台灣昆蟲 21: 321-328 (2001)
Formosan Entomol. 21: 321-328 (2001)

馬氏捕植蟎及少毛捕植蟎捕食南黃薊馬之生活史和捕食量

何琦琛* 陳文華 農委會農業試驗所應用動物系 臺中縣霧峰鄉中正路189號

摘 要

在28℃及13L:11D光照下，幼期取食神澤氏葉蟎(*Tetranychus kanzawai* Kishida)卵、成期取食南黃薊馬(*Thrips palmi* Karny)一齡幼蟲，馬氏捕植蟎(*Amblyseius maai* Tseng)雌和雄性的發育期分別為6.5及5.9天；交尾雌成蟎壽命40.2天，捕食薊馬幼蟲80.2隻，產卵22.6粒；未交尾雌蟎不產卵，壽命21.9天，捕食薊馬幼蟲24.3隻；雄蟎壽命17.5天，捕食薊馬幼蟲13隻。相同條件下，少毛捕植蟎(*A. asetus* (Chant))全為雌性個體，為產雌孤雌生殖。發育期5.8天，成蟎壽命24.5天，捕食薊馬幼蟲90.2隻，產卵43.5粒。少毛捕植蟎具有用以防治薊馬的潛力，馬氏捕植蟎常在茄園南黃薊馬族群中發現，應當扮演有抑制薊馬族群的角色。

關鍵詞：捕植蟎、薊馬、生活史、捕食量。

前 言

薊馬類為農作物上難防治之小型害蟲之一，體小、繁殖快，往往發生至極高數量，對農作物造成重大危害，利用天敵來壓抑薊馬族群乃成為被積極探討之題材。利用於防治薊馬之天敵，主要為小黑花椿象(*Orius*)類(Wang, 1994)及*Neoseiulus cucumeris* (Oudemans), *Amblyseius degenerans* (Berlese), *A. hibisci* (Chant), *A. barkeri* (Hughes) 等捕植蟎類(Ramakers and van Lieburg, 1982; Tanigoshi and Griffiths, 1982; Tanigoshi *et al.*, 1984; De Klerk and Ramakers, 1986; Hansen, 1988; Taborsky *et al.*, 1988; Lindqvist and Tiitanen, 1989; Hoy and Glenister, 1991; Riudavets, 1995)。這些捕植蟎均未發現於臺灣，而臺灣本地產之捕植蟎中，必亦有能捕食薊馬之種類，Hua (1999)及Riudavets (1995)所整理出的捕食薊馬的捕植蟎種類即超出上述種類甚多。筆者田野經驗中也發現有捕植蟎捕食薊馬，乃將所見之種類及可能會捕食之種類於實驗室中測試其對南黃薊馬的捕食情形，其中少毛捕植蟎(*A. asetus* (Chant))及馬氏捕植蟎(*A. maai* Tseng)的表現較佳，乃將其以南黃薊馬為食物時之發育、壽命、產卵及捕食量發表於本文，以助益於瞭解本地捕植蟎在抑制南黃薊馬族群上的貢獻。

材料與方法

*論文聯繫人
e-mail:ccho@wufeng.tari.gov.tw

馬氏捕植蟎採自南投縣國姓鄉茄園南黃薊馬族群中，少毛捕植蟎採自農業試驗所農場紫花藿香薊(*Ageratum houstonianum* Mill.)。攜回實驗室後，以神澤氏葉蟎卵混合南黃薊馬幼蟲供食，在以壓克力製成的凹穴片（長7 cm、寬4 cm，凹穴直徑3 cm、深0.3 cm）中行單隻飼育，俟產出後代、取樣製成玻片標本鑑定種類無誤後，合併成為試驗族群。少毛捕植蟎可在培養皿中刷入神澤氏葉蟎卵而飼養。

神澤氏葉蟎係以青皮豆苗飼養；南黃薊馬則參考Huang and Su (1997)的方法，以盆栽茄苗飼養。

取數十隻馬氏捕植蟎供以神澤氏葉蟎卵為食，繁殖為試驗母族群。自此族群挑取十隻雌成蟎，置於直徑4.5 cm之培養皿中，供以神澤氏葉蟎卵。每日將捕植蟎卵挑出，單粒移入凹穴載玻片，亦供以神澤氏葉蟎卵為食。凹穴緣置細吸水紙條，紙條末端垂入盛水皿中，提供濕度以防蟎卵脫水。而後覆上一般載玻片，並以長尾鋏夾緊，防止逃亡。每日觀察記錄發育情形，並適時補充食物。

