



Flora and vegetation study on Hairy Beggarticks (*Bidens pilosa* L.) plant in Egypt

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Abstract

Bidens pilosa L. is an (Asteraceae) plant that originated from South America and can be found in almost all countries from tropical and subtropical regions. There are 231 sampled stands that used in this research to study the surrounded habitats of *B. pilosa* (floristic analysis, habitat characterization and vegetation analysis). In floristic analysis there are 113 species associated with *Bidens pilosa* L. which studied with their families, life forms, duration, nation distribution and floristic categories are presented in. Also it deals with environmental services and economic goods of *B. pilosa* and the species that associated with it. It was found that Poaceae (Gramineae) had the highest number of associated species with *B. pilosa* (25 species), also Therophytes were the dominant life form and an annual were the dominant duration (habitat). The environmental services segetals had the highest number of associated species (39 species representing 34.5% of the total species). The economic goods medicine had the highest number of associated species (68 species = 60.2% of the total recorded species). A total of 113 species were recorded in the 231 sampled stands representing 12 different habitats in the study area were studied in habitat characterization. In addition, the number of species in each habitat and the number of habitats which a species found in it. It was found that the Canals and ditches habitat had the highest number of species (80 species representing 70.8% of the total recorded species). The application of TWINSPLAN on the cover estimates of 113 associated species recorded in the 231 sampled stands of *Bidens pilosa*, lead to the recognition of 13 vegetation groups. These groups showed a reasonable segregation along the habitats DECORANA. The vegetation groups are named according to first and second dominant species associated with *B. pilosa*. The presence of *B. pilosa* 100% in all vegetation groups, while cover varied from one group to another.

Key words: *Bidens pilosa* L., Floristic Analysis, Life forms, Habitat, TWINSPLAN, Phytogeographical Distribution, Vegetation groups, Diversity.

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1. Introduction

Bidens pilosa L. (Asteraceae) is originated from South America and can be found in almost all countries from tropical and subtropical regions [1, 2]. There are 230 to 240 known *Bidens* species. Among them, *Bidens pilosa* [3, 4]. *B. pilosa* has several varieties such as *B. pilosa* var. *radiata*, var. *minor*, var. *pilosa* and var. *bisetosa*. Alongside examination of morphological traits, authentication of *B. pilosa* can be aided by chemotaxonomy and molecular characterization [5].

B. pilosa is an erect, glabrous or hairy, with green opposite leaves that are serrate, lobed, or dissected. It has white or yellow flowers, and long narrow ribbed black achenes (seeds). It grows to an average height of 60 cm and a maximum of 150 cm in favorable environments [6] Fig. (1).

Locally, the economic importance of the *B. pilosa* is not particularly high and this is reflected in the low production of scientific publications about this plant. However, *B. pilosa* is an easy-to-grow herb that is widely distributed all over the world [3, 7]. There is increasing global interest in the use of *B. pilosa* as shown by the many studies conducted on the plant in recent years. The folkloric use of *B. pilosa* has been recorded in America, Africa, Asia and Oceania [8].

B. pilosa is used as an herb and as an ingredient in teas or herbal medicines. Its shoots and leaves, dried or fresh, are utilized in sauces and teas [9, 10]. In the 1970s, the United Nations Food and Agriculture Organization (FAO) promoted the cultivation of *B. pilosa* in Africa because it is easy to grow, edible, palatable, and safe [11].

According to the International Union for Conservation of Nature (IUCN) *B. pilosa* is a new invasive plant in Egypt and the surrounded countries. It has the ability to invade diverse habitats, including roadsides, crops, pastures, gardens, disturbed areas, fallow lands and urban open space [12].

B. pilosa is a problematic plant species for many reasons throughout its range. It is reported as a troublesome weed to at least 30 crops in over 40 countries because of its high potential to reduce the crop yields [13]. It has a fast growth rate, strong seed production capacity, forming dense stands as well as producing allelopathy compounds in addition to be a victor host for many plant parasites. For these reasons, presence of *B. pilosa* within the farm plants and crops is strong indicator for germination suppression, aggressive competition then significant low production and loss of crop yields. Thick stands of *B. pilosa* impede access to roads, trails and recreational areas; moreover, its burrs are a nuisance to people, as well as, sheep and other fleece producing livestock [14].

The objectives of this work are to study the distribution of *B. pilosa* along their different habitats, in addition to Identifying the common communities associated with *B. pilosa*. These objectives are significant in that the wide geographical distribution of *B. pilosa* likely due to its ability to compete with and displace many other annuals, in addition to its effects on a number of plant species by reducing their germination rates and seedling growth. Therefore, this study will evaluate the favorable habitat and form (wild or cultivated) for using this arable weed for different purposes.

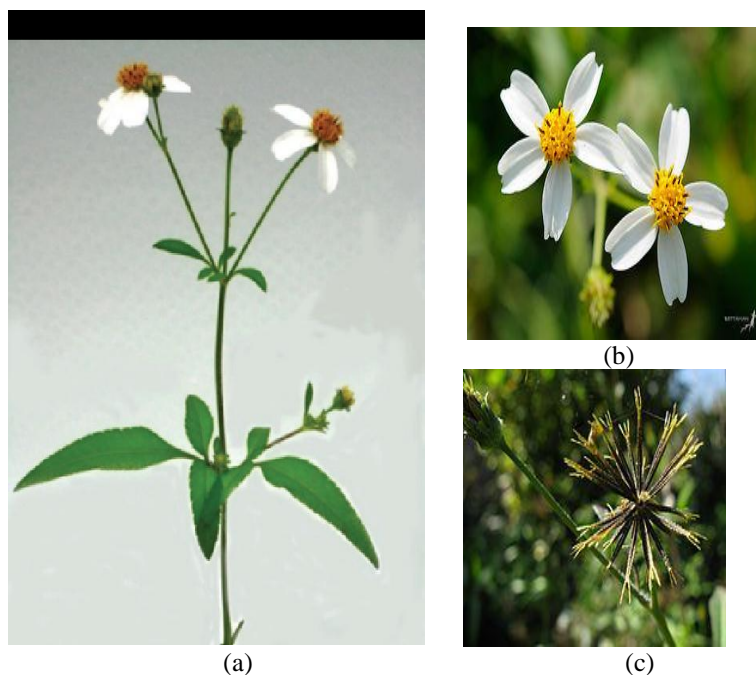


Fig (1): *B. pilosa* (a) and its flowers (b) and achenes (c)

2. Materials and Methods

2.1. Sites of study

Two hundred and thirty one stands were surveyed for studying taxonomy, distribution, phytosociology and ecology of *Bidens pilosa* located at four governorates of Egypt [Qalyubiya represented orchards (Al-khanka, sendiun, kalama, Al-Amar, Meet Asem, Meniawy, Bennha, Kafr Sandonhour and Shebeen Al Qanater) - Al-Sharkya represented (Kamaronh and Ezbat Abo Samra) - Al-Dacahlya represented (Ezbat bastah and Meet El Ezz) Cairo represented gardens (Nasr city) - city of 6-October] were selected to study plant vegetation associated with *Bidens pilosa*.

2.2. Species identification

The collected accessions were matched to the herbarium sheets of *Bidens pilosa* specimens deposited at Botany Department Herbarium (CAI) , Faculty of Science, University of Cairo.

2.3. Floristic analysis

Vegetation data were collected during winter and spring seasons at 2017. A number of stands (each 10 × 10 m) were selected randomly along the selected sites (231 stands). A list of plant species was made for each sampled stand. The cover of each species was visually estimated as a percentage using Rélève method [15]. Identification and nomenclature were performed according to [16, 17, 18, 19, 20, 21, and 22].

2.4. Multivariate analysis

The Two-way indicator species analysis (TWINSPAN), as a classification technique, and Detrended Correspondence Analysis (DCA), as an ordination technique, were applied to the matrix of cover estimates of 113 species in 231 stands in *Bidens pilosa* sites. TWINSPAN is a two-way classification FORTRAN program that constructs a key to the sample classification by identifying one to several species that are particularly diagnostic of each division in the classification. The most significant new feature is that the program first constructs a classification of samples, and then uses this classification to obtain a classification of species according to their ecological preferences [23,24,25]. DCA is a FORTRAN program for detrended correspondence analysis and reciprocal averaging. It was applied as a mean of axis construction to achieve a two-dimensional ordination of species and stands [26,27].

2.5. Diversity indices

Some diversity indices were calculated for the vegetation groups as derived from the multivariate analysis. Species richness (alpha-diversity) for each vegetation group was calculated as the average number of species per stands. Species turnover (beta-diversity) was calculated as a ratio between the total number of species recorded in a certain vegetation group and its alpha diversity [28]. Relative evenness or equitability (Shannon-Wiener index) of the species cover was expressed as $\hat{H} = -\sum P_i (\log P_i)$, where S is the total number of species and P_i is the relative cover of the species. The relative concentration of dominance is the second group of heterogeneity indices and is expressed by Simpson's index: $D = 1/C \{C = \sum (P_i)^2\}$, where S is the total number of species and P_i is the relative cover of species [29,30].

