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Population Density , Infestation Rate and Distribution of Varroa jacobsoni Oud. in Apis mellifera L. Colony 【Research report】

蜂蟹蟎 (Varroa jacobsoni Oud.) 於西洋蜂 (Apis mellifera L.) 群之族群密度、寄生率及分布【研究報告】

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Abstract

Varroa jacobsoni Oudemans populations in honeybee colonies showed seasonal high densities in the spring and autumn of 1992. The occurrences of the high densities of mites were related to the presence of pollen sources, honey flow and brood cells. The density of maternal mites in capped worker cells was significantly correlated with the density of adult bees (r = 0.75, p = 0.01). Infestation rates and densities of Varroa mites in capped drone cells were higher than those in capped worker cells. Numbers of maternal mites and / or their progeny in drone cells were higher than in worker cells. Food suitability and amount of resources, e.g., food and space, are higher in drone cells than in worker cells. The number of Varroa progeny produced per female in worker cells was higher than that produced in drone cells. However, the number of progeny produced by each female was significantly correlated with their densities of maternal mites in cells (worker cells : r = -0.96, p = 0.01 ; drone cells : r = -0.80, p = 0.05). The frequency of Varroa mites parasitizing the abdominal sternum of honeybees was highest among the 4 body parts compared. The difference of the distribution pattern on beehives in the same colony was not significant. The fact that mites concentrated on the "brood nests"located in the mid-low portion of the comb was consistent with the egg-laying pattern of the queen.

摘要

蜂蟹蟎族群密度分別於春、秋兩季各有一發生高峰，該等高峰與花粉源期、流蜜期及幼蟲產生期高峰相吻合，尤以幼蟲產生期為主。封蓋工蜂房內親代雌蟎密度與成蜂體上之蟹蟎密度間，呈顯著之正相關關係(r = 0.75, p = 0.01)。親代雌蟎於封蓋雄蜂房內之寄生率及其密度，均較封蓋工蜂房內為高；親代雌蟎所產之子代數及親代與子代總數，亦以雄蜂房者為高；雄蜂房似能提供較佳之食物源供蟹蟎存活及繁殖。封蓋工蜂及雄蜂房內每房親代雌蟎平均所產子代數，以封蓋工蜂房內較多；且每房中親代雌蟎密度及每雌所產子代密度之間，呈現著負相關關係(工蜂房：r = -0.96, p = 0.01；雄蜂房：r = -0.80, p = 0.05)。蟹蟎多外寄生於工蜂腹部，尤以腹板節間膜為甚。蟹蟎在蜂路間之分布差異不顯著，但在各巢脾上則多出現於中央偏下方之部位，應與幼蟲圈分布相吻合。

Key words: Varroa jacobsoni, population density, infestation rate, distribution.
關鍵詞: 蜂蟹蟎、族群密度、寄生率、分佈。

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蜂蟹蟎(*Varroa jacobsoni* Oud.)於西洋蜂(*Apis mellifera* L.)群之族群密度、寄生率及分布

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摘　要

蜂蟹蟎族群密度分別於春、秋兩季各有一發生高峰，該等高峰與花粉源期、流蜜期及幼蟲產生期高峰相吻合，尤以幼蟲產生期為主。封蓋工蜂房內親代雌蟎密度與成蜂體上之蟹蟎密度間，呈顯著之正相關關係(r=0.75, p=0.01)。親代雌蟎於封蓋雄蜂房內之寄生率及其密度，均較封蓋工蜂房內為高；親代雌蟎所產之子代數及親代與子代總數，亦以雄蜂房者為高；雄蜂房似能提供較佳之食物源供蟹蟎存活及繁殖。封蓋工蜂及雄蜂房內每房親代雌蟎平均所產子代數，以封蓋工蜂房內較多；且每房中親代雌蟎密度及每雌所產子代密度之間，呈顯著負相關關係(工蜂房：r=－0.96, p=0.01；雄蜂房：r=－0.80, p=0.05)。蟹蟎多外寄生於工蜂腹部，尤以腹板節間膜為甚。蟹蟎在蜂路間之分布差異不顯著，但在各巢脾上則多出現於中央偏下方之部位，應與幼蟲圈分布相吻合。

關鍵詞：蜂蟹蟎，族群密度，寄生率，分佈

前　言

蟹蟎科(Varroidae)已報導有2屬4種，寄生於蜜蜂屬(*Apis* spp.)身上，蜂蟹蟎(*Varroa jacobsoni* Oud.)外寄生於中國蜂(*Apis cerana* Fab.)及西洋蜂(*A. mellifera* L.)蜂群中(Crane, 1990)，可藉盜蜂、漂流等行爲而擴散(De Jong *et al.*, 1982)。De Jong *et al.* (1982)指出自1970年以來蟹蟎已成爲世界性的蜜蜂害蟎；至1993年除澳大利亞(Australia)、紐西蘭(New Zealand)及太平洋上的島嶼，包括夏威夷(Hawaii)等地之外，蟹蟎已遍佈世界各大洲(Crane, 1990; Rowntree, 1993); Akratanakul and Burgett(1975)鑑定確認台灣有該蜂蟹蟎(*V. jacobsoni*)存在。Lo and Chao(1975)調查亦發現蟹蟎已普遍發生於台灣各地之蜂場。

蟹蟎生活於蜂群中，因此其族群與蜜蜂族群之關係密切，故影響蜜蜂族群密度消長之因子，亦直接或間接地影響蟹蟎密度。除不同年度、季節變化、地理區域、氣候型式及外界粉蜜源等環境因素外，蜂種、蜂勢大

