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INFESTATION FEATURES OF THE LEAF MIDRIB MINER, *COSMOPTERIX PARARUFELLA* RIEDL, (LEPIDOPTERA : COSMOPTERIGIDAE), A NEW PEST ON SUGARCANE IN EGYPT

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Abstract

Cosmopterix pararufella Riedl (Lepidoptera: Cosmopterigidae) is a new recorded pest species on sugarcane, *Saccharum officinarum* L., in Egypt. At Al-Aiat region in Giza govenorate, was sampled from May to December in 2001 and 2002. Eggs are laid individually on the outer margins of the upper surface of the leaf midrib. Newly hatched larvae mine into the midrib feed on tissue leave brown tunnels with longitudinal patches on the other side results in easily broken of leaves which turned yellow and drying early. Mining tunnels extend from thin lines to wide as larvae move forward feeding and growing up. At the terminal end of mine, the full-grown larvae pupated in a chamber with covered circular opening for moth emergence. Moths developed from overwintering larvae are considered the main source of the new infestation by early May on ratoons in the old infested fields. Infestation reached 15.8 and 12.3% by late May and continued until late December with a peak of 28.5 and 24.6% by the first and the third weeks of June in the new growing fields in 2002 and 2001. In general, infestation rates were 9 and 9.5% and increased to 15.4 and 16% on infested plants in 2001 and 2002 with 106 mining tunnels/100 infested leaves in both years. The highest mine densities and infestation intensities113 and 114/100 infested leaves and 22.6 and 30.7% were recorded during the second half of May-early June and the first three weeks of June. Mining tunnels ranged between 1- 4 per infested leaf and distributed on the ten upper leaves. Leaves of 1 and 2 mines accounted for 94.5 and 5.2% of the total mines and the second leaf on the sugarcane plant received the highest midrib miner infestation 29.3%. Negative relationship was detected between the number of leaves on sugarcane plant and the degree of infestation by the midrib miner. Plants of 3 and 4 leaves harboured the highest infestation rates (36% and 35.6%) in both seasons of study.

INTRODUCTION

The leaf midrib miner *Cosmopterix pararufella* Riedl is a new pest species attacking sugarcane, *Saccharum officinarum* L., cultivations at Al- Aiat and Atfieh in Giza govenorate. Moths reared from sugarcane were submitted to identification by Dr. K. Sattler (The Natural History Museum, London, UK) in December 2000. He reported that

the specimens probably *Cosmopterix* sp. or possibly *Labdia* sp. (Lepidoptera: Gelechioidea: Cosmopterigidae). It did not contain one of three known species on sugarcane: (*Cosmopterix dulcivora* Meyrick) in Fiji and Indonesia, (*Cosmopterix ingeniosa* Meyrick) in West Malaysia and (*Cosmopterix pallifasciella* Snellen) in Indonesia. He suggested contact Dr. Sergey Yu. Sinev (Zoological Institute of the Academy of Sciences, St. Petersburg, Russia) the specialist of this group. Dr. Sinev identified the specimensas *Cosmopterix pararufella* Riedl in February 2001. He reported that the biology of this species was unknown yet and recently described from Tunisia by Riedl (1976).

Several lepidopterous leaf miner species as *Cosmopterix phyllostachysae* Kuroko (Cosmopterigidae), on *Phyllostachys heterocyla* (Carr.); *Glyphipterix simpliciella* (Stephens), (Glyphipterigidae), on *Dactylis glomerata* L. and *Caloptilia stigmatella* (Fabricius), *Phyllonorycter pastorella* (Zeller) and *Paraleucoptera sinuella* Reutti (Lyonetiidae) on *Salix miyabeana* Seemen were recorded (Togashi, 1974; Abdullah *et al*, 1989; Kagata and Ohgushi, 2001).

The present study aimed to obtain new information on nature, incidence and intensity of infestation of the leaf midrib miner *C. pararufella* in sugarcane fields in Al-Aiat.

MATERIALS AND METHODS

Four untreated sugarcane fields (one feddan each) were selected at Al-Aiat, Giza Govenorate. Thousand leaves were visually examined on the stand randomly-selected plants at weekly intervals from May 23 to December 26, except samples of September 5, 2001 and October 3, 2002 were unrecorded. In each inspection date, leaves classed as infested and non-infested. The characteristics of infestation were mining tunnels with red- browny color on the upper surface of the leaf midrib and appear of longitudinal dried slits on the other side midrib vein.