3. Results and discussion

3.1. Floristic Analysis

The recorded species associated with *Bidens pilosa* L. with their families, life forms and floristic categories are presented in Table 1. One hundred and thirteen species belong to 89 genera and 35 families were recorded associated with *B. pilosa*. The dominant families were Poaceae represented by (25 species) (Fig. 3); followed by Asteraceae (13 species); Brassicaceae and Fabaceae (7 species); Euphorbiaceae (6 species) and Convolvulaceae (5 species) Chenopodiaceae, Malvaceae and Solanaceae (4 species). In addition, four families were represented by three species, while three families included 2 species, and 19 families were represented by only one species Fig. (2).

Eighty species, representing (70.8% of the total species), were recorded as annuals; such as *Trianthema portulacastrum*, *Coriandrum sativum* and *Amaranthus hybridus*, while 36 species (31.9%) were perennials such as *Arum palaestinum*, *Zaleya pentandra* and *Cynanchum acutum* Table 1. Moreover, 77 species represented by 68.14% of the total species were terrestrial weeds such as *Amaranthus hybridus*, *Anagallis arvensis* and *Avena fatua*, while 23 species (20.4%) were natural plants; of them *Sesbania sesban*, *Conyza aegyptiaca* and *Lamium amplexicaule*, 8 species (7.1%) were plants escaped from cultivation such as *Imperata cylindrica*, *Zea mays* and *Helianthus annus*. 3 species (2.7%) were aquatic plants, which are *Veronica anagallis-aquatica*, *Ranunculus sceleratus* and *Phragmites australis* Fig. (3).

Table (1): Floristic characteristics of the recorded species associated with *Bidens pilosa* L. ME: Mediterranean, COSM: Cosmopolitan, SA-AR: Saharo-Arabian, Trop.: Tropical, S-Z: Sudano-Zambeziian, ER-SR: Euro-Siberian, IR-TR: Irano-Turanian, PAL: Palaetropical, and PAN: Pantropical, Ch: Chamaephytes, H: Hemicryptophytes, GH: Geophytes-helophytes, G: Geophytes, Ph: phanerophytes and Th: Therophytes

Species	Family	Arabic name	Habit (Duration)	Life form	Floristic category	Nation distribution
<i>Trianthema portulacastrum</i> L.	Aizoaceae	تريانثيما	Annual	Th	Trop.+ Sub. Trop.	GE
<i>Zaleya pentandra</i> (L.) C. Jeffrey	Aizoaceae	زالية خماسية الأسدية	Annual or Perennial	Ch	Trop.+ S-Z+SA-AR	N. De. R. GE. S
<i>Amaranthus hybridus</i> L.	Amaranthaceae	رعاف	Annual	Th	COSM	N, O, M, S
<i>Amaranthus lividus</i> L.	Amaryllidaceae	أمارنطون	Annual	Th	ME+IR-TR	N, M, S
<i>Ammi majus</i> L.	Apiaceae	خلة - سدا	Annual	Th	ME+IR-TR	N, O, M, S
<i>Apium graveolens</i> L.	Apiaceae	كرفس	Annual	Th	Cultivated	M, De, S
<i>Coriandrum sativum</i> L.	Apiaceae	كزبرة	Annual	Th	Cult+ ME+IR-TR+ ER-SR	N, O, M, S
<i>Arum palaestinum</i>	Araceae (arum)	لوف فلسطيني	Perennial	G	ME+SA-AR+ S-Z	M, D, S
<i>Cynanchum acutum</i> L.	Asclepiadaceae	عليق مدبب - الفللاف -	Perennial	Ch	ME+IR-TR	N, O, M
<i>Aster squamatus</i> (Speg.) Hieron	Asteraceae	..	Annual or Biennial	Th	ME+SA-AR+ S-Z	N, M, O, D, S
<i>Bidens pilosa</i> L.	Asteraceae	ذو السنين - حُسيكة	Annual or Perennial	Th	PAN	N, M, De, S
<i>Cichorium endivia</i> L. subsp pumilum Jacq.	Asteraceae	سريس - شيكوريا	Annual	Th	ME+IR-TR	N, O, M
<i>Conyza aegyptiaca</i> (L.) Dryand. In Ait.	Asteraceae	كونيزة	Annual	Th	S-Z+ Trop.+ IR-TR+ SA-AR	N, O
<i>Conyza bonariensis</i> (L.) Cronquist	Asteraceae	خوع- نفلا	Annual	Th	NEO	N, O, M, D, S
<i>Eclipta Prostrata</i> (L.)L., Mant	Asteraceae	منكسفة مقترشة	Annual	Th	Trop.+ COSM	N, O, M
<i>Galinsoga parviflora</i> Cav., Icon. Descr.	Asteraceae	..	Annual	Th	COSM	N

<i>Helianthus annuus</i> L.	Asteraceae	عباد الشمس	Perennial	Ch	Cultivated	Cult
<i>Launaea nudicaulis</i> (L.) Hook.	Asteraceae	حوا	Perennial	H	SA-AR+IR-TR+ S-Z	N, O, M, D, R, GE, S
<i>Pluchea dioscorides</i> (L.) Desf.	Asteraceae	برنوف	Perennial	Ph	SA-AR+S-Z	N, M, De, S
<i>Senecio glaucus</i> L. subsp. coronopifolius (Maire) C. Alexander	Asteraceae	الشيخة الرمادية	Annual	Th	ME+SA-AR+ IR-TR	M, D, S
<i>Sonchus oleraceus</i> L.	Asteraceae	جعضيض	Annual	Th	COSM	N, O, M, D, R, S
<i>Xanthium strumarium</i> L.	Asteraceae	الشبيط - اللزيق	Annual	Th	PAN	N, O, M, S
<i>Heliotropium supinum</i> L.	Boraginaceae	رقيب الشمس المنبطح	Annual	Th	COSM	N, M, O, D, S
<i>Brassica nigra</i> (L.) Koch	Brassicaceae	خردل اسود	Annual	Th	COSM	N, O, M, Da,
<i>Brassica rapa</i> L.	Brassicaceae	ملفوف - كرنب	Annual, Biennial	Th	Cultivated	N, O, M
<i>Capsella bursa-pastoris</i> (L.) Medik	Brassicaceae	كيس الراعي	Annual	Th	COSM	N
<i>Coronopus didymus</i> (L.) Sm.	Brassicaceae	..	Annual or Biennial	Th	COSM	N
<i>Coronopus niloticus</i> (Delile) Spreng	Brassicaceae	حارة	Annual	Th	S-Z	N, O, De
<i>Rorippa palustris</i> (L.) Besser	Brassicaceae	..	Annual or Perennial	Th	COSM	N,M
<i>Sisymbrium irio</i> L.	Brassicaceae	سمارة رثة	Annual	Th	ME+IR-TR+ER-SR	N, M, De , R,GE, S
<i>Cannabis sativa</i> L.	Cannabaceae	القنب المزروع	Annual	Th	Trop.+ Cult. + Sup. Trop.	N, M, O, D, S
<i>Stellaria pallida</i> (Dumort.) Murb.	Caryophyllaceae	حشيشة القزاز	Annual	Th	ME+ER-SR	N, O, M, S
<i>Beta vulgaris</i> L.	Chenopodiaceae	سلق	Annual	Th	ME+ER-SR+IR-TR	N, O, M, De, S
<i>Chenopodium album</i> L.	Chenopodiaceae	سرمق - زربيج ابيض	Annual	Th	COSM	N, O, M, D, S
<i>Chenopodium ficifolium</i> Sm. Fl. Brit.	Chenopodiaceae	..	Annual	Th	COSM	N. D
<i>Chenopodium murale</i> L.	Chenopodiaceae	لسان الثور	Annual	Th	COSM	N, O, M, D, R, GE, S
<i>Commelina benghalensis</i> L.	Commelinaceae	وعلان بنغالي	Perennial	Ch	ME+IR-TR+S-Z+SA-AR+ Trop.	N
<i>Convolvulus arvensis</i> L.	Convolvulaceae	عليق بري	Perennial	H	Trop.	N, O, M, D, S
<i>Ipomoea cairica</i> (L.) Sweet, Hort	Convolvulaceae	الديداء - الأثمان	Perennial	H	ME+ Trop. +S-Z+IR-TR+ Cultivated	N, M, D
<i>Ipomoea carnea</i> Jacq., Enum.	Convolvulaceae	عليق كبير - ايبوميا لحمية	Perennial	H	ME+IR-TR+ Trop.+ Cultivated	N
<i>Ipomoea hederacea</i> Jacq.	Convolvulaceae	ايبوميا عشقية الورق	Perennial	H	ME +Trop. +S-Z+ IR-TR	N
<i>Ipomoea purpurea</i> (L.) Roth	Convolvulaceae	الأثمان الأرجواني	Perennial	H	ME +Trop. +S-Z+ IR-TR	N
<i>Cyperus alopecuroides</i> Rottb	Cyperaceae	سعد ثعلبي	Perennial	GH	ME +Trop. +S-Z+ IR-TR	N. M. De
<i>Cyperus rotundus</i> L.	Cyperaceae	سعد مستدير	Perennial	GH	ME+IR-TR+ Trop.	N, O, M, D, R, GE, S
<i>Euphorbia heterophylla</i> L.	Euphorbiaceae	فربيون - حبلوب ارضي	Annual	Th	PAN	N, O, M
<i>Euphorbia helioscopia</i> L.	Euphorbiaceae	سعدة	Annual	Th	ER-SR+ME+IR-TR+S-Z	N, M
<i>Euphorbia peplus</i> L.	Euphorbiaceae	ودينه - فرجح	Annual	Th	ME+ER-SR+IR-TR	N, O, M, D, S
<i>Euphorbia prostrata</i> Aiton, Hort. Kew.,	Euphorbiaceae	لبين	Annual	Th	Trop.	N, M, S
<i>Euphorbia indica</i> Lam., Encycl.	Euphorbiaceae	..	Annual	Th	SA-AR+IR-TR+S-Z	N
<i>Ricinus communis</i> L.	Euphorbiaceae	خروع	Perennial	Ph	PAN	De, GE
<i>Medicago polymorpha</i> L.	Fabaceae	نفل	Annual	Th	ME+COSM+ Cultivated	N. O. M. D. S
<i>Melilotus indicus</i> (L.) All.	Fabaceae	حنذقوق هندي	Annual	Th	ME+IR-TR+ SA-SI	N, O, M, D, S
<i>Sesbania sesban</i> (L.) Merr.	Fabaceae	سيسبان	Perennial	Ph	COSM	N. M. O. S
<i>Trifolium alexandrinum</i> L.	Fabaceae	برسيم	Annual	Th	ME	N. O. M. D, S

