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SYSTEMATIC REVISION OF COMPOSITAE IN EGYPT. 11. *LAUNAEA* CASS. WITH SPECIAL REFERENCES TO ACHENE DIVERSITY

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A systematic revision for the species of *Launaea* Cass. in Egypt has revealed the presence of fourteen taxa belonging to 12 species, of which *L. acanthodes* (Boiss.) Kuntze is a new recorded. One new combination » *L. fragilis* subsp. *tenuiloba* (Boiss.) Zareh & Mohamed' is made. Achene diversity of the studied taxa of *Launaea* was studied using light and scanning electron microscopy. The taxonomic relationships between the studied taxa were discussed as well as SEM micrographs of achenes are provided. Synonyms and key for the identification of the investigated taxa based on morphological characters as well as notes on distribution are provided.

Key words: Achenes, Compositae, Egypt, *Launaea*, Morphology, SEM, Systematic, ultrastructure.

INTRODUCTION

Compositae is one of the largest and highly evolved most successful families; consists of 5 sub families, 43 tribes, 1600 genera and 23000 species (1). Compositae have a cosmopolitan distribution and are especially found in tropical and subtropical regions (2).

The easy recognition of the members of the tribe Cichorieae (subfamily Chicorioideae) comes along with a major drawback: the tribe is not only conspicuously poor in morphological features, but extensive parallel evolution of features further renders the recognition of natural groups difficult. This situation has given rise to considerable differences in the generic and suprageneric classification of the members of the tribe by various students of Cichorieae (3).

The genus *Launaea* Cass., which was established by Cassini (4), has a confused taxonomic history. The first attempt towards a revision of the genus *Launaea* in Egypt was that of Amin (5) and the most recent treatment of the genus is that of Kilian (6).

Launaea Cass. comprises 55 species and mainly distributed in the S. Mediterranean, Africa, and SW Asia (6). The taxonomy of the genus *Launaea* has always been problematic; this is reflected in the number of species that were described. According to Kilian (6), *Launaea* was subdivided into eight sections, which believed to represent natural groups; the Egyptian species can be grouped under 4 of these sections.

In Egypt, *Launaea* is the largest genus of the tribe Cichorieae (7). Forsskål and Niebuhr (8) recorded *L. spinosa* and *L. mucronata*. However, Boissier (9) reported 13 species of *Zollikoferia (Launaea)*, 6 of them recoded from Egypt viz. *L. nudicaulis, L. massauensis, L. procumbens (K.fallax), L. capitata (K.glomerata), L. mucronata* and *L. cassiniana*. Muschler (10) added *L. fragilis* and. Later, Amin (5) reported *L. intybacea* and finally Kilian (6) reported *L. amal-amine* from Suez and Sinai. Täckholm (11) as well as (12) reported 11 species from Egypt, while Zareh (7) reduced the number to 9 species ; the same number recorded by (13; 14) including 4 subspecies.

Achene features have been successfully used for the taxonomic classification of a wide range of Compositae groups (1; 15-20). They have also been used for a number of different taxonomic levels for the tribe Lactuceae (21-27).

The aim of the present study is to investigate the range of variation in achene and vegetative characters for the *Launaea* taxa to elucidate their usefulness in distinguishing them and their classification.

MATERIALS AND METHODS

The present study is based on intensive field work and the available material in the herbaria of CAI, CAIM and ASTU. The grouping of the genera and species is treated here as considered by Kilian (6). For each species, nomenclature, typification, representative specimens and distribution are provided.

Achenes were examined with light and scanning microscopes. Cleared preparations were made by soaking the achenes in a 5 % Sodium hydroxide solution overnight and then washed. The achenes were fixed and mounted on metal stubs using a common adhesive to secure them in position. After mounting, they were coated with a thin conducting layer of gold palladium and examined with Jeol JSM SEM 5400 LV scanning electron microscope, operated at accelerated voltage of 15 KV at the Scanning Electron Microscope Unit, Assiut University. The terminology of Stearn (28), Stant (29), Barthlott (30) and Boesewinkel and Bouman (31) were used to describe the achene coat characteristics.

The analyses were performed with NTSYSpc2.02k software (Applied Biostatistics Inc., Setauket, New York, USA). A cluster analysis was performed using average taxonomic distance and UPGMA clustering (procedures SIMINT, SAHN, and TREE).

TAXONOMIC TREATMENT

***Launaea* Cass., Cass. in Cuvier, Dict. Sei. Nat. 25: 321. 1822.**

About 55 species, principally S. Mediterranean, Africa, and SW Asia (6); the present study revealed the presence of twelve species including four subspecies (representing 4 sections) in Egypt.

A. Sect. Acanthosonchus (Sch. Bip.) O. Hoffm.

1. *Launaea spinosa* (Forssk.) Sch. Bip. ex Kuntze, Revis. Gen. Pl. 1: 350 (1891); Muschler, Man. F1. Egypt 2: 1061 (1912); Ramis, Best., Tabell. F1. Aegypt. 205 (1929); Schwartz, F1. Trop. Arab. 297 (1939); Täckh., St. F1. Egypt ed.1: 84 (1956); Amin, M. Sc. thesis Univ. Cairo 339 (1957); Täckh., St. F1. Egypt ed.2: 601 (1974); Feinbrun-Dothan, F1, Paleast. 3: 432 (1978); Abou El-Naga, Ph.D. thesis Univ. Mansoura 43 (1990); Kilian, Englera 17: 147 (1997); Boulos,. Fl. Egypt 3: 291 (2002); Zareh, Int. J. Agri. Biol. 7, 5: 837 (2005).TYPE: Described from Egypt, ad Ghobeibe 6 milliar. a Suez, 16.-18.9.1762 [Lectotype, Forsskål, BM not seen, BM image!, E not seen, E image!].

Prenanthes spinosa Forssk., Fl. Aegypt.-Arab. 144 (1775); Delile, Descr. Egypte, Hist. Nat. 2: 762 (1813).

Phoenixopus spinosus (Forssk.) Cass. in Cuvier, Dict. Sei. Nat. 48: 426 (1827).
Sonchus spinosus (Forssk.) DC., Prodr. 7: 189 (1838).
Zollikoferia spinosa (Forssk.) Boiss., Fl. Orient. 3: 826 (1875); Aschers. & Schweinf. , Mém. Inst. Egypt 2: 100 (1887).

Examined specimens: Suez Road, M. Drar s.n. (CAIM); Wadi Rishrash, *El-Hadidi* s.n. (CAI); Wadi Abu Rish, Shabetai 3638 (CAIM); Wadi Quseib, *Kassas* s.n. (CAI); S. Galalah, V. *Täckholm et al*. s.n. (CAI). El Tur, *EL-Hefnawi* s.n. (CAIM); Gebel el Deir, *V. Täckholm* s.n. (CAI).

***Distribution*:** In Egypt, rare in moist habitats of Eastern desert and Sinai. Mainly E. Saharo-arabian element.

2. *Launaea acanthodes* (Boiss.) Kuntze, Revis. Gen. Pl. 1: 350 (1891); N. Kilian, Englera 17: 157 (1997).TYPE: Iran, "Ispahan, 1837", Aucher-Eloy 3455 (Syntypes BM not seen, BM image!, Fl not seen, FI-W not seen, G not seen, E not seen, E image!, P not seen).
Zollikoferia acanthodes Boiss., Fl. Orient. 3: 827 (1875).