To assess intensity of infestation and mining tunnels density in each inspection date: fifty plants showing leaves infestation were selected. For each plant, the total number of vegetative leaves, number of infested leaves and its serial number on the plant and number of tunnels per leaf were recorded. To study the nature of infestation

in the different assessments, infested leaves were detached, dissected and examined by the aid of stereomicroscope.

RESULTS AND DISCUSSION

1. Nature and Symptoms of Infestation: Under field conditions, female moth laid her eggs individually on the upper leaf surface at the outer margins of the leaf midrib especially at the third upper part of the leaf blade. Newly hatched larvae mine the outer margin of the midrib eating tissue results in narrow tunnel, Fig. 1 a. The caterpillar crossed to the other side of the midrib results in transverse mine which repeating the same behavior, Fig. 1 b. Then, the mine widened as the caterpillar feeding and growing up, Fig. 1 c and d. This feeding habit results in red- brown tunnels on the upper side of the leaf midrib and longitudinal dry patches or slits on its other side, Fig. 2 a and b. The caterpillar running deeply in the thick midrib or eating all tissues of the thin midrib. Wet green faeces deposited continuously, which dried and changed into brown in early-formed tunnels or became white in late one. At the terminal end of the tunnel which are free from faeces, the full-grown larvae turning their body to the opposite direction. Then, made a pupation chamber with circular cover opening at the ending of deposited faeces, Fig. 3. The circular opening usually found at the basal part of infested leaves and sometimes in the other two parts of young infested leaves or when the caterpillar-feeding behavior changed in the hard tissues of old infested leaves. Cannibalism found and the post larvae killed the front one when reach it, however, two circular openings can be found per leaf when meetings not occurred. Full grown larvae, pupae and moth are shown in Fig. 4 a, b and c. The mined leaves turn yellowish and drying.

2. Incidence of Infestation: Infestation started by early May on the new ratoons in the old infested sugarcane fields and continued until late December with general mean of 9 and 9.5% in 2001 and 2002 years. In the first new growing ratoons, infestation rates were 15.8 and 12.3% by the third week of May, then increased to reach a maximum of 28.5 and 24.6% by the first and third weeks of June in 2002 and 2001, respectively. It decreased gradually to reach 4% by the third week of October in both years. Infested leaves were 5 and 3.6% by late October and increased to 6.8 and 8.5% by late November and December in the second field in 2002 and 2001, respectively.

3. Intensity of Infestation: The number of infested leaves per plant and number of tunnels per infested leaf can express intensity of infestation. Data in Table 1 indicate that the general means of infested leaves were 15.4 and 16% in 2001 and 2002 with a mean of 106 mining tunnels / 100 infested leaves in both years. The first and the third weeks of June attained the highest infestation rates, reaching 36 and 27.7% in 2001 and 2002, respectively. However, late May and early June recorded a maximum of 116 and 118 mining tunnels/100 infested leaves in the first and the second years. Number of tunnels 1, 2, 3 and 4 were recorded on 2025, 114, 7 and 1 infested leaves in 2001. The corresponding numbers in 2002 were 2035, 109, 6 and 1, respectively. The total number of 1 and 2 mining tunnels accounted for 94.3, 94.6% and 5.3, 5.1% of the total number of tunnels in 2001 and 2002, respectively. Tunnels were found on the ten infested upper leaves and distribution numbers in 2001 and 2002 are tabulated in Table 2. Majority of tunnels 84.3 and 74.2% were found on the three infested lower leaves and the highest values 32.9 and 27.6 % were observed at the first and the second infested leaves in 2001 and 2002, respectively. Infestation was markedly decreased by increasing the number of leaves per plant as an indicator of plant age. Significant negative relationship was found between number of leaves per plant and intensity of infestation. The r-value, regression equation and actual and estimated rates in 2001 and 2002 are illustrated in Fig. 5 a and b. The highest actual rates 36 and 35.6% were recorded on the plants of three and four leaves in 2001 and 2002, respectively.