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小及蜂群之管理方法等，亦影響蟹蟎族群密度之變動(Kuan, 1979; Fan and Li, 1988; Fries *et al.*, 1991; Moretto *et al.*, 1991)。蟹蟎在蜂群中的工蜂或雄蜂房及成蜂體上之寄生率及密度等，雖因地區、季節、蜂種、階級(工、雄蜂)及蜜蜂幼蟲發育日齡等而異，但無論於雄蜂房與雄蜂成蜂體上之寄生率及密度，均高於工蜂房與工蜂成蜂體上，因此蟹蟎有偏好寄生於雄蜂房與雄蜂成蜂體上之傾向(Lo and Chao, 1975; Sulimanovic *et al.*, 1982; Ritter and De Jong, 1984; Ruttner and Marx, 1984; Schulz, 1984; Issa *et al.*, 1986; Takeuchi and Sakai, 1986; Woyke, 1987; Thrybom and Fries, 1991; Marcangeli *et al.*, 1992)。雌蟹蟎平均產卵數，因工蜂或雄蜂房而異，通常以雄蜂房內較多(Lo and Chao, 1975; Grobov, 1977; Sakai *et al.*, 1979; Sulimanovic *et al.*, 1982; Ifantidis, 1984; Choi, 1986; Le Conte *et al.*, 1990; Thrybom and Fries, 1991; Beetsma and Zonneveld, 1992)。蜜蜂發育成熟羽化前，在工蜂及雄蜂房中，雌蟹蟎所產子代因受封蓋期不同之影響而異，但亦以雄蜂房內較多(Ifantidis, 1984; Schulz, 1984)。本研究乃針對蟹蟎族群之季節豐度、蜂群內之分佈等加以探究，期建立蟹蟎族群生態之基本資料，俾供今後防治蟹蟎時之參考。

材料與方法

一、蜂群內蟹蟎密度之變動

自1991年12月至1993年6月，於南投縣名間鄉蠶蜂業改良場蜜蜂繁殖場飼養之蜂群中，任選四群以47×39×31cm^3(長×寬×高，內部尺寸)蜂箱飼養試驗蜂群，每群含七巢脾及約二萬隻成蜂，及具一隻正常產卵之蜂王，每隔二週分別自試驗蜂群中選取一片具已封蓋之工蜂及／或雄蜂房的巢脾，逢機於巢脾兩面選100～200個封蓋蜂房，打開封蓋取出幼蟲或蛹，計算及記錄蜂房內各齡蟹蟎之數量。

於1992年8月至1993年6月任選4～12試驗蜂群，選取蜂巢中間部份的一巢脾，抖落其上部份成蜂入罐中(直徑9cm，高9cm)，再以熱水燙殺罐內成蜂及搖振後，檢視並記錄成蜂及蟹蟎數；同時再由各試驗蜂群中任取位於中間部份之巢脾，檢視100～200個封蓋工蜂房內之各齡期蟹蟎數；並計算封蓋工蜂房內親代雌蟎之密度，與成蜂體上蟹蟎密度間之關係。於試驗期間，蜂群缺蜜時則於巢脾上方置一塑膠盤，飼以1.2公升糖水(果糖：水＝1：1)，各群於調查期間未供應代用花粉，各試驗蜂群均未施用任何殺蟎劑。

二、蟹蟎於蜂房內之寄生率及其密度

改良Ifantidis(1983)之標記蜂房方法，在巢脾上逢機標記編號200個以上即將封蓋之工蜂及雄蜂房，再將此巢脾置於被蟹蟎寄生之蜂群中，每蜂群置一標記巢脾，計含雄蜂及工蜂測試巢脾各4片，即各四重覆。每隔4小時取出巢脾，檢視各標記蜂房封蓋與否，並記錄已封蓋蜂房之編號及蜂房封蓋時間。工蜂及雄蜂房分別於封蓋後之第9天及第10天，以鑷子移去房蓋後，蜂房內新熟化之子代雌成蟎可由其體色及體壁硬化度與親代雌蟹蟎區別，再檢視記錄200蜂房內蟹蟎數及子代齡期與性別。

三、蟹蟎於成蜂體上、蜂群內及巢脾上分佈之差異性

(一)蟹蟎於成蜂體壁不同部位之寄生頻度

任選四群被蟹蟎寄生之試驗蜂群，每群逢機鑷取工蜂100隻，分別檢視記錄吸附於工蜂胸背板、前伸腹節背板、腹部背板及腹部腹板等處之蟹蟎數。檢視後之成蜂均先隔離於玻璃瓶內，於取樣檢視完成後，再釋回蜂

群。

㈡蜂路(bee space)間工蜂體上蟹蟎寄生頻度

於含有七片巢脾及末端一隔王板的蜂群中，各蜂路之編號次序，以巢壁與第一巢片之空間爲1號蜂路，第一巢片與第二巢片之間爲2號蜂路，餘此類推。在各蜂路空間之兩側各取樣30隻工蜂，檢視每隻蜜蜂身上蟹蟎寄生的數量。

㈢蟹蟎在巢脾上不同部位蜂房之寄生頻度

自1991年12月至1992年7月，每隔二週由蜂場內選定四蜂群，並各選封蓋蜂房面積最廣的巢脾一片，除最底端1cm巢脾外，將每巢脾面由上至下依次均分爲6橫排，另由右至左依次均分爲14直列。每巢脾面共分成6×14個3cm×3cm(約含33個蜂房)之單元，自每單元中任取四個封蓋蜂房，於移去房蓋後檢查各齡子代及其親代數，分析蟹蟎出現於單脾之部位及密度。

結　果

一、蜂群內蟹蟎密度之變動

於1991年12月至1993年6月期間，蟹蟎在蜂群內之族群密度於1992年4月初有一高峰期，從4月初至5月初期間族群銳減，之後族群又開始緩慢增加，至10月族群達另一高峰，而1993年初蟹蟎族群密度仍低，至4～5月才開始增多，1992年10月中旬至翌年2月初無調查資料(圖一)。成蜂體上之蟹蟎密度與封蓋工蜂房內親代雌蟎密度間，具顯著之正相關關係($r=0.75$, $p=0.01$)(圖二)，顯示工蜂房內親代雌蟎密度，隨成蜂體上蟹蟎密度之增加而增加。

二、蜂房內蟹蟎密度及其出現頻度

親代雌蟎於所有檢視的封蓋工蜂及雄蜂房中之平均寄生率分別爲0.14及0.24，平均每房親代雌蟎數則分別爲0.16隻及0.54隻(表一)。但於被蟹蟎寄生的工蜂及雄蜂封蓋蜂房中，每房親代雌蟎數，分別以6隻及8隻爲最多，其中均以每房含1隻親代雌蟎之出現頻度最高，分別爲70%及40%(圖三)。雌成蟎在封蓋的工蜂與雄蜂房中，每房親代雌蟎所產之子代數量，皆以5隻子代蟹蟎之頻率最高，其出現頻度分別爲27.4%及21.8%；於工蜂房中其子代數最多可達10隻，而雄蜂房中其子代數則多達26隻(圖四、圖五)。而此等被蟹蟎寄生的蜂房中，在工蜂及雄蜂房中每房可容蟹蟎之數量，分別可達14隻及33隻；其中以工蜂房中6隻、雄蜂房中7隻出現之頻率最高，分別爲26.7%與17.7%(圖六、圖七)。