Atalanthus acanthodes (Boiss.) Kirp. in Siskin & Bobrov, Fl. SSSR 29: 241 (1964).

Examined specimen: Wadi Telah, *Fayed & Zareh* s.n. (ASTU). It is better to add the date of collection as the species is a new record.
Distribution: In Egypt, confined to gravelly tracts of wadi Telah, Sinai, New Record to the flora of Egypt, the species is known to occur in Iran. Mainly Irano-Turanian element.

B. Sect. Microrhynchus (Less.) O. Hoffm.

3. *Launaea nudicaulis* (L.) Hook. f., Fl. Brit. India 3: 416 (1881); Muschler, Man. F1. Egypt 2: 1059 (1912); Ramis, Best., Tabell. F1. Aegypt. 206 (1929); Schwartz, F1. Trop. Arab. 296 (1939); Täckh., St. F1. Egypt ed.1: 84 (1956); Amin, M. Sc. thesis Univ. Cairo 339 (1957); Täckh., St. F1. Egypt ed.2: 602 (1974); Rech.f., F1. Iran. 122: 156 (1977); Feinbrun-Dothan, F1, Paleast. 3: 431 (1978); Alavi, F1. Libya 107: 382 (1983); Abou El-Naga, PhD. thesis Univ. Mansoura 50 (1990); Kilian, Englera 17: 217 (1997); Boulos, Fl. Egypt 3: 291 (2002); Zareh, Int. J. Agri. Biol. 7, 5: 838 (2005). TYPE: [Egypt], Kairo, in pal-metis ad El Marg, 27.4.1908, Bornműller 10830 (Holotype, E not seen, E image! JE not seen).

Chondrilla nudicaulis L., Mant. Pl. 278 (1771).

Lactuca nudicaulis (L.) Murray , Comment. Soc. Regiae Sci. Gott. 3: 74 (1772).

Lomatolepis nudicaulis Cass. in Cuvier, Dict. Sci. Nat. 48: 424 (1827).

Microrhynchus nudicaulis (L.) Less., Syn. Gen. Compos. 139 (1832).

Sonchus nudicaulis (L.) Sch. Bip. in Webb & Berthelot, Hist. Nat. Iles Canaries 2(2): 427 (1849--50).

Zollikoferia nudicaulis (L.) Boiss., Fl. Orient. 3: 824 (1875); Aschers. & Schweinf. , Mém. Inst. Egypt 2: 100 (1887); Sickenb., Mém. Inst. Egypt 4(2): 252 (1901).

Examined specimens: wadi Agoza, Mersa-Matrouh Sollum road, *Zareh & Faried* s.n. (ASTU); Sidi-Abdelrahman, *Zareh & Aboul-Ela* s.n. (ASTU); Burg el Arab, *A. Amin* s.n. (CAI); Bir Lehfen S. Arish, *G. Täckholm* s.n. (CAI); Gebel Musa, *Shalaby & Hedini* s.n. (CAIM); El-Matmar, Assiut, Fayed & Zareh s.n. (ASTU); Fayium, *Khattab* 1484 (CAIM); Wadi Natrun, *Sharobim* 2912 (CAIM); Ismailia, *Simpson* 486 (CAIM); Wadi Hagol, *Zareh & Aboul-Ela* s.n. (ASTU).

Distribution: In Egypt, common annual herbs in moist habitats of the Nile regions, coastal plains along the Mediterranean coastal region, Western

and Eastern deserts. Distributed from N. E. Africa to Central Asia, mainly Saharo-Arabian and E. Mediterranean.

4. *Launaea intybacea* (Jacq.) Beauverd , Bull. Soc. Bot. Genéve, sér. 2(3): 114 (1910); Kilian, Englera 17:248 (1997). TYPE: Cultivated at Paris from seeds sent from Sengal by Sparrmann (Lectotype, K not seen, K image!, P not seen).

Lactuca intybacea Jacq.,. in Murray, Syst. Veg. ed. 14: 713 (1784).
Scorzonera pinnatifida Lour., Fl. Cochinch. 2: 479 (1790).
Sonchus goraeensis Lam., Encycl. 3: 397 (1792).
Brachyrhamphus goraeensis (Lam.) DC, Prodr. 7: 177 (1838).
Lactuca goraeensis (Lam.) Sch. Bip., Flora 25: 422 (1842).

Launaea goraeensis (Lam.) O. Hoffm. in Engler & Prantl, Nat. Pflanzenfam. 4(5): 370 (1893); Amin, M. Sc. thesis Univ. Cairo 242 (1957); Täckh., St. F1. Egypt ed.2: 602 (1974); Abou El-Naga, PhD. thesis Univ. Mansoura 41 (1990).

***Examined specimen*:** Wadi Laseitit, Täckholm *et al.* 1687 (CAI).

***Distribution*:** In Egypt, confined to moist habitats of Gebel Elba highlands. Widespread all over the world.

5. *Launaea massauensis* (Fresen.) Sch. Bip. ex Kuntze, Revis. Gen. Pl. 1: 351. 1891; Täckh., St. F1. Egypt ed.1: 84 (1956); Amin, M. Sc. thesis Univ. Cairo 216 (1957); Täckh., St. F1. Egypt ed.2: 601 (1974); Abou El-Naga, PhD. thesis Univ. Mansoura 38 (1990); Rech.f., F1. Iran. 122: 148 (1977); Kilian, Englera 17: 268 (1997); Zareh, Int. J. Agri. Biol. 7, 5: 837 (2005). TYPE: Ethiopia, Massaua, am Ufer, 3.1832, Ruppell (Holotype, E not seen, E image!, FR not seen).
Heterachaena massauensis Fresen. , Mus. Senckenberg. 3: 74 (1839); Andr., Fl. Sudan 3: 36 (1956).
Lactuca massauensis (Fresen.) Sch. Bip. ex A. Rich., Tent. Fl. Abyss. 1: 460 (1848).
Sonchus massauensis (Fresen.) Sch. Bip. in Schweinf. & Aschers., Beitr. Fl. Aethiop.: 160 (1867).
*Zollikoferia massauensis (*Fresen.) Boiss., Fl. Orient. 3: 825 (1875); Aschers. & Schweinf. , Mém. Inst. Egypt. 2: 100 (1887).

Examined specimens: Gebel Elba, Hassib s.n. (CAI) ; Wadi Ideib, Shabetai z4950 (CAIM); Wadi Akwamtra, Osborn & Helmy 3 (CAIM); Gabel Hamata, Täckholm *et al.* 363 (CAI); Wadi Abu Ghusun, Zareh & Faragili s.n. (ASTU).

***Distribution*:** In Egypt, confined to moist habitats of Red Sea and Gebel Elba highlands. Distributed from East Africa to South Asia, mainly Sudano-Zambezian and Saharo-arabian regions.