此外，另在直徑3.5 cm之培養皿中鋪入黑色濾紙，滴水一滴提供濕度，而後置入剪成直徑2 cm之茄葉圓片。俟上述凹穴載玻片內之捕植蟎發育為成蟎後，立即予以配對或單隻移至此茄葉圓片上，並供以5隻第一齡之南黃薊馬幼蟲為食。如適無雄蟎完成發育，則自母族群中挑取雄成蟎配對。培養皿上以保鮮膜封蓋，防止水分散失及捕植蟎逃亡。每日觀察記錄捕食量、產卵量，並補足所消耗之食物，維持為5隻一齡薊馬幼蟲，如有薊馬幼蟲發育成第二齡，則以第一齡幼蟲取代。

對少毛捕植蟎之觀察亦以和馬氏捕植蟎相同的方法進行。經預備試驗熟悉飼養方式後，二種捕植蟎均取50粒以上的卵進行觀察。除觀察時間外，所有參試個體均維持於28℃、13:11（L:D）之定溫箱中。所得結果需統計分析時，以SAS的*t*-test做比較，$\alpha = 0.05$。

結　果

一、馬氏捕植蟎

取食葉蟎卵時，雌性馬氏捕植蟎之發育期6.5天，略長於雄性個體之5.9天，但無顯著差異。成蟎期改供以薊馬一齡幼蟲為食，交尾雌蟎平均壽命為40.2天，5日齡後方有雌成蟎產卵，死亡前亦均有數天未產卵，明顯表現有產卵前期及產卵後期，產卵前期、產卵期及產卵後期分別為7.2、21.2及11.8天(表1)。一生平均產22.6粒卵，相當於日產0.6粒卵(表2)。未交尾雌蟎終生不產卵，成蟎期平均21.9天。雄蟎壽命17.5天。

觀測的馬氏捕植蟎雌成蟎產卵並不穩定，使得每日平均產卵量多在1粒或以下，且起伏不斷。主要產卵期約在第5至第31日齡間，由於逐日之平均產卵量多在1以下，並未表現出明顯的高峰(圖1)。

交尾雌蟎成蟎期平均可捕食南黃薊馬第一齡幼蟲80.2隻，約為每日捕食2隻，產卵期之每日捕食量則略高於此數，為2.5隻；未交尾雌成蟎平均可捕食24.3隻一齡薊馬幼蟲，平均每日1.3隻；雄蟎食量較小，僅捕食13隻一齡薊馬幼蟲，平均每日0.8隻(表2)。

二、少毛捕植蟎

整個試驗期間無論在試驗族群、母族群或觀察個體中，均未發現雄蟎，所有觀察的卵均發育成雌性個體，本種顯然為產雌孤雌生殖(thelyotoky)之種類。

取食葉蟎卵時，發育期5.8天。成蟎期改食薊馬一齡幼蟲，平均壽命為24.5天，產卵前

表一　馬氏捕植蟎各發育時期及壽命之長短

Table 1. Duration (day, mean ± SE) of various stages and longevity of *Amblyseius maai* at 28℃ and 13L:11D

Stage	Female (24)	Male (8)
Egg	1.9 ± 0.1	1.9 ± 0.1
Larva	1.7 ± 0.1	1.5 ± 0.2
Protonymph	1.7 ± 0.1	1.1 ± 0.1
Deutonymph	1.2 ± 0.1	1.4 ± 0.2
Total	6.1 ± 0.2	5.9 ± 0.2
Mated adult	40.2 ± 7.7 (6)	17.5 ± 2.5 (2)
Pre-ovipositing period	7.2 ± 2.1	
Ovipositing period	21.2 ± 3.1	-
Post-ovipositing period	11.1 ± 5.9	-
Non-mated adult	21.1 ± 2.3 (9)	-

Fed with Kanzawa spider mite eggs and first instar larvae of *Thrips palmi* during the developmental period and adult stage, respectively.

Numbers in parentheses indicate the number of individuals observed.

