

## Petiole indumentum types of the genus *Alchemilla* (Rosaceae) from Iran

Marzieh Beygom Faghir \*, Kobra Chaichi Khairkhah and Robabeh Shahi Shavvon

Department of Biology, Faculty of Sciences, University of Guilan, Rasht, Iran

### Abstract

Petiole indumentum types of 24 species of the genus *Alchemilla* were studied using scanning electron microscope (SEM) and digital microscope. All the examined petioles were belonged to the well-developed basal leaves. Two main indumentum types (cylindrical and flat ribbon shape) and seven subtypes including: dense appressed-subappressed; subappressed-erecto-patent; erecto-patent; dense erecto-patent; dense horizontal; glabri-horizontal-erecto-patent-declinate and declinate trichome were identified. The current results revealed that petiole micromorphological characters were taxonomically informative criteria and could be used in species classification. A key for species identification is presented.

**Key words:** *Alchemilla*, Indumentum, Petiole, Iran

### Introduction

*Alchemilla* L. (Rosaceae) was primarily introduced by Linnaeus (1753) and classified as *Eualchemilla* by Fock (1988), Lagerheim (1894) and Haumann and Balle (1936). The genus thought to be related to the subtribe *Sanguisorbinae* (Hutchinson, 1964) because of its inconspicuous flowers. However, its relation to the tribe *Potentilleae* (Notov and Kusnetzova, 2004) was confirmed by DNA sequence data (Eriksson *et al.*, 1998, 2003) and based on anther structure (anthers with one elliptic theca on the ventral side of the connective) it has been placed in the subtribe *Alchemillinae* (Soják, 2008).

The genus *Alchemilla* comprises more than 1000 species (Fröhner, 1995) and has Holarctic distribution, with a main center of species richness in west of Eurasia, but they also may grow in south India, Sri Lanka, Java, China, Japan and on the mountains of Africa and Madagascar (Gehrke *et al.*, 2008). Species of *Alchemilla* are distributed mainly in north and northwest of Iran. However, some species may occur in west and center of the country (Frohner, 1969; Khatamsaz, 1993). They have woody rhizome (Pawłowski and Walters, 1972), commonly growing in open meadows, stony slopes, shady places, river banks and forest edges of alpine and subalpine regions, from 1700 to 3300 m altitudes (Juzepczuk, 1941; Frohner, 1969; Khatamsaz, 1993). Frohner treatment's (1969) of *Alchemilla*, in Flora Iranica recognized 31 species from Iran, Afghanistan, parts of west Pakistan, north Iraq,

---

\* Corresponding Author: faghirmb@guilan.ac.ir

Azerbaijan and Turkmenistan, but Khatamsaz (1993) considered 24 species of the genus for Flora of Iran.

*Alchemilla* is a taxonomically difficult group (Izmailow, 1981) and a well-known example of polyploidy, autonomous apomixis (in the sense of agamospermy), in the Rosaceae (Czapik, 1996). Many representatives of this genus display heteroblastic plasticity, variability and instability in morphological characters (e.g. flowers, leaves and indumentum). This causes great difficulties in their identification and results in formation of several species complexes and micro-species (Asker and Jerling, 1992; Horandl, 2004). The present micromorphologic research, aims to find new consistent diagnostic characters (e.g. petiole micromorphological) for a precise delimitation of various species and to evaluate the extent to which the petiole indumentum micromorphology can be used for classification of the species of *Alchemilla* in Iran.

### Materials and Methods

In this study, petiole morphology of 24 species (including different taxa from several populations) of Iranian species of *Alchemilla* was examined. We used both freshly collected samples (from 2010 to 2012, during spring and late summer) and dried herbarium specimens of the Guilan University Herbarium (GUH), the Tehran University Herbarium (TUH) and the Herbarium of the Research Institute of Forests and Rangelands of Iran (TARI). All the examined petioles were belonged to well-developed basal leaves. The voucher specimen of each newly collected species deposited in the Guilan University Herbarium (GUH). Species sampled are listed in Appendix 1. For scanning electron microscopy (SEM), the petioles (a portion of them, constantly taken from distal end) were selected, washed and then kept for drying (Eriksen and Yurstev, 1999; Faghir *et al.*, 2010). Dried materials were mounted on SEM stubs by double-sided adhesive tape of silver paint and finally coated with gold in a sputter coater. Scanning electron microscopy was carried out using a Vega Tescan Razi instrument. The petiole photograph also were taken by digital microscope, Dino-Lite, AN-413T model. Flora Iranica (Frohner, 1969), Flora of Iran (Khatamsaz, 1993) and Flora of USSR (Juzepczuk, 1941), were the principal references for identification and terminology of indumentum in this paper.