C. Sect. Launaea

6. *Launaea procumbens* (Roxb.) Ramayya & Rajagopal , Kew Bull. 23: 465 (1969); Abou El-Naga, PhD. thesis Univ. Mansoura 47 (1990); Rech.f., F1. Iran. 122: 155 (1977); Alavi, F1. Libya 107: 383 (1983); Kilian, Englera 17: 278 (1997); Zareh, Int. J. Agri. Biol. 7, 5: 838 (2005). TYPE: Egypt, arvis Nilo vicinis, circa Cheik-Abadeh, 31.12.1847, Kralik (Isotype, E not seen, E image!, P not seen).

Prenanthes procumbens Roxb. Fl. Ind. ed.3: 404 (1832).
Youngia procumbens (Roxb.) DC, Prodr. 7: 193 (1838).

Paramicrorhynchus procumbens (Roxb.) Kirp. in Komarov, Fl. URSS 29: 237 (1964).

Microrhynchus fallax Jaub. & Spach, Ill. Pl. Orient. 3: 106 fig. 276 (1848).

Zollikoferia fallax (Jaub. & Spach) Boiss., Fl. Orient. 3: 824 (1875); Aschers. & Schweinf. , Mém Inst. Egypt. 2: 100 (1887).

Launaea fallax (Jaub. & Spach) Boiss. Fl. Orient.3: 824 (1875); Muschler, Man. Fl. Egypt 2: 1060 (1912); Ramis, Best.-Tabell. Fl. Aegypt. 206 (1929); Schwartz. Fl. Trop. Arab. 296 (1939).

Examined specimens: Wadi Abar, Gebel Ataqa, Amin s.n. (CAI); Wadi Seyal, N. Galalah, Imam s.n. (CAI).

***Distribution*:** In Egypt, confined to desert plains and wadies of Eastern desert. Eastern and Central Asian element.

7. *Launaea capitata* (Spreng.) Dandy in Andrews, Fl. Pl. Sudan 3: 40 (1956); Täckh., St. F1. Egypt. ed. 1: 84 (1956); Amin, M. Sc. thesis Univ. Cairo 137 (1957); Täckh., St. F1. Egypt ed.2: 602 (1974); Abou El-Naga, PhD. thesis Univ. Mansoura 38 (1990); Rech.f., F1. Iran. 122: 146 (1977); Feinbrun-Dothan., F1. Palaest. 3: 432 (1978); Alavi, F1. Libya 107: 387 (1983); Kilian, Englera 17: 296 (1997); Boulos, Fl. Egypt 3: 294 (2002); Zareh, Int. J. Agri. Biol. 7, 5: 837 (2005). TYPE: In desertis Aegypti ad Pyramides, Siber (Isotypes, K not seen. K image!, E not seen, E image!, G not seen, W not seen).

Sonchus capitatus Spreng., Syst. Veg. ed.16, 3: 650 (1826).

Lomatolepis glomerata Cass. in Cuvier, Dict. Sci. Nat. 48: 423 (1827) nom. illeg.

Microrhynchus glomeratus Jaub. & Spach, Ill. Pl. Orient. 3: 103, fig. 275 (1848).

Zollikoferia glomerata (Cass.) Boiss., Fl. Orient. 3: 826 (1875), nom. Illeg; Aschers. & Schweinf., in Mém Inst. Egypt. 2: 100 (1887).

Launaea glomerata (Cass.) Hook. f., Fl. Brit. India 3: 417 (1881), comb. Illeg; Muschler, Man. Fl. Egypt 2: 1060 (1912); Ramis, Best.-Tabell. Fl. Aegypt. 206 (1929); Schwartz. Fl. Trop. Arab. 297 (1939).

Examined specimens: AL-Oimed, Zareh & Aboul-Ela s.n. (ASTU); El-Arish, Shabetai z3930 (CAIM); Kom Ombo, Abdel Salam *et al.* s.n. (CAI); Abu Simbel, *M. Abdallah* 1603 (CAIM); K 45, wadi Natrun el Alameen road, Zareh & Fareid s.n. (ASTU); Wadi Hoff, Zareh s.n. (ASTU); Wadi Kharit, Fayed & Salama s.n. (ASTU); Wadi Abu Ghusun, Zareh & Fargali s.n. (ASTU); Farsh El-Hodein, Zareh & EL Garf s.n. (ASTU).

Distribution: In Egypt, common annual herbs in moist habitats of the Nile regions, coastal plains along the Mediterranean coastal region, Western and Eastern deserts. Distributed from N.E. Africa to Central Asia, mainly Saharo-Arabian and E. Mediterranean.

D. Sect. Zollikoferia (Pomel) O. Hoffm.

8. *Launaea amal-aminiae* N. Kilian, Englera 17: 346 (1997); Boulos,. Fl. Egypt 3: 295 (2002); Zareh, Int. J. Agri. Biol. 7, 5: 838 (2005). TYPE: Algeria, 32 km S von Abadla an der StraBe nach Beni Abbes, 610 m, sandiger StraBenrand, 3046'N, 244'W, 4.4.1980, Podlech 33787 (Holotype, M not seen M image!).

Examined specimens: Suakin el Qadim, V. Täckholm *et al.* 1135 (CAI); Suakin el Qadim, V. Täckholm *et al.* 1478 (CAI); Wadi Lasitat to Wadi Sarametai, V. Täckholm *et al*. s.n. (CAI)
Distribution: In Egypt, confined to moist habitats of Gebel Elba highlands. Distributed in N.E. Africa and Saharo-Arabian regions.

9. *Launaea angustifolia* (Desf.) Kuntze, Revis. Gen. Pl. 1:351 (1891); Ramis, Best. Tabell. F1. Aegypt. 205 (1929); Täckh., St. F1. Egypt ed.1:85 (1956) Amin, M. Sc. thesis Univ. Cairo 158 (1957); Täckh., St. F1. Egypt ed.2: 602 (1974); Feinbrun-Dothan, F1. Palaest. 3: 431 (1978); Alavi, F1. Libya 107: 386 (1983); Abou El-Naga, PhD. thesis Univ. Mansoura 35 (1990); Kilian, Englera 17: 361 (1997); Boulos, Fl. Egypt 3: 295 (2002); Zareh, Int. J. Agri. Biol. 7, 5: 838 (2005). TYPE: Tunisia, prope Cafsam [= Gafsa], Desfontaines (Holotype, K not seen, K image!, E not seen, E image!, P not seen).

Sonchus angustifolius Desf., Fl. Atlant. 2: 225 (1799).

Zollikoferia angustifolia (Desf.) Coss. & Durieu , Bull. Soc. Bot. France 2: 254 (1855); Aschers. & Schweinf. Mém. Inst. Egypt 2: 100 (1887); Sickenb. Mém. Inst. Egypt. 4(2): 252 (1901).

Launaea angustifolia (Desf.) Muschl., Man. F1. Egypt 1059 (1912).

9.a. *Launaea angustifolia* subsp. ***angustifolia***

Examined specimens: El-Dabaa, Simpison 4661 (CAIM); Abu Sir, El Hadidi s.n. (CAI); Mariut, Ghabour s.n. (CAI); Alamein Alexandria road, Zareh & Aboul-Ela s.n. (ASTU).

***Distribution*:** In Egypt, rare annual herbs in moist habitats along the Mediterranean coastal region. Also in Algeria, Tunisia and Libya.

