

Research Article

Natural predatory survey on vineyards infested by grape erineum mite, *Colomerus vitis* (Pagenstecher) (Acari: Eriophyidae) in western Iran

Saeid Javadi Khederi and Mohammad Khanjani*

Department of Plant Protection, Faculty of Agriculture, Bu-Ali Sina University, Hamedan, Iran.

Abstract: The grape erineum mite (GEM), *Colomerus vitis* (Pagenstecher) (Acari: Eriophyidae) is considered to be one of the most important pests, that sometimes causes irreversible damages to grapevine cultivars in western parts of Iran. Studies were carried out in order to find natural enemies associated with GEM, during 2011-2013. Results indicated that natural enemies included two species of predatory mites belonging to the families Phytoseiidae [*Typhlodromus* (*Anthoseius*) *khosrovensis*, *T. (Anthoseius) bagdasarjani*], Tydeidae (*Neopronematus* sp.), one species of Anystidae (*Anystis baccarum*), one species of Stigmaeidae (*Zetzellia mali*), one species of dipteran: Cecidomyiidae (*Arthrocnodax vitis* Rubsaaenen), four species, belonging to the family Coccinellidae (*Stethorus gilvifrons*, *Coccinella septempunctata*, *Hipodamia variegata*, *Harmonia* sp.), two species of predatory bugs belonging to the family Anthocoridae (*Orius albidipennis*, *O. niger*) and one species of Chrysopidae (*Chrysopa carnea*). Amongst them the cecidomyiid, the tydeid mite and the phytoseiid mites, had higher population densities in this area.

Keywords: grapevine, predatory species, grape erineum mite

Introduction

Grapevine plants are attacked by diseases, insects and mites. Amongst the phytophagous mites, the most important are those belonging to Eriophyidae, since they frequently reach damage level in the vineyards (Duso and De Lillo 1996). The most important eriophyid mite associated with vineyards is *Colomerus vitis* (Pagenstecher, 1857) (Duso and de Lillo 1996; Bernard *et al.*, 2005; Linder *et al.*, 2006; Walton *et al.*, 2007; Luchian *et al.*, 2008; Tomoioga and Comsa, 2010). Three reported strains of *Col. vitis*, each one characterized by

the type of injury produced, are: the bud strain, the erineum strain and leaf-curling strain (Jeppson *et al.*, 1975; Flechtmann 1979; Duso and De Lillo 1996). Erineum strain infestations have sometimes been considered economically important during spring or when the mite attacks young vines (Baggiolini *et al.*, 1969). Generally, GEM gives rise to patchy infestations on a few vines or on a few rows of plants and it causes obvious erineum on the lower leaf surface which appears to become blister-like on the other side of the leaves. They are whitish at first, later turn yellow and finally reddish brown (Duso and de Lillo, 1996). According to Javadi Khederi *et al.* (2014), GEM usually causes damage in vineyards in western Iran, and sometimes, chemical treatments are necessary to control this pest (Smith and Stafford, 1948) mainly in sensitive

Handling Editor: Hamidreza Hajiqaanbar

*Corresponding author, e-mail: mkhanjani@gmail.com

Received: 3 March 2014, Accepted: 16 July 2014

Published online: 18 July 2014

commercial grapevine nurseries situated in western Iran. To date, according to the hazards and adverse consequences caused by the use of chemical pesticides, more researchers are currently working on more eco-friendly pest control tactics such as biological control.

Natural enemies associated with eriophyids include predatory mites from various families (including Phytoseiidae, Tydeidae and Stigmaeidae), the larval stage of certain hoverflies (family Syrphidae) and predatory midges (family Cecidomyiidae), predatory hemipterans (family Anthorcoridae), and some species of coccinellid beetles (Perring and McMurtry, 1996). Although predatory mites from different families have already been reported to be associated with grapevine, few studies about GEM natural enemies have been carried out (Ferragut *et al.*, 2008). Phytoseiid mites are efficient natural enemies of pest mites of several crops, and their presence is frequently associated with eriophyid mites (Johann *et al.*, 2009; Monteiro, 1994; Ferragut *et al.*, 2008). The present work aimed to identify the natural predatory enemies associated to GEM in grapevine plants during the harvest of 2011/2013 in the western Iran.

