.4%) for parasitoid by February. It is, apparently, that flies emerged early from the seasonal diapause puparia are considered to be the main source of infestation in the new coming wheat season. It appeared in high population accompanied with insufficient numbers of parasitoid which deposited its eggs on the wheat leaves at tillering and stem extension of developmental plant stages. Duration of this winter generation is prolonged and discernable effect. However, adults of the second generation emerged from the active puparia of the first generation as well as those emerged late from seasonal or bi-seasonal diapause puparia which infested flag leaves at heading stage and can be resulting in considerable losses. Therefore, parasitoids can regulate the high numbers of host during March and early April, with a general actual total parasitism of 73.1%. The highest value was 82.9% of the puparia collected in the third week of March. To converse and promote the natural enemy *D.nipponica* and avoid excessive insecticidal applications, cultural control, i.e. high yielded and less susceptible varieties, intercropping system of wheat with two-rows barley and other agricultural practices are recommended as safe methods (El-Serwy 1996, 1997 and 1998).

Table 1. Numbers of collected and diapause puparia, emerged adults of *A. nigripes* and *D. nipponica* from active and diapause puparia and total percentage of parasitism during 1992-1995 seasons.

Date of Collection	Total no. of Co-lected puparia	No. of emerged adults from active puparia for:		No. of diapause puparia	No. of emerged adults from diapause during:					Total no. of emerged adults from active and diapause puparia	Parasitism %
		H	P		1993-1994 season 1994-1995 season						
10/3/1993	96	2	1	93	H	P	H	H	H	P	38.9
17/3/1993	229	3	1	225	8	17	0	0	11	18	62.1
24/3/1993	1303	4	2	1297	18	115	2	13	24	130	84.4
31/3/1993	407	2	6	399	33	13	0	0	35	19	35.2
7/3/1993	334	4	0	330	32	23	0	7	36	30	45.4
Total	2369	15	10	2344	100	174	2	20	117	204	
%		1.1		98.9	12.7						63.5

H = Adults of *A. nigripes* and P = Adults of *D. nipponica*.

Table 2. Numbers of collected and diapause puparia, emerged adults of *A.nigripes* and *D.nipponica* from active and diapause puparia and total percentage of parasitism during 1993-1996 seasons.

Date of Collection	Total no. of Collected puparia	No. of emerged adults from active puparia for:		No. of diapause puparia	No. of emerged adults from diapause during:						Total no. of emerged adults from active and diapause puparia		Parasitism %
		H	P		1994-1995 season			1995-1996 season			H	P	
					H	P	P	H	H	P			
10/3/1994	668	23	2	643	32	113	6	15	61	130	68.1		
17/3/1994	499	9	1	489	12	40	2	5	23	46	66.7		
24/3/1994	1659	6	0	1653	17	76	9	4	32	80	71.4		
31/3/1994	2931	7	2	2922	78	203	5	4	90	209	69.9		
7/3/1994	186	0	0	186	7	7	0	0	7	7	50.0		
Total	5943	45	5	5893	146	439	22	28	213	472			
%		0.9		99.1	12.7							68.9	

Table 3. Numbers of collected and diapause puparia, emerged adults of *A. nigripes* and *D. nipponica* from active and diapause puparia and total percentage of parasitism during 1994-1997 seasons.

Date of Collection	Total no. of Collected puparia	No. of emerged adults from active puparia for:		No. of diapause puparia	No. of emerged adults from diapause during:						Total no. of emerged adults from active and diapause puparia		Parasitism %
		H	P		1995-1996 season			1996-1997 season			H	P	
					H	P	H	P	H	P			
10/3/1995	137	6	0	131	1	38	0	1	7	39	84.8		
17/3/1995	297	14	0	583	7	92	2	10	23	102	81.6		
24/3/1995	2284	15	1	2268	58	414	0	0	73	415	85.0		
31/3/1995	275	5	0	270	11	37	0	0	16	37	69.8		
7/3/1995	126	3	0	123	16	4	0	0	19	4	17.4		
Total	3419	43	1	3375	93	585	2	11	138	597			
%		1.3		98.7	25.0							81.0	