### Result

Our findings revealed two main types of petiole indumentum including: the straight cylindrical and flat ribbon shape hairs (Figure 1).

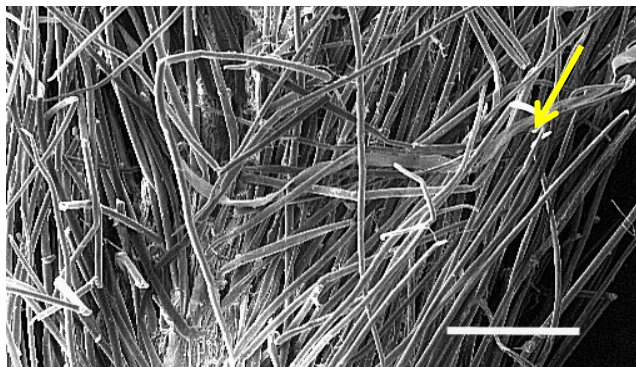


Figure 1. Cylindrical and flat ribbon shape trichome of *A. microscopica* (yellow arrow indicates the ribbon shape hair). Scale Bar = 200  $\mu$ m

The first type is found in all the 24 species but, the second type is observed only in the five studied species (*A. kurdica*, *A. hessii*, *A. fluminea*, *A. pseudo-cartalinica* and *A. sericata*). Seven subtypes were identified as following:

**Subtype I:** Densely appressed-subappressed: this subtype was recorded in *A. amardica* (Figures 2A and 2B), *A. pseudo-cartalinica* and *A. sericata*.

**Subtype II:** Subappressed-erecto-patent: this subtype was identified in *A. citrina*, *A. farinosa*, *A. plicatissima*, *A. valdehirsuta* and *A. gigantodus* (Figures 2C and 2D).

**Subtype III:** Erecto-patent: this subtype was recognized in *A. kurdica*, *A. persica*, *A. retinervis* and *A. sedelmeyeriana* (Figures 2E and 2F).

**Subtype IV:** Densely erecto-patent: this subtype was found in *A. rigida*, *A. condensa*, *A. surculosa* (Figures 2G and 2H) and *A. pectiniloba*.

