

**Dr. Duke's Phytochemical and Ethnobotanical Database**

**Chemicals Found in Achillea millefolium**

| Activity Count | Chemical                                | Plant Part | Low PPM | High PPM | StdDev               | Reference Citation   |
|----------------|---|------------|---------|----------|----------------------|--|
| 2              | (-)-BETONICINE                          | Plant      | --      | --       |                      | Jeffery B. Harborne and H. Baxter, eds. 1983. Phytochemical Dictionary. A Handbook of Bioactive Compounds from Plants. Taylor & Frost, London. 791 pp. |
| 0              | (-)-VIBURNITOL                          | Plant      | --      | --       |                      | Jeffery B. Harborne and H. Baxter, eds. 1983. Phytochemical Dictionary. A Handbook of Bioactive Compounds from Plants. Taylor & Frost, London. 791 pp. |
| 0              | (E)-NEROLIDOL                           | Leaf       | --      | --       |                      |  |
| 67             | 1,8-CINEOLE                             | Leaf       | 24      | 960      | -0.31413337784745815 |  |
| 0              | 2,3-DEHYDROXYDESACETOXYMATRICIN         | Plant      | --      | --       |                      | Bisset, N.G., ed. 1994. Herbal Drugs and Phytopharmaceuticals. CRC Press. Boca Raton, FL. 566 pp.  |
| 0              | 2,3-DIHYDROACETOXYMATRICIN              | Plant      | --      | --       |                      |  |
| 0              | 2-PENTYL-5-PROPYLRESORCINOL             | Plant      | --      | 70       |                      |  |
| 0              | 3-OXAGUAIANOLIDE                        | Plant      | --      | --       |                      |  |
| 0              | 4-OXO-3,4-DIHYDRO-2,3-DIAZAPHENOXANTHIN | Plant      | --      | 36       |                      |  |
| 0              | 5-HYDROXY-3,6,7,4'-TETRAMETHOXYFLAVONE  | Plant      | --      | --       |                      | J.S. Glasby Dict.Pls Containing 2ndary Metabolite. 1991.   |
| 0              | 6,10,14-TRIMETHYL-PENTADECAN-2-ONE      | Plant      | --      | 32       |                      |  |
| 0              | 8-ACETOCYARTABSIN                       | Plant      | --      | --       |                      |  |

| Activity Count | Chemical           | Plant Part | Low PPM | High PPM | StdDev | Reference Citation   |
|----------------|--------------------|------------|---------|----------|--------|--|
| 0              | 8-ACETYLAGELOLIDE  | Leaf       | --      | --       |        | Bisset, N.G., ed. 1994. Herbal Drugs and Phytopharmaceuticals. CRC Press. Boca Raton, FL. 566 pp.  |
| 0              | 8-ANELOOXYARTABSIN | Plant      | --      | --       |        |  |
| 0              | ACETYLBALCHANOLIDE | Plant      | --      | --       |        | J.S. Glasby Dict.Pls Containing 2ndary Metabolite. 1991.   |
| 0              | ACHICEINE          | Plant      | --      | --       |        | Williamson, E. M. and Evans, F. J., Potter's New Cyclopaedia of Botanical Drugs and Preparations, Revised Ed., Saffron Walden, the C. W. Daniel Co., Ltd., Essex UK, 362 pp, 1988, reprint 1989. |
| 1              | ACHILLEINE         | Plant      | --      | --       |        |  |
| 0              | ACHILLETINE        | Plant      | --      | --       |        | J.S. Glasby Dict.Pls Containing 2ndary Metabolite. 1991.   |
| 0              | ACHILLICIN         | Plant      | --      | --       |        | Williamson, E. M. and Evans, F. J., Potter's New Cyclopaedia of Botanical Drugs and Preparations, Revised Ed., Saffron Walden, the C. W. Daniel Co., Ltd., Essex UK, 362 pp, 1988, reprint 1989. |
| 2              | ACHILLIN           | Plant      | --      | --       |        |  |
| 1              | ACONITIC-ACID      | Plant      | --      | --       |        | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.   |
| 11             | ADENINE            | Plant      | --      | --       |        | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in Achillea millefolium L. (Asteraceae). Economic Botany 48(2): 111-120, 1994.                  |
| 1              | ALLO-OCIMENE       | Leaf       | 4       | 140      | 1      | Lawrence, B.M., Essential Oils 1976-1977, Essential Oils 1978, Essential Oils 1979-1980.   |

| Activity Count | Chemical               | Plant Part | Low PPM | High PPM | StdDev               | Reference Citation  |
|----------------|------------------------|------------|---------|----------|----------------------|---|
| 20             | ALPHA-BISABOLOL        | Leaf       | 1       | 915      | 1.264865272094972    |   |
| 3              | ALPHA-CADINOL          | Leaf       | 1       | 15       | 0.03356316627597684  |   |
| 0              | ALPHA-COPAENE          | Leaf       | --      | --       |                      |   |
| 3              | ALPHA-CURCUMENE        | Leaf       | --      | --       |                      |   |
| 2              | ALPHA-HUMULENE         | Leaf       | --      | --       |                      |   |
| 0              | ALPHA-MUUROLENE        | Leaf       | --      | --       |                      |   |
| 0              | ALPHA-PATCHOULENE      | Plant      | --      | 90       |                      |   |
| 4              | ALPHA-PEROXYACHIFOLIDE | Plant      | --      | --       |                      | Bisset, N.G., ed. 1994. Herbal Drugs and Phytopharmaceuticals. CRC Press. Boca Raton, FL. 566 pp. |
| 11             | ALPHA-PHELLANDRENE     | Leaf       | --      | --       |                      |   |
| 28             | ALPHA-PINENE           | Leaf       | 1       | 1000     | -0.15961997585151536 |   |
| 13             | ALPHA-TERPINENE        | Leaf       | 2       | 130      | 0.2663807470003411   |   |
| 23             | ALPHA-TERPINEOL        | Leaf       | 1       | 80       | -0.4498172854768475  |   |
| 0              | ALPHA-THUJENE          | Leaf       | --      | --       |                      |   |
| 6              | ALPHA-THUJONE          | Plant      | --      | --       |                      |   |
| 6              | ALPHA-THUJONE          | Leaf       | 3       | 240      | -0.5168544216563907  |   |
| 5              | ALUMINUM               | Plant      | 6       | 34       | -0.6894552686751528  |   |

