

Monitoring on two exotic spider mites in Taiwan

Chyi-Chen Ho

30, Lane 102, Chengkung Rd., Wufeng, Taichung, Taiwan, ROC
E-mail: mtho2005@yahoo.com.tw

ABSTRACT

Eotetranychus lewisi McGregor and *Tetranychus evansi* Baker & Pritchard are 2 spider mite species that are newly recorded in Taiwan. The authors traced their distribution, host plants, and natural enemies in the Taiwan area. *Eotetranychus lewisi* is mainly found in mountainous areas with cooler temperatures. Those found at lower elevations were always on potted seedlings of poinsettia (*Euphorbia* sp.). Populations of *Eo. lewisi* were also found on *Bauhinia variegata*, *Pueraria* sp., and *Musa* sp., in addition to poinsettia. Many predaceous mites and insects were found in the population of *Eo. lewisi*: *Amblyseius longispinosus* (Evans), *Phytoseius minutus* Narayanan et al., *Scolothrips* sp., a predaceous ceccidomyiid, *Oligota* sp., and a member of the Anthocoridae were observed to feed on *Eo. lewisi*. *Tetranychus evansi* was found in most counties of Taiwan, as well as the offshore islands of Kinmen and Matsu. Tomato, eggplant, and *Solanum nigrum* were heavily infested with this mite on Kinmen and Matsu. However, although heavy populations of *T. evansi* could be found on wild-grown tomatoes, it was mainly found on *S. nigrum* on the main island of Taiwan. Two phytoseiids, a predaceous ceccidomyiid larva and *Scolothrips* sp., were found in the population of *T. evansi*, and the thrips were observed to feed on this spider mite.

Key words: spider mite, field observation, distribution, host plant, natural enemies, Taiwan

Spider mite is a group of mite including many species of serious crop pest. It accordingly becomes one of the focuses of agricultural acarological research. Seventy-two species of tetranychids were recorded from Taiwan before 1990 (Lo, 1968a, b, 1969; Lo and Wu, 1979; Lo and Ho, 1989a, b; Tseng, 1975, 1980, 1990). No tetranychids was recorded from Taiwan after then for over 10 years. However, 3 spider mites were recorded from Taiwan after year 2003 by this author (Ho, 2003; Ho and Shih, 2004; Ho et al., 2005). Among these 3 spider mites, *Aponychus mallotus* is new to science, and *Eotetranychus lewisi* McGregor and *Tetranychus evansi* are

newly invaded exotic species. This author traced these 2 exotic spider mites in Taiwan area during 2003-2006 and reported the results in this article.

***Eotetranychus lewisi* McGregor**

Eotetranychus lewisi was first noticed in November, 2002 by Dr. Shih of the Taoyuan District Agricultural Research and Extension Station on poinsettia seedlings cultivated in the Station and some farms, with its different shape. Suspecting it is *Eo. lewisi*, he sent specimens to this author for an identification to confirm his anxiety. We inspected 2 ornamental farms in Dahsi and Guanyin, Taoyuan County in December, 2002, and an ornamental farm in Fuhsin, Taoyuan County in March, 2003. All had cultivated poinsettia seedlings heavily infested with. During March to April, 2003, the cooperative survey carried by entomologists in Taoyuan District Agricultural Research and Extension Station, Taichung District Agricultural Research and Extension Station, Taiwan Agricultural Chemicals and Toxic Substances Research Institute, and Taiwan Agricultural Research Institute located this mite from ornamental farm in Cholan, Maoli County; Hsinse, Taichung County; Puli, Nantou County. This author also located this mite from the roadside poinsettia trees in Taoyuan, Liuquei (Baolai, Laoloun), Kaohsiung County. These information in combine indicated this mite had invaded Taiwan in an earlier time and might have established in Taiwan. At this moment, it seemed too late for a wipe out plan of this mite. The questions in concern turned to be as follows:

- (1) Poinsettia is a popular ornament plant in Taiwan, had *Eo. lewisi* distributed island-wide in together with poinsettia in Taiwan?
- (2) Did it infect other plants in Taiwan?
- (3) Did the local predators that feed on spider mite adapted to feed on *Eo. lewisi*?
- (4) How did compete with other pests of poinsettia?