<i>Trifolium resupinatum</i> Boiss	Fabaceae	جريدة	Annual	Th	IR-TR+ER-SR+ME	N. O. M. D
<i>Trigonilla hamosa</i> L.	Fabaceae	حلبة متفرعة	Annual	Th	ME+SA-AR+IR-TR+ Cultivated	N. O. M. S
<i>Vicia sativa</i> subsp. <i>Sativa</i> L.	Fabaceae	جلبان	Annual	Th	ME+ER-SR+IR-TR+ Cultivated	N. M
<i>Funaria</i> sp.	Funariaceae	فيوناريا	Annual	Th	COSM	N, M, O, D, S
<i>Lamium amplexicaule</i> L.	Lamiaceae	فم السمكة	Annual	Th	ME+ER-SR+IR- TR+S-Z	N, O, M, S
<i>Mentha longifolia</i> (L.) Hudson	Lamiaceae	نعناع	Annual	Th	ME+ER-SR+IR- TR+S-Z	N, O, S
<i>Mentha pulegium</i> L.	Lamiaceae	نعناع أوروبي - التنعناع البري	Annual	Th	ME+ER-SR+IR- TR+SA-AR	N, O
<i>Hibiscus trionum</i> L.	Malvaceae	خطمي	Annual	Th	Cultivated +ME+IR- TR+S-Z+ Trop.	N, O, M, S
<i>Malva parviflora</i> L.	Malvaceae	خبيزة	Annual	Th	ME+IR-TR	N, O, M, D, R, GE, S
<i>Malvastrum coromandelianum</i> (L.) Garcke	Malvaceae	..	Annual	Th	Trop.+ Cultivated	N
<i>Sida alba</i> l.	Malvaceae	سيدا بيضاء	Annual or Perennial	Th	Cultivated+ Trop. +Sub. Trop.	N, O, M
<i>Ludwigia stolonifera</i> (Guill &Perr.) P. H. Raven	Onagraceae	حبق البحر	Perennial	Ch	ME+IR-TR+S-Z	N, O, M. S
<i>Oxalis anthelmintica</i> A Rich.	Oxalidaceae	حميضة	Perennial	H	Trop. +S-Z+ME	GE
<i>Oxalis corniculata</i> L.	Oxalidaceae	حميضة قرينية	Perennial	H	COSM	N, O, M, De
<i>Plantago major</i> L.	Plantaginaceae	لسان الحمل	Perennial	H	COSM	N, O, M, S
<i>Veronica anagallis-aquatica</i> L.	Plantaginaceae	ظرباب	Perennial	GH	COSM	N, O
<i>Veronica polita</i> Fr., Nov. Fl. Suec	Plantaginaceae	زهرة الحواشي اللامعة	Annual	Th	COSM	N, O, M
<i>Agrostis stolonifera</i> L.	Poaceae	أغروستيس رندي	Perennial	Ch	ER-SR+ME+IR- TR+S-Z	S
<i>Arundo donax</i> L.	Poaceae	غاب	Perennial	G	ME+IR-TR+SA-AR	N. O. M. D. S
<i>Avena fatua</i> L.	Poaceae	شوفان	Annual	Th	COSM	N, O, M, De
<i>Brachiaria eruciformis</i> (Sm.) Griseb.	Poaceae	نسيله	Annual	Th	ME+IR-TR+S-Z	N, O. S
<i>Bromus catharticus</i> Vahl.	Poaceae	..	Annual	Th	ME+ER-SR+IR-TR +MA	N, O, M, De
<i>Cenchrus biflorus</i> Roxb .	Poaceae	..	Annual	Th	SA-AR+S-Z+IR-TR	N, D. S
<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	نجيل بلدي	Perennial	G	COSM	N, O, M, D, R, GE, S
<i>Dactyloctenium aegyptium</i> (L.) P. Beauv.	Poaceae	النجم	Annual	Th	Cultivated+ Trop.+ COSM	N. O. M. D. S
<i>Digitaria sanguinalis</i> (L.) Scop.	Poaceae	ابوركية	Annual	Th	PAL	N, O, M, De, S
<i>Echinochloa colona</i> (L.) Link	Poaceae	ابو ركه - ذنبيه	Annual	Th	ME+IR-TR+ Trop.	N, O, M, D, R, GE, S
<i>Echinochloa stagnina</i> (Retz.) P. Beauv., Ess. Agrostogr.	Poaceae	..	Annual	Th	Trop.+ IR-TR+S-Z	N. O. M. De
<i>Imperata cylindrica</i> (L.) Raeusch.	Poaceae	حلفا - حلف - ديس	Perennial	GH	ME+SA-AR+IR-TR	N, O, M, D, R, S
<i>Lolium temulentum</i> L.	Poaceae	زوان مسكر	Annual	Th	ME+ER-SR+IR-TR+S- Z	N. O. M. Dw. S
<i>Panicum repens</i> L.	Poaceae	الثمام المنتفخ - الثمام الزاحف	Perennial	G	PAN	N, O, M, De
<i>Paspalidium geminatum</i> (Forssk.) Stapf	Poaceae	نسيله - أبو بيض	Perennial	GH	Trop.	N, O, M, De
<i>Phalaris minor</i> Retz.	Poaceae	ذيل القط	Annual	Th	ME+IR-TR	N, O, M, De, S
<i>Phragmites australis</i> (Cav.)Trin.ex Steud	Poaceae	بوص	Perennial	GH	COSM	N, O, M, D, R, S
<i>Poa annua</i> L.	Poaceae	سبل أبو الحسين	Annual	Th	ME+ER-SR+IR-TR	N. O. M. S
<i>Polypogon monspeliensis</i> (L.) Desf.	Poaceae	ذيل القط	Annual	Th	COSM	N. O. M. D. R. S
<i>Setaria glauca</i> (L.) P. Beauv	Poaceae	ذيل الثعلب الازرق	Annual	Th	S-Z+ Trop.	N, O, De, GE
<i>Setaria verticillata</i> (L.) Beauv.	Poaceae	ذيل الثعلب	Annual	Th	COSM	N, O, M, D, R, GE, S