9.b. *Launaea angustifolia* subsp. ***arabica*** (Boiss.) N. Kilian in Willdenowia 25: 274 (1995); Kilian, Englera 17: 366 (1997); Zareh, Int. J. Agri. Biol. 7, 5: 838 (2005). TYPE: Saudi Arabia, in regione Hauara [= Hawara], 15.3.1835, Schimper 208 (Syntype, G not seen, E not seen, E image!).

Zollikoferia arabica Boiss., Diagn. Pl. Orient, ser.1, 7: 12 (1846); Boiss., Fl. Orient. 3: 823 (1875).

Zollikoferia foxii Post, Fl. Syria, ed. 1: 19 (1896).

Launaea foxii (Post) Eig , Feddes Repert. Beih. 63(1): 48 (1931).

Launaea arabica (Boiss.) H. Lindb., Acta Soc. Sci. Fenn., Ser. B, Opera Biol. 1(2): 163 (1932).

Examined specimens: Siwa, Zahran s.n. (CAI) . S. Sinai, Mrs Palmer pasha s.n. (CAI); Wadi el Homara, Shabetia z4017 (CAI); Wadi el Homara, M. Abdalla, 624 (CAIM); Wadi el Mizerie, Amal 1483 (CAIM); Wadi Farian, M. Abdalla 1142, (CAIM); Abo Zenima, M. Abdalla 542 (CAIM).
Distribution: In Egypt, rare annual herbs in Western and Eastern deserts. Distributed from N.E. Africa to Central Asia, mainly Saharo-Arabian and E. Mediterranean.

10. *Launaea fragilis* (Asso) Pau in Bol. Soc. Aragonesa Ci. Nat. 16: 68 (1917); Kilian, Englera 17: 374 (1997); Zareh, Int. J. Agri. Biol. 7, 5: 838 (2005). TYPE: Spain, in monte Torrero, circa Epila, Asso (Holotype, E not seen, E image!, P not seen).
Lactuca fragilis Asso, Syn. Stirp. Aragon: 109 (1779).
Sonchus chondrilloides Desf., Fl. Atlant. 2: 226 (1799).
Zollikoferia chondrilloides (Desf.) DC. Prodr. 7: 183 (1838).

10. a. *Launaea fragilis* subsp. ***Fragilis***

Zollikoferia longiloba Boiss. & Reut., Pug. Pl. Afr. Bor. His-pan.: 70 (1852).
Zollikoferia resedifolia var. *longiloba* (Boiss. & Reut.) Bonnet & Barratte, Expl. Sci. Tunisie, Cat. Pl.: 266 (1896).

Launaea longiloba (Boiss. & Reut.) Maire , Bull. Soc. Hist. Nat. Afriq. N. 25: 308 (1934).

Launaea resedifolia subsp. *longiloba* (Boiss. & Reut.) Maire in Jahandiez & Maire, Cat. Pl. Maroc 3: 845 (1934).

Launaea resedifolia var. *longiloba* (Boiss. & Reut.) Pamp. in Arch. Bot. (Forli) 12: 51 (1936).

Examined specimens: Sidi Abdel Rahman, K. 153, Zareh & Aboul-Ela s.n. (ASTU); Abu Sir, Amal Amin s.n. (CAI); Burg el Arab Alamein road, F. Saad 132 (CAIM); Burg el Arab, Batanony s.n. (CAI); Alexanderia K. 75, El Hadidi s.n. (CAI); Rosetta, Alaa Amer 17005 (CAI); El Arish, Wadi Heridin, Drar s.n. (CAIM); Rafah, Shaetai z7422 (CAIM).

***Distribution*:** In Egypt, confined to moist habitats along the Mediterranean coastal region. Also in Morocco, Algeria, Tunisia and Libya.

10.b. *Launaea fragilis* subsp. ***tenuiloba*** (Boiss.) Zareh & Mohamed comb.et stat. nov. *Zollikoferia tenuiloba* Boiss., Diagn. Pl. Orient., ser. 1, 11: 50 (1849); Boiss. Fl. Orient. 3: 822 (1875); Aschers. & Schweinf., Mém. Inst. Egypt. 2: 100 (1887); Sickenb., Mém. Inst. Egypt. 4(2): 252 (1901). TYPE: Gaza, in Arabia petraea Palaestina contermina, 4.1846, Boissier (Syntype, K not seen, K image!, G not seen).

Launaea tenuiloba (Boiss.) Kuntze, Revis. Gen. Pl. 1: 351 (1891); Muschler, Man. F1. Egypt 2: 1058 (1912); Ramis, Best.-Tabell. F1. Aegypt. 206 (1929); Täckh., St. F1. Egypt ed.1: 85 (1956); Täckh.,ibid. ed.2: 602 (1974); Feinbrun-Dothen, F1. Palaest. 3: 430 (1978); Alavi, F1. Libya 107: 391 (1983); Abou El-Naga, PhD. thesis Univ. Mansoura 62 (1990).

Examined specimens: Alexandria Mersa-Matrouh road, K. 137, Zareh & Aboul-Ela s.n. (ASTU); Ras el Hekma, Zareh & Faried s.n. (ASTU); Burg el Arab, Amal Amin s.n. (CAI) ; Arish, Shabetai 2558 (CAIM); Wadi el Arish, Shabetai z4646 (CAIM); Nubaria, Zareh & Aboul *Ela* (ASTU); Wadi Hodeit, Mersa Halaib, Shabetai z5506 (CAIM).

***Distribution*:** In Egypt, common annual herbs in moist habitats along the Mediterranean coastal region, Western and Eastern deserts. Also in Palestine, jordan and Cyprus.

11. *Launaea mucronata* (Forssk.) Muschl., Man. Fl. Egypt 2: 1057 (1912); Täckh., St. F1. Egypt ed.1: 85 (1956); Täckh.,ibid. ed.2: 602 (1974); Rech.f., F1. Iran. 122: 159 (1977); Feinbrun-Dothan, F1. Palaest. 3: 431 (1978). Abou El-Naga, PhD. thesis Univ. Mansoura 57 (1990); Kilian, Englera 17: 399 (1997); Boulos, Fl. Egypt 3: 297 (2002); Zareh, Int. J. Agri. Biol. 7, 5: 838 (2005). TYPE: Egypt, in desertis Kahirinis, Forsskål 1401, 1402 (Isotype, C not seen, E not seen, E image!).

Leontodon mucronatum Forssk., Fl. Aegypt.-Arab.: 144 (1775).

Zollikoferia mucronata (Forssk.) Boiss., Diagn. Pl. Orient., ser. 1,7: 12 (1846).

Launaea resedifolia subsp. *mucronata* (Forssk.) Maire , Bull. Soc. Hist. Nat. Afriq. N. 28: 366 (1937).

Examined specimens: Ras el Hekma, Moizi & Khattab s.n. (CAIM); Burg el Arab, Drar s.n. (CAIM); Rosetta, Abdel Fattah 6 (CAIM); Rafah, Khattab 51 (CAIM); Wadi El Arish, Shabetai (CAIM); Giza, Drar & Khattab 1480 (CAIM); Wadi Natrun, El Hadidi s.n. (CAI); Siwa, Mioze & Khattab s.n. (CAIM); Kharga, Drar s.n. (CAIM); Wadi Hagol, Zareh & Aboul-Ela s.n. (ASTU); Wadi Askhar, S. Galala, Fahmy & Fadl s.n. (CAI); Wadi Sheit, E. Kom Ombo, V. Täckholm *et al*. s.n. (CAI); Wadi Adeleib, V. Täckholm *et al.* 1424 (CAI).