封蓋雄蜂房內子代密度(1.36蟎／房)高於工蜂房(0.55蟎／房)，但雄蜂房內每雌蟎所產子代密度(2.61子蟎／雌蟎／房)反少於工蜂房(3.46子蟎／雌蟎／房)(表一)。工蜂房內含1隻親代雌蟎密度之出現頻度較雄蜂房內爲高，此可由每房中親代雌蟎之標準偏差証明之(表一)。封蓋工蜂房內親代雌蟎密度及其每雌子代蟹蟎密度間，呈顯著負相關關係($r=-0.96$, $p=0.01$)，故其子代密度可由其親代雌蟎密度評估之(圖八)；於封蓋雄蜂房內，每房親代雌蟎密度及其每雌子代蟹蟎密度之間，亦有顯著負相關關係($r=-0.80$, $p=0.05$)(圖九)。

三、蟹蟎於成蜂體上、蜂群內及巢脾上分佈

㈠成蜂體表各部位之蟹蟎寄生頻度

雌蟹蟎寄生於工蜂體表時，其吸附於工蜂腹部腹板所佔比率較高(60%, $p=0.01$)，而寄生在腹部背板者次之(33.5%)(圖十)。

㈡蜂路間工蜂體上蟹蟎寄生頻度

測定蟹蟎寄生於工蜂體上於各蜂路間出現頻度之結果，顯示分佈於第2與第3巢脾間、第3與第4巢脾間及第5與第6巢脾間之頻

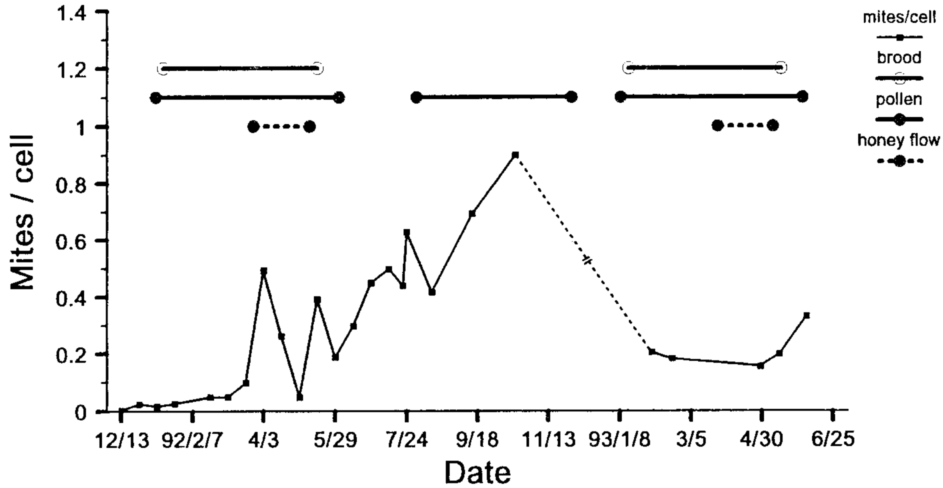

圖1 南投名間地區義大利蜂*A. mellifera*蜂群中蟹蟎*Varroa*的季節豐度Dec. 1991～Jun. 1993(Oct. 1992～Jan. 1993蜂群未調查)。

Fig. 1. Seasonal population density of *Varroa* mites in colonies of *Apis mellifera* during Dec. 1991～Jun. 1993 in Mingchen, Nantou (Colonies not survey from Oct. 1992 to Jan. 1993).

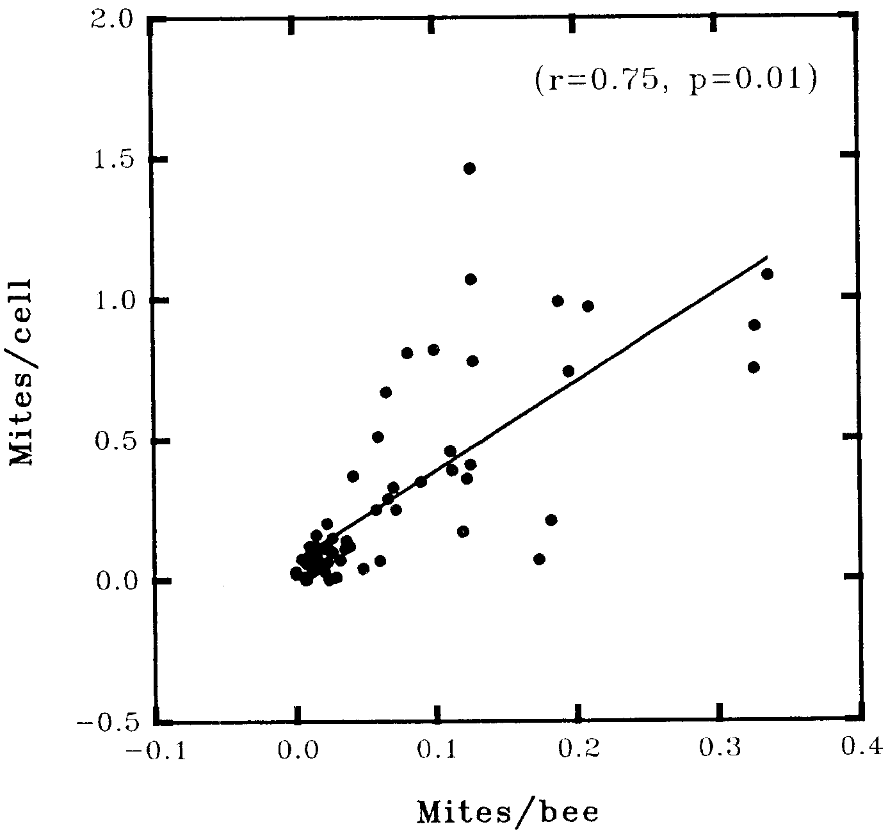

圖2 成蜂體蟹蟎密度與封蓋工蜂房中親代蟹蟎密度間之直線相關關係。

Fig. 2. Correlation between *Varroa* parental mites in capped worker cells and *Varroa* mites on adult bees.