<i>Setaria viridis</i> (L.) Beauv	Poaceae	ذيل الثعلب الاخضر	Annual	Th	PAL	N, O, De, S
<i>Triticum aestivum</i> L.	Poaceae	قمح	Annual	Th	Cultivated	N, Cult
<i>Vossia cuspidata</i> (Roxb.) Griff.	Poaceae	..	Perennial	GH	Trop.	N
<i>Zea mays</i> L	Poaceae	ذره	Annual	Th	PAL	N
<i>Emex spinosa</i> (L.) Campd	Polygalaceae	ضرس العجوز - حنزاب	Annual	Th	ME + SA-SI	N, O, M, D, S
<i>Persicaria salicifolia</i> (Brouss. ex Willd.) Assenov	Polygonaceae	أبو عين حمرة	Perennial	GH	COSM	N, M
<i>Persicaria senegalensis</i> (Meisn.) Sojak.	Polygonaceae	..	Annual	Th	Trop.+ S-Z+SA- AR+ME	N, M
<i>Rumex dentatus</i> (L.) subsp. mesopotamicus	Polygonaceae	حميض	Annual	Th	ME+ER-SR+IR- TR+SA-AR	N, O, M, S
<i>Portulaca oleracea</i> subsp. oleracea L.	Portulacaceae	رجله	Annual	Th	COSM	N, O, M, D, S
<i>Anagaliis arvensis</i> L.	Primulaceae	زغلنت - عين القط	Annual	Th	COSM	N, O, M, D, R, GE, S
<i>Adiantum capillus-veneris</i> L.	Pteridaceae	كزبرة البئر	Perennial	H	Trop.+ S-Z+IR- TR+ER-SR+ME	N, M, O, D, R, GE, S
<i>Ranunculus sceleratus</i> L.	Ranunculaceae	زغلنتة	Annual	Th	ME+ER-SR+IR-TR	N,O
<i>Riccia</i> sp.	Ricciaceae	ريشيا	Annual	Th	COSM	N, M, O, D, R, GE, S
<i>Rubus sanctus</i> Schreb . Icon . Dscr.	Rosaceae	عَلَيْقٍ مقدس	Annual	H	ME+ER-SR+IR-TR	N, M, S
<i>Physalis angulata</i> L.	Solanaceae	..	Annual	Th	Cultivated+ Trop.+ S- Z+SA-AR+ME	N
<i>Solanum lycopersicum</i> L.	Solanaceae	طماطم	Annual	Th	Cultivated	Cult
<i>Solanum nigrum</i> L.	Solanaceae	عنب الديب	Annual	Ch	ME+ER-SR+IR-TR	N, O, M, D, S
<i>Withania somnifera</i> (L.) Dunal.	Solanaceae	عجعب منوم	Perennial	Ch	ME+ER-SR+IR-TR+S- Z	N, O, M, GE
<i>Corchorus olitorius</i> L.	Tiliaceae	ملوخيه	Annual	Th	PAN	N, O, M, S
<i>Urtica urens</i> L.	Urticaceae	حريق	Annual	Th	ME+ER-SR	N, O, M, De
<i>Phyla nodiflora</i> L.	Verbenaceae	ليبيا	Perennial	H	ME+IR-TR+ Trop.	N, O, M, D, S

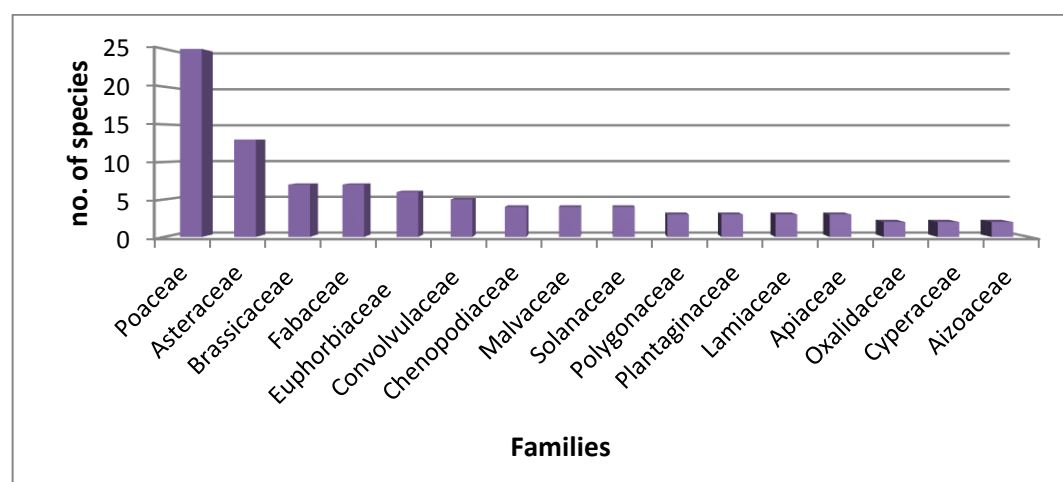


Fig (2): Number of plant species belonging to the different families associated with *Bidens pilosa*

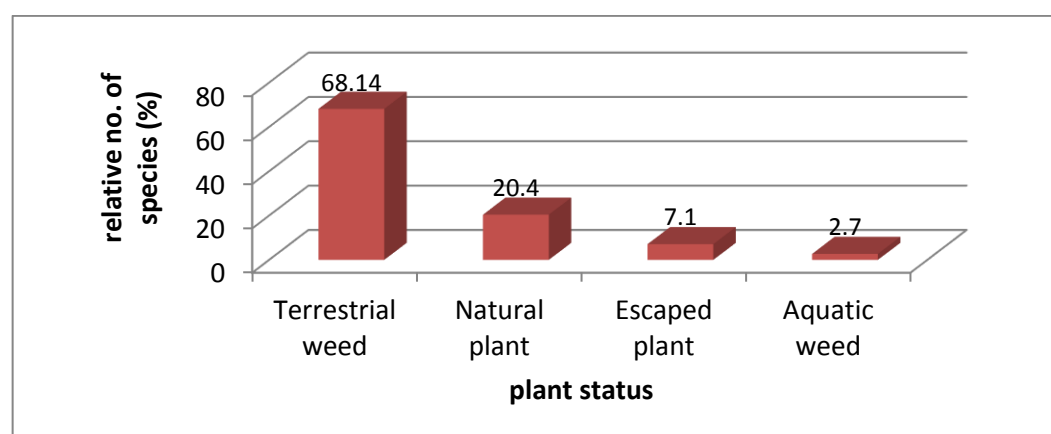


Fig (3): Status of the recorded species associated to *Bidens pilosa*

3.1.1. Life forms

The life forms spectra of the recorded species associated with *Bidens pilosa* indicated the presence of six different categories: hemicryptophytes, geophytes-helophytes, geophytes, chamaephytes, phanerophytes and therophytes Fig. (4). It was found that, therophytes were the dominant life form represented by 78 species (69.03% of the total species), followed by hemicryptophytes represented by 12 species for each (10.62%). Chamaephytes and geophytes-helophytes represented by 8 species for each (7.1%), while geophytes represented by 4 species for each (3.54%) phanerophytes represented by 3 species for each (2.7%).

3.1.2. Global Phylogeographical Distribution

The chorological analysis of the recorded species associated with *B. pilosa* indicated the predominance of pluri-regional elements represented by 51 species (45.13% of the total species), followed by cosmopolitans represented by 27 species (23.9%). Mono-regional taxa represented by 16 species (14.2%) and bi-regional taxa represented by 14 species (12.4%). There are 5 species representing (4.42%) of the total species were recorded as only cultivated plants Fig. (5).

3.1.3. Local Phylogeographical Distribution

The national phylogeographical distribution of the recorded species associated with *B. pilosa* was found that 13 species had a wide geographical distribution all over Egypt (i.e. occur in all the 12 geographical regions) of them *Echinochloa colona*, *Cynodon dactylon* and *Cyperus rotundus*. In addition, 10 species were distributed in 11 regions (*Imperata cylindrica*, *Anagallis arvensis* and *Chenopodium murale*). Moreover, *Chenopodium ficifolium* was restricted to the Nile delta region, while *Amaranthus hybridus* and *Amaranthus lividus* were exclusively belonged to Nile delta region, Nv and S regions, respectively.

According to the abundance categories of the recorded species associated with *B. pilosa*, it was found that 49.9% of the total species were common, while 38.6% were very common, 15.1% were rare and 5.5% were very rare Fig. (6).

Moreover, the highest proportions of species (100% of the total species) were belonged to the Nile Delta region, while the lowest (11.7%) were related to Gebel Elba.