Materials and Methods

Spatial and temporal surveys were conducted in Hamedan vicinity (Heydareh village, Siagoonaj region, Heyran village) and Kordestan province (Khosroabar village in Bijar vicinity, Gorge village) during summer 2011-2013. Grapevine (*Vitis vinifera* L.) is widely cultivated throughout the mentioned areas and GEM is reported seasonally in the region. In each survey area, twenty five leaves with erineae were chosen from three sections of plants, upper (tip), middle and lower (base) at random from each location. Samples were stored in plastic bags within a cool box and transported to the laboratory where, leaves were put in a chamber at 4° C for 20 min to slow down the activity of the predatory mites. Immediately afterwards, erineae were observed under a stereoscopic microscope to find

natural enemies of this mite in action. In the case of the mites, the Berlese-Tullgren funnel was also used to obtain a gradient of temperature and humidity to extract the mites from the erineae. The predatory mites were transferred into special glass tubes to keep the alcohol content at 70%. Predatory mites for clearing and bleaching were placed in an oven at a temperature of 50 °C for one week. Mites were identified under an Olympus BX51 phase contrast microscope. Other natural enemies of GEM were picked up using a paint brush and placed into tubes containing ethanol (70 %) and 2 drops of glycerine. All specimens studied were preserved in the Laboratory of Acarology at the Faculty of Agriculture, Bu-Ali Sina University, Hamedan (Iran).

Results

A list of the predators found during the survey is given in Table 1. The main predators were dipteran Cecidomyiidae and mites from Tydeidae, and Phytoseiidae families. The majority of specimens discovered during the surveys was cecidomyiid (46%), *Arthrocnodax* and were provisionally identified as *A. vitis* Rubsaamen 1895. The tydeid mite, *Neopronematus* sp. with phytoseiid mites *Typhlodromus* (*Anthoseius*) *khosrovensis* Arutunjan, *Typhlodromus* (*Anthoseius*) *bagdasarjani* Wainstein and Arutunjan were found in lower abundance of 26 and 11 %, respectively.

One species of Stigmaeidae: *Zetzelia mali* (Ewing), and one species of Anystidae: *Anystis baccarum* (L.), were found in low abundance with 3 and 3 % respectively. The number of coccinellids discovered was relatively low (5%) but four different species were observed, including (*Stethorus gilvifrons* (Mulsant), *Coccinella septempunctata* (Mulsant), *Hippodamia variegata* (Goeze), and *Harmonia* sp. (Mulsant). Other insect predators Neuroptera *Chrysopa carnea* (Stephens) (0.72%), Hemiptera *O. albidipennis* (Reuter), and *O. niger* (Wolff) (3%) were found.

Table 1 Predatory natural enemies observed feeding on *Colomerus vitis*.

Order	Family	Species	Location
Acari	Phytoseiidae	<i>T. (A.) khosrovensis</i> Arutunjan	Heydareh village (Hamedan) Siagoonaj region (Hamedan) Khosroabar village (Kordestan)
		<i>T. (A.) bagdasarjani</i> Wainstein & Arutunjan	Heydareh village (Hamedan) Siagoonaj region (Hamedan) Khosroabar village (Kordestan)
	Tydeidae	<i>Neopronematus</i> sp.	Heydareh village (Hamedan) Siagoonaj region (Hamedan) Heyran village (Hamedan) Khosroabar village (Kordestan) Gorve village (Kordestan)
	Anystidae	<i>Anystis baccarum</i> (Linnaeus)	Heydareh village (Hamedan) Siagoonaj region (Hamedan)
	Stigmaeidae	<i>Zetzelia mali</i> (Ewing)	Heydareh village (Hamedan) Siagoonaj region (Hamedan) Heyran village (Hamedan) Khosroabar village (Kordestan) Gorve village (Kordestan)
Diptera	Cecidomyiidae	<i>Arthrocnodaax vitis</i> Rubsaamen	Heydareh village (Hamedan) Siagoonaj region (Hamedan) Heyran village (Hamedan) Khosroabar village (Kordestan) Gorve village
Coleoptera	Coccinellidae	<i>Stethorus gilvifrons</i> (Mulsant)	Heydareh village (Hamedan) Siagoonaj region (Hamedan)
		<i>Coccinella septempunctata</i> (Mulsant)	Heydareh village (Hamedan) Siagoonaj village (Hamedan) Gorve village (Kordestan)
		<i>Hippodamia variegata</i> (Goeze)	Heydareh village (Hamedan) Siagoonaj region (Hamedan)
		<i>Harmonia</i> sp. (Mulsant)	Heydareh village (Hamedan) Siagoonaj region (Hamedan) Khosroabar village (Hamedan)
Hemiptera	Anthocoridae	<i>Orius albidipennis</i> (Reuter)	Heydareh village (Hamedan) Siagoonaj region (Hamedan) Khosroabar village (Kordestan) Gorve village (Kordestan)
		<i>Orius niger</i> (Wolff)	Heyran village (Hamedan) Khosroabar village (Kordestan) Gorve village (Kordestan)
Neuroptera	Chrysopidae	<i>Chrysopa carnea</i> (Stephens)	Heydareh village (Hamedan) Siagoonaj region (Hamedan)