To collect information on the above questions, this author made surveys around Taiwan area since the autumn of 2003.

Distribution

The collection record of *Eo. lewisi* on poinsettia from the Autumn of 2004 to the Spring of 2006 was listed in Table 1. For each township, only the first collection record was listed when surveyed more than once. Symptom of heavy infestation by spider mites was noticed in 2004 on a poinsettia tree in Gukong, Yunlin County. *Eotetranychus* mites were observed on leaves of this tree. However, it was not recorded as no adult male was collected, and the existence of *Eo. lewisi* was not confirmed. Though the mite was almost in certain to be *Eo. lewisi*. These data showed

Eo. lewisi had distributed island-wide in Taiwan, very likely followed the sailing of poinsettia seedling.

Table 1. Collection record of *Eotetranychus lewisi* on poinsettia (*Euphorbia* sp.) from various places in Taiwan

Date	County	Township	Note	
Nov. 2003	Nantou	Yuchih	Sun Moon Lake	
Mar. 2004	Taitung	Haiduang	Wuloo	
	Pintung	Sandimen	Dalai	
	Kaohsiung	Taoyuan	Laoloun, Chinho, and Meishan	
	Nantou	Hsinyi	Tungpu	
	Chiayi	Fangloo	Lounmei and Liaowauntai (along Hwy 18)	
Mar. 2005	Taitung	Haiduang	Tsulai	
	Taitung	Guanshan	Guanshan and the end of Hwy 20	
Apr. 2005	Chiayi	Puzi	Puzi Elementary School	Potted seedling
	Kaohsiung	Liuguei	Laoloun	
	Taichung	Lounjen	Tunghai	Potted seedling
May 2005	Hsingchu	Wufeng	Daai	
	Hsingchu	Gienshih	Chialo	
	Pintung	Shihzi	Souka	
Jun. 2005	Taichung	Guguan	Maluenshan	
Jul. 2005	Taichung	Taiping	Tungbien	
Oct. 2005	Hualien	Gian		Potted seedling
Apr. 2006	Chiayi	Yunsuei	Along Hwy 3	
May 2006	Taipei	Wulai		
May 2006	Ilan	Datung		

As the survey in various place was not made within a short time interval, the date only indicated when the place was visited, and gave no information on the disperse of *Eo. lewisi* in Taiwan.

Owner of the ornamental farm in Fuhsin, Taoyuan County inspected in March, 2003 said he had notice the damage symptom on poinsettia imported during 2001. This mite might invade Taiwan in 2001 or even earlier. An inference on the invading time of this mite was attempted based on the collecting information from the following place.

(1) Highway 20

Poinsettia are cultivated along a large portion of the road side of highway 20. I checked highway 20 in March of each year of 2003-2005. In 2003, *Eo. lewisi* was

found in Liuguei and Taoyuan (Laoloun, Baolai) of Kaohsiung County, not in Meisan (Kaohsiung County) or Taitung County. Spider mite found on poinsettia of Taitung County was *Tetranychus* species. In 2004, *Eo. lewisi* spread eastward to Wuloo, Taitung County. It reached the end of highway 20 in Taitung County in 2005 and was located from Guanshan, Taitung County also.

(2) Highway 24

Poinsettia are cultivated along the road side of highway 24. Highway 24 was checked in 2004-2005 up to Dalai. Almost all poinsettia were heavily infested by *Aleurodicus dispersus* Russell in 2004. *Eo. lewisi* was only found on 1 poinsettia in Dalai. In 2005, heavy infestation by *Eo. lewisi* was observed from Dalai to 200m downward.

(3) Sun Moon Lake area

In November, 2003, only one poinsettia near was found to be infested (heavily) by *Eo. lewisi*. One year later, in December, 2004, all poinsettias around Ts -en pagoda were heavily infested. Also were some poinsettias along the Sun Moon Lake surrounding road.