表一　工蜂及雄蜂房之蟹蟎平均感染率及其子代數

Table 1 Average fraction of infested cells and *Varroa* progeny in worker and drone cells.

	Cell type	
	Worker	Drone
No. of colonies	4	4
No. of cells examined	200	200
Average fraction of infested cells(mean(S.D.))	0.14(0.04)	0.24(0.10)
Parental females per cell(mean(S.D.))	0.16(0.05)	0.54(0.31)
Parental males per cell	0	0
No. of progenies per cell(mean (S.D.))	0.55(0.28)	1.36(0.81)
Progenies / female / cell(mean (S.D.))	3.46(0.69)	2.61(0.57)

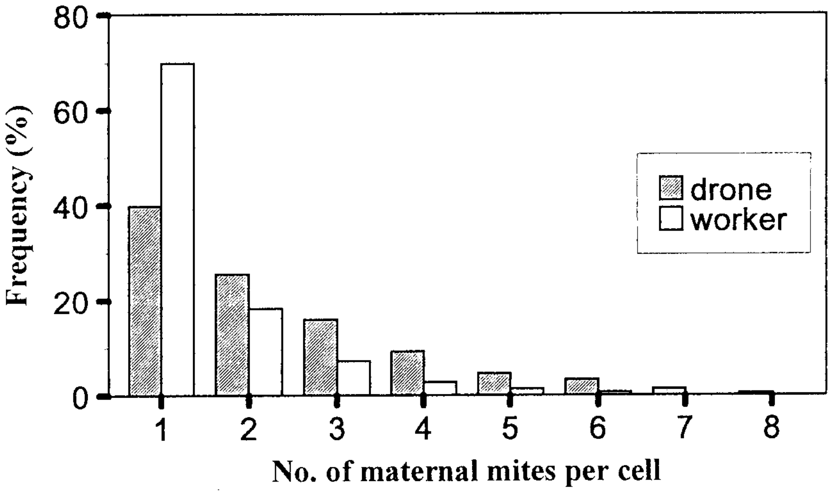

圖3　親代雌蟎寄生封蓋工蜂房及雄蜂房內之密度及其頻度分布。

Fig. 3. Density and frequency of *Varroa* parental mites in capped worker and drone cells.

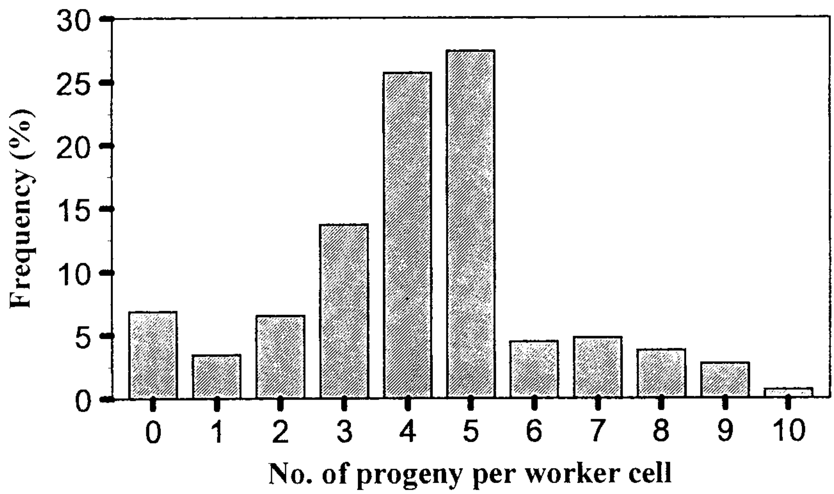

圖4　封蓋工蜂房內子代蟹蟎密度及其頻度分布。

Fig. 4. Density and frequency of *Varroa* progeny in capped worker cells.

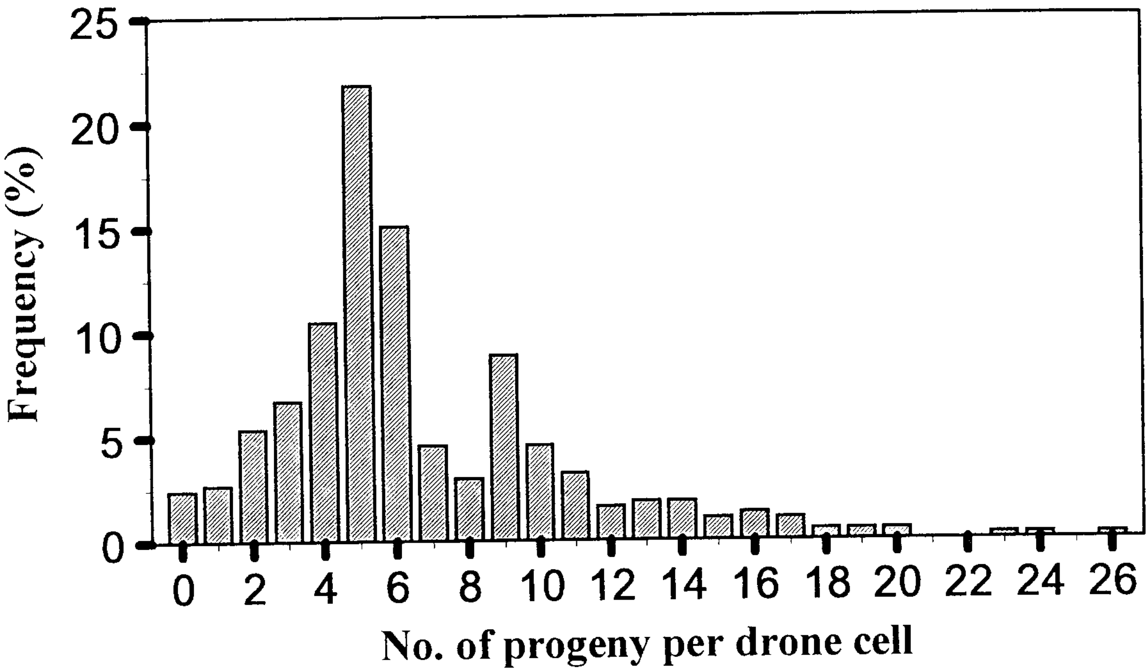

圖5　封蓋雄蜂房內子代蟹蟎密度及其頻度分布。

Fig. 5. Density and frequency of *Varroa* progeny in capped drone cells.