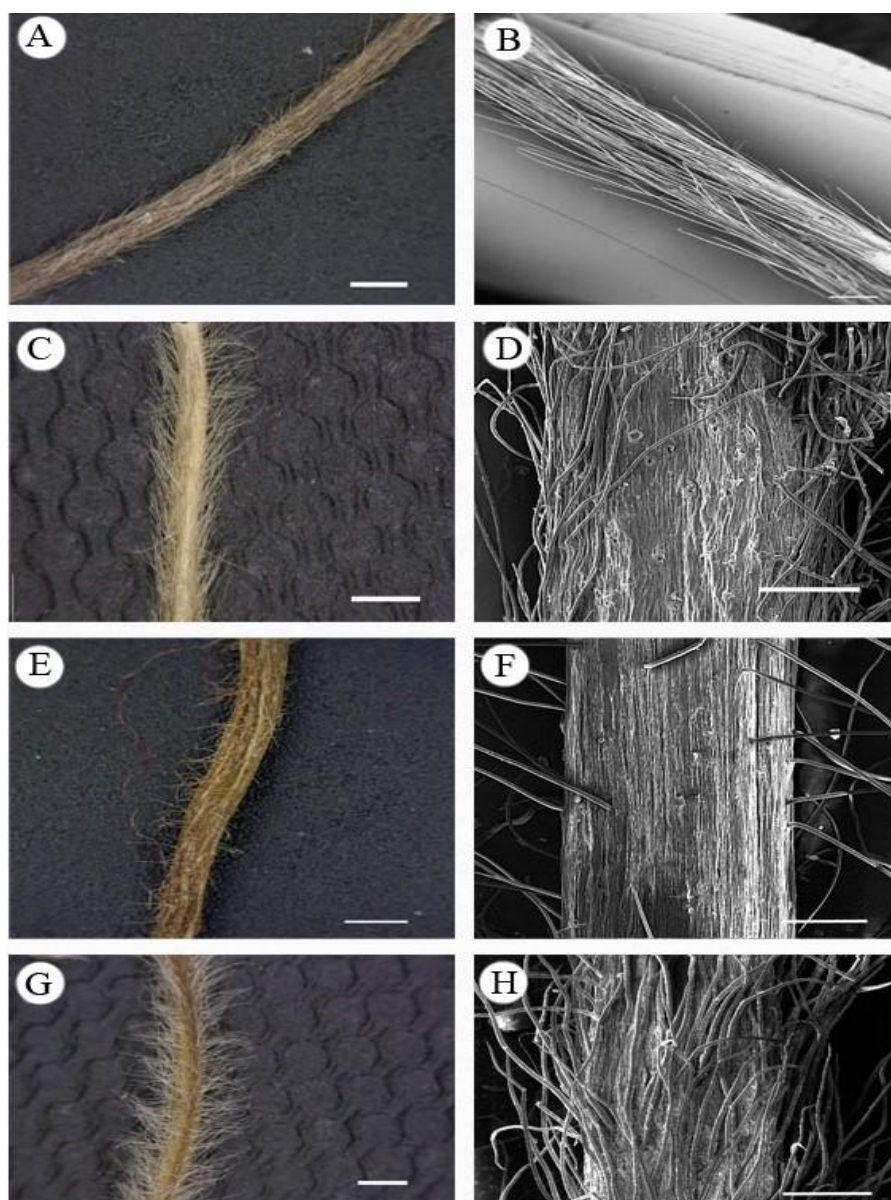


Figure 2. A and B. *A. amardica*; C and D. *A. gigantodus*; E and F. *A. sedelmeyeriana*; G and H. *A. surculosa*, Scale Bars: A, C, E and G = 1 mm, B, D, F and H = 200  $\mu$ m

**Subtype V:** Densely horizontal: this subtype was present in *A. caucasica* (Figures 3A and 3B), *A. hyrcana* and *A. microscopica*.

**Subtype VI:** Glabri-horizontal-erecto-patent-declinate: this subtype was common in *A. fluminea*, *A. hessii* and *A. rechingeri* (Figures 3C and 3D).