In the above examples, *Eo. lewisi* might just dispersed to that place or dispersed no longer ago at the first survey date. When first surveyed, both in highway 24 and Sun Moon Lake area, only 1 poinsettia was infested with *E. lewisi*. The mite spread to nearby in the 2nd year. *Eotetranychus lewisi* might have dispersed to highway 20 in 2002 or even in 2001. Early than 2001 is not likely in according to the spreading distance between 2004 and 2005. The found of *E. lewisi* in Hsinchu County (2005), Highway 18 (Chiayi County, 2004), and Laoloun hwy (Kaohsiung County, 2005) were also limited to a few poinsettia trees. The time when *E. lewisi* invaded Taiwan is therefore estimated to be not earlier than 2001, with a high possibility to be 2002.

Several elementary schools in Yunlin County had planted poinsettia. No *E. lewisi* were found on these place. In my collection record, *E. lewisi* was only found on potted poinsettia seedlings in lower elevation area. In a few cases, the new shoots of potted poinsettia seedling generated after pruning are free from *E. lewisi*. Probably the high temperature in the lower land of Taiwan is not suitable for *E. lewisi*. The study of Lai and Lin. (2005) also found *E. lewisi* lived better under 24C.

Host plants in Taiwan

Eotetranychus spider mite had been found on plants nearby poinsettia, including

Bauhinia variegata, *Pueraria* sp., *Musa* sp., giant alocasia, plum. However, adult male *E. lewisi* was collected from *Bauhinia variegata*, *Pueraria* sp., *Musa* sp. only. Population found on *Bauhinia variegata* and *Pueraria* sp. were high and scattered on many leaves. Only one case on banana was observed and the number is low. Though adult male was collected, it is not sure whether banana is a suitable host for *E. lewisi* or not.

Poinsettia is often pruned in spring. At this time, *E. lewisi* is not able to survive on poinsettia as no leaf exists. *Eotetranychus lewisi* would need other host plant(s) before poinsettia grows new shoots and new leaves. These are waiting for to be explored.

Competition with other insect pests

Aleurodicus disperses is the pest usually found on and severely infested poinsettia. Field observations in two cases provided some information on the competition between *A. disperses* and *E. lewisi*.

(1) Highway 24:

Poinsettias along the road side of highway 24 up to Dalai Police Station were heavily infested by *A. disperses* in April, 2004. *Eotetranychus lewisi* was only found on one poinsettia in front of Dalai Police Station, in quite heavy population. In February, 2005, poinsettias within 200 m down from Dalai Police Station were all severely infested with *E. lewisi*; none was infested with *A. disperses*. The rest poinsettias downward were all infested with *A. disperses*. In March, 2006, the poinsettias were pruned, and the new leaves were at the size of approximately 6 x 2 cm². Though most poinsettias were free from insect and mite pests yet, *E. lewisi* was found on a poinsettia approximately 2 km down from Dalai Police Station.

(2) Highway 20A:

In March, 2005, in Tsulai, Taitung County, *E. lewisi* was found in together with *A. disperses* on several poinsettias, both in high density. Returned to there 3 months later, there were only new leaves on poinsettias with no sign of pruning was observed. Many leaves contained a small population of *E. lewisi*. The leaves contained *A. disperses* were even less, mostly with one spiral only, some with *E. lewisi* in together..

In these 2 cases, *E. lewisi* won in the competition to *A. disperses*. Along highway 24, it started from just a single poinsettia, expelled *A. disperses*, and expanded its distribution to 200-2000 m. In the case of highway 20A, my inference is:

due to the heavy infestation by both of *A. disperses* and *E. lewisi*, all leaves fallen prematurely. *Eotetranychus lewisi* recovered the new bourn leaves quicker than *A. disperses*. With a much shorter developmental time and a high fecundity, *E. lewisi* increased its individuals faster than *A. disperses*. This inference may be able to apply to the case in highway 24 also.

Natural enemies

Predacious insects or mites had been observed among *E. lewisi* in poinsettia samples collected from Gienshih, Sun Moon Lake, Baolai, Taoyuan (Kaohsiung County), Haiduang, Tsulai, Guanshan, including *Amblyseius longispinosus*, *A. ovalis*, *Phytoseius minutus*, *P. rugauts*, ceccidomyiids, *Scolothrips* spp., *Oligota* sp., *Lasioseius* sp., stigmatid, and *Orius* sp. Among these predators, *Amblyseius longispinosus*, *Phytoseius minutus*, *Scolothrips* sp., ceccidomyiid larvae, *Oligota* larvae, and *Orius* larvae were observed to feed on *E. lewisi*. These preying behaviors were observed from samples collected from Taoyuan, Hsinchu, Nantou, Kaohsiung, and Taitung Counties. It reveals local predators are adapting to restrain *E. lewisi*.

