*Proc. 2nd Saudi Sci. Conf. Fac. Sci., KAU, 15-17 March 2004, **Part I**, pp. 167-174 (2005 A.D./1425 A.H.*

# A Comparative Abundance of Entomopathogenic Fungi of Cereal Aphids in Assiut, Egypt

[1]AHMED Y. ABDEL-MALLEK, [2]MOHAMED A.A. ABDEL-RAHMAN, [1]SHOKRY A. OMAR and [1]GAMAL H.A. HAMAM

*[1]Botany Department, Faculty of Science, Assiut University, Egypt*

*[2]Plant Protection Research Institute, Agriculture Research Center, Giza, Dokki, Egypt*

ABSTRACT. The comparative abundance of entomopathogenic fungi of cereal aphids, *Rhopalosiphum padi* L., *Rhopalosiphum maidis* (Fitch.) and *Schizaphis graminum* (Rondani) was examined during two successive wheat growing seasons, 1999-2000 and 2000-2001. From 2100 alive aphid individnals colleeted during the two seasons, 598 individuals were proved to be infected by fungi. Twelve species of entomopathogeuic fungi could be identified.

According to the percentage frequency of occurrenee, regardless of aphid speeies, gathered fungal species could be arranged into three groups. The first one those of high oceurrence (≥ 10%) inelude = *Beauveria bassiana* , *Pandora neoaphidis*, and *Zoophthora radicans*. The second group of moderate oceurrence ranged between 5% - 9% was represented by five species viz: *Beauveria brongniartii*, *B. alba*, *Conidiobolus coronatus*, , *C. obscurus* and *Entomophthora planchoniana*. The third group of low occurrence (≤ 5%) contains four species: *Basidiobolus* sp., *C. thromboides*, *Paecilomyces farinosus* and *Verticillum lecanii*.

## Introduction

Cereal aphids are considered one of the most serious pests attacking wheat plants in Assiut, Egypt. They damage the plants roughly through loss of sap by sucking, reaction of plant tissues stimulated by aphid saliva; excreting liquid, viscous honeydew, that is very harmful and on which sooty-moulds usually develop and, finally aphid transmission of viral diseases to plants. Insecticides are in general used to control these pests. However, several serious problems arose from the extensive application of these chemicals. The routine application of common pesticides has two well-known adverse features: firstly, they are mostly non-selective and kill a lot of aphid natural enemies, which cause further disturbance to the eereal crop ecosystem; seeondly, as in other species, resistant strains of aphids can be expected to develop soon (Doutt and Smith, 1971).

Several species of Entomopathogenic fungi were found infecting cereal aphids in the field under natural conditions (Dean and Wilding 1971, 1973; Dedryver 1983; Papierok and Havukkala 1986; Feng *et al.* 1991, 1992; Hatting et al 1999, 2000; Abdel-Rahman 2001 and Abdel-Rahman and Abdel-Mallek 2001). Therefore several authors have considered fungi as promising natural enemies for applied aphid biological control to be included in an integrated pest management programs (IPM) (Latge and Papierok, 1988; Humber, 1991; and Milner, 1997).

The present study aimed to evaluate the dominance degrees and host preference of entomopathogenic fungi infecting cereal aphids.

## Materials and Methods

The present investigations were carried out at the Experimental Farm of Assiut University (Faculty of Agriculture - Agronomy Department) throughout two successive wheat-growing seasons, 1999-2000 and 2000-2001. An area of ca. 4200 $m^2$ was cultivated with wheat (cultivar Giza 164) normally at mid-November in all cultivated seasons. Regular conventional agricultural practices were normally performed and no chemical control (insecticides or fungicides) was used during the study period. Weeds were removed by hand.

During the two seasons, weekly samples of 50 living individuals from each of *R. padi*, *R. maidis* and *S. graminum* were randomly collected from the field and transferred to the laboratory. Aphids were reared individually on 5-cm leaf sections in 65- mm petri dishes. Moist cotton was placed over the ends of the leaf sections in the dish to maintain relative humidity near saturation. Petri dishes containing alive aphids were incubated for 10 days at 20°C with a photoperiod of 16:8 (L:D). Leaf sections remained fresh for several days and were replaced twice a week. Dead aphids were recorded, placed in 1x5 cm vials and stored at 5°C.