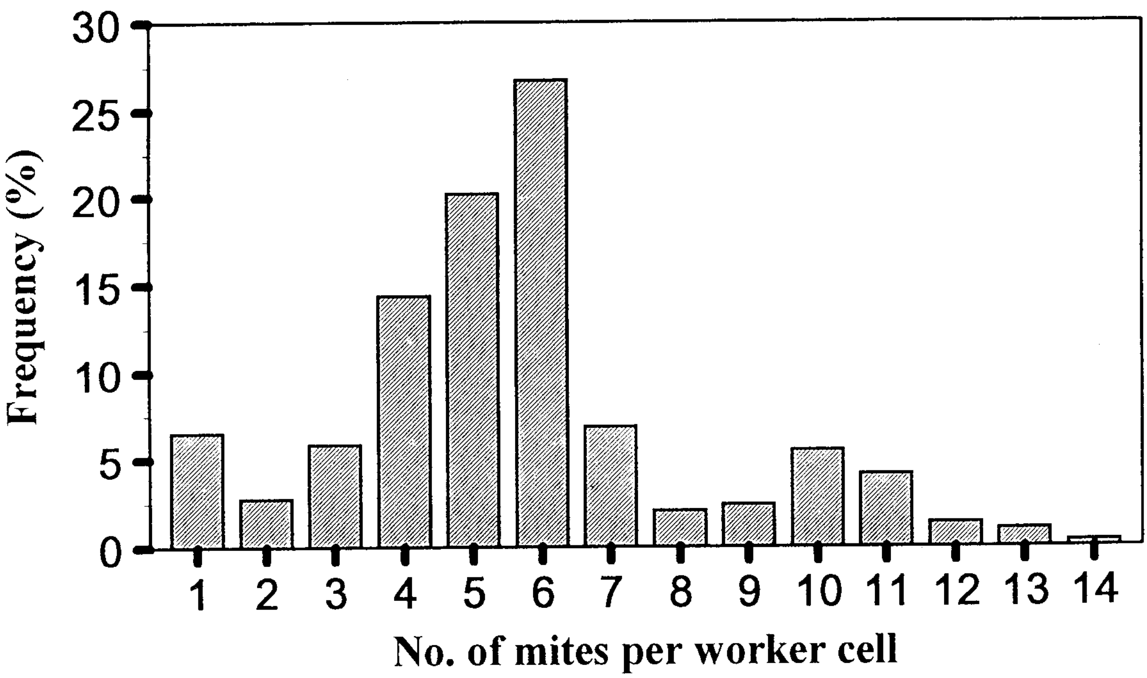

圖6　封蓋工蜂房內蟹蟎密度及其頻度分布。

Fig. 6. Density and frequency of *Varroa* mites in capped worker cells.

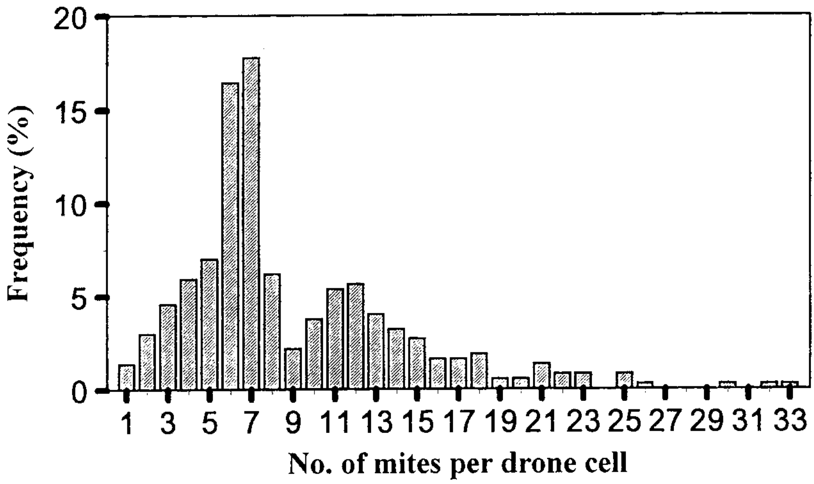

圖7　封蓋雄蜂房內蟹蟎密度及其頻度分布。
Fig. 7. Density and frequency of *Varroa* mites in capped drone cells.

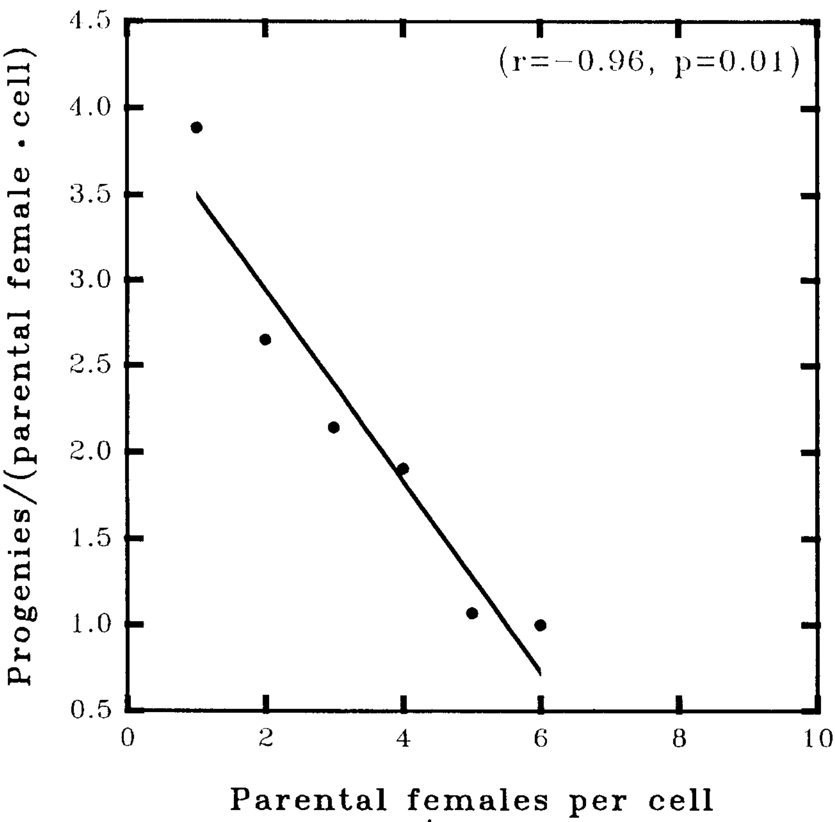

圖8　封蓋工蜂房內親代雌蟹蟎數對其子代數之影響。
Fig. 8. Effects of *Varroa* female densities on their progeny in capped worker cells.