Discussion

This survey showed that a large number of natural enemies are associated with the leaves infested by

GEM in our experimental regions. Amongst the predatory mites, the Phytoseiidae presented the higher diversity, mainly in Heydareh village. *Typhlodromus (Anthoseius) khosrovensis*, the

most common species, was observed in both localities, associated with *C. vitis*. Also *Typhlodromus (Anthoseius) bagdasarjani* were found in lower abundance. The phytoseiid mite diversity in Heydareh can be related to the presence of GEM mites, while low diversity was found in Siagoonaj region where number of this phytophagous group was lower (Javadi Khederi *et al.*, 2014). Eriophyoid mites are favorable preys to Phytoseiidae predator mites and the presence of these preys can hold higher number of phytoseiid mites (James, 1989; Camporese and Duso, 1995). Phytoseiids have been well documented as predators of phytophagous mites and a number of species have been reported in association with GEM (Smith and Schuster, 1963; Dennill, 1986). The majority of phytoseiids reported in association with GEM are from the genus *Amblyseius* and *Typhlodromus*. The Tydeidae also were present in great numbers and *Neopronematus* sp. was the most abundant in the localities evaluated. The species was more frequent on leaves in late summer during the mid-ripening growth stage of the berries. Amongst the Stigmaeidae, *Zetzelia mali* was the only species with high population in the evaluated regions in the same period when *C. vitis* was in high population. According to Ferla and Moraes (2003), Eriophyidae are the most preferred food to *Z. mali*. The *Arthrocnodax vitis* was the most frequent predatory of Cecidomyiidae and *C. vitis* was the most abundant phytophagous species associated with vineyards in these regions (Javadi Khederi *et al.*, 2014), suggesting that it can be an important natural enemy of this species. Species of Cecidomyiidae may be of interest as an element of a biological control program. Although few studies have been made on releasing these dipterans as biological control agents of GEM and reports mostly concern free living species rather than gall formers. There are reports of cecidomyiid larvae opening up the entrance to galls (Perring and McMurtry, 1996), of mites feeding on gall mites while they are migrating from old galls to new sites (Castagnoli and Oldfield, 1996) and the impact of predators on gall inducing mites on grapes (Duso and de Lillo, 1996). Of the other predators, sometimes

anthocorids, chrysopids, and coccinellids have been observed preying on GEM and along with the ladybird beetle, *Stethorus* sp. are widely regarded as being mite specific predators (Flint and Dreistadt, 1998).

Although attempts have been made to quantify the numbers of predators in relation to the GEM in the field and their possible impact, there is still scope for further investigation, especially in order to establish a candidate predator for a biological control program. The following steps will be necessary to evaluate these predators, especially the frequent and effective species, for their effectiveness against this pest in western Iran.