Aphid cadavers were examined under a dissecting microscope as soon as possible after death to observe external symptoms and fungal reproductive structures produced in situ on the plant. Desiccated and fresh cadavers were placed in a moist chamber for about 20 h. to allow hyphae and reproductive structures to develop. Individual aphids were mounted in cotton blue and observed under a compound microscope. Fungal identification was based on external symptoms, the morphology of spores and sporulating structures (Waterhouse and Brady, 1982), and new revision of the classification of Entomophthorales (Humber 1989) was followed. Fungi identified as known aphid pathogens were considered to be the cause of death of their host.

Data were statistically analyzed using analysis of variance (F test) and means were compared according to Duncan's multiple range test.

## Results

Data in Tables 1-3 demonstrate the relative abundance of twelve species of Entomopathogenic fungi on three species of cereal aphids throughout 2000 and 2001 wheat growing seasons.

In 2000 season, data in Table 1 revealed that 365 individuals of aphids were infected from 1050 alive individuals from the three-cereal aphid species consisted of 34.76% mortality rate during the whole season due to mycosis. Data showed that the frequency of fungal infection varied between the different species of aphid host. *R. padi* exhibited much higher mortality from fungal pathogens (37.81%) followed by *S. graminum* (31.78%)m, while *R. maidis* seemed to be least commonly infected (30.41). Eleven fungal species were identified infecting those aphid species. These fungal species were *Beauveria bassiana*, *B. brongniartii*, *B. alba*, *Conidiobolus coronatus*, *C. obscurus*, *C. thromboides*, *Entomophthora planchoniana*, *Paecilomyces farinosus*, *Pandora (Erynia) neoaphids*, *Verticillium lecanii* and *Zoophthora radicans*.

Table (1). Abundance of entomopathogenic fungi infecting cereal aphid species during 2000 season.

| Fungi species | Number and abundance | | | | |
|---|---|---|---|---|---|
| | Aphid species | | | TNI | % & OR |
| | *R. maidis* | *R. padi* | *S. graminum* | | |
| *Beauveria bassiana* | 25 (40.98)a | 36 (59.02)a | 0 | 61b | 16.71 H |
| *B. brongniartii* | 0 | 11 (55.00)b | 9 (45.00)c | 20d | 5.48 M |
| *B. alba* | 25 (75.76)a | 6 (18.18)c | 2 (6.06)d | 33c | 9.04 M |
| *Conidiobolus coronatus* | 8 (22.86)b | 6 (18.18)c | 21 (60.00)a | 35c | 9.59 M |
| *C. obscurus* | 10 (32.26)b | 3 (9.68)c | 18 (58.06) b | 31c | 8.49 M |
| *C. thromboides* | 8 (38.9)b | 0 | 13 (61.91)b | 21d | 5.75 M |
| *Entomophthora planchoniana* | 0 | 0 | 12 (63.16)b | 19d | 5.21 M |
| *Paecilomyces farinosus* | 0 | 14 (100.0)b | 0 | 14d | 3.84 L |
| *Pandora neoaphidis* | 13 (16.88)b | 40 (51.95)a | 24 (31.17)a | 77a | 21.09 H |
| *Verticillium lecanii* | 0 | 0 | 2 (100.00)d | 2e | 0.55 L |
| *Zoophthora radicans* | 22 (42.31)a | 15 (28.85)b | 15 (28.85)b | 52b | 14.25 H |
| Total | 111c | 138a | 116b | 365 | 100 |
| (%) | 30.41 | 37.81 | 31.78 | 100 | - |

Values followed by the same letter vertically, are not significantly different at <0.05 probability.

* Number of infected individuals / 50 alive aphid.

** Figure in parenthesis refer to the percentage of infection (%) within a row from the total.

TNI = total number of infected individuals out of 1050, % = percentage frequency & OR = occurrence remark; H = High occurrence (≥10%); M= moderate occurrence (between 5-9 %); L = low occurrence (≤ 5%).