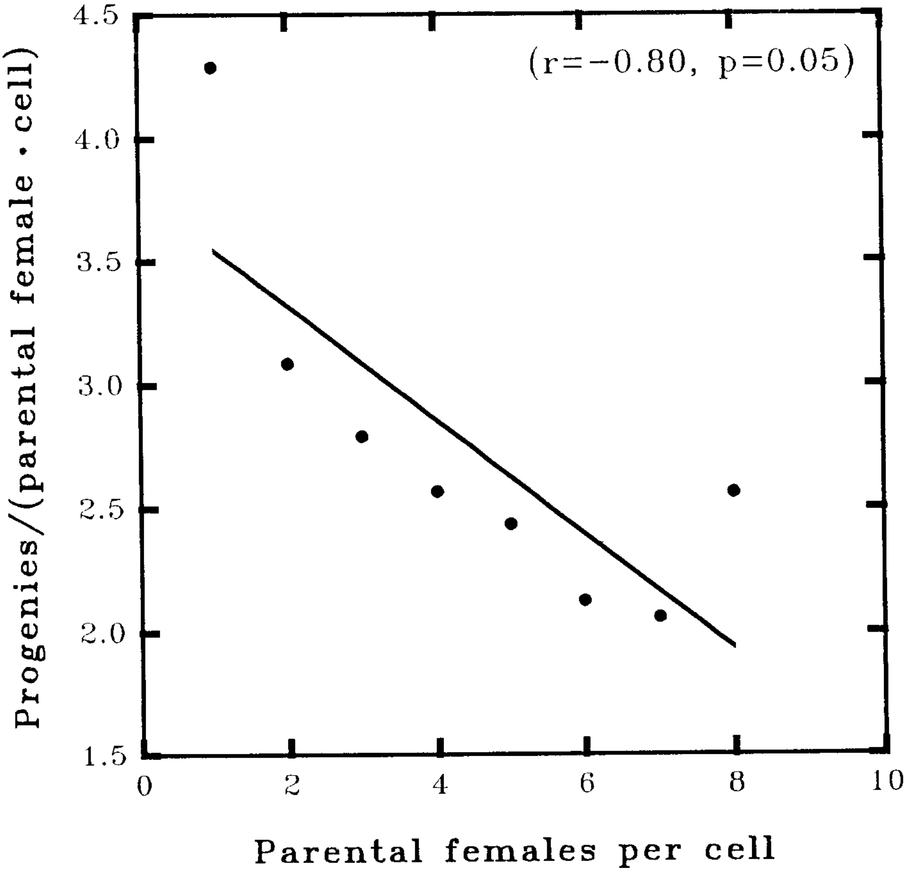

圖9 封蓋雄蜂房內親代雌蟹蟎數對其子代數之影響。
Fig. 9. Density and frequency of *Varroa* mites in capped drone cells.

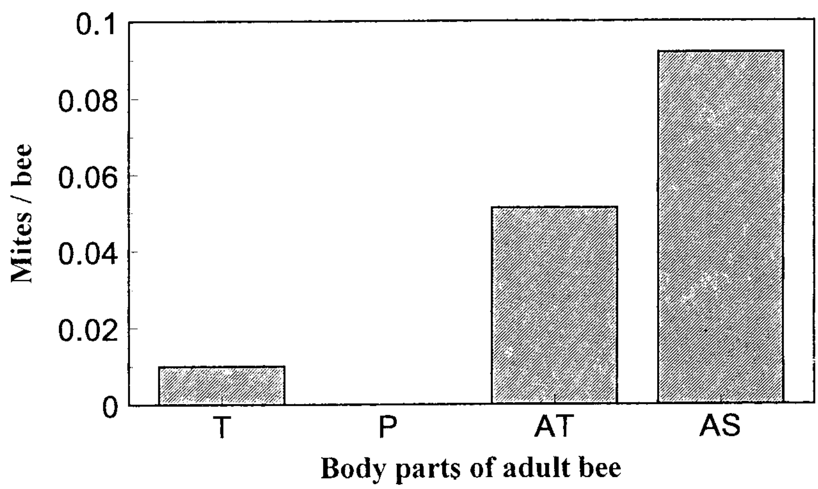

圖10 蟹蟎外寄生於工蜂體表部位之頻度分布。
Fig. 10. Frequency of occurrence of *Varroa* mites on body parts of adult bees(T=thorax, P=propodeum, AT=abdominal terga, AS=abdominal sterna).

度較高，但其間差異不顯著(ANOVA分析，p=0.05)(圖十一)。雌蟹蟎寄生於工蜂體上時，隨工蜂在蜂群之活動，而隨機出現於各蜂路間。

㈢巢脾上蟹蟎寄生頻度

蟹蟎於巢脾上不同部位之蜂房內寄生頻度結果顯示，位於巢脾中央及下方之蜂房，蟹蟎之出現頻度較高(表二)。

討　　論

每年3月至5月爲本省龍眼及荔枝開花流蜜期，此時蜂王產卵量多，幼蟲數目劇增，蜂群強盛，尤其雄蜂幼蟲數量增加極多(Kuan, 1979)，又雄蜂蜂房內蟹蟎寄生數量較多(Lo and Chao, 1975; Sulimanovic *et al.*, 1982)，且蟹蟎在雄蜂房內的繁殖力較高(Ifantidis, 1984; Schulz, 1984)，同時雄蜂平均封蓋期較工蜂多2天(Winston, 1987)，均有利於蟹蟎之發育及增殖。於1992年4～5月期間進行3次採蜜作業，採蜜過程中所造成蜂群之騷擾，除嚴重影響蟹蟎之活動外，同時割除蜂群內之贅脾及巢脾上之雄蜂房，均能中斷蟹蟎於封蓋蜂房內之增殖，此可能爲蟹蟎族群銳減之原因。本省7～9月自然界之粉蜜源較缺乏致蜂勢減弱，工蜂無法周全照顧蜂群之幼蟲，且蜂群的防衛能力差，有利於蟹蟎的存活率提昇，反之工蜂的積極防衛行爲，可造成蟹蟎足部與身體表皮之傷害(Ruttner and Hanel, 1992)，且於蜂群內此等受傷害蟹蟎的比率與蟹蟎數量呈明顯負相關(Moosbeckhofer, 1992)。蟹蟎族群變動似受流蜜期、蜂群幼蟲數量及外界花粉源之影響。蟹蟎族群密度於春季期間之高峰期，與Kuan