Acknowledgements

The authors are grateful to Keith Harris (Ripley, Working, UK), and Enrico de Lillo (Department of Soil, Plant and Food Sciences, Entomological and Zoological Section, University of Bari Aldo Moro, Bari, Italy) for their help and contribution in improving the paper. This paper is extracted from part of Ph. D. Thesis of the senior author which was financially supported by research vice-chancellor of Bu-Ali Sina University, Hamedan, Iran

References

- Baggiolini, M., Guignard, E., Hugi, H. and Epard, S. 1969. Contribution à la connaissance de la biologie de l'ériose de la vigne et nouvelles possibilités de lutte. *Revue Suisse de Viticulture Arboriculture Horticulture*, 1: 50-52.
- Bernard, M. B., Horne, P. A., and Hoffmann, A. A. 2005. Eriophyid mite damage in *Vitis vinifera* (grapevine) in Australia: *Calepitrimerus vitis* and *Colomerus vitis* (Acari: Eriophyidae) as the common cause of the widespread «Restricted Spring Growth» syndrome. *Experimental and Applied Acarology*, 35: 83-109.
- Camporese, P. and Duso, C. 1995. Life history and life table parameters of the predatory mite *Typhlodromus talpii*. *Entomologia Experimentalis et Applicata*, 17: 149-157.
- Castagnoli, M., and Oldfield, G. N. 1996. Other fruit trees and nut trees. In: Lindquist, E. E.,

- Sabelis, M. W. and Bruin, J. (Eds.), Eriophyoid mites: their biology, natural enemies and control, Elsevier, The Netherlands, pp. 543-559.
- Dennill, G. B. 1986. An ecological basis for timing control measures against the grape vine bud mite *Eriophyes vitis* Pgst. Crop Protection, 5: 12-14.
- Duso, C, and de Lillo, E. 1996. Damage and control of Eriophyoid mites in crops: 3.2.5 Grape. In: Lindquist, E. E., Sabelis, M. W. and Bruin, J. (Eds.), Eriophyoid mites-Their Biology, Natural Enemies and Control. Elsevier Science Publishing, Amsterdam, Netherlands, (World Crop Pests), 6: 571-582.
- Ferla, N. J. and G. J. de Moraes. 2003. Oviposição de ácaros predadores *Agistemus floridanus* Gonzalez, *Euseius concordis* (Chant) e *Neoseiulus anonymus* (Chant and Baker) (Acari) em resposta a diferentes tipos de alimento. Revista Brasileira de Zoologia, 20 (1): 153-155.
- Ferragut, F., Gallardo, A., Ocete, R. and López, M.A. 2008. Natural predatory enemies of the erineum strain of *Colomerus vitis* (Pagenstecher) (Acari, Eriophyidae) found on wild grapevine populations from southern Spain (Andalusia). Vitis, 47 (1): 51-54.
- Flechtmann, C. H. W. 1979. Ácaros de importância agrícola. São Paulo: Nobel. 189 p.
- Flint, M. L. and Dreistadt, S.H. 1998. Natural Enemies Handbook: In: The Illustrated Guide to Biological Pest Control. California Press, 160 pp.
- James, D. G. 1989. In (luence of diet on development) survival and oviposition in an Austrlnian phytoseiid, *Amblyseills victoriellsis* (Acari: Phytoseiidae). Experimental and Applied Acarology, 6: 1-10.
- Javadi Khederi, S., Khanjani, M. and Asali Fayaz, Bahman. 2014. Resistance of three grapevine cultivars to Grape Erineum Mite, *Colomerus vitis* (Acari: Eriophyidae), in field conditions. Persian Journal of Acarology, 2 (3): 63-75.
- Jeppson, L. R., Keifer H. H. and Baker, E. W. 1975. Mites injurious to economic plants. Berkeley: University of California Press. 614 p.
- Johann, L, Klock, C. L., Ferla, N. J. and Botton, M. 2009. Acarofauna (Acari) asociada à videira (*Vitis vinifera* L.) no Estado do Rio Grande do Sul. Biociências, 17 (1): 1-19.
- Linder, C., Jermini, M. and Zufferey, V. 2006. Impact of the erineum mite *Colomerus vitis* on Muscat. IOBC-WPRS Bulletin, 36: 273-277.
- Luchian, V., Savulescu, E. and Tudose, M. 2008. Behavior of several varieties of *Vitis vinifera* L. to the attack caused by *Colomerus vitis* Pagst. and *Tetranychus urticae* Koch. Universitatea de Stiinte Agronomice si Medicina Veterinara Bucuresti, Bucuresti, Seria B, Horticultura, 52: 123-127.
- Monteiro, L. B. 1994. Ocorrência de *Polyphagotarsonemus latus* (Banks) (Acari: Tarsonemidae) em videira em Bento Gonçalves, RS, Brasil. Anais da Sociedade Brasileira de Entomologia, 23 (2): 349-350.
- Pagenstecher, H. A. 1857. Über Milben, besonders die Gattung *Phytoptus*. Verhandlungen des Naturhistorisch-Medizinscher Vereins zu Heidelberg, 1: 46-53.
- Perring, T. M. and McMurtry J. A. 1996. Other Predatory Arthropods. In: Lindquist, E. E., Sabelis, M. W., and Bruin, J. (Eds.). Eriophyoid mites: their biology, natural enemies and control, Elsevier, The Netherlands, pp. 471-479.
- Smith, L. M. and Schuster, R. O. 1963. The nature and extent of *Eriophyes vitis* injury to *Vitis vinifera* L. Acarologia, 5: 530-539.
- Smite, L. M. and Stafford, E. M. 1948. The bud mite and the Erineum Mite of grapes. Hilgardia 18: 317-334.
- Tomoioaga, L. and Comsa, M. 2010. Monitoring the population of Eriophyoid mites, the species *Calepitrimerus vitis* and *Colomerus vitis*, in the vineyards specific conditions of Central Transylvania. Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Horticulture, 67 (1): 499.
- Walton, V. M., Dreves, A. J., Gent, D. H., James, D. J., Martin, R. R., Chambers, U. and Skinkis, P. A. 2007. Relationship between rust mite *Calepitrimerus vitis* (Nalepa), bud mite *Colomerus vitis* (Pagenstecher) (Acari: Eriophyidae) and Short Shoot Syndrome in Oregon vineyards. International Journal of Acarology, 33 (4): 307-318.