表二　馬氏捕植蟎成蟎捕食南黃薊馬第一齡幼蟲量及產卵量

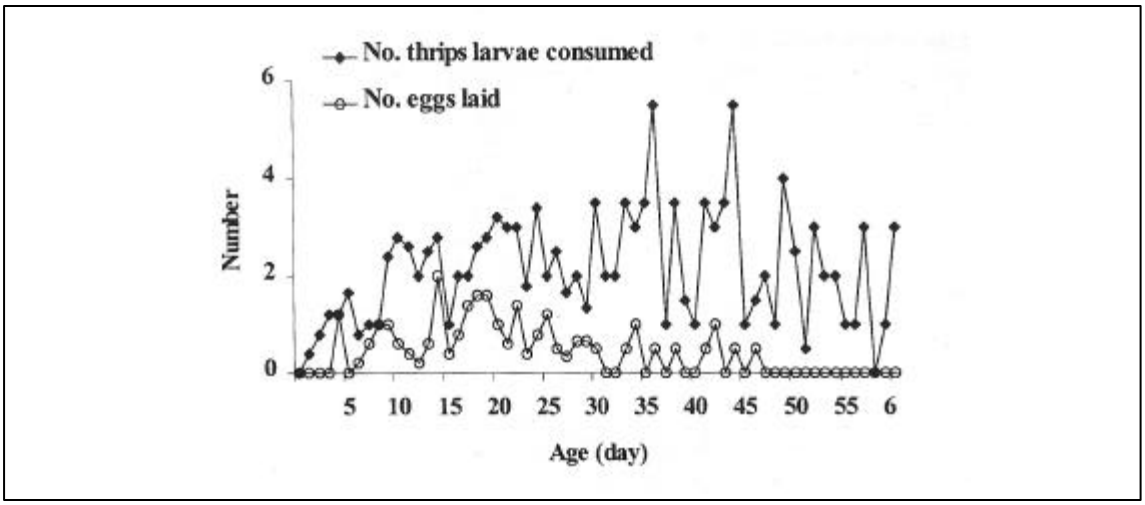
Table 2. Feeding amount and fecundity (Mean ± SE) of adult *Amblyseius maai* at 28℃ and 13L:11D while being fed first instar larvae of *Thrips palmi*

	Mated female	Virgin female	Non-mated male
Daily feeding amount	2.0 ± 0.2	1.3 ± 0.1	0.8 ± 0.1
Total feeding amount	80.2 ± 22.5	24.3 ± 4.5	13.0 ± 3.0
Daily fecundity/female	0.6 ± 0.1	0	-
Eggs/female	22.6 ± 4.6	0	-
No. larval thrips eaten/No. eggs laid	4.4 ± 1.8		

期2.9天，產卵期16.1天，產卵後期5.5天(表3)。所有受測個體在第一日齡均未產卵，產卵前期明顯存在；但許多個體產卵至死亡日，是以產卵後期不一定存在。一生平均產43.5粒卵，每日產卵1.5粒(表4)。產卵有明顯的高原期，約在第4-20日齡(圖2)。成蟲期終生捕食南黃薊馬一齡若蟲90.2隻，平均每日捕食3.8隻。產卵期食量略高，全期捕食72.3隻，平均每日4.5隻。以成蟲期食量計算，平均每捕食2隻薊馬若蟲可產一粒卵，若以產卵期食量計算，則為捕食1.6隻薊馬若蟲可產卵1粒(表4)。

討　論

本文報導的兩種捕植蟲在發育期中似無能力捕捉薊馬幼蟲，即使是第一齡的薊馬幼蟲亦然。初次測試時，僅供以薊馬幼蟲為食物，幼期發育成功率極低，常不能活過前若蟲期。因此，乃改供應神澤氏葉蟎卵為其發育期之食物，進行觀察，至成蟲期方改為以南黃薊馬一齡幼蟲為食物。以此觀之，除南黃薊馬外，兩種捕植蟲應尚有其它種類的食物。筆者過去常於茶樹葉片上之落花下採得馬氏捕植蟲，其個體皆飽滿壯碩，而除花粉外未見可能之食物。此蟲或亦能食花粉，以花粉飼養之試驗當可檢驗此點。筆者目前仍缺乏有關少毛捕植蟲其它食物的資訊，然懷疑其與馬氏捕植蟲可能都會



圖一　馬氏捕植蟎於 28℃及 13L:11D 光周期下捕食南黃薊馬第一齡幼蟲時的每日產卵量與捕食量

Fig. 1.　Daily fecundity and food consumption of adult female *Amblyseius maai* while being fed first instar larvae of *Thrips palmi* at 28℃ and 13L:11D.