**Subtype VII:** Declinate pilose: this subtype was found in *A. erythropoda* (Figures 3C and 3D) and *A. meloncholica*.

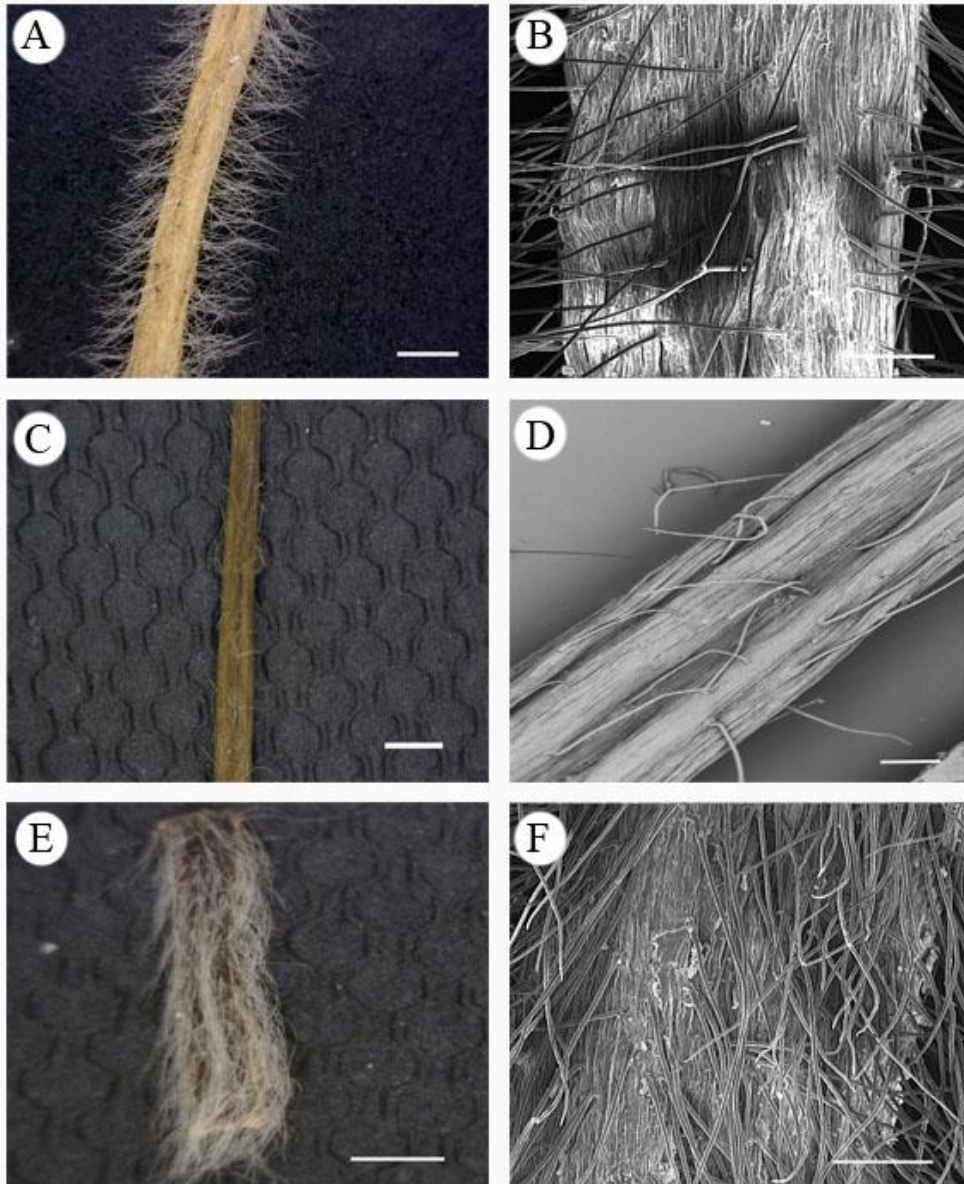


Figure 3. A and B. *A. caucasica*; C and D. *A. rechingeri*; E and F. *A. erythropoda*. Scale Bars: A, C and E = 1 mm, B, D and F = 200  $\mu$ m

The indumentum length was measured (Table 1). *A. erythropoda* with 1.76-1.80 mm and *A. persica* with 0.82-0.84 mm had the maximum and minimum hair length, respectively. In many species scattered secretory glands, wax granules and platelets were visible on the petiole surfaces.

Table 1. Trichome length of different studied species

Species	length (mm)
1. <i>A. amardica</i>	1.30-1.47
2. <i>A. hyrcana</i>	1.43-1.48
3. <i>A. kurdica</i>	1.35-1.40
4. <i>A. rechingeri</i>	0.95-0.98
5. <i>A. pectiniloba</i>	1.08-1.11
6. <i>A. sericata</i>	0.85-0.90
7. <i>A. citrina</i>	0.85-0.90
8. <i>A. pseudo-cartalinica</i>	1.50-1.58
9. <i>A. rigida</i>	1.53-1.58
10. <i>A. sedelmeyeriana</i>	0.85-0.88
11. <i>A. caucasica</i>	1.70-1.75
12. <i>A. surculosa</i>	1.40-1.43
13. <i>A. fluminea</i>	0.92-0.95
14. <i>A. valdehirsuta</i>	1.58-1.64
15. <i>A. condensa</i>	1.41-1.53
16. <i>A. farinosa</i>	1.28-1.30
17. <i>A. gigantodus</i>	1.38-1.41
18. <i>A. hessii</i>	0.82-0.85
19. <i>A. retinervis</i>	0.91-0.95
20. <i>A. microscopica</i>	1.24-1.30
21. <i>A. plicatissima</i>	0.94-1
22. <i>A. erythropoda</i>	1.76-1.80
23. <i>A. persica</i>	0.82-0.84
24. <i>A. meloncholica</i>	1-1.1

## Discussion

Our observations confirmed the taxonomical usefulness of petiole trichome micromorphological characters within the studied taxa. The diagnostic application of petiole indumentum types is well known in the family Rosaceae and especially in closely related genera of the tribe *Potentilleae* (Rosaceae) (Notov and Kusnetzova, 2004; Soják 2008) like *Alchemilla* and *Potentilla* L. (Eriksen and Yurstev, 1999; Faghir *et al.*, 2010, Faghir *et al.*, 2011). Juzepczuk treatment's (1941), in the Flora USSR, used petiole indumentum evidences (along with other diagnostic criteria) at different taxonomic ranks (section, series and species level). Hayirlioglu-Ayaz and Beyazoglu (1997) identified different species of Turkish *Alchemilla* (e.g. *A. plicatissima*, *A. stevenii*, *A. monticola*) using hair types of petiole and other parts (e.g. stem and hypanthium). In Flora Iranica (Fröhner, 1969) and Flora of Iran (Khatamsaz, 1993) several species of *Alchemilla* were separated based on petiole indumentum types.