مطالعه شکارگرهای طبیعی در باغات انگور آلوده به کنه نمدی مو، *Colomerus vitis* (Acari: Eriophyidae) در غرب ایران

سعید جوادی خدری و محمد خانجانی*

گروه گیاهپزشکی، دانشکده کشاورزی، دانشگاه بوعلی سینا.

* پست الکترونیکی نویسنده مسئول مکاتبه: mkhanjani@gmail.com

دریافت: ۱۲ اسفند ۱۳۹۲؛ پذیرش: ۲۵ تیر ۱۳۹۳

چکیده: کنه نمدی مو، *Colomerus vitis* (Pagenstecher) (Acari: Eriophyidae) یکی از آفات مهم باغات انگور بوده و گاهی اوقات خسارت قابل توجهی به ارقام مختلف انگور در بخش‌های غربی ایران وارد می‌نماید. بدین لحاظ مطالعه‌ای در رابطه با دشمنان طبیعی مرتبط با آن در باغات انگور قسمت‌های غربی ایران در طی سال‌های ۱۳۹۰-۱۳۹۲ انجام شد. نتایج حاصله نشان داد که دشمنان طبیعی متعددی در کنترل جمعیت آن مؤثر هستند و در این راستا دو گونه کنه شکارگر از خانواده فیتوزئیده شامل *Typhlodromus (Anthoseius) khosrovensis* [T. (Anthoseius) bagdasarjani]، یک گونه از خانواده Tydeidae (*Neopronematus* sp.)، یک گونه Anystidae (*Anystis baccarum*)، یک گونه از خانواده Stigmaeidae (*Zetzellia mali*)، یک گونه پشه از خانواده Cecidomyiidae (*Arthrocnodax vitis* Rubsaaenen)، چهار گونه کفشدوزک از خانواده Coccinellidae شامل *Coccinella Stethorus gilvifrons*، دو گونه سن شکارگر از خانواده Chrysopidae شامل *O. niger*، *Orius albidipennis* و یک گونه بالتوری از خانواده Chrysopidae سبزی *Chrysopa carnea* جمع‌آوری و گزارش گردید. در بین گونه‌های شکارگر جمع‌آوری شده پشه cecidomyiid، کنه tydeid و کنه‌های phytoseiid از تراکم جمعیت بالاتری برخوردار بودند.

واژگان کلیدی: انگور، گونه شکارگر، کنه نمدی مو