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Neozygites fresenii CAUSING EPIZOOTIC IN APHIDS (*Aphis craccivora* KOCH.) POPULATION ON FABA BEAN IN EGYPT

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ABSTRACT

The entomopathogenic fungus *Neozygites fresenii* (Nowaka-wski)Remaudiere & Keller was found in populations of cowpea aphids *Aphis craccivora* Koch. on faba bean during November – December 1998 . This fungus is epizootic in high populations of *A. craccivora* on faba bean plants . Infection levels ranging between the 11 – 66.7 % of aphids were found in the field . Preliminary morphological studies of the fungus were conducted . The study suggested that *Neozygites fresenii* may be a promising biocontrol agent against *A. craccivora* in Egypt .

Key words *: Aphis craccivora, biological control, fungal epizootic, Neozygites fresenii.*

1. INTRODUCTION

The cowpea aphid *Aphis craccivora* Koch.is an important pest of a wide range of crops of economic importance especially faba bean *Vicia faba* L.in Egypt (Saleh *et al.*, 1973).It causes damage directly through feeding and indirectly through the transmission of plant viruses (Abdel–Wahab , 1998) .

In Egypt , *A. craccivora* occurred on faba bean plants during mid November to late March and its maximum populations are found in

January and March (Saleh *et al.*, 1973 , El-Deffrawy, 1987 and Abdel-Wahab , 1998) .

In 1998, a sudden increase in *A. craccivora* populations was observed in faba bean fields in Egypt. Fungal epizootic have been noted in *A. craccivora* populations in Giza Governorate . Fungi pathogens to aphids are known, including fungi belonging to Order: *Entomophthorales*, in addition to *Verticillium lecanii* (Zimm.) Vieges (Wilding , 1981 and Sewify, 1989) .

This study reports for the first time the appearance of *Neozygites fresenii* (Zygomycotina Neozygotaceae) on aphid *A. craccivora* in Egypt and includes a preliminary description of the fungus and observations on its occurrence

2. MATERIALS AND METHODS

2.1. Field sampling

In 1998, the cowpea aphid *Aphis craccivora* populations were monitored on faba bean plants and their numbers were counted during November to December in the farm of the Faculty of Agriculture , Cairo University at Giza , Egypt. No insecticides were applied in the field. The density of aphids was assessed weekly during this period by counting the number of aphids on 100 randomly selected faba bean plants. Then, ten plants were collected in plastic bags and transferred to the laboratory. Ten aphids were sampled from each plant and examined microscopically to assess the percentage of fungal infected aphids .

2.2. Microscopic examination

Some aphid cadavers on leaves were collected and immediately dissected and mounted for microscopic examination . Other cadavers were placed under humid conditions in order to collect the primary and secondary spores. These spores were received on glass slides and stained with lactophenol cotton blue using the method of Keller (1987).

2.3. Infectivity tests

Laboratory tests were conducted to evaluate the ability of the fungus to infect *A. craccivora*. These tests were carried out using the method described by Odour *et al.*, (1996) and Junior *et al* ., (1997). *A.craccivora* mumies were collected during the epizootic in November – and December and stored in a refrigerator in the dark at 4°C.

Two mumies were put in the center of cotton leaf disks (2 cm diameters) . The disks were put inside Petri dishes kept on moistened filter paper at 23 C over night . The high humidity and darkeness caused the fungus to discharge primary conidia which formed , together with their attached capilliconidia ,a halo around each mummy . Twenty apterous adults of *A. craccivora* (obtianed from mass rearing culture of Chrysopa Mass Production Project) were placed on leaf disks near sporulating mumies (20 aphids per disk) . Five replicates were used in each test . The control consisted of the same treatment but using leaf disks without infected mumies. All the dead insects during the observation period were mounted in lactophenol / cotton blue and examined microscopilly to evaluate the fungal infection .