In conclusion, the leaf midrib miner *C. pararufella* found in winter as larvae of different instars in the mining tunnels of the sugarcane midrib leaves. Emerged moths infested the new ratoons in the old infested sugarcane fields by early May and continued in the new fields until late December with a general mean of 9.2%. Maximum means 19.9 and 25.3% occupied with intensities of infestation 22.6 and 30.7% were obtained during the first three weeks of June in 2001 and 2002. Susceptibility of the midrib miner infestation is negatively correlated with the number of leaves on sugarcane plant. It decreases as the sugarcane plants advance in growth during the sugarcane-growing season. However, the highest mining tunnel densities113 and 114/ 100 infested leaves were found early during the last two weeks of May and the first week of June, accordingly. Majority of leaves 94.5% had one mining tunnel per leaf and 29.3% of the total

mines occurred on the second leaf of the plant. It is apparently that moths preferred the young vegetative leaves for oviposition and hatched larvae mined into the midrib vein and feed inside, causing damaged midrib and drying leaves, especially in early season. Sinev (1997) reported that the genus *Cosmopterix* numbers more than 200 species described species and the trophic relations were studied for less than 10% of species. *C. dulcivora* and *C. pallifasciella* slightly damage sugarcane in SE Asia. More studies on the biology and natural enemies are needed.

ACKNOWLEDGMENT

The author wishes to thank Dr. K. Sattler (The Natural History Museum, London, UK) and Dr. Sergey Yu. Sinev (Zoological Institute of the Academy of Sciences, St. Petersburg, Russia) for primary and final identification of *Cosmopterix pararufella* Riedl.

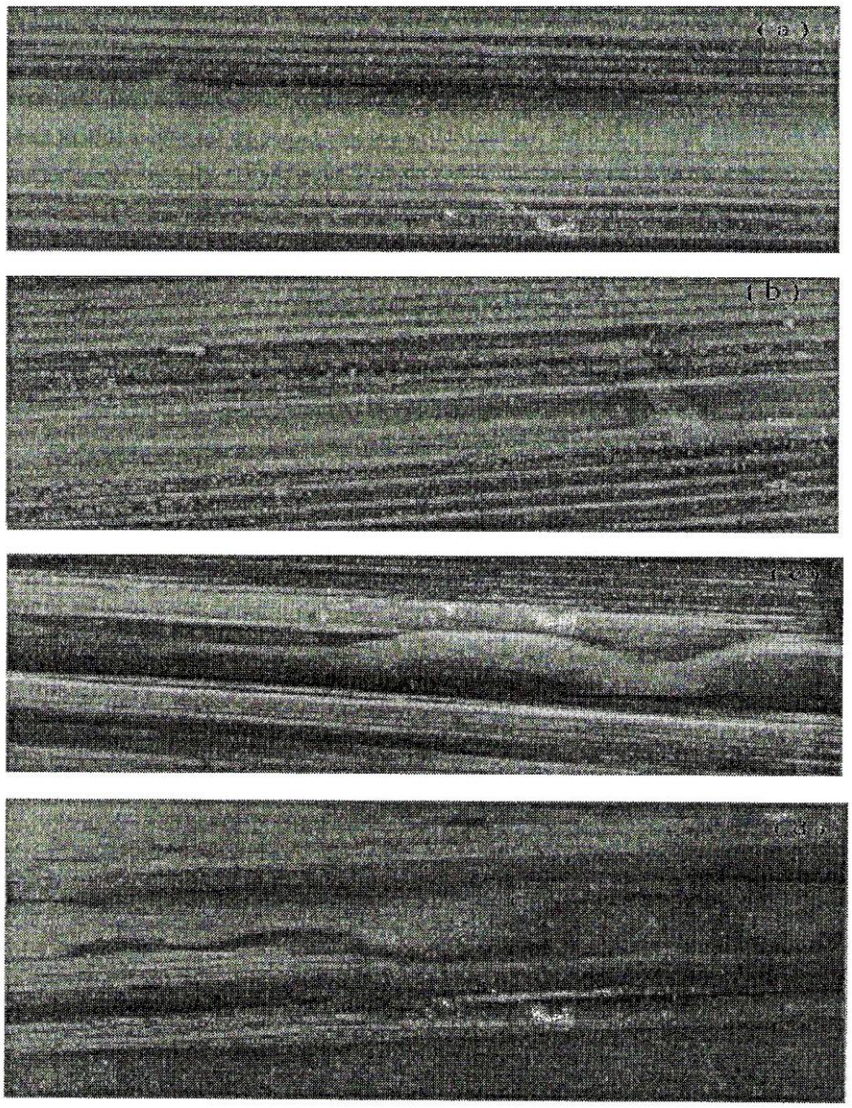

Fig. 1. Narrow (a), transverse (b) and wide (c), (d) mining tunnels of *C. pararufella* on the upper surface of sugarcane leaf midrib.