*Pandora neoaphids* was the most common speeies and occurred in 21.09% of infected aphid samples examined. It was recovered from 16.88, 51.95 and 31.7% of infected *R. maidis*, *R. padi* and *S. graminum*, respectively. *Beauveria bassiana* and *Zoophthora radicans* followed *P. neoaphids* and recovered in high frequency of occurrence (16.71% and 14.25%, respectively). Three fungal species were identified from all aphid species. They were: *B. alba*, *C. coronatus*, and *C. obscurus* were represented in 9.04%, 9.59% and 8.49% of aphid examined. *B. brongniartii*, *C. thromboides* and *E. planchoniana* infected at least one type of aphid species but recovered in moderate frequency of occurrences. *P. farinosus* infected only *R. padi* while *V. leccenii* recovered from *S. graminum* and both fungal species occurred in rare frequency.

In season 2001, (Table 2) 233 individuals were infected from 1000 individuals alive from the three aphid species consisted of 23.30% mortality rate during the whole season. Twelve species of fungi were identified during this season. *R. padi* (42.49%) was the most common species infected with fungal pathogens followed by *S. graminum* (38.63%) and then *R. maidis* (18.88%), which seemed to be least commonly infected.

Statistical aualysis showed that *Zoophthora radicans* was the most dominant and common species composting 20.17% of the total aphid cadavers followed by *Pandora neoaphidis*, *Beauveria bassiana* and *B. brongniartii* composting 16.31%, 15.88% and 12.45% of the total aphid cadavers, respectively. *C. coronatus* (8.16%), *C. obscurus* (6.01%) and *E. planchoniana* (5.15%) were recovered in moderate frequency of occurrence. The remaining five species listed in Table (2) were of low frequency of occurrence ranged between 0.43% to 4.72%.

Table (2). Abundance of entomopathogenic fungi infecting cereal aphid species during 2001 season.

| Fungi species | Number and abundance | | | | |
|---|---|---|---|---|---|
| | Aphid species | | | TNI | % & OR |
| | *R. maidis* | *R. padi* | *S. graminum* | | |
| *Basidiobolus sp.* | 0 | 0 | 11 (100.00)c | 11c | 4.72 L |
| *Beauveria bassiana* | 14 (37.84)a | 23 (62.16)a | 0 | 37b | 15.88 H |
| *B. brongniartii* | 1 (3.45)c | 22 (75.86)a | 6 (20.69)d | 29b | 12.45 H |
| *B. alba* | 9 (81.82)b | 2 (18.18)d | 0 | 11c | 4.72 L |
| *Conidiobolus coronatus* | 3 (15.57)c | 5 (26.32)c | 11 (57.89)c | 19c | 8.16 M |
| *C. obscurus* | 1 (7.14)c | 4 (28.85)d | 9 (64.29)c | 14c | 6.01 M |
| *C. thromboides* | 2 (28.85)c | 2 (28.57)d | 3 (42.86)d | 7d | 3.00 L |
| *Entomophthora planchoniana* | 0 | 6 (50.00)c | 6 (50.00)d | 12c | 5.15 M |
| *Paecilomyces farinosus* | 0 | 1 (14.29)d | 6 (85.14)d | 7d | 3.00 L |
| *Pandora neoaphidis* | 7 (18.42)b | 16 (42.11)b | 15 (39.47)b | 38b | 16.31 H |
| *Verticillium lecanii* | 0 | 1 (100.00)d | 0 | 1d | 0.43 L |
| *Zoophthora radicans* | 7 (14.89)b | 17 (36.17)b | 23 (48.94)a | 47a | 20.17 H |
| Total | 44c | 99a | 90b | 233 | 100 |
| (%) | 18.88 | 42.49 | 38.63 | 100 | - |

Values followed by the same letter vertically, are not significantly different at <0.05 probability.
* Number of infected individuals / 50 alive aphid.
** Figure in parenthesis refer to the percentage of infection (%) within a row from the total.
TNI = total number of infected individuals out of 1050, % = percentage frequency & OR occurrence remark: H = High occurrence (≥10%); M= moderate occurrence (between 5-9 %); L = low occurrence (≤ 5%).