This study deals with the micromorphological details of petiole indumentum types and according to our findings, two main types, seven subtypes of petiole hairs were recorded in the genus *Alchemilla*. However, presence of flat ribbon shape trichome has not been reported earlier (Fröhner, 1969; Khatamsaz, 1993). The cylindrical hair was the most dominant type and erecto-patent was the most abundant subtype in the studied species. The erecto-patent indumentum was found either alone or mixed with sub-appressed trichome of the subtype II and horizontal and declinate hairs of the subtype IV. In contrast, densely appressed-subappressed of the subtype I and declinate pilose of the subtype VII had minimum occurrence within the studied species.

In the current analysis, the petiole hairs of several populations of the same species were examined. The petiole indumentum type was constant within the populations of the same species (e.g. *A. caucasica*, *A. farinosa*, *A. hessii*, *A. hyrcana* and *A. persica*). Erecto-patent

hair types were recorded from all the studied populations of *A. persica* (Appendix 1), the most widely distributed (north, northwest, center and west provinces) species of the genus in Iran. However, petiole hair density of the studied taxa, varied from young to old plants and the leaves produced in early and later growing seasons (Juzepczuk, 1941).

Based on the current results, petiole indumentum data supported the previous classification of Fröhner (1969) and Khatamsaz (1993) and was reliable criterion for distinguishing the species. Based on petiole indumentum features, an identification key has been prepared as followings:

### Key to species

- 1- Petiole covered by densely appressed-subappressed or sub-appressed-erecto-patent hairs ..... 2
  - Petiole glabrous or covered by erecto-patent, horizontal or declinate hairs .... 9
- 2- Petiole with densely appressed-subappressed hairs ..... 3
  - Petiole with subappressed erecto-patent hairs ..... 5
- 3- Hairs argenteo-sericatae, 0.85-0.90 mm long ..... 1. *A. sericata*
  - Hairs appressed-subappressed, more than 1 mm in length ..... 4
- 4- Appressed-subappressed, pilose hairs of 1.50-1.58 mm long ..... 2. *A. pseudo-cartolonica*
  - Appressed-subappressed, sericeo-pubescent hairs of 1.30-1.47 mm long ..... 3. *A. amardica*
- 5- Subappressed-erecto-patent hairs 0.85-1 mm long ..... 6
  - Subappressed-erecto-patent hairs of 1->1.50 mm long ..... 7
- 6- Densely pilose hairs of 0.94-1 mm long ..... 4. *A. plicatissima*
  - Pilose-subsericeo hairs of 0.85-0.90 mm long ..... 5. *A. citrina*
- 7- Hairs densely pilose, 1.58-1.64 mm long ..... 6. *A. valdehirsuta*
  - Hairs sericeo-pilose or pilose > 1.50 mm ..... 8
- 8- Hairs sericeo-pilose, 1.38-1.41 mm long ..... 7. *A. gigantodus*
  - Hairs pilose, 1.28-1.30 mm long ..... 8. *A. farinosa*
- 9- Petiole covered by only declinate hairs ..... 10
  - Petiole glabrous or covered by erecto-patent, horizontal or declinate hairs .. 11
- 10- Petiole with densely pilose hairs of 1-1.1 mm long ..... 9. *A. melancolica*
  - Petiole with densely subhirsute hairs of 1.76-1.80 mm long ..... 10. *A. erythropoda*
- 11- Petiole covered by sparsely to ± densely erecto-patent hairs ..... 12
  - Petiole glabrous or covered by erecto-patent, horizontal and declinate hairs ..... 19
- 12- Petiole with only sparsely to subdensely erect-patent hairs ..... 13
  - Petiole with densely erecto-patent hairs ..... 16
- 13- Hairs shorter than 1 mm long ..... 14
  - Hairs longer than 1 (1.35-1.40) mm long ..... 11. *A. kurdica*
- 14- Hairs 0.82-0.88 mm long ..... 15
  - Hairs 0.91-0.95 mm long ..... 12. *A. retinervis*
- 15- Hairs 0.85-0.88 mm long ..... 13. *A. sedelmeyeriana*
  - Hairs 0.80-0.83 mm long ..... 14. *A. persica*
- 16- Petiole densely hirsute ..... 17
  - Petioles densely sericeo-subsericeo grayish ..... 18
- 17- Hairs 1.40-1.42 mm long ..... 15. *A. surculosa*