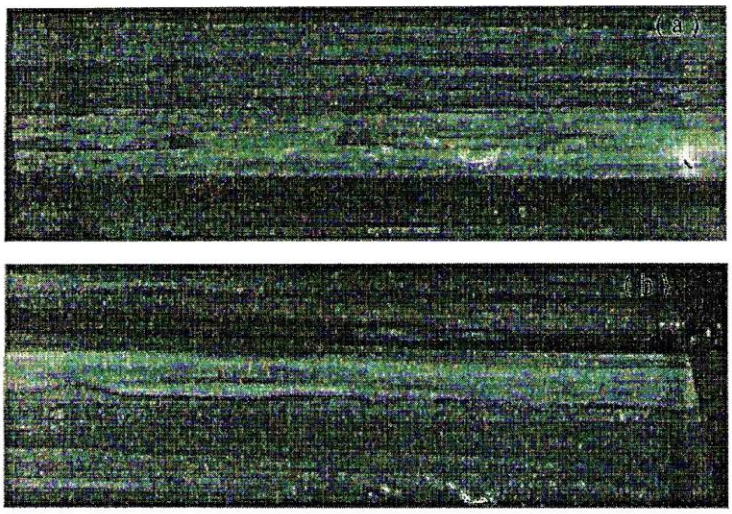

Fig. 2. Longitudinal patches (a) and dried midrib (b) of *C. pararufella* on lower surface of the sugarcane leaf midrib.

Fig. 3. Covered circular opening at the terminal end of mining tunnel.

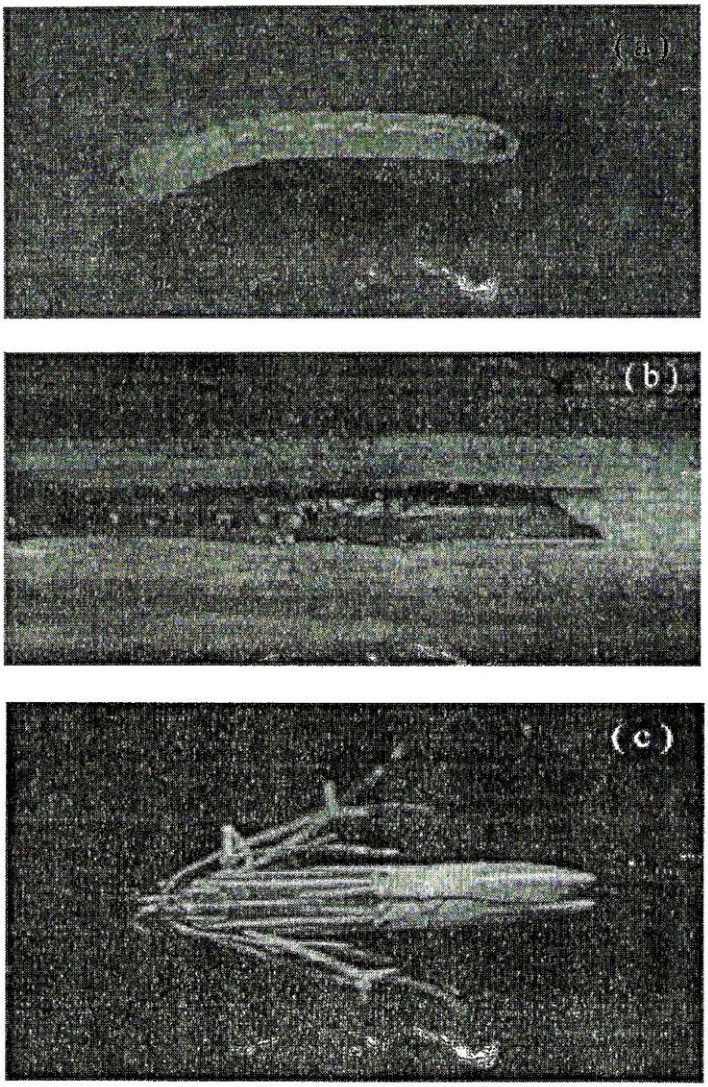

Fig. 4. Full grown larvae (a), pupa inside the mining tunnel (b) and moth (c) of *C. pararufella*.