Table (3). Abundance of entomopathogenic fungi infecting cereal aphid species regardless seasons.

| Fungi species | Number and abundance | | | | |
|---|---|---|---|---|---|
| | Aphid species | | | TNI | % & OR |
| | *R. maidis* | *R. padi* | *S. graminum* | | |
| *Basidiobolus sp.* | 0 | 0 | 11 (100.00)c | 11d | 1.84 L |
| *Beauveria bassiana* | 39 (39.79)a | 59 (60.21)a | 0 | 98a | 16.39 H |
| *B. brongniartii* | 1 (2.04)d | 33 (67.35)b | 15 (30.61)c | 49b | 8.19 M |
| *B. alba* | 34 (77.27)a | 8 (18.18)c | 2 (4.56)d | 44b | 7.36 M |
| *Conidiobolus coronatus* | 11 (20.37)c | 11 (20.37)c | 32 (59.26)a | 54b | 9.03 M |
| *C. obscurus* | 11 (24.44)c | 7 (15.56)d | 27 (60.00)b | 45b | 7.52 M |
| *C. thromboides* | 10 (35.71)c | 2 (7.14)e | 16 (57.15)c | 28c | 4.68 L |
| *Entomophthora planchoniana* | 0 | 13 (41.94)c | 18 (58.06)c | 31c | 5.18 M |
| *Paecilomyces farinosus* | 0 | 15 (71.43)c | 6 (28.57)d | 21c | 3.51 L |
| *Pandora neoaphidis* | 20 (17.39)b | 56 (48.69)a | 39 (33.91)a | 115a | 19.23 H |
| *Verticillium lecanii* | 0 | 1 (33.33)e | 2 (66.67)d | 3d | 0.50 L |
| *Zoophthora radicans* | 29 (29.29)b | 32 (32.32)b | 38 (38.38)a | 99a | 16.56 H |
| Total | 155 | 237 | 206 | 598 | 100 |
| (%) | 25.92 | 39.63 | 34.45 | 100 | - |

Values followed by the same letter vertically, are not significantly different at <0.05 probability.
* Number of infected individuals / 50 alive aphid.
** Figure in parenthesis refer to the percentage of infection (%) within a row from the total.
TNI = total number of infected individuals out of 2100, % = percentage frequency & OR = occurrence remark. H = High occurrence (≥10%); M= moderate occurrence (between 5-9 %); L = low occurrence (≤ 5%).

In general, regardless of the growing season, data in Table 3 indicated that 598 individuals were infected from 2050 individuals alive from the three aphid species consisted of 29.17% mortality rate dnring the two seasons. There are twelve species of entomopathogenic fungi identified infecting cereal aphid species during 2000 and 2001 seasons. *R. padi* was the most aphid species infected comprised 39.63% of the total mortality followed by *S. graminum* and *R. maidis* encountered 34.45% and 25.92%, respectively.

The dominance of entomopathogenic fungi recovered during the present investigation could be grouped into three categories viz: high, moderate and low frequency of occurrence. The first category includes the predominant fungi: *P. neoaphids*, *Z. radicans* and *B. bassiana*. They oeeurred in 19.23%, 16.56% and 16.39%, respectively. The seeond category had moderate frequency of occurrenee and ineludes five fungal species namely: *Beauveria brongniartii* (8.19%), *B. alba* (7.36%) *C. coronatus* (9.03%), *C. obscurus* (7.52%) and *E. planchoniana* (5.18%). The least category (recovered in low frequeucy of occurrenee) includes: *Basidioblus sp.*, *C. thromboides*, *Paecilomyces farinosus* and *Verticillium lecanii*.

## Discussion

Based on limited epizootiological literatures, factors determining the development of myeosis in aphid populations are complex and vary among crop-aphid-fungus systems. The oeeurrence of precipitation or heavy dews before the occurrence of epizootics among cereal aphid populations has been emphasized by several authors (Dean and Wilding 1971, 1973; Voronina 1971; Wilding 1975; Dedryver 1983). Missonnier *et al.* (1970) tried to quantify this relationship, postulating that there must be a minimum of 90% RH for ≥8 h/d for an enzootic and ≥10 h/d for three consecutive days for the development of an epizootic of *Entomophthora* sp. in an aphid population. In addition, Milner and Bourne (1983) detected no consistent effect of temperature on infectivity of *P. neoaphidis* primary spores to *Acyrthosiphon knodi* Shinij, but the final level of infection increased with increasing periods of leaf wetness up to 24 h after inoculation. However, a poor relationship was found between *Entomophthora* infection of populations of the bean aphid, *Aphis fabae* Scopoli, and any weather factors (Wilding and Perry 1980). However, Soper and Macleod (1981) concluded that inoculums levels, host density and, perhaps more abundant, the degree of host aggregation, were major factors controlling epizootics among *Schizolachnus piniradiatae* (Davidson).