3. RESULTS

3.1. Morphological features of the fungus (Fig.1 – 6)

Infected cadavers remained attached to leaves and were covered with a whitish dust. The microscopic examinations showed that the hyphal bodies are spherical , primary conidia are subglobose , with relating flattened basal papilla 18 – 20 µm. x 13– 15 µm (18 x 14 µm); secondary conidia capilliconidia are almond – shaped 20 – 30 µm x 11 x 14 µm (25 x 12 µm) supported by a capillary conidiophore 20 - 30 µm (26 µm) typing bent near the tip. No resting spores were observed .

3.2. Fungal infectivity

According to the morphological features and the pathogenic capabilities of the studied fungus , it has been identified as *Neozygites fresenii*_ (Nowakawski)Remaudiere & Keller ,Fam. Neozygitaceae, Order: Entomophthorales Sub-Division Zygomycotina . Moreover, the identification of the fungus was also confirmed by Dr. Richard A. Humberc(USDA-ARS Collection of Enteomopathogenic Fungal Cultures , Plant Protection Research Unit, U. S. Plant, Soil and Nutrition Laboratory . Ithaca, NY 148553-2901). Throughout the period of exmination , most of the infected aphids were dead between 5 and 7 days after infection . The procedure employed to test Kock's postulates resulted in reasonable levels of infection of *A. craccivora* by the fungus . Nine days after the inoculation , the mortality of infected

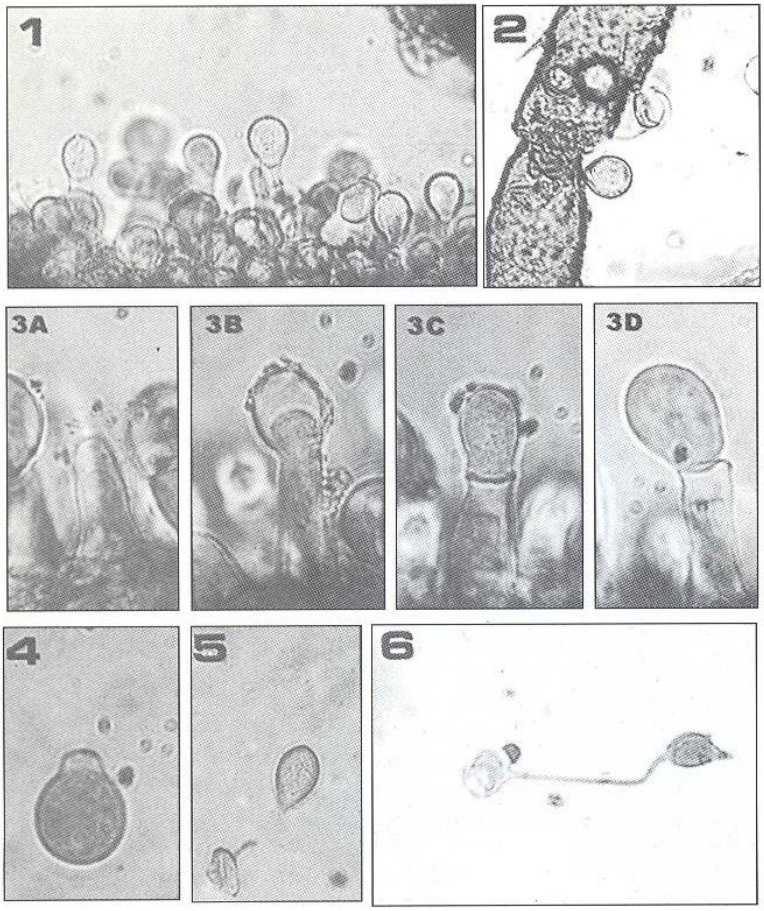

Fig. (1): Emerging conidiophores and conidia of *Neozygites fresenii* from *A. crassivora.* (200X)

Fig. (2): Primary conidium of *Neozygites fresenii* attached to leg of Aphid *A. craccivora* (400X)

Fig. (3): A,B,C,and D formation and discharge of primary conidium of *Neozygites fresenii* (1000X)

Fig. (4): Primary conidium of *Neozygites fresenii*(1000X)

Fig. (5): Capilliconidium of *Neozygites fresenii* (400X)

Fig. (6): Capilliconidium of *Neozygites fresenii* still attached to capillary conidophore which developed from conidium (400X)

aphids was 71% (N = 100) compared with 10% (N = 100) of the uninfected aphids . This mortality seemed relatively not high. The results also recommend to use stored mumies for less than 6 months .