Table 1. Total no. of infested and non-infested leaves per 50 plants and average number of mining tunnels per 100 infested leaves during May- December in 2001 and 2002 years.

Year		2001					2002				
Sampling date		Total no. of leaves/ 50 plants			Total	No. of	Total no. of leaves/ 50 plants			Total	No. of
Month	Day	Non-infested	Infested	%	no. of mined tunnels	mined tunnels / 100 infested leaves	Non-infested	Infested	%	no. of mined tunnels	mined tunnels / 101 infested leaves
May	23	304	71	18.9	79	111	237	76	24.3	87	114
	30	275	79	22.3	92	116	233	79	25.3	87	110
June	6	325	75	18.8	83	111	215	121	36	143	118
	13	264	71	21.2	78	110	277	116	29.5	127	109
	20	263	101	27.7	109	108	314	113	26.5	129	114
	27	300	87	22.5	93	107	380	106	21.8	111	105
July	4	328	72	18	79	110	378	88	18.9	101	115
	11	333	71	17.6	77	108	397	78	16.4	81	104
	18	377	76	16.8	81	107	391	80	17	80	100
	25	426	76	15.1	86	113	401	70	14.9	71	101
August	1	401	80	16.6	91	114	340	67	16.5	69	103
	8	418	78	15.7	87	112	393	62	13.6	63	102
	15	334	69	17.1	76	110	432	61	12.4	64	105
	22	358	68	16	69	101	420	56	11.8	57	100
	29	416	59	12.4	63	107	447	58	11.5	61	106
September	5	Uncollected					448	66	12.8	66	104
	12	417	71	14.5	74	104	430	54	11.2	57	102
	19	477	59	11	60	102	456	56	10.9	58	100
	26	511	55	9.7	56	102	496	55	10	56	102
October	3	519	53	9.3	53	100	Uncollected				
	10	514	52	9.2	52	100	540	56	9.4	56	100
	17	522	56	9.7	56	100	492	54	9.9	55	102
	24	536	56	9.4	58	104	514	52	9.2	52	100
	31	555	67	10.8	71	106	315	55	14.9	57	104
November	7	502	67	11.8	67	100	344	59	14.6	62	105
	14	515	66	11.3	69	105	374	54	12.6	54	100
	21	532	60	10.1	60	100	387	61	13.6	63	103
	28	412	72	14.9	72	100	316	67	17.5	71	106
December	5	450	67	12.9	67	100	365	61	14.3	64	105
	12	351	68	16.2	70	103	373	58	13.5	59	102
	19	262	71	21.3	75	106	343	56	14	57	102
	26	289	74	20.4	75	101	364	56	13.3	57	102
Total		12486	2147		2278		11812	2151		2275	
Mean		402.8	69	15.4	73.5	106	381	69	16	73.4	106

Table 2. Distribution number of *C. pararufella* mining tunnels on the ten upper leaves of infested sugarcane plants in 2001 and 2002 years.

No. of the ten upper leaves on the plant	Distribution no. of mining tunnels during			
	2001		2002	
	No.	%	No.	%
1	750	32.9	481	21.1
2	709	31.1	627	27.6
3	462	20.3	581	25.5
4	208	9.1	316	13.9
5	88	3.9	177	7.8
6	36	1.6	63	2.8
7	14	0.6	24	1
8	7		4	
9	2	0.5	1	0.3
10	2		1	
Total	2278		2275	