One variable we did not measure was inoculums level, which was found to be of importance for *S. piniradiatae* epizootics (Soper and Macleod 1981). Additionally, the virulence of entomophthoralean fungi varies between host aphid species (Feng *et al* 1990, Feng and Johnson 1991). Thus, a complete explanation is impossible.

However, another factor that appear to affect mycosis development is the location each species of aphid typically occupies on the wheat plant. The most important seems to be the tendency to inhabit microhabitats with or without characteristics favourable ro fungal infection. Such characteristics may influence the exposure of an aphid and its immediate surroundings to sunlight and wind. These, in turn, affect the aphids' exposure to pathogens aud microclimates that influence the ability of the fungi to infect aphid hosts.

Duriug our study we observed that *R. padi* aud *S. graminum* typically resides on the undersurface of lower leaves. In this location, these aphids are exposed to fungal activity discharged or splashed from inocula possibly overwintered on the soil surface (Latteur and Godefroid 1983), which are shaded from ultraviolet radiation to increase their longevity. Simultaneously, the microhabirat is shaded and protected from wind, which tends to moderate temperatures and increase relative humidity, facilitating fungal infection.

Consequently, it seems that *S. graminum* and *R. padi* are more likely to encounter viable spores of entomophthogenic fungi under circumstances suitable for establishing infection. It is also among the eereal aphid species that are very susceptible to such fungi, particularly *P. neoaphidis*.

*R. maidis* is relatively xerophilic, typically feeding on upper leaves. It is exposed to an environment less suitable for germination of the spores that are encountered. Thus, it is not surprising that *R. maidis* populations experience mycosis less frequently than populations of the more mesophilic species. This eould also explain the greater correlation between precipitation and mycoses among *R. maidis* than in the other two species.

The occurrence of each fungal pathogen infecting the three aphid hosts provides further evidenee for the postulation stated above. The majority of mycosed *S. graminum* and *R. padi* found in the field were infected with *P. neoaphidis*, whereas most diseased *R. maidis* were infected with *Conidiobolus* spp. Roberts and Campbell (1977) summarized that epizootics induced by *P. neoaphidis* usually require for more moisture than do those caused by *Conidiobolus* spp. Therefore, the relative abundance of these fungi in *S. graminum*, and *R. padi* cadavers seem to be related to the site each aphid species occupies on the host plant.

Dedryver (1983) observed Entomophthorales caused diseases to drastically reduce the populations of various cereal aphids in six of eight years. In the other years, the weather was extremely dry. He distinguished three types of mycoses in the populations of cereal aphids. An epizootic develops when the number of disease-killed aphids increases more quiekly than does the number of living aphids and eventually leads to nearly local extinction of the aphids. An enzootic occurs when the proportion of mycoses aphids remains approximately stable during population growth and diminution. Such a level of mycosis contributes to the decline of host populations, hut by itself does not bring it about. The third type of mycosis occurs when the activity of fungal pathogens lacks significant effect on the development of its host population. Other reports have also revealed that the control of cereal aphid by fungal pathogens is as important to control cereal aphids and agreement with the document (Lazzari 1985, Papierok and Havukkala 1986). The fungi are thus excellent candidates for biological of various aphids (Latge and Papierok 1988).

## References

**Abdel-Rahman, M.A.** (2001). Seasonal prevalence of entomopathogenic fungi attacking cereal aphids infesting wheat in Southern Egypt. *International Symposium Organic Agriculture, Agadir* – Maroc, 7-10 Oct. 2001: 381-389.

**Abdel-Rahman, M.A.** and **Abdel-Mallek, A.Y.** (2001). Preliminary records on the entomopathogenic fungi attacking cereal aphids infesting wheat plants in Southern Egypt. *First Conference For Safe Alternatives of Pesticides For Pest Management, Assiut* (Oct. 28 – 29th 2001): 183-190.