***Distribution*:** In Egypt, very common in coastal plains along Mediterranean. Rare in wadi beds of Eastern desert along the Red Sea Coast and Gebel Elab. Distributed from N.E. Africa to Central Asia, mainly Saharo-Arabian and W. Mediterranean

12. *Launaea cassiniana* (Jaub. & Spach) Kuntze, Revis. Gen. Pl. 1: 351 (1891); Muschler, Man. F1. Egypt 2:1058 (1912); Ramis, Best.-Tabell. F1. Aegypt. 205 (1929); Schwartz. F1. Trop. Arab :296 (1939); Täckh., St. F1. Egypt ed.1: 85 (1956), Täckh., ibid. ed.2: 602 (1974); Rech.f., F1. Iran. 122: 157 (1977). TYPE: Egypt, Olivier & Bruguiere (Syntype, P not seen).
Sonchus cassinianus Jaub. & Spach, Ill. Pl. Orient. 3: 112, fig. 280 (1848).
Zollikoferia cassiniana (Jaub. & Spach) Boiss., Fl. Orient. 3: 822 (1875).
Launaea mucronata subsp. *cassiniana* (Jaub. & Spach) N. Kilian, Willdenowia 25: 277 (1995); Boulos, Fl. Egypt 3: 298 (2002); Zareh, Int. J. Agri. Biol. 7, 5: 838 (2005).

Examined specimens: Burg el Arab, El Hadidi s.n. (ASTU); Cairo, G. Täckholm s.n. (CAI); Sahel Selem, Fayed & Zareh s.n. (ASTU); Kharga Oasis, Shabetai z4641 (CAIM); Dakhla Oasis, Simpson 6045 (CAIM); Suez, G. Täckholm s.n. (CAI); Gebel Ahmer, Ekhladuos s.n. (CAI) ; Wadi Hoff, Ekladious, s.n. (CAI); Wadi Liblab, *V.* Täckholm s.n. (CAI); Wadi Gemal, Osborn & Helmy s.n. (CAI); Mersa Alam Abu Ghusun road, Zareh & Faraghali s.n. (ASTU); Sinai, el Rebba, El Hadidi s.n. (ASTU); Wadi Yahamib, V. Täckholm *et al.* 279 (CAI).

***Distribution*:** In Egypt, very common in coastal plains along Mediterranean and wadi beds of Eastern desert, Red Sea Coast and Gebel Elab. Distributed from N.E. Africa to Central Asia, mainly Saharo-Arabian and W. Mediterranean.

RESULTS and DISCUSSION

The analysis of morphological data was applied for the systematic studies of *Launaea* species, these characters were proved useful in the distinction and differentiation between the studied taxa. 76 morphological characters concerned with habit, stem, leaves, peduncles, heads, involucral

bracts, flowers, achenes and pappus were studied. The morphological criteria used in computer analysis were indicated in Table (1).

Table 1. Characters and character state used in morphological analysis of Launaea

N	Character & character state	N	Character & character state
1	Habit	38	Median bracts broad
	1. Annual		1. (1.5-2.0 mm)
	2. Perennial		2. (2.5-3.0 mm)
	3. Shrub		3. (3.5-4.0 mm)
2	Plant nature	39	Median bracts length
	1. Spinescent		1. (4.0-5.0 mm)
	2. Spineless		2. (5.5-6.0 mm)
3	Growth pattern		3. (6.5-7.0 mm)
	1. Prostrate	40	Inner bracts apex nature
	2. Procumbent		1. Fleshy
	3. Twining		2. Cartilagineous
	4. Erect	41	Inner bracts apex shape
4	Plant form		1. Acute
	1. Scape-like		2. Obtuse
	2. Caulescent	42	Inner bracts broad
5	Plant base		1-1.5 mm
	1. Woody		2-2.5 mm
	2. Herbaceous	43	Inner bracts length
6	Plant height		8.0-9.0 mm
	1. (± 10 cm)		9.5-10.0 mm
	2. ((± 25 cm)		10.5-12.0 mm
	3. ((± 30 cm)		12.5-15.0 mm
	4. ((± 40 cm)	44	Flowers per capitulm
	5. ((± 100 cm)		6-10
7	Branching		15-20
	1. From base		25-33
	1. Above		35-50
8	Branch leafness		≥55
	1. Leafy	45	Ligules length
	2. Leafless		4.0 – 6.0 mm
9	Branch texture		6.5 – 8.0 mm
	1. Glabrous		8.5-12.0 mm
	2. Tomentose		12.5-20.0mm
	3. Puberulent	46	Ligules width
	4. Glaucescent		0.8 - 1.5 mm
10	Basal leaves presence		1.7 - 2.2 mm
	1. Rosetted		2.4 – 2.8 mm
	2. Early deciduous		3.0 – 5.5 mm
11	Basal leaves shape	47	Flowers tube length
	1. Spathulate		3.5 - 6.0 mm
	2. linear to linear-spathulate		6.5 – 9.0 mm
	3. Oblong	48	Anther length
	4. Lanceolate		1.2 – 2.2 mm
	5. Oblanceolate-elliptic		2.5-3.2 mm
12	Basal leaves margin		3.5-5.5 mm

	1. Entire	49	Style-arms long
	2. Dentate		0.5-1mm
	3. Sinuate-dentate to pinnatifid		3-3.5mm
	4. Sinuate-dentate to pinnatisect		3.5-4mm
13	Leaf margin nature	50	Style sweeping hairs color
	1. White cartilaginous		yellow
	2. Green fleshy		blackish
14	Basal leaves apex	51	Achenes symmetry
	1. Acute		sub homomorphic
	2. Obtuse		heteromorphic
	3. Acuminate	52	Achenes wings
15	Cauline leaves blade		Not winged
	1. Reduced		1-winged
	2. Ovate		2-3-winged
	3. Auriculate	53	Achenes length
16	Cauline leaves apex		2.0-3.0 mm
	1. Reduced		3.5-4.0 mm
	2. Acute		4.5-6.0 mm
	3. Obtuse		6.5-8.0 mm
17	Early leaves margin	54	Achenes width
	1. Sub-entire		0.5 - 0.6 mm
	2. Serrate-dentate		0.7-0.9mm
18	Longer leaf length		1-1.3mm
	1. (7-8 cm)	55	Achenes base
	2. (9-10 cm)		obtuse teethed
	3. (11-12 cm)		not teethed
	4. (15-16 cm)	56	Marginal achenes color
19	Synflorescence		whitich
	Heads single		brown
	Heads glomerate		grey
20	Head broad		blackish
	less than 2.5 mm		yellow
	more than 4.0 mm	57	Marginal achenes angles
21	Peduncles long		±5 angular
	Absent		±4 angular
	0.3-0.8 mm		not angular
	1.0-2.5 mm	58	Marginal achenes length
	30 - 70 mm		shorter than inner
22	Receptacle diameter at fruiting		longer than inner
	1.5-2.0 mm	59	Marginal achenes shape
	2.5-3.0 mm		columnar
	3.5-5.5 mm		compressed
	6.0-10 mm	60	Marginal achenes apex
23	Head shape		truncate
	Cylindrical		cuspidate
	Broadly cylindrical	61	Marginal achenes sculpture
	Narrowly cylindrical		wrinkled
	Campanulate		papillose
24	Head color	62	Achenes secondary ribs
	Green		±2 distinct
	Grayish green		not distinct
25	Head broad at anthesis	63	Achene ribs surface
	2-2.5mm		hirsute at angles