***Tetranychus evansi* Baker & Pritchard**

There are 2 mites, *Tetranychus marianae* and *T. takafujii*, very close to *T. evansi* and only differ in detailed characters (de Moraes et al., 1987; Ehara and Ohashi, 2002). *Tetranychus evansi* mentioned here is not examined on whether it included those 2 species yet.

Tetranychus evansi was firstly collected from eggplant from Tungshih, Chiayi County in 2001, and was again found on *Solanum nigrum* from Tsaotwen, Nantou County in 2002. My survey on agricultural mite fauna in Kinmen and Matzu Islands also found this mite. This triggered the survey on *T. evansi* in whole Taiwan area.

Distribution and host plant

As the survey on *T. evansi* was started 3 years after its first recording, the collecting date in various place is of no meaning on the disperse of *T. evansi* in Taiwan. The collection record of this mite in various place of Taiwan was then listed in together with host plants without date in Table 2.

Except Miaoli and Penghu Counties, *T. evansi* had been located in every counties of Taiwan. Locating *T. evansi* in Miaoli and Penghu Counties may be just a matter of time. Its host plants include *Solanum nigrum*, *Lycopersicon esculentum*, *S. melongena*, *S. aculeatissimum*, *Passiflora fortida* L. var. *hispidis*, *Dioscorea alata*,

Pueraria sp., *Ricinus communis*, and *Aristolochia* sp. In most cases it was found on *S. nigrum*. Except in Kinmen and Matzu Islands and one case in Tungshih, Chiayi County, it was not found on commercial grown tomato or eggplant. The invading of *T. evansi* to commercial growing tomato, eggplant, or other crops is subjected to keep under observation.

Natural enemies

Predators found among *T. evansi* include *Amblyseius womersleyi*, *A. longispinosus*, ceccidomyiid larvae, and *Scolothrips* sp., with *Scolothrips* sp. had been observed to feed on *T. evansi*. These predators are the commonly found predators that feeding on *Tetranychus* spider mites in Taiwan. Discovery of *Oligota* and *Stethorus* species, the other 2 commonly found predators of *Tetranychus* spider mites, preying on *T. evansi* is expected.

Table 2. Collection records of *Tetranychus evansi* from the Taiwan area

County	Township	Host plant
Taipei	Dansuei	<i>Solanum aculeatissimum</i>
Hsinchu	Chubei	<i>Solanum nigrum</i>
Taichung	Dali, Wufeng	<i>S. nigrum</i> , <i>S. aculeatissimum</i>
Nantou	Tsaotwen	<i>S. nigrum</i>
Changhua	Hemei	<i>S. nigrum</i>
Yunlin	Sihu, Tsitung Yuantsaung	<i>S. nigrum</i> , <i>Passifora fortida</i> L. var. <i>hispisa</i>
Chiayi	Chuchi, Liugiao	Potted <i>Lycopersicon esculentum</i> , <i>S. nigrum</i>
Tainan	Hsingshih, Hsingyin, Sanhua, Hsinhua	<i>L. esculentum</i> , <i>S. nigrum</i> , <i>P. fortida</i> L. var. <i>hispisa</i>
Kaohsiung	Taoyuan,	<i>S. nigrum</i> , <i>Aristolochia</i> sp.
Pintung	Yenpu	<i>S. nigrum</i>
Ilan	Dongshan, Sanhsing	<i>S. nigrum</i> , <i>L. esculentum</i>
Hualien	Gian, Yuli	<i>Dioscorea alata</i> , <i>S. nigrum</i>
Taitung	Chyiben, Haiduan, Luyei	<i>S. nigrum</i>
Kinmen	Chinhu, Chinnin, Chinsha	<i>L. esculentum</i> , <i>S. melongena</i>
	Beigan(Chaozai, Chingbee),	
Lienchiang	Nangan (Bieyuan, Chingshuei, Machung, Taiping farm, Wuchienpai, Zulo)	<i>S. nigrum</i> , <i>S. aculeatissimum</i> , <i>Pueraria</i> sp., <i>L. esculentum</i> , <i>S. melongena</i> , <i>Ricinus communis</i>