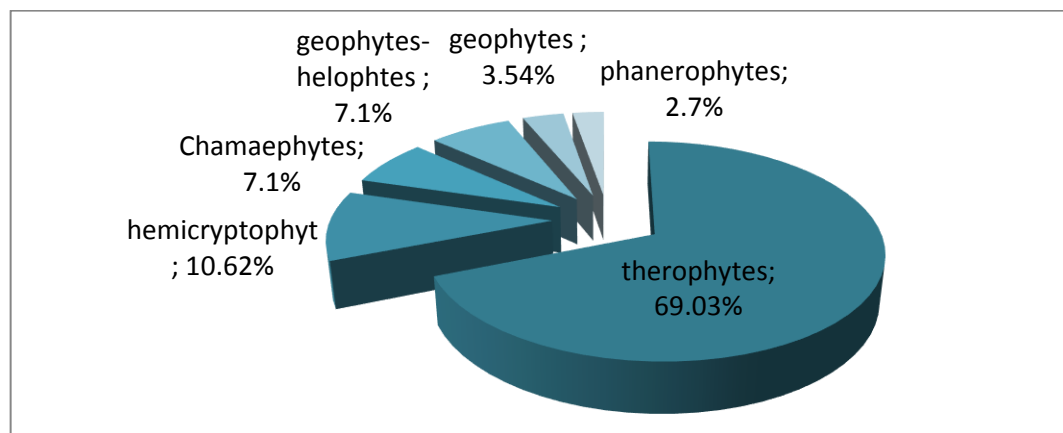


Fig (4): Life forms spectra of the recorded species associated with *Bidens pilosa*. Th: Therophytes, H: hemicryptophytes, G: geophytes, GH: geophytes-helophytes, Ph: phanerophytes and Ch: chamaephytes

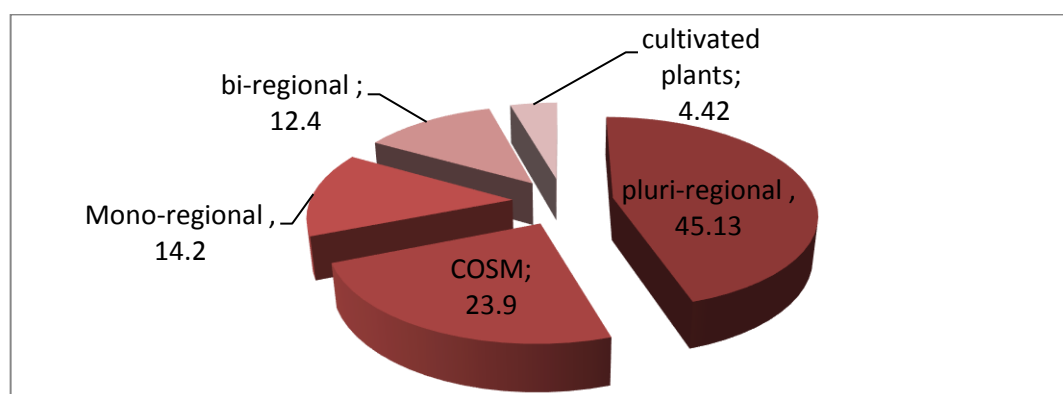


Fig (5): Global phylogeographical distribution of the recorded associated species

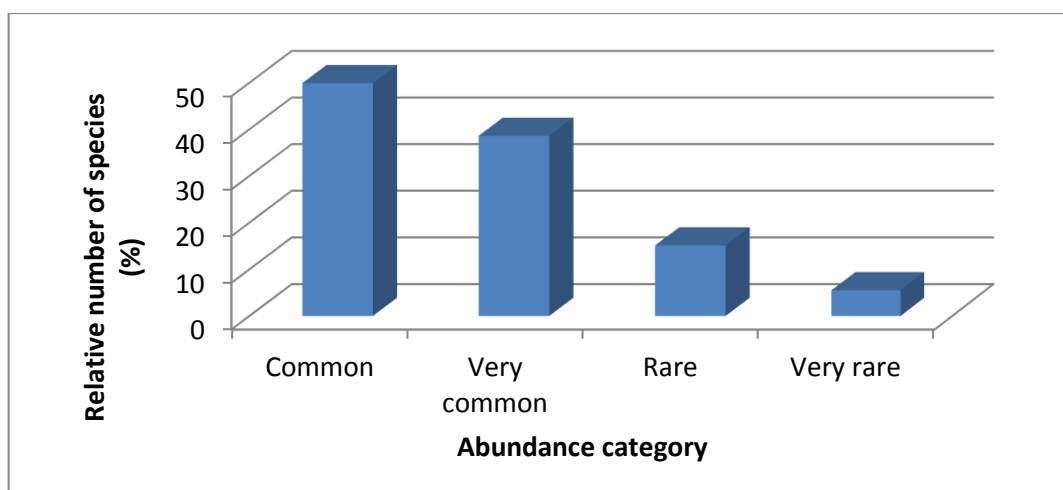


Fig (6): Abundance categories of the recorded species associated with *Bidens pilosa* in the different phylogeographical regions

3.1.4. Environmental services and Economic goods

There are 111 species have environmental and economic importance from the total species (113 species). About 55 species, representing (48.8%) of the total species has both environmental services and economic goods Fig. (7). In addition, 16 species (14.3%) had only environmental

services, while 39 species (34.6%) exclusively had economic goods. Also, there are 2 species have no importance until this day.

Environmental Services

The potential and actual environmental services of the recorded species were classified into 11 major Categories: segetals, ruderals, sand controllers (i.e. sand binder, hummock formers and wind breaks), bank retainers, shaders, parasites, poisonous plants, invaders, weed controllers, nitrogen fixers and water purifiers. The environmental services of the recorded species could be arranged descendingly as follows Fig. (8): segetals (39 species representing 34.5% of the total species), followed by ruderals (15 species =13.3%), poisonous plants (9 species = 8.0%), other

uses (8 species = 7.1%), sand controllers (6 species = 5.3%), weed controllers (5 species = 4.4%), water invaders (3 species = 2.7%), bank retainers (2 species =1.8%), shaders (2 species =1.8%), nitrogen fixers (2 species = 1.8%), and water purifiers (1 species = 0.9%). Moreover, 54 species, representing (47.8%) of the total species, of the environmentally important species have only one importance (A), 13 species (11.5%) have two importance (B), and 4 species (3.6%) have three importance(C) Fig. (9).

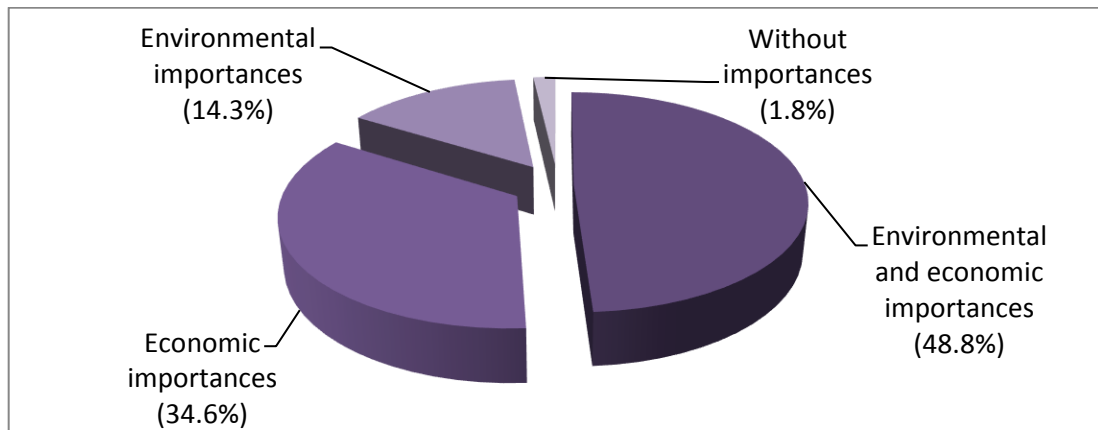


Fig (7): Environmental services and Economic goods of the recorded species associated with *Bidens pilosa L*

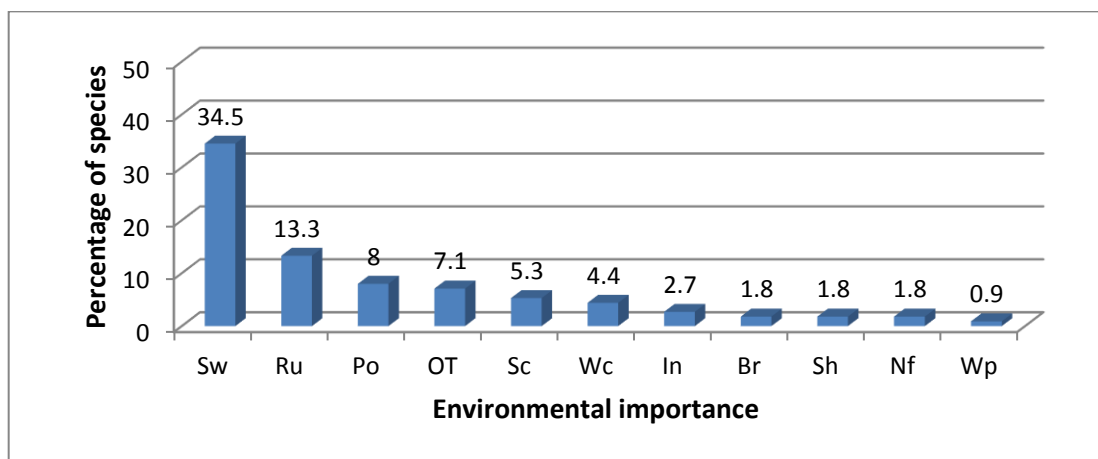


Fig (8): Environmental services of the recorded species in the different habitats of *Bidens pilosa*. Sw: segetals, Ru: ruderals, Sc: sand controllers, Br: bank retainers, Sh: shaders, Po: poisonous plants, In: invaders, Wc: weed controllers, Nf: nitrogen fixers, and Wp: water purifiers