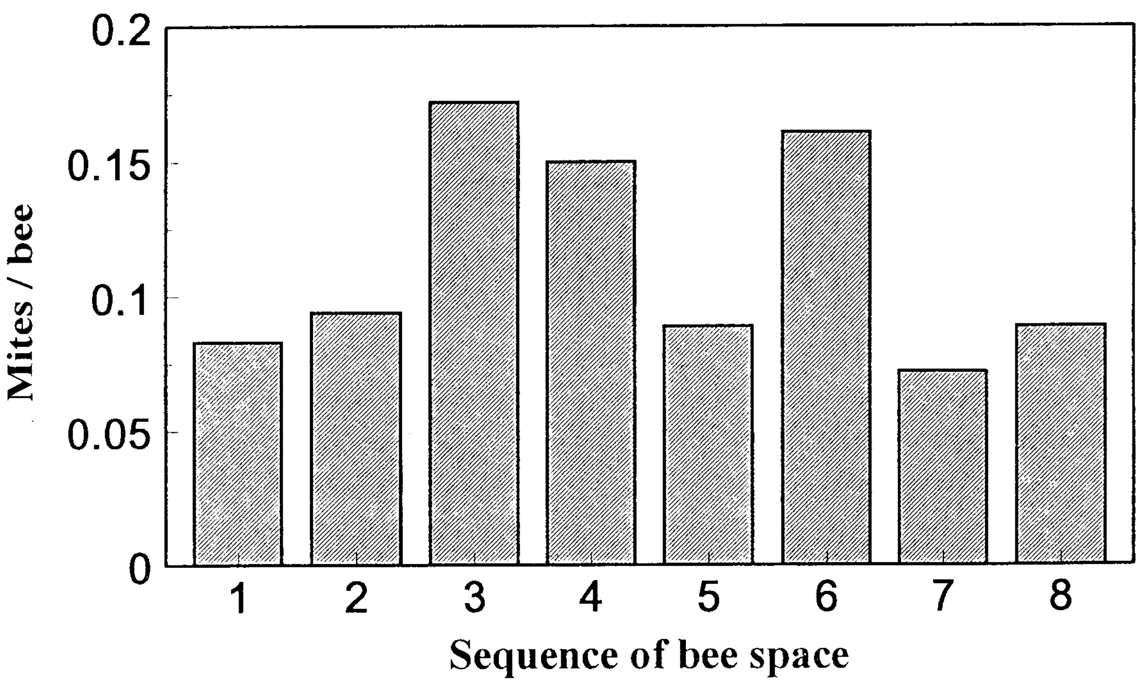

圖11　蟹蟎在不同蜂路成蜂體上之頻度分布。

Fig. 11. Frequency of *Varroa* mites on adult bees among bee spaces in the colony.

表二　巢脾上不同部位之蟹蟎密度

Table 2 Density of *varroa* mites in different portions of the comb

No. of column from either end of comb[a]		Mites per cell					
		No. of row from top (1) to bottom (6) of comb[a]					
		1 (mean (S.D.))[b]	2 (mean (S.D.))	3 (mean (S.D.))	4 (mean (S.D.))	5 (mean (S.D.))	6 (mean (S.D.))
right	1	0	0	0.01(0.01)	0.03(0.02)	0.05(0.07)	0.03(0.03)
	2	0	0.01(0.01)	0.06(0.01)	0.06(0.04)	0.13(0.10)*	0.13(0.04)*
	3	0.02(0.04)	0.10(0.04)	0.14(0.06)*	0.20(0.10)**	0.20(0.06)**	0.15(0.09)*
	4	0.01(0.02)	0.05(0.04)	0.16(0.07)*	0.22(0.10)**	0.23(0.08)**	0.24(0.15)**
	5	0.08(0.12)	0.08(0.03)	0.17(0.12)**	0.22(0.07)**	0.21(0.15)**	0.16(0.04)*
	6	0.05(0.05)	0.19(0.03)**	0.27(0.15)**	0.17(0.11)**	0.18(0.12)**	0.13(0.03)*
	7	0.08(0.12)	0.10(0.08)	0.34(0.21)**	0.22(0.15)**	0.21(0.10)**	0.20(0.12)**
	7	0.11(0.16)	0.20(0.07)**	0.28(0.13)**	0.27(0.14)**	0.22(0.07)**	0.18(0.09)**
	6	0.02(0.02)	0.15(0.03)*	0.29(0.06)**	0.26(0.18)**	0.15(0.15)*	0.21(0.05)**
	5	0.03(0.02)	0.15(0.06)*	0.29(0.12)**	0.30(0.07)**	0.27(0.17)**	0.14(0.04)*
	4	0.02(0.02)	0.10(0.05)	0.24(0.15)**	0.23(0.02)**	0.20(0.06)**	0.21(0.10)**
	3	0.03(0.02)	0.10(0.04)	0.16(0.03)*	0.23(0.12)**	0.15(0.09)*	0.08(0.02)
	2	0.01(0.01)	0.03(0.02)	0.09(0.09)	0.18(0.07)**	0.07(0.03)	0.08(0.07)
left	1	0	0	0.02(0.02)	0.10(0.06)	0.07(0.06)	0.10(0.08)

a.Each column and row width is 3 cm, and each comb is divided into 6×14 units.

b.Mean followed by one or two stars represents significant difference at the 5% or 1% level, respectively, with Duncan's new multiple range test.