3.3.Prevalence of *Neozygites fresenii* in *Aphis craccivora* population.

During November and December 1998, a sudden increase in cowpea aphid *Aphis craccivora* population was observed on faba bean plants in Giza Governorate. The average numbers of aphids ranged from 5.9 to 279.8 aphids / plant during this period (Fig.7) .

The fungus *Neozygites fresenii* was found in the aphid population during this period. The proportion of infected individuals reached a maximum of 66.7 % in faba bean fields during the second week of December (Fig.7). The fungal infection increased when the aphid population started to decrease.

4. DISCUSSION

The first appearance in Egypt of the aphid entomopathogenic fungus *Neozygites fresenii* (Nowakawski)Remaudiere & Keller is described. This description agree with those reported by Keller (1991). The present study reported that fungal epizoon had been noticed during the outbreak of cowpea aphid *A. craccivora* on faba bean from November to December 1998. *Neozygites fresenii* had been noted by several investigators in dense populations of several aphid species. It has been found infecting the cotton aphid *Aphis gossypii* in USA and Africa (Steinkraus and Slaymaker, 1994) and *Brevicoryne brassicae* in Yugoslavia (Sivceu , 1992) . The reported epizoon effectively reduced *A. craccivora* population on faba bean plants in Egypt . Such reduction in the cotton aphid *A. gossypii* populations by *N. fresenii* was reported in the Southeastern United States and Africa (Steinkraus *et al* ., 1991 ; Slivie and Papierok, 1991 ; Weathersbee and Hardee , 1994). This study suggested that *Neozygites fresenii* had caused epizoon in *A. craccivora* population in dry climatic conditions. Thoizon (1970) and Dedryver (1978) reported that *N . fresenii* appears to be somewhat a typical entomopathogenic fungus because it has caused epizoon during relatively dry period . Steinkraus and Slaymaker (1994) mentioned that cotton aphid *A. gossypii* mortality and sporulation from *N. fresenii* infections occurred mainly during night and early morning hours when humidity was much higher than during the daylight hours .