	4-5mm		transversally wrinkled
	6-7mm		squamulose-papillose
26	Head broad at fruiting	64	Inner achenes color
	2-3mm		whitich
	4-5mm		Brown
	6-7mm		Yellow
27	Head long at anthesis	65	Inner achenes shape
	8-9 mm		columnar
	10-12 mm		compressed
	15-20 mm	66	Inner achenes apex
28	Head long at fruiting		cuspidate
	9.0-10.0 mm		not cuspidate
	10.5-12.0 mm	67	Inner achenes sculpture
	12.5-14.0 mm		smooth
	15.0-20.0 mm		wrinkled
29	Involucral bracts margin		papillose
	Not scarious	68	Inner achenes ribs
	narrow scarious		4 main
	broadly scarious		5 main
30	Outer bracts apex nature	69	Inner achenes secondary ribs
	Fleshy		2, distinct
	Callous-tipped		not differentiated
	Cartilaginous	70	Inner achenes ribs surface
31	Outer bracts apex shape		transversally wrinkled
	Acute		glabrous
	Obtuse		squamulose-papillose
	Acuminate	71	Pappus long
32	Outer bracts broad		5-6 mm
	1.5-2mm		7 - 8 mm
	± 3mm		9-10 mm
33	Outer bracts length	72	Pappus
	1.5-2.5 mm		persistent
	±3mm		deciduous
34	Median bracts shape	73	Pappus symmetry
	oblong-lanceolate		monomorphic
	ovate-lanceolate		dimorphic
35	Median bracts apex nature	74	Pappus disk
	Fleshy		present
	Cartilagineous		absent
36	Median bracts apex shape	75	Inner setaceous
	acute		absent
	obtuse		small number
	acuminate		large number
37	Median bracts shape	76	Outer downy
	oblong-lanceolate		absent
	ovate-lanceolate		large number

The cluster analysis based on morphological data divided the studied taxa into two major groups; the first group comprises the species of sect. Zollikoferia which characterized by papillose marginal achenes and absence of pappus disk (*L. amal-aminiae, L. angustifolia*, *L. fragilis L. mucronata* and *L. cassiniana*); the second group comprises the the species of the other three

sections (Acanthosonchus, Launaea and Microrhynchus) that characterized by wrinkled or weakly papillose marginal achenes.

The later group can be divided into three groups; one comprises the two species of sect. Launaea (*L. procumbens* and *L. capitata*) which are characterized by prostrate habit and aggregate heads; the second group comprises the two species of sect. Acanthosonchus which characterized by spinescent plants and 5-ribbed achenes (*L. spinosa* and *L. acanthodes*); the third group comprises the species of section Microrhynchus (*L. nudicaulis, L. intybacea* and *L. massauensis*) that can be separated based on pappus characters. This grouping agrees with Kilian's regard (6) in which he arranged the studied species in 4 different tribes. This approach illustrated by the dendogram shown in Fig. 1.

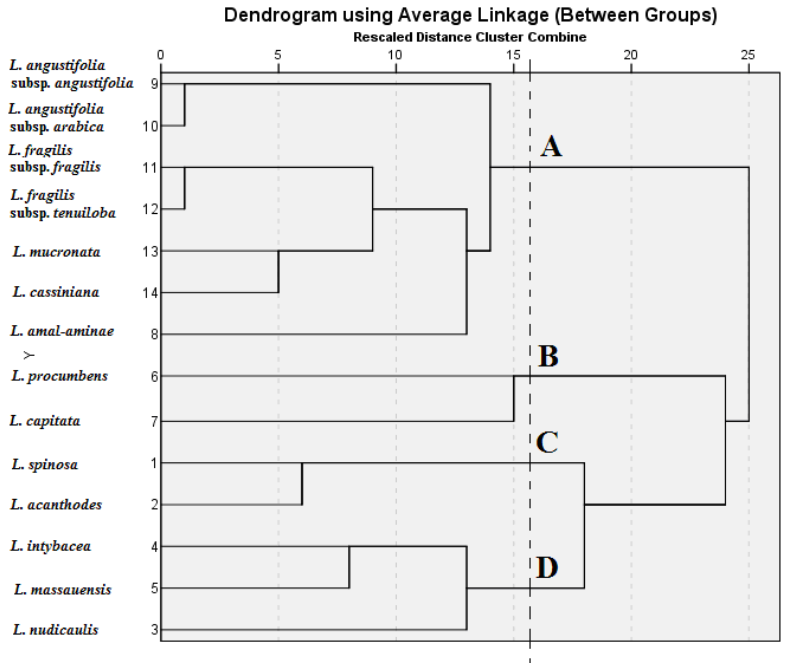

Fig. 1. Dendograms illustrating the relationships among the 14 studied taxa of *Launaea* based on the morphological characters. A, sect. Zollikoferia; B, sect. Launaea; C, sect. Acanthosonchus; D, sect. Microrhynchus.

L. cassiniana (Jaub. & Spach) Kuntze is treated by Kilian (6) and Boulos (13) as *L. mucronata* subsp. *cassiniana*; the plant is much differ than *L. mucronata* in several characters such as involucral bracts (not scarious margined), achenes (longer than 6 mm and columnar not angular) and absence of downy pappus (homomorphic); in *L. mucronata*, the involucral bracts are scarious margined, the achenes are shorter than 6-mm, compressed,

5-angeled and the pappus are heteromorphic; these in favour of treating *L.cassiniana* as a distict species.

On the other hand, *L. tenuiloba* (Boiss.) Kuntze is treated by Kilian (6) and Boulos (13) as a synonym to *L. fragilis*, the plant is differ in being procumbent, branched from base with subentire leaves and wrinkled inner achenes, thus it is treated here as *L. fragilis* subsp. *tenuiloba*.

The morphological characters used by earlier investigators are still among the most reliable diagonistic characters for distinguishing between the confused taxa of *Launaea.* The annual and perennial herbs represent the predominant habit of *Launaea*, only the two species of sect. Acanthosonchus (*L. spinosa* and *L. acanthodes*) are spinescent rosette subshrubs.

In most of *Launaea* species, the main axis always terminated by a single capitulum, only the two species of sect. Launaea (*L. procumbens* and *L. capitata*) have clustered capitula on its secondary synflorescence axes. The capitula size are also various considerably, all the examined species range in size from 12-14 mm; the smallest are presented by *L. intybacea* and *L. massauensis* (8-10 mm) and the largest by *L. angustifolia* (15-20 mm).