- Hairs 1.08-1.11 mm long ..... 16. *A. pectinoloba*
- 18- Hairs 1.41-1.43 mm long ..... 17. *A. condensa*
- Hairs 1.53-1.58 mm long ..... 18. *A. rigida*
- 19- Petiole covered by horizontal hairs ..... 20
- Petiole glabrous or covered by erecto-patent, horizontal and declinate hairs of >1 mm long ..... 22
- 20- Petiole densely pilose ..... 21
- Petiole covered by cylindrical and ribbon shape hairs ..... 19. *A. microscopica*
- 21- Petiole densely hairy; hairs 1.53-1.58 mm long ..... 20. *A. hyrcana*
- Petiole pubescent; hairs 1.70-1.73 mm long ..... 21. *A. caucasica*
- 22- Petiole pilose, with flat ribbon shaped hairs ..... 23
- Petiole pilose ..... 22. *A. rechingeri*
- 23- Hairs 0.82-0.85 mm long ..... 23. *A. hessii*
- Hairs 0.92-0.95 mm long ..... 24. *A. fluminea*

### Acknowledgement

The authors are grateful to Dr. Farideh Attar (Central Herbarium of Tehran University and School of Biology, University College of Science, Tehran,) and the curator of the Herbarium of the Research Institute of Forests and Rangelands, Tehran (TARI), for their cooperation and allowing us to access the herbarium specimens.

### References

- Asker, S. E. and Jerling, L. (1992) Apomixis in Plants. CRC Press. Boca Raton, Florida.
- Czapik, R. (1996) Problems of apomictic reproduction in the families Compositae and Rosaceae. *Folia Geobotanica and Phytotaxonomica* 31: 381-387.
- Eriksen, B. and Yurstev, B. A. (1999) Hair types in *Potentilla* sect. *Niveae* (Rosaceae) and related taxa, terminology and systematic distribution. *Norske Videnskaps-Akademi Matematisk.-Naturvidenskapelig Klasse* 38: 201-222.
- Eriksson, T., Donoghue, M. J. and Hibbs, M. S. (1998) Phylogenetic analysis of *Potentilla* using DNA sequences of nuclear ribosomal internal transcribed spacers (ITS), and implications for the classification of Rosoideae (Rosaceae). *Plant Systematic and Evolution* 212: 155-179.
- Eriksson, T., Hibbs, M. S., Yoder, A. D., Delwiche, C. F., Donoghue, M. J. (2003) The phylogeny of Rosoideae (Rosaceae) based on sequences of the internal transcribed spacers (ITS) of nuclear ribosomal DNA and the trnL/F region of chloroplast DNA. *International Journal of Plant Science* 164(2): 197-211.
- Faghir, M. B., Attar, F., Farazmand, A., Ertter, B. and Eriksen, B. (2010) Leaf indumentum types in *Potentilla* (Rosaceae) and related genera in Iran. *Acta Societatis Botanicorum* 79(2): 139-145.
- Faghir, M. B., Attar, F. and Soják, J. (2011) Reporting *Potentilla botschantzeviana* Adylov (Syn: *Potentilla butkovii* var. *botschantzeviana* (Adylov) Soják) (Rosaceae) as a new record species for the flora of Iran. *Taxonomy and Biosystematics* 8: 1-6.
- Fröhner, S. (1995) *Alchemilla* L. In: *Illustrierte Flora von Mitteleuropa* (Ed. Hegi, G) vol. 4. BlackwellWissenschafts-Verlag, Berlin-Wien.
- Frohner, S. (1969) *Alchemilla* L. In: *Flora Iranica* (Ed. Rechinger, K. H.) vol. 66. Akademische Druck-und Verlagsanstalt, Graz.