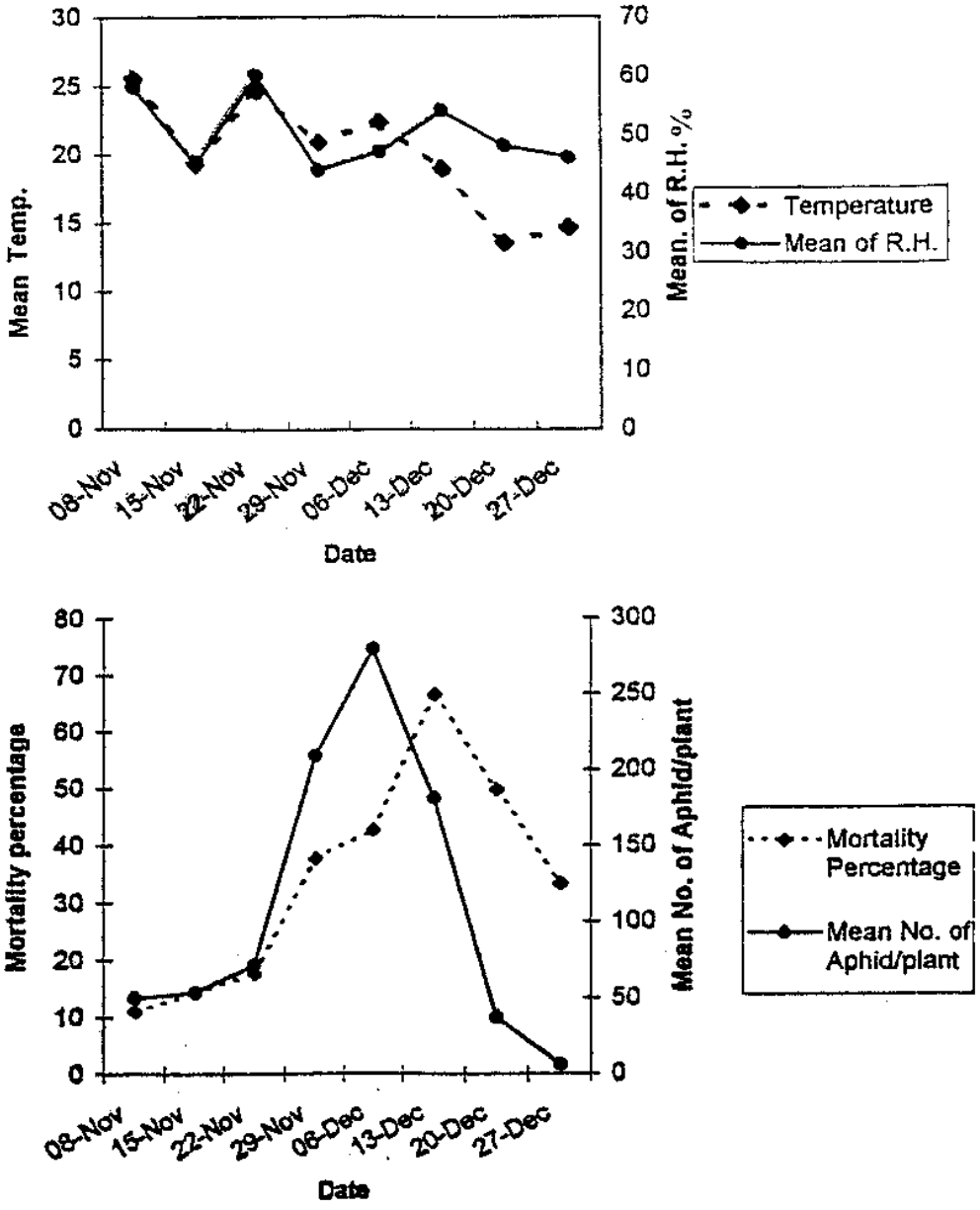

Fig.(7): Mean numbers of healthy , *A. craccivora* and aphids infected by *Neozygites fresenii* on faba bean plants under field conditions during November-December1998.

In this study the recorded temperature during the period of fungus appearance was optimal for fungal development. No resting spores were observed in infected aphids perhaps due to the warm climatic winter in Egypt . The possible relationships between population density of the aphids, weather conditions and development of fungus epizoon deserve further studies. Field and laboratory observations suggest that *Neozygites fresenii* may be a promising natural enemy for use in the biological control of *A. craccivora* in Egypt .

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5. REFERENCES

Abdel–Wahab A. S. (1998) . Aphid species borneviruses associated with faba bean in Egypt. M.Sc. Thesis , Faculty of Agriculture , Cairo University. 147 pp.

Dedryver C. A. (1978) . Facteurs de limitation des populations d' *Aphis fabae* dans L'ouest de la France. III. Repartition et incidence des differents especes d' Entomophthora dans les populations. Entomophaga 23, 137 – 151.

El–Deffrawy G. M. (1987) . Studies on insect vectors of plant virus diseases infesting legumes in Egypt. Ph.D. Thesis , Fac. Agric. Ain Shams Univ., Cairo , Egypt 134 pp.