The involucral bracts of *Launaea* are frequently dark with white scarious-margins (Fig. 2 & 3). In some species (*L. nudicaulis* and *L. capitata*), the scarious margins are distinctly broad; on the other hand, the involucral bracts of *L. cassiniana* are appearently without scarious margins. Furthermore, in *L. mucronata*, the scarious margin is very thin and present only in inner bracts. Nevertheless, the tips of the involucral bracts are commonly acute or rounded; in some species (*L. angustifolia* & *L. mucronata*) the bracts are cartilaginous or callous-tipped.

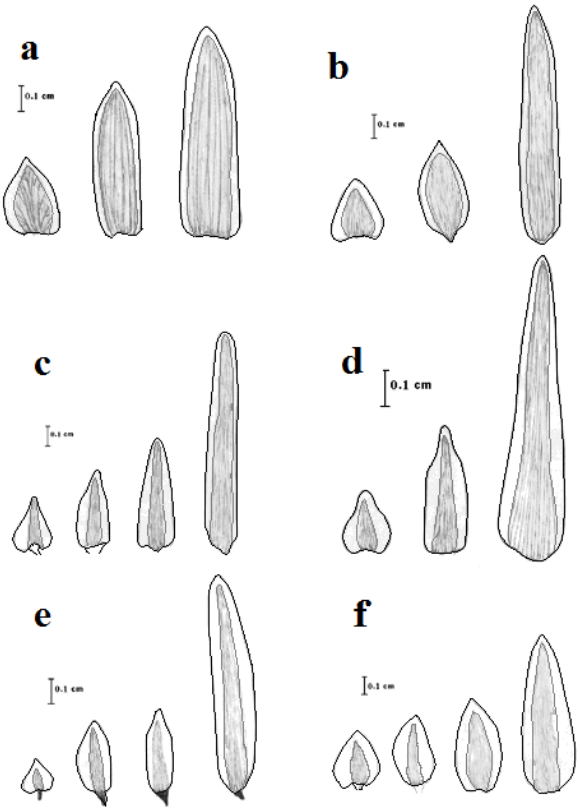

Fig. 2. Launaea involucral bracts: a. L. spinosa; b. L. acanthodes; c. L. nudicaulis; d. L. intybacea; e. L. massauensis; f. L. capitata

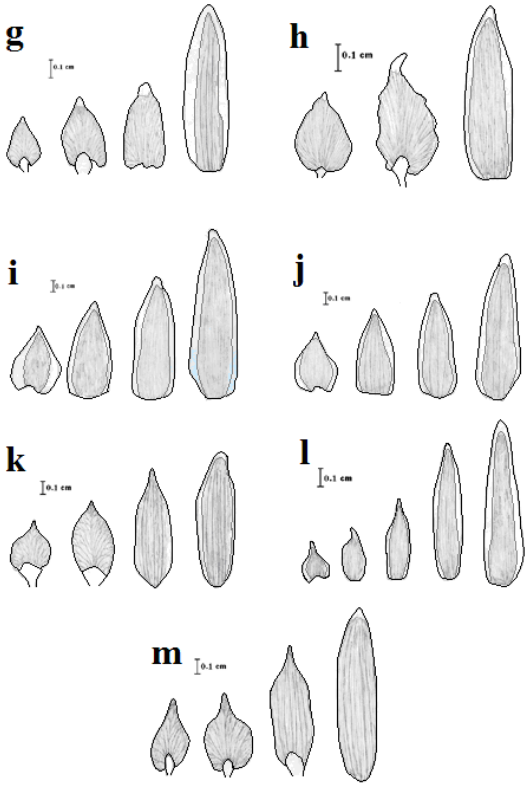

Fig. 3. Launaea involucral bracts: g. L. angustifolia subsp. angustifolia h. L. angustifolia subsp. arabica; i. L. fragilis subsp. fragilis; j. k. L. fragilis subsp. tenuiloba; l. L. mucronata; L. amal-aminae; m. L. cassiniana

The mature achenes of *Launaea* proved to be the most useful characters in the distinction between the studied taxa. The achenes of the studied species are commonly heteromorphic except the two species of sect. Acanthosonchus (*L. spinosa* and *L. acanthodes*) which are subhomomorphic. Most of the examined species range in size from 2-6 x 0.5-1.3 mm (including beak if present); in *L. massauensis* and *L. procumbens* the achenes are appearently smaler being (2-3 x 0.5-0.7 mm, Plate 1) and in *L. acanthodes, L. capitata* and *L. angustifolia* the achenes are larger being (4-8 x 0.9-1.3 mm, Plate 1 & 2). All the studied species provided with compressed outer achenes except L. *nudicaulis*, L. *angustifolia* and L. *cassiniana* being cylindrical not compressed (Plate 1 & 2). The achenes are commonly wrinkled except the species of sect. Zollikoferia (*L. angustifolia, L. fragilis L. mucronata* and *L. cassiniana*) which characterized by papillose marginal achenes and wrinkled or smooth inner achenes (Plate 1 & 2).

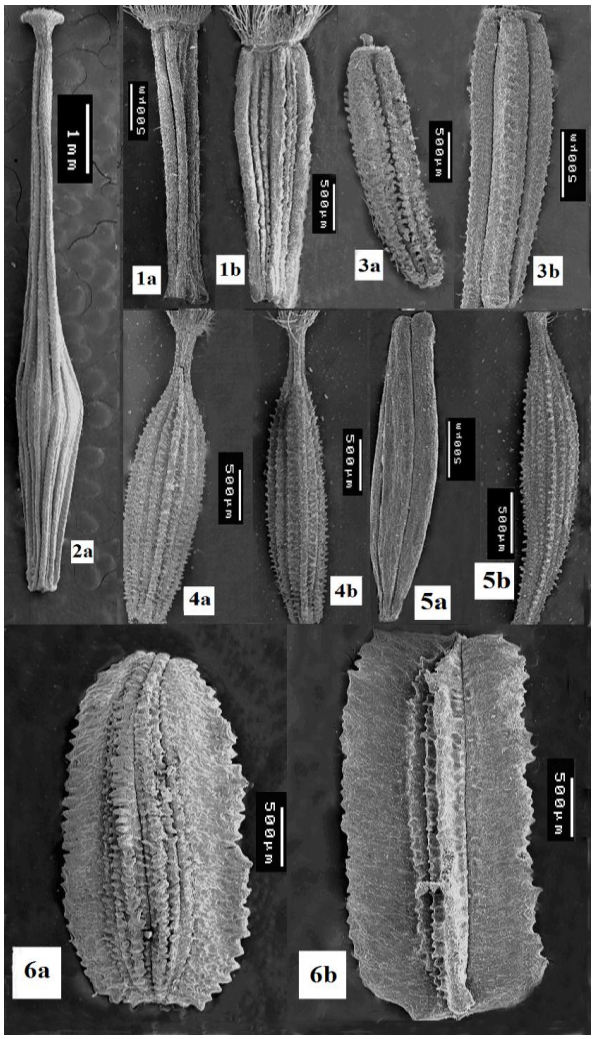

Plate 1. Launaea achenes (a. inner & b. outer): 1. L. spinosa; 2. L. acanthodes; 3. L. nudicaulis; 4. L. intybacea; 5. L. massauensis; 6. L. capitata