Competition

Up to date, field surveys on *T. evansi* did not provide information on the competition this mite and other pests. The recorded host plants of *T. evansi* include tomato, eggplant, tobacco, beans, *Phaseolus*, *Populus*, *Ricinus communis*, corn, and rose. What would the result be if *T. evansi* competes with the insect or mite pests of these crops? My prediction would be: *T. evansi* may become the major spider mite pest on tomato but not other crops based on the following reasons:

- (1) Tomato does not have important mite pest yet.
- (2) *Tetranychus kanzawai*, *T. urticae*, and *T. cinnabarinus* are major spider mite pest on other crops (Ho et al., 1995, 1997)
- (3) Reproductive potential of *T. evansi* is not higher than *Tetranychus kanzawai*, *T. urticae*, and *T. cinnabarinus*.

However, as tomato pests are always controlled cautiously with pesticides, *T. evansi* may not become major pest in years.

References

- Ehars, S. and K. Ohashi. 2002. A new species of *Tetranychus* (Acari: Tetranychidae) from the Kinki District, Japan. *Acta Arachnologica* 51: 19-22.
- Ho, C. C. 2003. A new species of *Aponychus* from Taiwan and a redescription of *A. corpuzae* (Acariformes: Tetranychidae). *Plant Prot. Bull.* 45 (4): 401-403.
- Ho, C. C. and S. P. Shih. 2004. *Eotetranychus lewisi*, a new pest of poinsettia from Taiwan. *Plant Prot. Bull.* 46: 173-176.
- Ho, C. C., S. C. Wang, and Y. L. Chien. 1 2004. Field observation on 2 newly recorded spider mites in Taiwan. *Plant Prot. Bull.* 47: 391 - 402 .
- Lo, P. K. C. 1968a. Tetranychoid mites infesting tea in Taiwan. *Bull. Sun Yat-sen Cult. Found.* 1: 275-285.
- Lai, H. S., and Lin, F. C. * 2005. Development and population parameters of the Lewis spider mite, *Eotetranychus lewisi*, on poinsettia. *Plant Prot. Bull.* 47: 379-390.
- Lo, P. K. C. 1968b. Tetranychoid mites infesting fruit Plants in Taiwan. *Bull. Sun Yat-sen Cult. Found.* 2: 97-137.
- Lo, P. K. C. 1969. Tetranychoid mites infesting Special Crops in Taiwan. *Bull. Sun Yat-sen Cult. Found.* 4: 43-82.
- Lo, K. C. and C. C. Ho. 1989. A new species of spider mite from Taiwan (Acarina: Tetranychidae). *J. Taiwan Museum* 42(2): 55-58.
- Lo, K. C. and K. C. Wu. 1979. A new record spider mite, *Panonychus ulmi* (Koch) (Acarina: Tetranychidae) from Taiwan? *J. Agric. Res. China* 28: 125-126 (in Chinese).

- Lo, K. C. and C. C. Ho. 1989. The spider mite family Tetranychidae in Taiwan I. The genus *Oligonychus*. Journal Taiwan Museum 42: 59-76.
- De Moraes, G. J., J. A. McMurtry, and E. W. Baker. 1987. Redescription and distribution of the spider mites *Tetranychus evansi* and *T. marianae*. Acarologia 28: 333-343.
- Tseng, Y. H. 1975. Systematics and distributions on the phytophagous mites of Taiwan. Part I. A revision of the mite family Tetranychidae, with an illustration key to genera of the world. Plant Quarant. Bull. 10: 1-141 (In Chinese).
- Tseng, Y. H. 1980. Mites associated with conifers of Taiwan. (1) Tetranychoida, with check list of the world. J. Entomol. (Chung-Hsing Univ.). 15: 145-168.
- Tseng, Y. H. 1990. A monograph of the mite family Tetranychidae (Acarina: Trombidiformes) from Taiwan. Taiwan Mus. Spec. Publ. ser. 9, 234 pp.