

INSECT SPECIES ASSOCIATED WITH THE THISTLE PLANT, *Cynara* SP. IN EL-GABAL EL-AKHDAR, LIBYA

Amin, A. H.

Dept. of Plant Protection, College of Agriculture, University of Salahaddin, Erbil, Iraq. E-mail: ahkorachi@yahoo.com .

ABSTRACT

The present study was conducted to survey the insect species associated with the thistle plant, *Cynara* sp. at El-Baida area, El-Gabal El-Akhdar, Libya during the period from September 2001 through August 2003. Obtained results revealed the presence of 27 insect species belong to 19 families and seven orders associated with *Cynara* sp. Order Coleoptera was represented by nine species; *Agapanthia annularis* L. and *A. cardui* L. (Family Cerambycidae), *Cassida* sp. and *Phyllotreta* sp. (Family Chrysomelidae), *Coccinella septempunctata* L. and *C. novemnotata* L. (Family Coccinellidae), *Larinus* sp. and *Lixus* sp. (Family Curculionidae) and *Potosia morio* F. (Family Scarabaeidae). Order Diptera was represented by two species; *Acanthiophilus helianthi* Rossi and *Chaetorellia carthami* Stack (Family Tephritidae). Order Hemiptera was represented by three species, *Anthocoris* sp. (Family Anthocoridae), *Spilostethus pandurus* Scop. (Family Lygaeidae) and *Dolycoris baccarum* L. (Family Pentatomidae). Order Homoptera was represented by three species, *Aphis compositae* Theobald and *A. craccivora* Koch (Family Aphididae), and *Empoasca* sp. (Family Cicadellidae). Order Hymenoptera was represented by three species; *Andrena* sp. and *Apis mellifera* L. (Family Apidae), and *Megachile* sp. (Family Megachilidae). Order Lepidoptera was represented by six species; *Pieris rapae* L. and *Colias croceus* Fourc. (Family Pieridae), *Pyrgus* sp. (Family Hesperidae), *Vanessa cardui* L. (Family Nymphalidae), *Pyronia* sp. (Family Satyridae), and *Macroglossa stellatarum* L. (Family Sphingidae). Order Thysanoptera was represented by one species, *Thrips* sp. (Family Thripidae). The results suggest that the species; *A. annularis*, *A. cardui*, *Larinus* sp., *Lixus* sp., *P. morio*, *A. helianthi* and *C. carthami* can be used as biological control agents for controlling the thistle plant, *Cynara* sp. at El-Baida area, El-Gabal El-Akhdar, Libya.

INTRODUCTION

The thistle plant, *Cynara* sp. belongs to family Asteraceae (= Compositae) and is considered a common weed in most areas of El-Gabal El-Akhdar in Libya. It grows in the scrub-lands and roadsides causes several damages, in addition that it itself is a plant pest in the grasslands, sheltering many insect pests. It causes also mechanical damages, such as wounds and physical injuries resulting from the sharp spines and spurs, which cover plant surfaces to the animals, especially in its late stages of growth. Beside, it creates general problems, such as preventing visibility on the roads, especially in the corners and sometimes it is a source of fires in natural forests (Abu Ramila, 1988).

Cynara sp. is subject to be infested with several species of insects belong to various orders and families. The most important and common ones are the flies belong to Order Diptera, Family Tephritidae; *Acanthiophilus helianthi*, *Chaetorellia australis*, *Tephritis postica* and *Urophora quadrifasciata* (Clement and Mimocchi, 1988; Maddox *et al.*, 1990; Manojlovic, 1991-1992 and Briese *et al.*, 1996), Order Coleoptera including; *Larinus latus*, L.

Amin, A. H.

cynarae, *L. cardui*, *L. curtus*, *L. minutus*, *Lixus cardui* and *Trichocerocalus horridus* species of Curculionidae (Kok and Mays, 1991; Briese *et al*, 1995 and Lang *et al.*, 1996), the beetle *Cassida rubiginosa*, Family Chrysomelidae (Cartwright and Kok, 1990), the beetle *Megacyllene mellyi*, a species of Cerambycidae (Boldt, 1987) and also the bug *Megalonatus sabulicola* that belongs to Family Lygaeidae, Order Hemiptera (Wheeler, 1989). The insect species commonly found on the thistle plant of the genus *Cynara*, are mostly belong to the two families; Tephritidae and Curculionidae (Petney, 1988 and Briese *et al.*, 1996).