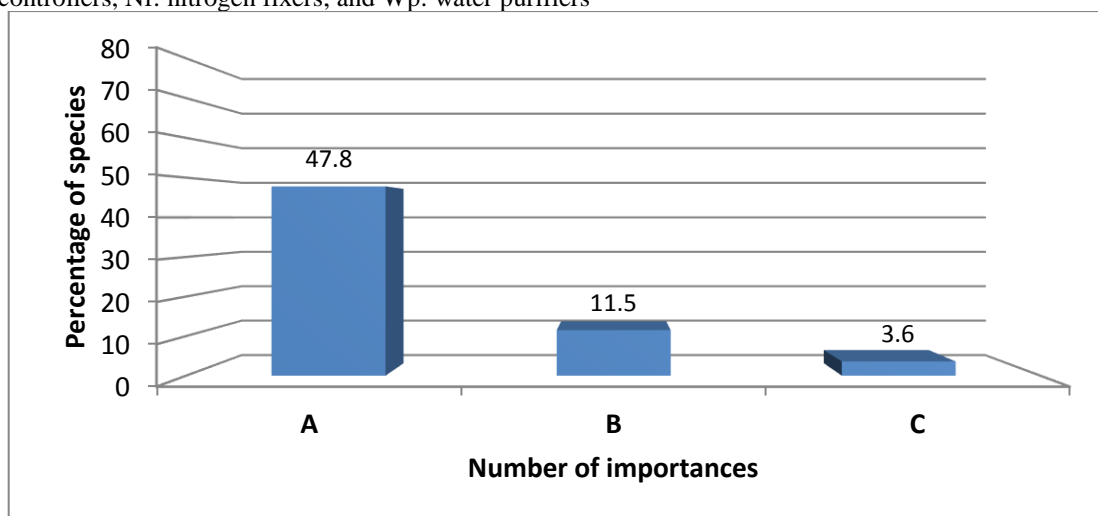


Fig (9): The relative number of species in relation to the number of environmental services

Economic Goods

The potential and actual economic goods of the recorded species were assessed in the different habitats of *Bidens pilosa L*. The economic goods are classified into 6 major Categories: grazing, medicinal, human food, timber, fuel, and other uses (e.g. making mats, baskets, chairs, ornamentals, fibers, fodders, beach beds, and oils and dye extractions). The economic goods of the recorded species could be arranged descending as follows Fig.

(10): medicinal (68 species = 60.2% of the total recorded species), human food (43 species = 38.1%), grazing (40 species = 35.4%), other uses (9 species = 8%), fuel (5 species = 4.4%), and timber (1 species = 0.9%). Moreover, 41 species of the economically important species have only one good 36.3 % (A), 38 species have two goods 33.6% (B), 13 species have 3 goods 11.5% (C), 2 species have five goods 1.8% (D) Fig. (11).

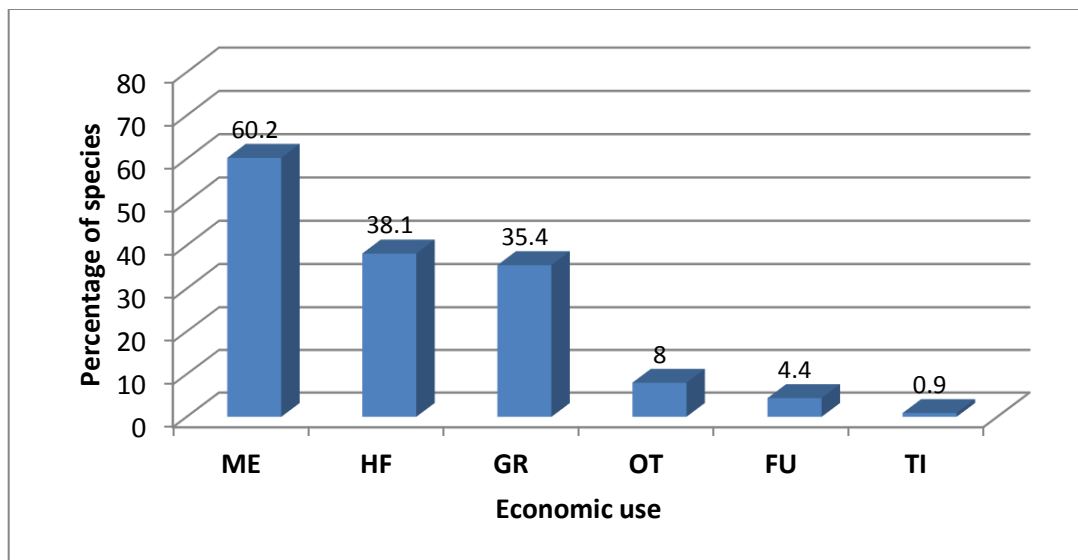


Fig (10): Economic goods of the recorded species in the different habitats of *Bidens pilosa*.GR: grazing, ME: medicinal, HF: human food, OT: other uses, FU: fuel, TI: Timber use

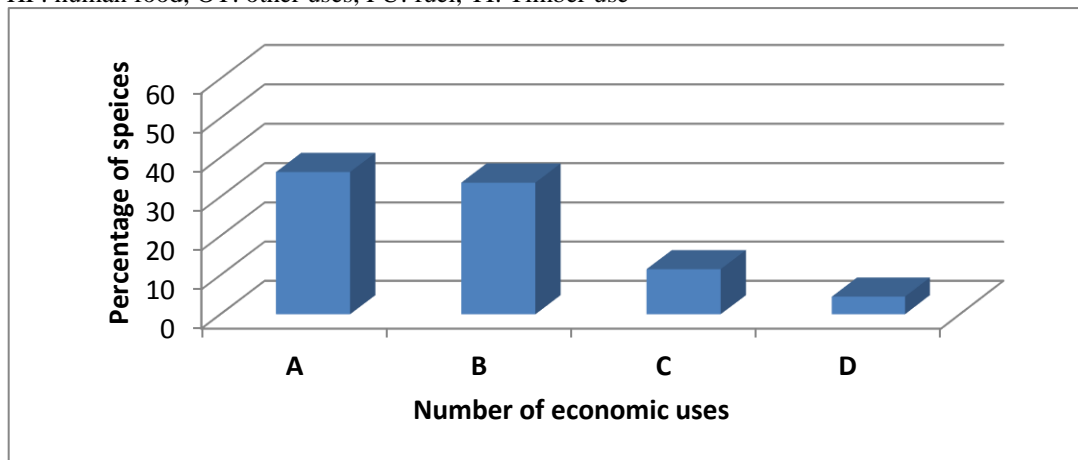


Fig (11): Relative number of species in relation to the no. of economic goods

3.2. Habitat Characterization

A total of 113 species were recorded in the 231 sampled stands representing 12 different habitats in the study area. It was found that *Anagalis arvensis*, *Bidens pilosa*, *Chenopodium moral*, *Convolvulus arvensis*, *Cynodon dactylon*, *Euphorbia peplus*, *Euphorbia helioscopia*, *Euphorbia heterophylla*, *Malva parviflorae*, *Oxalis corniculata* and *Soncuhs oleraceous* were recorded in the 12 habitats; while *Solanum nigram*, *Rorippa palustris*, *Panicum ripins* and *Emisx spinosa* were recorded in 11 habitats. The species *Digitaria sanguinalis*, *Lamium amplexicaule*, *Poa annua*, *Sillaria pallida* and *Setaria viridis* were recorded in 10 habitats. In addition, 2 species (*Avena fatuta* L. and *Chenopodium album* L.) were recorded in 9 habitats; and 7 species (*Arum palaestinum*, *Cynanchum acutum*, *Cyperus rotundus*, *Dactyloctenium aegyptium*, *Physalis angulata*, *Plantago major* and *Sesbania sesban*) recorded in 8 habitats. There are 8 species (eg. *Ludwigia stolonifera*, *Echinochloa colona*, *Conyaza bonariensis*, *Cichorium indiva*) in 7 habitats and 4 species (*Aster squamatus*, *Imperata cylindrical*, *Veronica anagallis-aquatica* L. and *Medicago polymorpha*) were recorded in 6 habitats. Moreover, 3 species (*Ricinus communis*, *Galinsoga parvijlora* and *Conyza aegyptiaca*) were recorded in 5 habitats. There are 8 species (eg. *Adiantum*

capillus-veneris, *Capsella bursa-pastoris*, *Helianthus annuus*, *Ranunculus sceleratus*) were recorded in 4 habitats, while 13 species (eg. *Vicia sativa*, *Trianthema portulacastrum*, *Setaria verticillata*, *Phyla nodiflora*) were recorded in 3 habitats. In addition, 12 species (eg. *Apium graveolens*, *Coriandrum sativum*, *Euphorbia indica*, *Heliotropium supinum*) were recorded in 2 habitats. finally, there are 31 species were recorded exclusively in 1 habitat.