Junior I. D. , Humbar , R. A. , R. A., Bento , J. M. S. and De Matos, A. P. (1997). First record of the entomopathogenic fungus *Neozygites fumosa* on the cassava mealybug *Phenacoccus herreni* . Journal of Inverteberate Pathology 69, 276 – 278.

Keller S. (1987) . Arthropod – pathogenic entomopathorales of Switzerland. I. *Conidiobolus, Entomophaga* and *Entomophthora.* Sydowia 40, 122 – 167.

Keller S. (1991). Arthropod–pathogenic entomopathorales of Switzerland . II. *Erynia , Eryniopsis, Neozygites , Zoophthora* and *Tarichium* Sydowia 43, 39 – 122.

Oduor G. I., Yaninek, J. S., Van Der Geest, L.P. and De Moraes, G . J. (1996) . Germination and viability of capilliconidia of *Neozygites floridana* (Zygomycetes : Entomophthorales) under constant temperature , humidity , and light conditions. Journal of Inverteberate Pathology 67, 267 – 278 .

Saleh M. R. A., Hassanein, M. A. and El-Sebae, A. M. (1973). Population dynamics of *Aphis craccivora* Koch. on broad bean and cowpea in Upper Egypt. Bull. Ent. Soc. Egypt. 56, 135 – 138.

Sewify G.H.(1989). Evaluation of *Verticillium lecanii* entomopathogenic fungus and its prospects in controlling aphid pests. Ph. D. Thesis , Faculty of Agriculture, Cairo University . 134 pp.

Silvie P. and Popierok , B. (1991) .Les ennemis naturels d'insects du cotonnier ou Tchad : Premieres donnees sur les champignons de l'ordre des Entomophthorales . Coton Fibers Trop. 46 , 293 – 308.

Sivceu I. (1992) . Seasonal dynamics and density of the entomogenous fungi of the cabbage aphid (*Brevicoryne brassicae*). Zastita – Bilja. 43 (3), 181 – 195 .

Steinkraus D. C. and Slaymakes , P. H. (1994). Effect of temperature and humidity on formation , germination , and infectivity of conidia of *Neozygites fresenii* (Zygomycetes:Neozygitaceae) from *Aphis gossypii* (Homoptera : Aphididae) . J. of Invertebr.Path. 64 , 130 – 137.

Steinkraus D. C., Kring, T. J., and Tugwell, N. P. (1991) . *Neozygites fresenii* in *Aphis gossypii* on cotton , Southwest . Entomol. 16, 118 – 122.

Thoizon G. (1970) . Specificite de parasitisme des aphides par les Entomphthorales. Ann. Soc. Ent. Fr. (N. S.) 6, 517 – 562.

Weathersbee A. A., and Hardee , D. D. (1994) . Abundance of cotton aphids (Homoptera : Aphididae) and associated biological control agents on six cultivars. J. Econ. Entomol. 87 , 258 – 265.

Wilding N. (1981) . Pest control by entomophthorales in "Microbial control of pests and plant diseases 1970 – 1980 " Edited by H. D. Burges. PP.539 – 553 . Academic Press , London , New Yourk , Toronto, Sydney , San Francisco.

الإصابة الوبائية بالفطر *Neozygites fresenii* الممرض لحشرة من اللوبيا على نباتات الفول في مصر

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ملخص

توضح الدراسة الحالية انتشار الفطر الممرض للحشرات *Neozygites fresenii* بصورة وبائية في أعداد حشرة من اللوبيا الكثيفة التي سجلت على نباتات الفول في محافظة الجيزة خلال الفترة من نوفمبر إلى ديسمبر 1998، وقد تراوحت نسبة العدوى بهذا الفطر بين 11 – 66.7% خلال هذه الفترة . تناول البحث وصف لهذا الفطر الذي يسجل لأول مرة في مصر.وتشير الدراسة إلى إمكانية استخدام هذا الفطر كوسيلة فعالة في المكافحة الحيوية ضد حشرة من اللوبيا في مصر .

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