In the case of the Libyan Arab Jamahiriya, especially El-Gabal El-Akhdar, there are no previous studies in this region in this respect, except the preliminary study of Amin *et al.* (1998) on the insects' fauna at El-Baida area, including insect species found on the weeds of family Asteraceae.

The present study aims to survey the insect species associated with the thistle plant, *Cynara* sp. in nature and to evaluate the role of some species that might be benefit for biological control programs of this harmful plant.

MATERIALS AND METHODS

The survey was carried out regularly by weekly sampling to the fields and farms of El-Baida area at El-Gabal El-Akhdar, Libya during the period from September 2001 till August 2003. The whole plant parts of *Cynara* sp., except the roots were examined. All insect species associated with the plant were collected using several methods; a sweep-net, an aspirator and hand picking. Immature stages were collected, transferred to the laboratory and reared under laboratory conditions in glass jars (1/2 L.), covered with clothes and fixed with rubber bands to complete their development until they reach adult stage.

Plant species was identified as, *Cynara* sp. by the Biology Department, Faculty of Science, University of Omar Al-Mukhtar, Libya. As well, the insect species were identified based on the preserved collection of the Entomological Museum, Department of Plant Protection, Faculty of Agriculture, University of Omar Al-Mukhtar and by the use of some taxonomic catalogs such as that of Priesner and Alfieri (1953); Hargreaves and Chinery (1981); Blackman and Eastop (1985) and Booth *et al.* (1990).

RESULTS AND DISCUSSION

Results of the present study summarized in Table (1), revealed the presence of 27 species of insects belong to 19 Families and 7 Orders. Highest number of species (9 species) was recorded from Order Coleoptera represented by 33.3% of the total number, followed by Order Lepidoptera (6 species) represented by 22.2%, while number of the species of other orders ranged between 1-3 and their represented percentages ranged between 3.7-11.1%. Most insect species were found belong to (Diptera: Tephritidae) and (Coleoptera: Curculionidae). These results agree with previous studies of Petney (1988) who recorded 8 species affecting thistle plants of family Cynareae. Also, Talosi *et al.* (1989) recorded 94 species of insects belong to

34 Families and 7 Orders in their survey of insects associated with the thistle grasses of genus *Carduus*, Family Asteraceae.

As shown in Table (1), the results also indicated that the insect species, recorded in the present study, attacked different parts of the thistle plant, *Cynara* sp. 15 species was recorded on the flower buds, represented 55.5%, 10 species on the stems, represented 37.03% and 2 species on the leaves, represented 7.4 %. For those insects recorded on the flower buds, 9 species were found feeding on nectar, 3 species belong to Order Hymenoptera, including the honey bee, *Apis mellifera* and 2 species of wild bees; *Andrena* sp. and *Megachile* sp. and 6 species belong to Order Lepidoptera; *Pyrgus* sp., *Vanessa cardui*, *Pieris rapae*, *Colias croceus*, *Pyronia* sp. and *Macroglossa stellatarum*. Additional 6 species of insects were recorded on the flower buds, including a species of thrips, *Thrips* sp., 2 species of weevils belong to Family Curculionidae; *Larinus* sp. and *Lixus* sp. and 2 species of flies belong to Family Tephritidae; *Acanthiophilus helianthi* and *Chaetorellia carthami*. Larvae of the weevils and flies were found feeding on the contents of the flower buds. Besides, a species from Scarabaeidae, *Potosia morio*, its adults were found also feeding on the contents of the flower buds.