- Gehrke, B., Bräuchler, C., Romoleroux, K., Lundberg, M., Heubl, G. and Eriksson, T. (2008) Molecular phylogenetics of *Alchemilla*, *Aphanes* and *Lachemilla* (Rosaceae) inferred from plastid and nuclear intron and spacer DNA sequences, with comments on generic classification. *Molecular Phylogenetic and Evolution* 47: 1030-1044.
- Hauman, L. and Balle, S. (1936) Les *Alchemilla* de l'Abyssinie et de Madagascar. *Bulletin du Jardin botanique de l'État a Bruxelles* 14: 1-55.
- Hayirlioglu-Ayaz, S. and Beyazoglu, O. (1997) A new species of *Alchemilla* (Rosaceae) from Turkey. *Annales Botanici Fennici* 34: 109-113.
- Hutchinson, J. (1964) *The Genera of Flowering Plants*. Oxford University Press, Oxford.
- Horandl, E. (2004) Comparative analysis of genetic divergence among sexual ancestors of apomictic complexes using isozyme data. *International Journal of Plant Science* 165: 615-622.
- Izmailow, R. (1981) Karyological studies in species of *Alchemilla* L. from the Calycinae Bus. (Section *Brevicaulon* Rothm.). *Acta Biologica Cracoviensia Series Botanica* 23: 117-180.
- Juzepczuk, S. W. (1941) *Alchemilla* L. In: *Flora USSR* (Ed. Komarov, V. L.) vol. 13. Publishing House of the Academy of Sciences of the USSR, Moscow and Leningrad (in Russian).
- Khatamsaz, M. (1992) Rosaceae. In: *Flora of Iran* (Eds. Assadi, M., Khatamsaz, M. and Maassoumi, A. A.) vol. 6. Research Institute of Forests and Rangelands Publication, Tehran, Iran (in Persian).
- Lagerheim, N. G. (1894) Ueber die andinen *Alchemilla*-Arten. *Kungl. Svenska vetenskapsakademiens handlingar* 51: 15-18.
- Linnaeus, C. (1753) *Species plantarum*. L. Salvius, Holmia [Stockholm].
- Notov, A. A. and Kusnetzova, T. V. (2004) Architectural units, axiality and their taxonomic implications in *Alchemillinae*. *Wulfenia* 11: 85-130.
- Pawlowski, B. and Walters, S. M. (1972) *Alchemilla* L. In: *Flora of Turkey and the East Aegean Islands* (Ed. Davis, P. H.), vol. 4. Edinburgh University Press, Edinburgh.
- Soják, J. (2008) Notes on *Potentilla* XXI. A new division of the tribe *Potentilleae* (Rosaceae) and notes on generic delimitations. *Botanische Jahrbücher für Systematik* 127: 349-358.