The number of recorded species varied remarkably from one habitat to another Fig. (12). Canals and ditches had the highest number of species (80 species representing 70.8% of the total recorded species), while orange and citrus orchards had 73 species (64.6%). However, orange and citrus orchards habitats representing in (70 stands from 231 sampled stands) are contain the largest distribution of *B. pilosa* in Egypt. Crops had 54 species (47.8%), while both of waste lands and gardens habitats have 46 species (40.7%). The habitats Mango and Guava orchards have 39 species (34.5%), and Apricots orchards had 38 species (33.6%). Pear orchards had 36 species (31.9%), plantations had 32 species (28.3%), and Banana orchards had 27 species (23.9%), finally Fig orchards which had 25 species (22.1%).

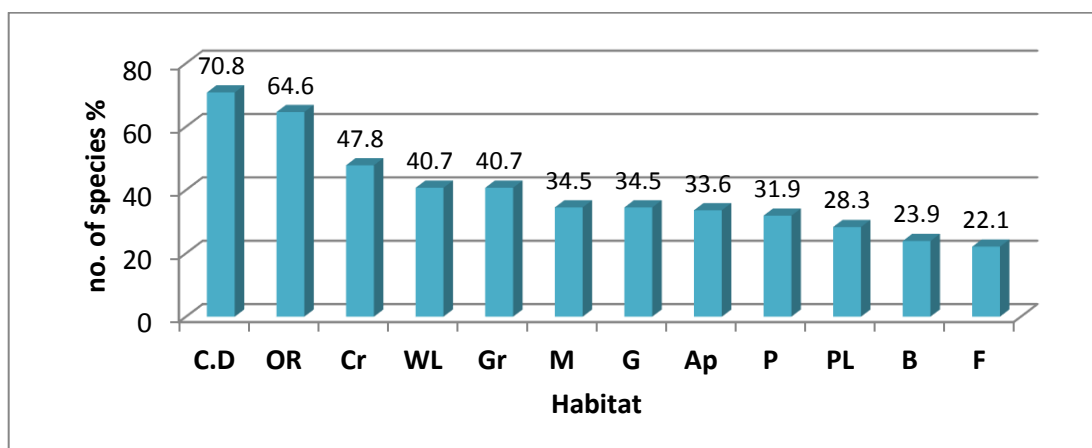


Fig (12): Distribution of species among different habitats and their relative number

3.3. Vegetation Analysis

3.3.1. Vegetation groups

The application of TWINSPAN on the cover estimates of 113 associated species recorded in the 231 sampled stands of *Bidens pilosa*, lead to the recognition of 13 vegetation groups Table 2 and Fig. (13). The vegetation groups are named according to first and second dominant species associated with *B. pilosa* (the species that have the highest presence percentage and / or the highest relative cover). The presence of *B. pilosa* 100% in all vegetation groups, while cover varied from one group to another. The description of these vegetation groups was as follows:

Commelina benghalensis - *Cyperus rotundus* (VG1): It included one stand and 7 species. In this group, *C. benghalensis* represented by 45% cover and 100% presence, while *C. rotundus* was represented by 1% cover, and 100% presence. The associated species include *Galinsoga parviflora*, *Euphorbia peplus*, *Ipomoea hederacea* and *setaria glauca*.

Withania semenifera - *Oxalis corniculata* (VG2): It included 2 stands and 15 species. *W. semenifera* was represented by 2% cover and 100% presence, while *O. corniculata* was represented by 1% cover and 50% presence. The associated species include *Ricinus communis*, *Euphorbia indica*, *Solanum lycopersicum* and *Melilotus indicu*.

Euphorbia peplus - *Cynodon dactylon* (VG3): It included 4 stands and 8 species. In this group *E. peplus* was represented by 17.5% cover and 100% presence, while *C. dactylon* was represented by 1.4% cover and 100% presence. The associated species include *Sonchuhs oleraceous*, *Avena fatuta*, *Euphorbia indica* and *Imperata cylindrica*.

Cynodon dactylon - *Euphorbia peplus* (VG4): It included 7 stands and 42 species. *C. dactylon* was represented by 51% cover and 100% presence, while *E. peplus* was represented by 1.6% cover and 100% presence. *Romix dentatus*, *Oxalis corniculata*, *Phragmites australis* and *Malva parviflorae* are the common associated species.

Cynodon dactylon - *Phyla nodiflora* (VG5): It comprised 6 stands and 16 species. *C. dactylon* was represented by 16.3% cover and 100% presence, while *P. nodiflora* was represented by 15% cover and 33.3% presence. The associated species include *Bromus catharticus*, *Panicum ripins*, *Solanum nigram* and *Percicaria salicifolium*.

Phalaris minor - *Convolvulus arvensis* (VG6): This group comprised 8 stands and 22 species. *P. minor* was represented by 4.8 % cover, while *C. arvensis* was represented by 2.7 %. The two species are represented by 100 % presence. The associated species include *Trifolium alexandrnum*, *sisyprrium irio*, *Bromus catharticus* and *Beta vulgaris*.

Bromus catharticus - *Phalaris minor* (VG7): It included 13 stands and 40 species. The cover of *B. catharticus* was 12.6 and 92.3% presence, while that of *P. minor* was 7.7% cover and 76.9% presence. *Aster squamatus*, *Melilotus indicu*, *Apium graveolens* and *Brasica nigra* are the common associated species.

Sillaria pallid - *Soncuhs oleraceous* (VG8): This group included 77 stands and 80 species. It was found that *S. pallid* had 3.8 % cover and 81.8% presence, while *S. oleraceous* had 3.3% cover and 90.9% presence. The associated species comprise *Anagalis arvensis*, *Lamium amplexicaule*, *Cynanchum acutum* and *Romix dentatus*.

Cynodon dactylon - *Digitaria sanguinalis* (VG9): This group included 70 stands and 94 species. *C. dactylon* had 5.8 % cover and 84.3% presence, while *D. sanguinalis* had 2.3% cover and 20.0% presence. The common associated species are *Malvastrum cororandelianurn*, *Triticum aestivum*, *Conyaza bonariensis* and *Echinochloa colona*.

Triticum aestivum - *Euphorbia helioscopia* (VG10): nine stand and 38 species represented this group. *T. aestivum* had 7.6 % cover and 88.9% presence, while *E. helioscopia* had 6.6% cover and 100% presence. The common associated species are *Emisx spinosa*, *Coronopus didymus*, *Cichorium indiva* and *Seda alba*.

Oxalis corniculata - *Emisx spinosa* (VG11): This group included 7 stands and 27 species. It was found that, *O. corniculata* had 9.9 % cover and 100% presence, while *E. spinosa* had 5.6% cover and 85.7% presence. The common associated species comprise *Cynanchum acutum*, *Trianthema portulacastrum*, *Lamium amplexicaule* and *Euphorbia helioscopia*.

Galinsoga parviflora - *Cynodon dactylon* (VG12): This group included 14 stands and 37 species with *G. parviflora* had 5.9 % cover and 100 % presence. However, *C.dactylon* had 2% cover and 64.3% presence. The common associated species are *Anagalis arvensis*, *Sillaria pallida*, *Capsella bursa-pastoris* and *Cynanchum acutum*.

Echinochloa colona - *Cynodon dactylon* (VG13): It comprised 13 stands and 37 species. *E. colona* had 9.4 % cover and 30.8 % presence, while *C.dactylon* 8.3% cover and 84.6% presence. The associated species comprise *Euphorbia heterophylla*, *Setaria viridis*, *Cichorium indiva* and *Digitaria sanguinalis*.