Visiting insect species of the flower buds recorded in the present study, agree with the reports given by some researchers. (Btau, 2001) mentioned that the main insect species visiting flowers usually belong to only four orders. Bees and wasps from Order Hymenoptera were the dominant, followed by the dipterous flies, moths and butterflies and lastly came the coleopterans beetles. Amin *et al.* (1998) recorded some insect species attacking the flower buds of several species of grasses of family Asteraceae at El-Baida region. These species included 4 hymenopteran's species; the honey bee *A. mellifera* and 3 species of wild bees: *Andrena* sp., *Megachile* sp. and *Bombus terrestris*, in addition to 6 lepidopterous species; *Hespera* sp., *Lycaena* sp., *V. cardui*, *Colias croceus*, *Pieris brassicae* and *P. rapae*. The insects that feed on the flower buds of family Asteraceae are of great importance in biological control of these weeds, as the present results agree with many previous studies conducted in this respect, particularly recorded insects belong to Tephritidae and Curculionidae on several species of the thistle plants of family Asteraceae. Talosi *et al.* (1989) surveyed insect species of the thistle plants belong to genus *Carduus*. 35.1% of the larvae of the recorded insects complete their development inside the flower buds and these include the species of family Tephritidae and Curculionidae. Other studies also recorded the species of the flies; *Acanthiophilus helianthi*, *Chaetorellia australis*, *Tephritis postica* and *Urophora quadrifasciata* as well as the species of the weevils of the genera; *Larinus* and *Lixus* on the flower buds of the thistle plants (Clement and Mimmochi, 1988, Maddox *et al.*, 1990, Manojlovic, 1992 and Briese *et al.*, 1995).

Table (1): Insect species collected from the thistle plant, *Cynara* sp. at El-Baida district, El-Gabal El-Akhdar, Libya during the period from September 2001 through August 2003

Order and Family	Scientific Name	Part of the plant
Order: Coleoptera		
Fam.: Cerambycidae	<i>Agapanthia annularis</i> L.	Stems
	<i>A. cardui</i> L.	Stems
Fam.: Chrysomelidae	<i>Cassida</i> sp.	Leaves
	<i>Phyllotreta</i> sp.	Leaves
Fam.: Coccinellidae	<i>Coccinella novemnotata</i> H.	Stems
	<i>C. septempunctata</i> L.	Stems
Fam.: Curculionidae	<i>Larinus</i> sp.	Flower buds
	<i>Lixus</i> sp.	Flower buds
Fam.: Scarabaeidae	<i>Potosia morio</i> F.	Flower buds
Order: Diptera		
Fam.: Tephritidae	<i>Acanthiophilus helianthi</i> Rossi	Flower buds
	<i>Chaetorellia carthami</i> Stack.	Flower buds
Order: Hemiptera		
Fam.: Anthocoridae	<i>Anthocoris</i> sp.	Stems
Fam.: Lygaeidae	<i>Spilostethus pandurus</i> Scop.	Stems + Leaves
Fam.: Pentatomidae	<i>Dolycoris baccarum</i> L.	Stems
Order: Homoptera		
Fam.: Aphididae	<i>Aphis compositae</i> Theobald	Stems
	<i>A. craccivora</i> Koch.	Stems
Fam.: Cicadellidae	<i>Empoasca</i> sp.	Stems
Order: Hymenoptera		
Fam.: Apidae	<i>Andrena</i> sp.	Flower buds
	<i>Apis mellifera</i>	Flower buds
Fam.: Megachilidae	<i>Megachile</i> sp.	Flower buds
Order: Lepidoptera		
Fam.: Hesperidae	<i>Pyrgus</i> sp.	Flower buds
Fam.: Nymphalidae	<i>Vanessa cardui</i> L.	Flower buds
Fam.: Pieridae	<i>Pieris rapae</i> L.	Flower buds
	<i>Colias croceus</i> Fourc.	Flower buds
Fam.: Satyridae	<i>Pyronia</i> sp.	Flower buds
Fam.: Sphingidae	<i>Macroglossa stellatarum</i> L.	Flower buds
Order: Thysanoptera		
Fam.: Thripidae	<i>Thrips</i> sp.	Flower buds

Petney (1988) confirmed these results that the weevil *L. latus* attacks the flower buds of the plants belong to family Cynareae. Also, Briese *et al.*, (1995) stated that the species of the weevils; *L. cynarae*, *L. latus* and *L. cardui* infested the thistle grasses of genus *Cynara* and had a significant role in biological control of these weeds.

The fact that the infestation of the beetle *P. morio* to the flower buds of *Cynara* sp. and feeding on them agrees with Btau, 2001 who mentioned that the visiting beetles to the flowers sometimes cause destructions more than help them as they feed on all their contents.