APPENDIX 1.	IRAN: Province, Collector, Date	Accession No.
1. <i>A. amardica</i>	Guilan: Deylaman; Shahe shahidan; Chaichi, Faghir and Shahi; 6.2012.	4872 (GUH)
2. <i>A. caucasica</i>	Mazandaran: Karaj-Chalus road, Pol-e Zanguleh, 3000 m; Nazarian; 2.8.1999. Mazandaran: Kojur, Firuzabad Village, 1700 m; Ghahreman and Attar; 19.6.1997.	33155 (TUH) 20598 (TUH)
3. <i>A. citrina</i>	Guilan: Deylaman; Shahe shahidan; Chaichi, Faghir and Shahi; 6.2012.	4876 (GUH)
4. <i>A. erythropoda</i>	Mazandaran: Kojur, Firuzabad Village, 1700 m; Ghahreman and Attar; 19.6.1997.	20595 (TUH)
5. <i>A. condensa</i>	Guilan: Masal; Chaichi; 2012. Guilan: Deylaman, Larikhani, 1500 m; Saeidi; 20.5.1993.	4871 (GUH) 18845 (TUH)
6. <i>A. farinosa</i>	Ardebil: Almas pass; Chaichi, Faghir and Shahi; 8.2012. Mazandaran: Ramsar; between Lapasar and Pishgah, 2600-3200 m; Maasoumi; s.d.	4870 (GUH) 55188/9 (TARI)
7. <i>A. fluminea</i>	Guilan: Deylaman, Larikhani, 1530 m; Ghahreman and Attar; s.d.	18844 (TUH)
8. <i>A. gigantodus</i>	Mazandaran: Kojur, Keikuh Mountain, 2000-2300 m; Khatamsaz and Gholizadeh; s.d.	57149 (TARI)
9. <i>A. hessii</i>	Mazandaran: Kojur, Firuzabad Village, 1700 m; Ghahreman and Attar; 19.6.1997. Mazandaran: Kandavan; Ghahreman, Aghostin and Sheikholeslami; 6.1974.	20600/1 (TUH) 19418 (TUH)
10. <i>A. hyrcana</i>	Guilan: Deylaman, Shahe shahidan, Chaichi; Faghir and Shahi; 6.2012. Mazandaran: Kojur, Firuzabad Village, 1700 m; Ghahreman and Attar; 19.6.1997.	4873 (GUH) 20597 (TUH)
11. <i>A. kurdica</i>	Guilan: Masal, Khashkhami, Chaichi; Faghir and Shahi; 6.2012.	4875 (GUH)
12. <i>A. meloncholica</i>	Guilan: Espili, Larikhani, 1530 m; Saeidi; 1993.	18841 (TUH)
13. <i>A. microscopica</i>	Ardebil: Almas pass, 2200 m; Khatamsaz and Salehnia; 6.1984.	56694 (TARI)
14. <i>A. persica</i>	Mazandaran: Tonekabon, Jannat rudbar, 1600 m; Ghahreman, Attar and Khatamsaz; 20.6.1997. Mazandaran: Kojur, Firuzabad Village, 1700 m; Ghahreman and Attar; 19.6.1997. Mazandaran: on the road of Karaj to Chalus, Pol-Zanguleh, 2600 m; Nazarian, 15.6.1999. Tehran: Damavand, Attar and Mehdigholi; 5. 1992.	20603 (TUH) 205594 (TUH) 33440 (TUH) 25576 (TUH)
15. <i>A. pectinoloba</i>	Azarbijan: Arasbaran, After three way to Veighan, Makidi, 1400 m; Ghahreman, Attar and Hamzehee; 2006.	35575 (TUH)
16. <i>A. plicatissima</i>	Guilan: Deylaman, Larikhani, 1530 m; Saeidi; 5.1993.	18837 (TUH)
17. <i>A. pseudo-cartalinica</i>	Ardebil: Almas pass, Chaichi, Faghir and Shahi; 8.2012.	4869 (GUH)
18. <i>A. rechingeri</i>	Mazandaran: Kojur, Firuzabad Village, 1700 m; Ghahreman and Attar; 19.6.1997.	20602 (TUH)
19. <i>A. retinervis</i>	Mazandaran: Kojur, Firuzabad Village, 1700 m; Ghahreman and Attar; 19.6.1997.	20601 (TUH)
20. <i>A. sedelmeyeriana</i>	Mazandaran: Kojur, Firuzabad Village, 1700 m; Ghahreman and Attar; 19.6.1997.	20599 (TUH)
21. <i>A. sericata</i>	Mazandaran: Kojur, Firuzabad Village, 1700 m; Ghahreman and Attar; 19.6.1997.	20593 (TUH)
22. <i>A. surculosa</i>	Azarbaijan: Kelaybar to Makidi, 1510 m; Ghahreman, Mozaffarian and Sheikholeslami; 5.1993.	17540 (TUH)
23. <i>A. rigida</i>	Guilan: Masal, Chaichi; 2012. Guilan: Espili, Larikhani, 1510 m; Saeidi; 5.1993.	4874 (GUH) 18842 (TUH)
24. <i>A. valdehiruta</i>	Mazandaran: Kojur, Firuzabad Village, 1700 m; Ghahreman and Attar; 19.6.1996. Mazandaran: Koj, Firuzabad Village, 2200 m; Khatamsaz and Gholizadeh; 3.7.1989.	20598 (TUH) 57160 (TARI)



## انواع کرک دمبرگ جنس *Alchemilla* از تیره Rosaceae از ایران

مرضیه بیگم فقیر\*، کبری چایچی خیرخواه و ربابه شاهی شاووان  
گروه زیست‌شناسی، دانشکده علوم، دانشگاه گیلان، رشت، ایران

### چکیده

انواع کرک دمبرگ ۲۴ گونه از جنس *Alchemilla* با استفاده از میکروسکوپ الکترونی (SEM) و دیجیتالی مطالعه شد. تمام دمبرگ‌ها متعلق به برگ‌های کاملاً توسعه یافته قاعده‌ای هستند. دو نوع کرک اصلی (استوانه‌ای و مسطح نواری) و هفت زیرگروه آنها شامل: کرک‌های خوابیده/تقریباً خوابیده، تقریباً خوابیده/افراشته/پراکنده، افراشته/پراکنده انبوه، افقی انبوه، بدون کرک، دارای کرک افقی/افراشته/پراکنده/برگشته و کرک برگشته شناسایی شد. نتایج این تحقیق نشان داد که صفات ریزریخت‌شناسی دمبرگ از نظر تاکسونومیکی دارای اهمیت است و می‌تواند برای رده‌بندی گونه‌های این جنس استفاده شود. یک کلید شناسایی برای تفکیک گونه‌ها نیز ارائه شده است.

واژه‌های کلیدی: *Alchemilla*، کرک، دمبرگ، ریزریخت‌شناسی، ایران