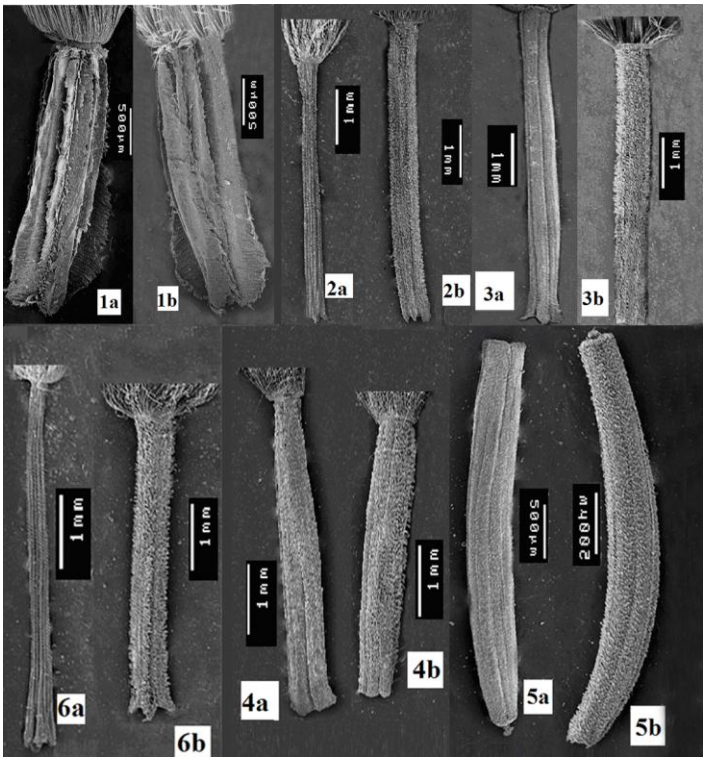

Plate 2. Launaea achenes (a. inner & b. outer): 1. L. angustifolia subsp. angustifolia; 2. L. angustifolia subsp. arabica; 3. L. fragilis subsp. fragilis; 4. L. fragilis subsp. tenuiloba; 5. L. mucronata; 6. L. cassiniana

Finally, the pappus characters are much useful for the distinction between some taxa; the setaceous type is only absent in L. *angustifolia* subsp. *arabica* and the downy type is absent in four species (*L. acanthodes*, *L. cassiniana*, *L. procumbens* and *L.* capitata), the pappus of the two later species have pappus disk.

In conclusion our research reveals that in the genus *Launaea* in Egypt, fourteen taxa belonging to 12 species are recorded, of which *L. acanthodes* (Boiss.) Kuntze is a new recorded, only one new combination » L. fragilis subsp. tenuiloba (Boiss.) Zareh & Mohamed' is made.

Key to the taxa based on morphological characters

1.a. Spinescent shrub
2.a. Shoots entirely glabrous; achene apex truncate, pappus persistent ……1. L. spinosa

2.b. Shoots white tomentose; achene apex attenuate, pappus deciduous . 2. L. acanthodes
1.b. Spineless annual or perennial herbs.

3.a. Heads densely glomerate in groups of 2-7 in the centre of the rosette and at the end of flowering scape; achenes whitich, broadly 2-3 winged .. 7. L. capitata
3.b. Heads solitary or in a few branched corymb; achenes brownish to black, not winged.
4.a. Outer achenes tapering or beaked.
5.a. Heads aggregate in 2-3 lax corymbs; pappus with disk, deciduous, monomorphic of setaceous bristles ……..…. 6. L. procumbens
5.b. Heads solitary; pappus without disc, persistent, dimorphic of setaceous and silky hairs.

6.a. Stem dichotomously branched; heads c. 2-mm broad; inner involucral

bracts more than 5-times as long as outer ones; style arms more than

1/3 of sweeping hairs region ……..…….....…… 5. L. massauensis
6.b. Stem monopodially branched; heads broader than 4-mm; inner involucral bracts less than 4-times as long as outer ones; style arms less than
1/5 of sweeping hairs region ……...…….…….. 4. L. intybacea
4.b. Outer achenes truncate, not beaked.
7.a. Marginal achenes glabrous, wrinkled; pappus with pappus disk …3. L. nudicaulis
7.b. Marginal achenes papillose or hairy, not wrinkled pappus without pappus disk.
8.a. Involucral bracts with herbaceous margins and callous-tipped; outer achenes

silky, hirsute at angles, pappus of cottony hairs, setaceous bristles absent.
9.a. Innermost achenes glabrous, others papillose; pappus dimorphic
of setaceous and silky hairs ……..… 9.a. L. angustifolia subsp. angustifolia
9.b. All achenes papillose; pappus monomorphic of silky hairs only ……..……... 9.b. angustifolia subsp. arabica
8.b. Involucral bracts with scarious margins and callousless-tipped; achenes not silky, not hirsute at angles, base not toothed; setaceous bristles present.
10.a. Leaf lobes linear; achenes longer than 6-mm, innermost achenes 4-horned at base.

11.a. Plant erect, branched in upper half; leaf lobes oblong to ovate, dentate or serrate; pappus as long as or slightly shorter than achene
…….……...… 10.a. L. fragilis subsp. Fragilis
11.b. Plant ascending, branched from base; leaf lobes linear to filiform, mostly entire; pappus longer than the achene
……..……..… 10.b. L. fragilis subsp. tenuiloba
10.b. Leaf lobes oblong to ovate; achenes shorter than 5-mm, all achenes

not horned at base.
12.a. Plant less than 25-cm high; branches leafless; florets less than 30 per head …… …..……...……..…. 8. L. amal-aminiae
12.b. Plant more than 50-cm high; branches with smaller auriculate leaves; florets more than 40 per head.
13.a. Inner involucral bracts with scarious margins; pappus persistant, dimorphic setaceous and silky hairs ……..... 11. L. mucronata
13.b. All involucral bracts without scarious margins; pappus deciduous, monomorphic of setaceous bristles ..... 12. L. cassiniana

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مراجعة تصنيفية للفصيلة المركبة في مصر ١١. لاونيا مع اشارة خاصة لتنوع الثمرة

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يتناول البحث مراجعة تصنيفية للوحدات المختلفة لجنس اللاونيا التي تنمو بريا في مصر. ولقد أوضحت الدراسة ان جنس اللاونيا ممثل في مصر باثنى عشر نوعا متضمنة أربعة عشر وحدة تصنيفية منها لاونيا أكانثويدس الذي يسجل لأول مرة في مصر، كما تم اعادة تسمية لاونيا فراجيلس تحت نوع تنيولوبا. بالإضافة الي ذلك تم دراسة تنوع الثمرة للوحدات التصنيفية المختلفة لجنس اللاونيا باستخدام كل من الميكروسكوب الضوئي والالكتروني. ولقد تم تصميم مفتاح لتعريف الوحدات التصنيفية التي تمثل جنس اللاونيا في مصر مبنياً علي الخصائص المورفولوجية واتبعه سرد للعينات التي بنيت علي اساسها الدراسة الحالية مع توضيح التوزيع الجغرافي لمختلف الوحدات التصنيفية داخل وخارج مصر.