(1979)於本省各地蜂場全年蟹蟎密度變動調査結果相似，而Lo and Chao(1975)報告指出，於台北地區1月至3月蟹蟎族群呈明顯下降之趨勢，3月至7月間的蟹蟎族群則變化不大。Fuchs(1985)報告成蜂感染率與幼蟲感染率間亦有顯著關係(r=0.76, p<0.001)，對蜂房內親代雌蟎與成蜂體上之蟹蟎密度間關係並未加以闡明；本試驗結果顯示當成蜂體上蟹蟎密度愈多，亦即蜂群內蟹蟎之數量相對地增多，似能使親代雌蟎寄生於工蜂房內之密度增加。

由表一被蟹蟎寄生的蜂房中，估計平均每房之親代雌蟎密度，於封蓋工蜂及雄蜂房內分別為1.1(0.16／0.14)及2.3(0.54／0.24)，在封蓋蜂房中，雄蜂房平均每房親代雌蟎密度高於工蜂房，工蜂房之直徑為5.0～5.4mm，深11.4mm，而雄蜂房之直徑為6.2～6.96mm，深12.55mm(Winston, 1987; Ruttner, 1988)，就蜂房空間而言，雄蜂房大於工蜂房，故可容較多的親代雌蟎寄生及產生較多子代；且雄蜂幼蟲釋放較多之開洛蒙(kairomone)，故似可吸引較多的蟹蟎寄生於雄蜂房內(Le Conte *et al.*, 1989); Sulimanovic *et al.* (1982)亦指出蟹蟎在蜂房之寄生率以雄蜂房較高，故於雄蜂房中發現較多的蟹蟎寄生，與本試驗結論相符。又在工蜂及雄蜂房中，每房均以寄生1隻親代雌蟎的頻度最高，此等現象似可說明，當雌蟎侵入蜂房時，除需具適齡幼蟲外，幼蟲圈分布位置，及蟹蟎可能亦具優先選擇寄生於尚未被其他蟹蟎寄生的幼蟲之能力。Lo and Chao(1975)的報告指出未封蓋蜂房內之蟹蟎密度，於工蜂及雄蜂房中分別為1～3隻及1～8隻，此未封蓋蜂房內之蟹蟎應為親代雌蟎，唯此等未封蓋蜂房至蜂房封蓋之期間，未加以闡明。Ritter (1981)報導雄蟎熟化後在未開封蓋之蜂房內

與雌蟎交尾後，隨即死亡；於被蟹蟎寄生的蜂房內，本試驗僅見親代雌蟎存在，而親代雄蟎則均未調查到（表一），因此蟹蟎是以授精後之雌成蟎來擴散其族群分佈，且雄蟎僅短暫存活於未開封蓋前之蜂房內。

Lo and Chao(1975)報導工蜂及雄蜂房內蟹蟎數分別平均為3.56隻（1～12隻）及5.77隻(1～14隻)；Sulimanovic *et al.* (1982)與Schulz(1984)報告雄蜂房內的蟹蟎密度為工蜂房內之11.9倍及8.6倍；故於封蓋蜂房內蟹蟎所產之子代密度及每房內可容蟹蟎密度，均以在雄蜂房內較多，應是雄蜂房空間較大所致。每房親代雌蟎密度及其每雌子代蟹蟎密度之間，亦有顯著負相關關係。此等每房親代雌蟎密度愈高，其每雌所產平均子代數愈低之關係，此種現象是否由於親代雌蟎於蜂房內，對空間和食物相互競爭的結果，或因自殘作用所致，則有待進一步之探究。

Lo and Chao(1975)報導蟹蟎多位於蜜蜂腹部前端周圍，並鑽入節間膜間，以其口器吸取蜜蜂之體液為生，De Jong *et al.* (1982)報導常在蜜蜂腹部板片下方或胸腹間發現蟹蟎，Rath(1993)報告蟹蟎多吸附於蜜蜂腹部背板側方節間膜處；本試驗結果顯示蟹蟎多吸附於蜜蜂腹部腹板位置。蜂王於巢脾上產卵時，自中央部位以螺旋順序擴大，依次展及巢脾左右上下各側，常呈橢圓形，此即"產卵圈"，亦稱"幼蟲圈"(brood nests)，Bulter(1963)及Winston(1992)指出通常蜂蜜貯存於幼蟲圈之上方及周圍部位，幼蟲圈即位於巢脾之中央部位，利於集中保溫及育幼活動，花粉則圍繞著幼蟲圈貯存，以便於育幼蜂取得。此幼蟲圈與蟹蟎高頻度分佈區相近；又巢脾之幼蟲圈上方或兩側經常為儲粉或儲蜜區，且本區蜜蜂幼蟲蜂房之低出現率，似可推測為蟹蟎出現頻度較低之因。內勤蜂係以蜂巢中央幼蟲圈為中心，隨日齡而逐漸向外活動(Crane, 1990)，蟹蟎吸附於工蜂體上時，隨工蜂在蜂群之活動，而隨機出現於各蜂路間，Kraus *et al.* (1986)、Kraus(1993)與Boot *et al.* (1994)指出蟹蟎吸附成蜂時偏好內勤蜂(3～14日齡)身上，且內勤蜂多半逗留幼蟲圈上；似可推測蟹蟎於近蜂巢中央蜂路間工蜂體上出現頻度較高之原因。

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Population Density, Infestation Rate and Distribution of *Varroa jacobsoni* Oud. in *Apis mellifera* L. Colony

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ABSTRACT

Varroa jacobsoni Oudemans populations in honeybee colonies showed seasonal high densities in the spring and autumn of 1992. The occurrences of the high densities of mites were related to the presence of pollen sources, honey flow and brood cells. The density of maternal mites in capped worker cells was significantly correlated with the density of adult bees ($r=0.75$, $p=0.01$). Infestation rates and densities of *Varroa* mites in capped drone cells were higher than those in capped worker cells. Numbers of maternal mites and / or their progeny in drone cells were higher than in worker cells. Food suitability and amount of resources, e.g., food and space, are higher in drone cells than in worker cells. The number of *Varroa* progeny produced per female in worker cells was higher than that produced in drone cells. However, the number of progeny produced by each female was significantly correlated with their densities of maternal mites in cells (worker cells: $r=-0.96$, $p=0.01$; drone cells: $r=-0.80$, $p=0.05$). The frequency of *Varroa* mites parasitizing the abdominal sternum of honeybees was highest among the 4 body parts compared. The difference of the distribution pattern on beehives in the same colony was not significant. The fact that mites concentrated on the "brood nests" located in the mid-low portion of the comb was consistent with the egg-laying pattern of the queen.

Key words: *Varroa jacobsoni,* population density, infestation rate, distribution

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