捕食細蟲。

兩種捕植蟲在28℃下發育期均為6天上下，與*Neoseiulus cucumeris* (Gillespie and Ramey, 1988; Gillespie, 1989; Castagnoli *et al.*, 1990)及*A. barkeri* (Bonde, 1989)相似；少毛捕植蟲的每日產卵量及捕食量也與前二種相似，但馬氏捕植蟲則較前二種低而不如。因此，在選擇薊馬天敵進行生物防治時，可考慮使用少毛捕植蟲，馬氏捕植蟲則可能不是好的對象，至少對南黃薊馬如此。

然而從另一方面來看，筆者在南投縣茄園調查南黃薊馬的發生時，每每於採回的南黃薊馬族群中發現馬氏捕植蟲，實驗室中也曾觀察到雌成蟲捕食南黃薊馬長成幼蟲，方始觀察其以南黃薊馬為食物時的發育與繁殖，試驗結果證實其確可捕食南黃薊馬而繁殖，雖然食量與產卵量不盡理想。馬氏捕植蟲也是台灣田間常見的捕植蟲，筆者的採集經驗中，此蟲在蔬果

表三　少毛捕植蟎各發育時期及壽命之長短

Table 3.　Duration (Mean ± SE) of various stages and longevity of *Amblyseius asetus* at 28℃ and 13L:11D

Stage	Time (day)
Egg	2.0 ± 0.1
Larva	0.7 ± 0.1
Protonymph	1.2 ± 0.1
Deutonymph	1.8 ± 0.1
Total	5.8 ± 0.2
Adult longevity	24.5 ± 2.2
Pre-ovipositing period	2.9 ± 0.3
Ovipositing period	16.1 ± 1.1
Post-ovipositing period	5.5 ± 1.5

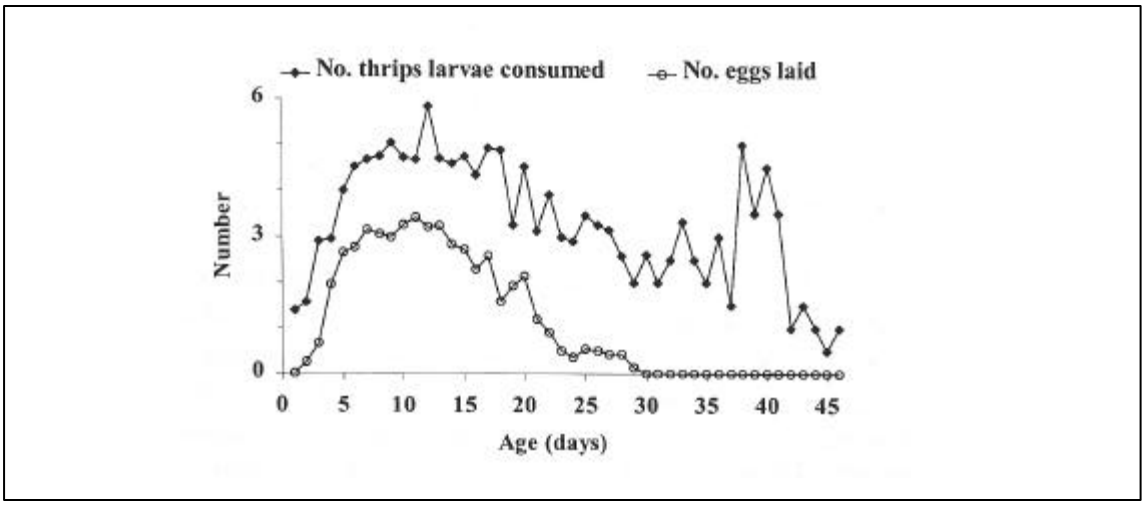
n = 21, fed with Kanzawa spider mite eggs and first instar larvae of *Thrips palmi* during the developmental period and adult stage, respectively.