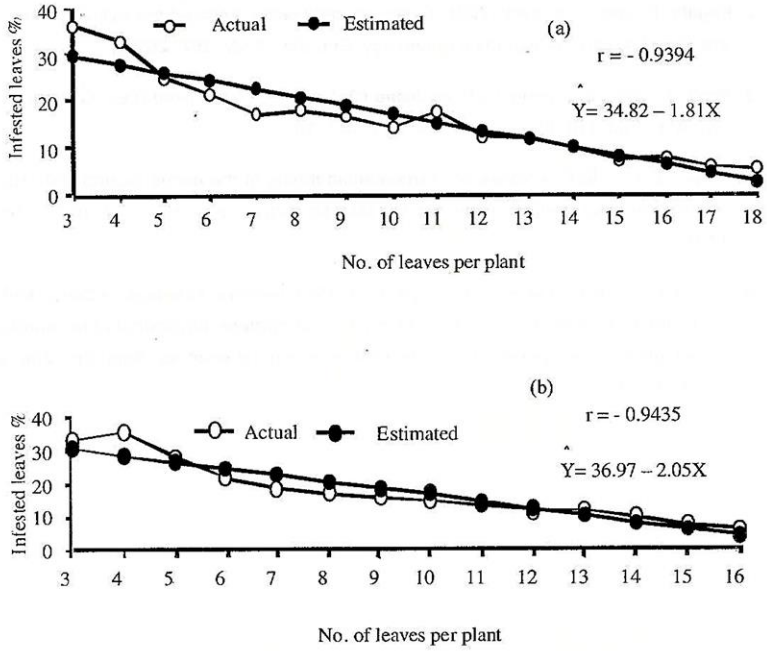

Fig. 5. Relationship between no. of leaves per plant and infestation by the leaf midrib miner *C. pararufella* in 2001 (a) and 2002 (b) years.

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ملامح الإصابة بصانعة أنفاق العرق الوسطى للأوراق *COSMOPTERIX PARARUFELLA* RIEDL, كآفة جديدة على قصب السكر في مصر

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سجلت صانعة أنفاق العرق الوسطى للأوراق *Cosmopterix pararufella* Riedl من عائلة ورتبة حرشفية الأجنحة كآفة جديدة على القصب في مصر. أخذت العينات من Cosmopterigidae منطقة العياط في محافظة الجيزة من مايو إلى ديسمبر في عامي ٢٠٠١ و ٢٠٠٢ . أشا رت النتائج المتحصل عليها إلى أن البيض يوضع فرديا على الحواف الخارجية للعرق الوسطى على السطح العلوي للورقة. تحدث اليرقات الحديثة الفقس نفقا في العرق الوسطى وتتغذى عل أنسجته تاركة أنفاق بنية اللون يقابلها شقوق طولية على السطح السفلي للعرق الوسطى وينتج عنها سهولة كسرالأوراق واصفرارها وجفافها المبكر. تمتد الأنفاق من خيوط رفيعة إلى عريضة نتيجة لتغذية ونمو اليرقات وحركتها إلى الأمام. فى النهاية الطرفية للنفق، تعمل اليرقات التامة النمو حجرة مبطنة للتعذير ذات فتحة دائرية مغطاة مهيأة لخروج الفراشات. تعتبر الفراشات الخارجة وألتي تعبر يرقاتها فترة الشتاء المصدر الرئيسي لاصابة الخلفات الجديدة في حقول القصب القديمة الإصابة في أوائل مايو. تصل الإصابة ١٥,٨ و ١٢,٣٪ في أواخر مايو وتستمر حتى نهاية ديسمبر وتصل ذروتها ٢٨,٥ و ٢٤,٦٪ في الأسبوعين الأول والثالث من يونيو على النموات الجديدة في حقول القصب كما حدث في سنوات ٢٠٠٢ و٢٠٠١ . كانت معدلات الإصابة بصفة عامة ٩ و ٩,٥٪ ازدادت على النباتات المصابة إلى ١٥,٤ و ١٦٪ في عامي ٢٠٠١ و ٢٠٠٢ بينما وجد ١.٦ نفق/ ١٠٠ ورقة مصابة في كلا العامين. سجل أعلا كثافة للانفاق١١٣ و ١١٤ لكل ١٠٠ ورقة مصابة وشدة إصابة ٢٢,٦ و ٣٠,٧٪ خلال النصف الأخير من مايو وأوائل يونيو وكذلك الثلاث أسابيع الأولى من يونيو. تراوح عدد الأنفاق مابين ١-٤ لكل ورقة مصابة وتوزعت على العشرة أوراق العليا للنبات. تمثل الأوراق التي عليها ١ و ٢ نفق ٩٤,٥ و ٥,٢٪ من مجموع الأنفاق وتصل أقصاها ٢٩,٣٪ على الورقة الثانية. وجد علاقة عكسية بين عدد الأوراق على النبات وشدة الإصابة حيث تزداد بنقص عدد الأوراق على النبات. كانت أعلى نسبها ٣٦ و ٣٥,٦٪ على النباتات ذات ٣ و٤ أوراق في عامي ٢٠٠١ و ٢٠٠٢ .