As shown in Table (1), ten species of insects were found on the stems of *Cynara* sp. feeding on the plant sap. Those included two species of aphids; *Aphis compositae* and *A. craccivora*, one species of plant hoppers,

Empoasca sp. and two species of plant bugs; *Spilostethus pandurus* and *Dolycoris baccarum*. These results are similar to that of Swailem and Amin (1976) who stated that some species of the plant bugs such as; *S. pandurus* and *D. baccarum* infest several types of grasses at Hamam El-Aleel area in Iraq. Amin *et al.* (1998) recorded *A. compositae*, *A. craccivora*, *S. pandurus* and *D. baccarum* on several grass species at El-Baida district in Libya. Kasees and Ahmadi (1987) reported leafhoppers belong to family Cicadellidae attacked some grasses and fed on plant juices.

The results showed also the presence of two species of long-horned beetles of family Cerambycidae; *Agapanthia annularis* and *A. cardui* on the stems of *Cynara* sp. and this is agree with what Kasees and Ahmadi (1987) mentioned that the larvae of long-horned beetles dig tunnels in the stalks of the plants which leads to their death. Boldt (1987) confirmed the presence of the beetle *Megacyllene mellyi* on the thistle plants of Asteraceae.

Also, the results indicated the presence of two predacious species of the lady-beetles; *Coccinella septempunctata* and *C. novemnotata* and one species of the flower-bug *Anthocoris* sp. They were found preying on the aphids present on the stems of *Cynara* sp. These results are identical to those reported by many researchers; Tawfik (1997) who stated that species of the genus *Coccinella* prefer preying on aphids. Btau *et al.* (2002) mentioned that *C. septempunctata*, *C. novemnotata* and *Anthocoris* sp. were recorded preying on several species of aphids at El-Baida district in Libya. The present study also revealed the presence of two species of beetles; *Cassida* sp. and *Phyllotreta* sp. This result is close to the approach of Cartwright and Kok (1990) who stated that the beetle, *Cassida rubiginosa* feeds on the thistle plants of Asteraceae and matching with what Amin *et al.* (1998) reported that the beetle *Phyllotreta* sp. infests several types of grasses at El-Baida district.

Table (1) shows that in the present study, seven species of insects that attack economic crops at El-Baida district were recorded on *Cynara* sp. included; *A. craccivora*, *Phyllotreta* sp., *Empoasca* sp., *V. cardui*, *P. rapae*, *C. croceus* and Thrips sp. (Amin *et al.*, 1998 and El-Ghiryani *et al.*, 2000). Obtained data agree with previous studies which indicated that the grasses are considered secondary hosts for some economic insect pests (Abu Ramila, 1988). Swailem and Amin (1976) recorded 28 species of economically important on some grasses at Hammam El-Aleel district. Amin *et al.* (1998) also recorded 23 species of grasses, which are considered secondary hosts for some insect species that infest agricultural crops at El-Baida district.

In conclusion, the present study on the thistle plant, *Cynara* sp. showed that the plant harbors many species of insects that feed on the flower buds, damage their contents and lead to their destruction, particularly the insect weevils; *Larinus* sp. and *Lixus* sp., the flies; *A. helianthi* and *C. carthami* and the scabid species *P. morio*. In addition, some species larvae bore in the stems making tunnels which lead to the death of the plant, such as the beetles; *A. annularis* and *A. cardui*. Therefore, such species of insects have a certain role in biological control of these weeds and can be exploited successfully. Also, existence of these species in the micro-habitat of the plant

may protect them from their natural enemies (Tawfik, 1997). Therefore, the results suggest that the species; *A. annularis*, *A. cardui*, *Larinus* sp., *Lixus* sp., *P. morio*, *A. helianthi* and *C. carthami* can be used as biological control agents for controlling the thistle plant, *Cynara* sp. at El-Baida area, El-Gabal El-Akhdar, Libya but further studies on the effectiveness of these species of insects are still needed.