表四　少毛捕植蟎成蟎捕食南黃薊馬第一齡幼蟲量及產卵量

Table 4. Feeding amount and fecundity (Mean ± SE) of adult *Amblyseius asetus* at 28℃ and 13L:11D while being fed first instar larvae of *Thrips palmi*

	Adult stage	Ovipositing period
Daily feeding amount	3.8 ± 0.3	4.5 ± 0.3
Total feeding amount	90.2 ± 9.5	72.3 ± 6.6
Daily fecundity	1.5 ± 0.1	2.7 ± 0.1
Total fecundity	43.5 ± 3.2	-
No. larval thrips eaten/No. eggs laid	2.0 ± 0.1	1.6 ± 0.1

n = 21



圖二　少毛捕植蟎於 28℃及 13L:11D 光周期下捕食南黃薊馬第一齡幼蟲時的每日產卵量與捕食量

Fig. 2. Daily fecundity and food consumption of adult female *Amblyseius asetus* while being fed first instar larvae of *Thrips palmi* at 28℃ and 13L:11D.

類作物上的發現率高於長尾捕植蟎(*Amblyseius herbicolus* (Chant))及卵形捕植蟎(*A. ovalis* (Evans)) (一般植物上最常見的兩種)，它在抑制薊馬類族群上所扮演的角色不容忽視。

兩種捕植蟎皆可以葉蟎為食物而繁殖族群，唯馬氏捕植蟎繁殖速率較慢，葉蟎應非其理想食物，在發展出更好的繁殖方法以前，較難進行對馬氏捕植蟎的進一步研究。而少毛捕植蟎雖可利用葉蟎為食物而繁殖，族群數量足供試驗研究，但如欲進行田間測試，規模明顯不足。筆者亦曾在發生南黃薊馬的胡瓜葉片上釋放少毛捕植蟎，觀察薊馬族群的數量變化，可能由於釋放的捕植蟎隻數不足，釋放葉上的薊馬族群增長似乎有被暫時減緩的跡象，卻不顯著而未能顯示出有抑制效果。由於少毛捕植蟎的食量與產卵能力與*N. cucumeris*和*A. bakeri*相若，*N. cucumeris*為目前最常用於薊馬生物防治之種類，已商業化供應上市；而少毛捕植蟎為產雌孤雌生殖，後代全為雌性個體，在繁殖能力上實勝過*N. cucumeris*及前述其它應用於防治薊馬的捕植蟎種類，是以少毛捕植蟎極具應用於薊馬生物防治之潛力。

筆者曾經觀察到捕食薊馬的蟎類尚有卵

形捕植蟎、*A. bellatulus* 及採自本所農場胡瓜植株上薊馬族群中之一種囊蟎(ascid mite)，均包含入本研究，測試其捕食南黃薊馬之情形，惜皆未能飼養成功，彼等可能更需有其它食物同時存在。

誌　謝

本試驗蒙農委會「98科技農建」計畫補助經費，試驗期間蒙陳婉玲小姐協助良多，謹此誌謝。

參考文獻

Bonde, J. 1989. Biological studies including population growth parameters of the predatory mite *Amblyseius barkeri* (Acarina: Phytoseiidae) at 25 ℃ in the laboratory. Entomophaga 34: 275-287.

Castagnoli, M., G. Bene, E. del Gargani, and S. Simoni. 1990. Possibilita de controllo biologico di *Thrips tabaci* Lind. e *Frankliniella occidentalis* (Pergande) (Thys. Thripidae) con *Amblyseius cucumeris* (Oud.) (Acarina: Phytoseiidae). Redia 73: 53-62.

de Klerk, M. L. and P. M. J. Ramakers. 1986. Monitoring population densities of the phytoseiid predator *Amblyseius cucumeris* and its prey after large scale introductions to control *Thrips tabaci* on sweet pepper. Med. Fac. Landhouww. Rijksuniv. Gent. 51: 1,045-1,048.

Gillespie, D. R. 1989. Biological control of thrips (Thysanoptera: Thripidae) on greenhouse cucumber by *Amblyseius cucumeris*. Entomophaga 34: 185-192.

Gillespie, D. R. and C. A. Ramey. 1988. Life history and cold storage of *Amblyseius cucumeris* (Acarina: Phytoseiidae). J. Entomol. Soc. Br. Columbia 85: 71-76.

Hansen, L. S. 1988. Control of *Thrips tabaci* (Thysanoptera: Thripidae) on glasshouse cucumber using large introductions of predatory mite *Amblyseius barkeri* (Acarina: Phytoseiidae). Entomophaga 33: 33-42.