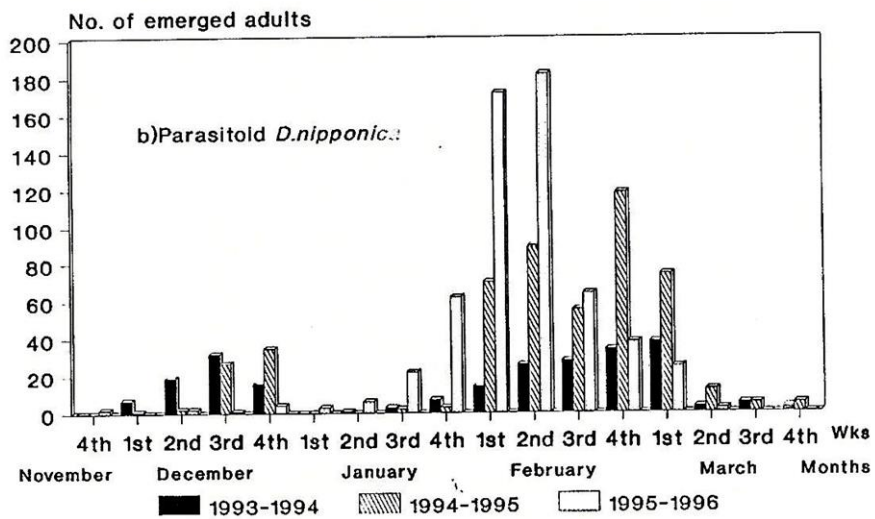
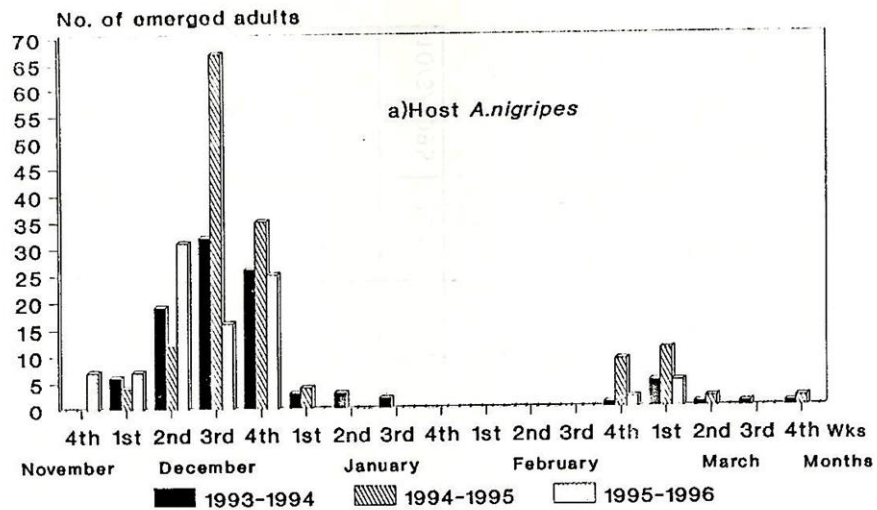


Figure 1. Distribution of numbers of emerged adults of host *A. nigripes* (a) and parasitoid *D. nipponica* (b) during the first diapause seasons 1993-1994, 1994-1995 and 1995-1996.