**Dean, G.J.** and **Wilding, N.** (1971). *Entomophthora* infecting the cereal aphids, *Metopolophium dirhodum* and *Sitobion avenae*. *Journal of Invertebrate Pathology,* **18:** 169-176.

**Dean, G.J.** and **Wilding, N.** (1973). Infection of cereal aphis by the fungus *Entomophthora*. *Ann. App. Biol.,* **74:** 133-138.

**Dedryver, C.A.** (1983). Field pathogenesis of three species of Entomophthorales of cereal aphids in Western Franee, pp. 10-11. In: **R. Cavalloro** [ed.], *Aphid antagonists*. Balkema, Rotterdam.

**Dontt, R.L.** and **Smith, C.F.** (1971). The pesticide syndrom – diagnosis and suggested prophylaxis. In: **Huffaker C.B.** [ed.]: *Biological control,* 3-15.

**Feng, M.G.** and **Johnson, J.B.** (1991). Bioassay of four entomophthoralean fnngi (Entomophthorales) against *Diuraphis noxia* and *Metopolophium dirhodum* (Homoptera: Aphididae). *Environ. Entomol.*, **20:** 338-345.

**Feng., M.G.; Johanson, J.B.** and **Kish, L.P.** (1990). Survey of entomopathogenic fungi naturally infecting cereal aphids (Homoptera: Aphididae) of irrigated grain crops in Southwestern Idaho. *Environ. Entomol.*, **19:** 1534-1542.

**Feng, M.G.; Johnson, J.B.** and **Halbert, S.E.** (1991). Natural control of cereal aphids (Homoptera: Aphididae) by entomopathogenie fungi (Zygomycetes: Entomophthorales) and parasitoids (Hymenoptera: Braconidae and Encyrtidae) on irrigated spring wheat in Southwestern Idaho. *Environ. Entomol.*, **20:** 1699-1710.

**Feng, M.G.; Nowierski, R.M.; Johnson, J.B.** and **Poprwski, T.J.** (1992). Epizootics caused by entomophthoralean fungi: (Zygomycetes, Entomophthorales) in populations of cereal aphids (Hom., Aphididae) in irrigated small grain in Southwestern Idaho USA. *J. Appl. Entomol.*, **16:** 376-390.

**Hatting, J.L.; Humber, R.A.; Poprawski, T.J.** and **Miller, R.M.** (1999). A survey of fungal pathogens of aphids from South Africa, with special reference to cereal aphids. *Biological control*, **16**(1): 1-12.

**Hatting, J.L.; Paprawski, T.J.** and **Miller, R.M.** (2000). Prevalences of fungal pathogens and other natural enemies of cereal aphids (Homoptera: Aphididae) in wheat under dry land and irrigated conditions in Sonth Africa. *Biocontrol*, **45**(2): 179-199.

**Humber, R.A.** (1991). An alternative view of certain taxonomic criteria used in the Entomophthorales (Zugomycetes). *Mycotaxon*, **15:** 167-184.

**Humber, R.A.** (1989). Synopsis of a revised classification for Entomophthorales (Zygomycotina). *Mycotaxon*, **34:** 441-460.

**Latge, J.P.** and **Papierok, B.** (1988). Aphid pathogens. pp. 323-336. In **A.K. Minks** & **Harrewjn** [eds]. *Aphids: their biology natural enemies and control*, **vol. 2b** Elsevier, Amsterdam.

**Lattenr, G.** and **Godefroid, J.** (1983). Trial of field treatments against cereal aphids with mycelinm of *Erynia neoaphids* (Entomophthorales) produced in vitro. In: **Cavalloro, R.** [ed.] *Aphid Antagonists*, A.A. Balkema, Roterdam, the Netherlands, pp. 2-10.

**Lazzari, S.N.** (1985). Natural enemies of aphids (Homoptera, Aphididae) on barley (*Hordeum* sp.) in Parana. *An. Soc. Entomol. Bras.*, **14:** 5-15.

**Milner, R.J.** (1997). Prospects for biopesticides for aphid control. *Entomophaga*, **42:** 227-239.

**Milner, R.J.** and **Bourne, J.** (1983). Influence of temperature and dnration of leaf wetness on infection of *Acyrthosiphon kondoi* with *Erynia neoaphidis*. *Ann. Appl. Biol.*, **102:** 19-27.