Hoy, C. W. and C. S. Glenister. 1991. Releasing *Amblyseius* spp. (Acarina: Phytoseiidae) to control *Thrips tabaci* (Thysanoptera: Thripidae) on cabbage. Entomophaga 36: 561-573.

Hua, T. 1999. Biological control of thrips (Thysanoptera: Thripidae) with phytoseiid mites (Acari: Phytoseiidae). Chinese J. Entomol. Special publ. 12: 137-150 (in Chinese).

Huang, L. H. and W. Y. Su. 1997. Improvement of the consecutive rearing methods of *Thrips palmi* Karny (Thysanoptera: Thripidae) in the laboratory. Plant Prot. Bull 39: 281-287.

Lindqvist, I. and K. Tiitanen. 1989. Biological control of *Thrips tabaci* (Thysanoptera, Thripidae) on greenhouse cucumber. Acta Entomol. Fennica 53: 37-42.

Ramakers, P.M.J. and M. J. van Lieburg. 1982. Start of commercial production and introduction of *Amblyseius mckenziei* Sch. & Pr. (Acarina: Phytoseiidae) for the control of *Thrips tabaci* Lind. (Thysanoptera: Thripidae) in glasshouses. Med. Fac. Landbouww. Rijksuniv. Gent. 47: 541-545.

Riudavets, J. 1995. Predators of *Frankliniella occidentalis* and *Thrips tabaci*. pp. 43-87 *In* J. C. van Lenteren, A. J. M. Loomans, M. G. Tommasini, S. Maini, and J. Riudavets eds. Biological control of thrips pests. Wageningen Agricultural University.

Taborsky, V., A. M. Moanas, and J. Fateh. 1988. Use of the predatory mite *Amblyseius mckenziei* Sch. and Pr. for control of thrips on glasshouse cucumbers. Agric. Trop. et Subtrop. 21: 98-111.

Tanigoshi, L. K. and H. J. Griffiths. 1982. A new look at biological control of citrus thrips. Citrograph. 67: 157-158.

Tanigoshi, L. K., J. Y. Nishio-Wong, and J. Fargerlund. 1984. *Euseius hibisci*: its control of citrus thrips in southern California citrus orchards. pp. 699-702 *In* D. A. Griffiths and C. E. Bowman eds. Acarology VI, vol. 2. Ellis Horwood, Chichester, England.

Wang, C. L. 1994. The predacious capacity of two natural enemies of *Thrips palmi* Karny, *Campylomma chinensis* Schuh (Hemiptera: Miridae) and *Orius sauteri* (Poppius) (Hemiptera: Anthocoridae). Plant Prot. Bull. 36: 141-154.

收件日期：2001 年 9 月 13 日
接受日期：2001 年 10 月 16 日

Life History and Feeding Amount of *Amblyseius asetus* and *A. maai* (Acari: Phytoseiidae) on *Thrips palmi* (Thysanoptera: Thripidae)

Chyi-Chen Ho* and Wen-Hua Chen Department of Applied Zoology, Taiwan Agricultural Research Institute, Wufeng 413, Taichung, Taiwan, R.O.C.

ABSTRACT

The life history and feeding amount of *Amblyseius maai* Tseng and *A. asetus* (Chant) were studied in an incubator at 28℃ with a photoperiod of 13L:11D. Eggs of *Tetranychus kanzawai* Kishida and first instar larvae of *Thrips palmi* Karny were supplied as food to the immature and adult stages, respectively, of these two phytoseiid mites. The development stages of female and male individuals of *A. maai* lasted 6.5 and 5.9 days, respectively. Mated adult females lived 40.2 days, consumed 80.2 thrips larvae, and laid 22.6 eggs; virgin females lived 21.9 days with no egg laid, and consumed 24.3 thrips larvae; while adult males lived 17.5 days, and consumed 13 thrips larvae. No male individual of *A. asetus* was found during the testing period. *A. asetus* is apparently a thelyotokous species. Its development stage lasted 5.8 days; adults lived 24.5 days, laid 43.5 eggs, and consumed 90.2 thrips larvae. *A. asetus* has the potential to be used for the biological control of thrips pest. *A. maai* were frequently found among the population of *T. palmi* on eggplant. It possibly plays a role in the reduction of thrips populations.

Key words: phytoseiids, thrips, life history, feeding amount.