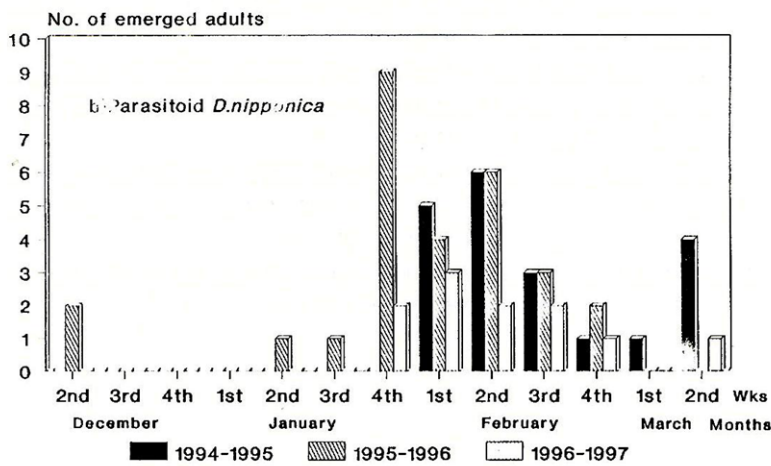
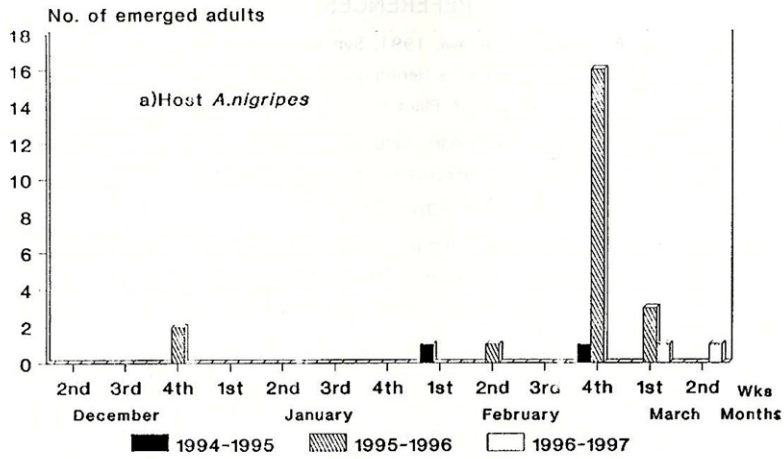


Figure 2. Distribution of numbers of emerged adults of host *A. nigripes* (a) and parasitoid *D. nipponica* (b) during the second diapause seasons 1994-1995, 1995-1996 and 1996-1997.

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دراسة عن السكون لصانعة أنفاق أوراق القمح *Agromyza nigripes*  
(Meigen) والتطفل بالطفيل *Dacnusa nipponica*

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درس السكون لصانعة أنفاق أوراق القمح *Agromyza nigripes* من عائلة Agromyzidae ورتبة ذات الجناحين والطفيل *Dacnusa nipponica* من عائلة Braconidae ورتبة غشائية الأجنحة. وجد أن ٩٩٪ من العذارى تدخل السكون فى نهاية موسم نمو القمح. لوحظ خروج الذباب فى موسمين متعاقبين (١٩٩٣ - ١٩٩٥)، (١٩٩٤ - ١٩٩٦) و (١٩٩٥ - ١٩٩٧) وأن أغلبيته (٩٢,٩٪) خرجت فى الموسم الأول للسكون وإمتدت فترة الخروج من أواخر نوفمبر حتى أواخر مارس مع وجود ذورتان (فى الأسبوع الثالث من ديسمبر والأسبوع الأول من مارس). كما وجد أن الطفيل إتبع نفس أسلوب الخروج حيث يزداد إضطرابا حتى يصل ذروته فى الأسبوع الثانى من فبراير. هذا التوافق فى الخروج له أهمية كبرى فى المكافحة الحيوية. كما وجد أن التطفل على العذارى الحية يكون مرتفعا بصفة عامة على العذارى الساكنة مقارنة بالعذارى النشطة. وكانت أعلى قيمة للتطفل الكلى الفعلى ٨٢,٩٪ على العذارى التى جمعت فى الأسبوع الثالث من مارس.