**Missonnier, J.; Robert, Y.** and **Thoizon, G.** (1970). Epidemiological circnmstances with seem to promote entomophthorosis in three aphids. *Entomophaga*, **15:** 169-190.

**Papierok, B.** and **Havukkala, I.** (1986). Entomophrhoraceous fungi parasitizing cereal aphids in Finland. *Ann. Entomol. Fenn.*, **52:** 36-38.

**Roberts, D.W.** and **Campbell, A.S.** (1977). Stability of entomopathogenic fungi, pp. 19-76. In: *Miscellaneous publication 10, Entomological Society of America*, College Park, Md.

**Soper, R.S.** and **Macleod, D.M.** (1981. Descriptive epizootiology of an aphid mycosis. *USDA Science Educational Administration. Tech. Bull.*, **1632:** 16pp.

**Voronina, E.G.** (1971). Entomophthorosis epizootics of the pea aphid *Acyrthosiphon pisum* Harris (Homoptera, Aphididae). *Entomol., Rev.*, **4:** 444-453.

**Waterhouse, G.M.** and **Brady, B.L.** (1982). Key to the species of *Entomophthora sensu* Lato. *Bulletin of British Mycological Society*, **16:** 113-143.

**Wilding, N.** (1975). *Entomophthora* species infecting pea aphid. *Trans. R. Entomol. Soc.*, **127:** 171-183.

**Wilding, N.** and **Perry, J.N.** (1980). Studies on *Entomophthora* in populations of *Aphis fabae* on field beans. *Ann. Appli. Biol.*, **94:** 367-378.

# مقارنة وفرة الفطريات الممرضة لحشرات من النجيليات بأسيوط – مصر

أ.د. احمد يحيى عبد المالك[1] ، د. محمد علاء الدين احمد عبد الرحمن[2] ،
أ.د. شكري احمد عمر[1]، السيد / جمال همام عبد العليم همام[1]
[1] كلية العلوم ، قسم النبات ، جامعة أسيوط
[2] معهد بحوث وقاية النباتات ، مركز البحوث الزراعية

*المستخلص.* أجريت هذه الدراسة خلال موسمين زراعيين متتاليين ١٩٩٩-٢٠٠٠ ، ٢٠٠٠-٢٠٠١ على الفطريات التي تتطفل على حشرات من النجيليات التي تصيب نباتات القمح بأسيوط بهدف دراسة وفرة وتفضيل هذه الفطريات لأنواع حشرات من النجيليات المختلفة ، وهى حشرات من الشوفان ، وحشرات من أوراق الذرة وكذا حشرات البق الأخضر.

تم تسجيل اثنى عشر نوعا من الفطريات الممرضة التي تتطفل على أنواع حشرات المن السابقة بصورة طبيعية وتعتبر عاملا مهمًا من عوامل المكافحة الحيوية. واتضح من الدراسة أن نسبة الموت الناتجة من الفطريات الممرضة لحشرات من النجيليات بصورة طبيعية تصل إلى حوالي ٣٠% من إجمالي التعداد. واتضح أيضا أن كلا من حشرات من الشوفان وكذا حشرات من الغلال من أكثر الأنواع إصابة بالفطريات الممرضة مقارنة بحشرات من أوراق الذرة.

أمكن من الدراسة تقسيم الفطريات الممرضة لحشرات من النجيليات إلى ثلاثة أقسام حسب درجة وفرتها بغض النظر عن أنواع حشرات المن وكذلك المواسم الزراعية وهى (١) المجموعة الأولى وهى تضم الأنواع الأكثر سيادة وهى *Beauvaria bassiana* ، *Pandora neoaphids* ، *Zoophthora radicans*. (٢) الأنواع متوسطة التواجد وهى *Beauveria brongniartii* ، *B. alba* ، *Conidiobolus coronatus* ، *C. obscurus* ، *Entomophthora planchoniana*. (٣) المجموعة الثالثة وهى تضم الأنواع الأقل تواجدا وهى *Basidiobolus* ، *C. thromboides* ، *Verticillium lecanii* ، *Paecilomyces*.