REFERENCES

- أبو رميلة، بركات (1988). النباتات السامة في البيئة الأردنية، منشورات الجامعة الأردنية، عمان، 236 صفحة.
- الغرياني، إبراهيم محمد، عادل حسن أمين، علي عبد القادر بطاو (2000). الحشرات التي تصيب المحاصيل الحقلية والبستانية بمنطقة الجبل الأخضر، ليبيا، مجلة المختار للعلوم 7: 18-9 .
- أمين ، عادل حسن ، علي عبد القادر بطاو وإبراهيم الغرياني (1998). دراسة أولية للحشرات المتواجدة على بعض الحشائش بمنطقة البيضاء ، ليبيا . مجلة المختار للعلوم 5: 150-143 .
- بطاو، علي عبد القادر (2001). علاقة الحشرات بالنبات ، الطبعة الأولى . منشورات جامعة عمر المختار، البيضاء، ليبيا. 150 صفحة.
- بطاو، علي عبد القادر، إبراهيم محمد الغرياني، عادل حسن أمين، رأفت أبوراس (2002). حصر أولي للمفترسات والمتطفلات الحشرية بمنطقة الجبل الأخضر (البيضاء) ، ليبيا ، مجلة وقاية النبات العربية (2)20 : 149-145 .
- توفيق، محمد فؤاد (1997). مكافحة البيولوجية للآفات الزراعية. المكتبة الأكاديمية، القاهرة، مصر. 757 صفحة.
- قسيس ، وجيه وأحمد زياد الأحمد (1987). مقدمة في دراسة الحشرات ، مورفولوجيا وتصنيف. منشورات جامعة دمشق، دمشق، سورية. 646 صفحة.
- Blackman, R. L. and V. F. Eastop (1985). Aphids on the world's crops: An Identification Guide. John Wiley and Sons, London, UK. 466 pp.
- Boldt, P. E. (1987). Host specificity and laboratory rearing studies of *Megacyllene mellyi* (Coleoptera: Cerambycidae), a potential biological control agent of *Baccharis neglecta* Britt. (Asteraceae). Proceedings of the Entomological Society of Washington 84(4): 665-672.
- Booth, R. G., M. L. Cox and R. B. Madge (1990). IIE Guides to Insects of Importance to man, 3 Coleoptera. International Institute of Entomology, London, UK. 384 pp.
- Briese, D. T., A. W. Sheppard and J. M. Reifenberg (1995). Open-field host-specificity testing for potential biological control agents of *Onopordum* thistles. Biological Control 5(2): 158-166.
- Briese, D. T., C. Espiau and A. Pouchot – Lermans (1996). Microevolution in the weevil genus *Larinus*: the formation of host biotypes and speciation. Molecular Ecology 5(4): 531-545.
- Cartwright, B. and L. T. Kok (1990). Feeding by *Cassida rubiginosa* (Coleoptera: Chrysomellidae) and the effects of defoliation on growth of musk thistles. Journal of Entomological Science 25(4): 538-547.
- Clement, S. L. and T. Mimocchi (1988). Occurrence of selected flower head insects of *Centaurea solstitialis* in Italy and Greece. Proceedings of the Entomological Society of Washington 90(1): 47-51.

- Hargreaves, B. and M. Chinery (1981). Butterflies and Moths, Wm Collins Sons and Co. Ltd., Glasgow. 240 pp.
- Kok, L. T. and W. T. Mays (1991). Successful biological control of *plumeless thistle*, *Carduus acanthoides* L. (Companulatae: Asteraceae (= Compositae)), by *Trichosirocalus horridus* (Panzer) (Coleoptera: Curculionidae) in Virginia. *Biological Control* 1(3): 197-202.
- Lang, R. F., J. M. Story and G. L. Piper (1996). Establishment of *Larinus minutus* Gyllenhal (Coleoptera: Curculionidae) for biological control of diffuse and spotted knapweed in the western United State. *Pan-Pacific Entomologist* 72(4): 209-212.
- Maddox, D. M., A. Mayfield and C. E. Turner (1990). Host specificity of *Chaetorellia australis* (Diptera: Tephritidae) for biological control of yellow star thistle (*Centaurea solstitialis*, Asteraceae). *Proceeding of the Entomological Society of Washington*, 92(3): 426-430.
- Manojlovic, B. (1991-1992). Phytophagous species of the family Tephritidae (Diptera) registered in the *Centaurea solstitialis* L. (Asteraceae) flower heads. *Zastita Bilja* 24(196): 127-136.
- Petney, T. N. (1988). Influence of insect attack on reproductive potential of thistle species in Jordan. *Entomological Generalis* 14(1): 25-35.
- Priesner, H. and A. Alfieri (1953). A review of the Hemiptera-Heteroptera known to us from Egypt. *Bulletin Society de Fouad ier Entomology* 37: 1-119.
- Swailam, S. M. and A. H. Amin (1976). A survey of insect fauna associated with weed plants in the Hamman Al-Alil region, Iraq. *Mesopotamia Journal of Agriculture* 11: 71-85.
- Talosi, B., R. Sekulic, T. Keresi, B. Manojlovic, J. Iqrc, M. Maceljski and V. Zolf (1989). Investigations on the entomofauna of *Carduus* (Asteraceae) plants in Yugoslavia. *Zastita Bilja*.
- Wheeler, A. G. (1989). *Megalanotus sabulicola* (Heteroptera: Lygaeidae), an immigrant seed predator of *Centaurea* ssp. (Asteraceae): distribution and habits in eastern North America. *Proceedings of the Entomological Society of Washington* 91(4): 538-540.