3.3.2. Diversity of the plant communities

The total number of species recorded in the 13 vegetation groups Table 3, identified according to TWINSPAN classification technique, ranged between 7 in *Commelina benghalensis* - *Cyperus rotundus* group (VG 1) which had the lowest species turnover (1.0), and 94 in *Cynodon dactylon* - *Digitaria sanguinalis* group (VG 9), which had the highest values of species turnover (5.2). the highest values of Shannon index were (2.7) in *Sillaria pallid* - *Soncuhs oleraceous* group (VG 8). It was fongd that *Bromus catharticus* - *Phalaris minor* group (VG 7) had the highest species richness (19.3 species stand⁻¹), while *Cynodon dactylon* - *Phyla nodiflora* group (VG 5) had the lowest species richness (5.5 species stand⁻¹). The lowest Shannon index and Simpson index were (0.4, 1.2) in *Cynodon dactylon* - *Euphorbia peplus* group (VG 4), respectively. Moreover, the highest value of Simpson index (105.0) was recorded in *Withania semenifera* - *Oxalis corniculata* group (VG 2).

Table (2): 1st dominant species and 2nd dominant species in vegetation groups, with *Bidens pilosa*

V.G.	No. of stands	1st. dominant species	c	p	2st. dominant species	c	p
VG1	1	Commelina benghalensis	45.0	100	Cyperus rotundus	1.0	100
VG2	2	Withania semenifera	2.0	100	Oxalis corniculata	1.0	50.0
VG3	4	Euphorbia peplus	17.5	100	Cynodon dactylon	1.4	100
VG4	7	Cynodon dactylon	51.0	100	Euphorbia peplus	1.6	100
VG5	6	Cynodon dactylon	16.3	100	Phyla nodiflora	15	33.3
VG6	8	Phalaris minor	4.8	100	Convolvulus arvensis	2.7	100
VG7	13	Bromus catharticus	12.6	92.3	Phalaris minor	7.7	76.9
VG8	77	Sillaria pallida	3.8	81.8	Soncuhs oleraceous	3.3	90.9
VG9	70	Cynodon dactylon	5.8	84.3	Digitaria sanguinalis	2.3	20.0
VG10	9	Triticum aestivum	7.6	88.9	Euphorbia helioscopia	6.6	100
VG11	7	Oxalis corniculata	9.9	100	Emisx spinosa	5.6	85.7
VG12	14	Galinsoga parviflora	5.9	100	Cynodon dactylon	2.0	64.3
VG13	13	Echinochloa colona	9.4	30.8	Cynodon dactylon	8.3	84.6

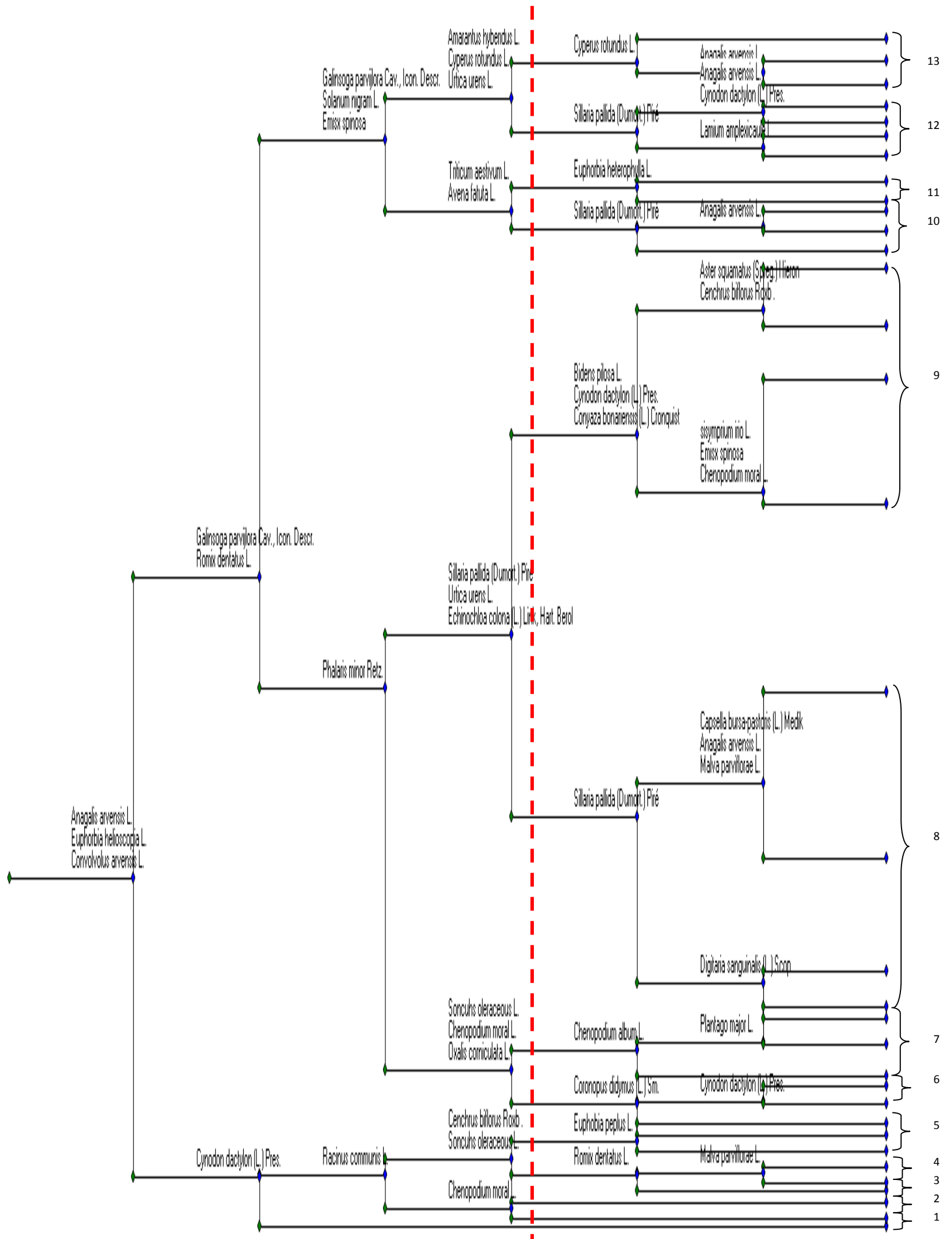


Fig (13): The dendrogram resulting from the application of TWINSPLAN on the 231 sampled stands. 1: *Commelina benghalensis*-*Cyperus rotundus* , 2: *Withania semenifera* -*Oxalis corniculata*, 3: *Euphorbia peplus* -*Cynodon dactylon*, 4: *Cynodon dactylon*-*Euphorbia peplus*, 5: *Cynodon dactylon*-*Phyla nodiflora*, 6: *Phalaris minor* - *Convolvulus arvensis*, 7: *Bromus catharticus*-*Phalaris minor*, 8: *Sillaria pallid* - *Sonchuus oleraceous*, 9:*Cynodon dactylon*-*Digitaria sanguinalis*, 10: *Triticum aestivum*-*Euphorbia helioscopia*, 11:*Oxalis corniculata*- *Emixx spinosa*, 12: *Galinsoga parvijlora* - *Cynodon dactylon* and 13: *Echinochloa colona* - *Cynodon dactylon*

Table (3): Diversity indices of the 13 vegetation groups produced from TWINSpan. Maximum and minimum values are underlined

Vegetation group	Diversity index				
	No. of species	Species richness	Species turnover	Shannon Index	Simpson index
VG 1	<u>7</u>	7.0	<u>1.0</u>	0.6	1.3
VG 2	15	12.5	1.2	2.6	<u>105.0</u>
VG 3	8	6.0	1.3	1.0	1.8
VG 4	42	13.6	3.1	<u>0.4</u>	<u>1.2</u>
VG 5	16	<u>5.5</u>	2.9	0.9	2.3
VG 6	22	13.3	1.7	2.4	15.0
VG 7	40	<u>19.3</u>	2.1	2.4	9.0
VG 8	80	18.6	4.3	<u>2.7</u>	22.6
VG 9	<u>94</u>	18.0	<u>5.2</u>	2.6	14.8
VG 10	38	18.1	2.1	2.2	8.0
VG 11	27	13.1	2.1	2.0	6.3
VG 12	37	16.6	2.2	1.9	4.1
VG 13	37	13.8	2.7	2.3	9.9

4. Conclusions

It was found that Poaceae (Gramineae) had the highest number of associated species with *B. pilosa* (25 species), The environmental services (segetals) had the highest number of associated species (39 species representing 34.5% of the total species). The economic goods medicine had the highest number of associated species (68 species = 60.2% of the total recorded species). *B. pilosa* has a wide distribution in more of 12 habitats, but Orange (citrus) orchards habitats representing in (70 stands from 231 sampled stands) are contain the largest distribution of *B. pilosa* in Egypt.

Canals and ditches habitat had the highest number of associated species (80 species representing 70.8% of the total recorded species). The application of TWINSpan on the cover estimates of 113 associated species with *B. pilosa* lead to the recognition of 13 vegetation groups. *Sillaria pallid - Sonchu s oleraceous* group (VG 8) that included the highest number of stands (77 stands) and 80 species, had the most associated species with *B. pilosa*.

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