الحشرات المرتبطة بالنبات الشوكي (*Cynara sp.*) في منطقة الجبل الأخضر

بليبيا

عادل حسن أمين

قسم وقاية النبات، كلية الزراعة، جامعة صلاح الدين، أربيل، العراق، البريد الإلكتروني:

ahkorachi@yahoo.com

أجريت الدراسة الحالية بهدف حصر أنواع الحشرات المرتبطة بالنبات الشوكي *Cynara sp.* في منطقة البيضاء، بالجبل الأخضر، لبيا خلال الفترة من سبتمبر/ أيلول 2001 – أغسطس/ آب 2003. أوضحت النتائج تسجيل 27 نوعاً من الحشرات تتبع 19 عائلة و7 رتب مرتبطة ب *Cynara sp.*، ضمت هذه الأنواع 9 أنواع من رتبة غمدية الأجنحة Coleoptera، شملت نوعان من الخنافس هما *Agapanthia anularis* L. و *A. cardui* L. من عائلة Cerambycidae، ونوعان من عائلة Chrysomelidae هما *Cassida sp.* و *Phyllotreta sp.* ونوعان من عائلة Coccinellidae هما *Coccinella septempunctata* L. و *C. novemnotata* L. ونوعان من حشرات السوس *Larinus sp.* و *Lixus sp.* ونوع واحد من عائلة Scarabaeidae هو *Potosia morio* F. كما تضمنت نوعان من الذباب هما *Acanthiophilus helianthi* Rossi و *Chaetorellia carthami* Stack من رتبة ذات الجناحين Diptera. وشملت أيضاً 3 أنواع من رتبة نصفية الأجنحة Hemiptera وهي *Anthocoris sp.* من عائلة Anthocoridae و *Spilostethus* و *Lygaeidae* من عائلة *Dolycoris baccarum* L. و *Lygaeidae* من عائلة Pentatomidae. كما سجلت 3 أنواع من رتبة متشابهة الأجنحة Homoptera نوعان من حشرات المن هما *Aphis composita* Theobald و *A. craccivora* Koch من عائلة Aphididae ونوع واحد من عائلة Cicadellidae هو *Empoasca sp.* وتضمنت النتائج أيضاً 3 أنواع من رتبة غشائية الأجنحة Hymenoptera، منها نوعان من عائلة Apidae هما *Andrena sp.* و *Apis mellifera* L. ونوع واحد من عائلة Megachilidae هو *Megachile sp.* كما شملت رتبة حرشفية الأجنحة Lepidoptera 6 أنواع منها *Pieris rapae* L. و *Colias croceus* Fourc. من عائلة Pieridae و *Pyrgus sp.* من عائلة Hesperidae و *Vanessa cardui* L. من عائلة Nymphalidae و *Pyronia sp.* من عائلة Satyridae وكذلك *Macroglossa stellatarum* L. من عائلة Sphingidae. وتضمنت رتبة هديبية الأجنحة Thysanoptera نوعاً واحداً هو *Thrips sp.* من عائلة Thripidae. وأوضحت نتائج الدراسة إمكانية استخدام بعض هذه الأنواع الحشرية في برامج مكافحة الحبيوية للنبات الشوكي *Cynara sp.* بمنطقة الجبل الأخضر بليبيا، وهذه الأنواع هي: *Larinus sp.* و *A. cardui* و *A. annularis* و *P. morio* و *C. carthami* و *A. helianthi* و *Lixus sp.*

قام بتحكيم البحث

أ. د/ عبد البديع عبد الحميد غانم

أ. د/ أحمد حسن هنيدي

كلية الزراعة – جامعة المنصورة

مركز البحوث الزراعية