| Activity Count | Chemical               | Plant Part | Low PPM | High PPM | StdDev              | Reference Citation   |
|----------------|------------------------|------------|---------|----------|---------------------|--|
| 2              | ANACYCLIN              | Root       | --      | --       |                     | Jeffery B. Harborne and H. Baxter, eds. 1983. Phytochemical Dictionary. A Handbook of Bioactive Compounds from Plants. Taylor & Frost, London. 791 pp.   |
| 101            | APIGENIN               | Plant      | --      | --       |                     | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.   |
| 2              | APIGENIN-7-O-GLUCOSIDE | Plant      | --      | --       |                     | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.   |
| 0              | APIGENIN-GLUCOSIDE     | Plant      | --      | --       |                     |  |
| 0              | ARABINOSE              | Plant      | --      | --       |                     | Pedersen, M. 1987. Nutritional Herbology. Pederson Publishing. Bountiful, Utah. 377 pp.  |
| 0              | ARTEMISIA-ALCOHOL      | Leaf       | 1       | 80       |                     |  |
| 0              | ARTEMISIA-KETONE       | Leaf       | --      | --       |                     |  |
| 0              | ARTEMISIATRIENE        | Leaf       | 1       | 65       | -1.414213562373094  |  |
| 0              | ARTEMITIN              | Plant      | --      | --       |                     | Williamson, E. M. and Evans, F. J., Potter's New Cyclopaedia of Botanical Drugs and Preparations, Revised Ed., Saffron Walden, the C. W. Daniel Co., Ltd., Essex UK, 362 pp, 1988, reprint 1989. |
| 15             | ASCARIDOLE             | Leaf       | 120     | 6600     | -0.3837260705884196 |  |
| 0              | ASCARIDOLE-ISOMER      | Leaf       | 5       | 335      |                     |  |
| 112            | ASCORBIC-ACID          | Plant      | 119     | 672      | -0.4359276103428388 |  |

| Activity Count | Chemical                        | Plant Part | Low PPM | High PPM | StdDev               | Reference Citation   |
|----------------|---------------------------------|------------|---------|----------|----------------------|--|
| 112            | ASCORBIC-ACID                   | Leaf       | 580     | 3100     | -0.15627959906914124 | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.   |
| 0              | ASH                             | Plant      | 17700   | 100000   | -0.3796129196407384  |  |
| 2              | ASPARAGINE                      | Plant      | --      | --       |                      | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.   |
| 0              | AUSTRICIN                       | Plant      | --      | --       |                      | Wealth of India.   |
| 10             | AZULENE                         | Leaf       | --      | 7140     |                      |  |
| 0              | BALCHANOLIDE                    | Plant      | --      | --       |                      | Williamson, E. M. and Evans, F. J., Potter's New Cyclopaedia of Botanical Drugs and Preparations, Revised Ed., Saffron Walden, the C. W. Daniel Co., Ltd., Essex UK, 362 pp, 1988, reprint 1989. |
| 0              | BALCHANOLIDE-ACETATE            | Plant      | --      | --       |                      | Bisset, N.G., ed. 1994. Herbal Drugs and Phytopharmaceuticals. CRC Press. Boca Raton, FL. 566 pp.  |
| 0              | BENZALDEHYDECYANHYDRINGLYCOSIDE | Plant      | --      | --       |                      | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.   |
| 53             | BETA-CAROTENE                   | Plant      | --      | --       |                      |  |
| 0              | BETA-CARYOPHYLLENE              | Leaf       | 1       | 65       | -0.303004238741691   |  |
| 0              | BETA-CARYOPHYLLENE-OXIDE        | Leaf       | 1       | 30       | -1                   |  |
| 0              | BETA-CUBEBENE                   | Leaf       | 1       | 15       | -0.27140166674948796 |  |
| 5              | BETA-ELEMENE                    | Leaf       | --      | --       |                      |  |

| Activity Count | Chemical                | Plant Part | Low PPM | High PPM | StdDev               | Reference Citation   |
|----------------|-------------------------|------------|---------|----------|----------------------|--|
| 0              | BETA-FARNESENE          | Leaf       | --      | --       |                      |  |
| 0              | BETA-HIMACHALENE        | Plant      | --      | 50       |                      |  |
| 13             | BETA-PINENE             | Leaf       | 1       | 720      | 0.6328642794210592   |  |
| 47             | BETA-SITOSTEROL         | Plant      | --      | --       |                      | Pedersen, M. 1987. Nutritional Herbology. Pederson Publishing. Bountiful, Utah. 377 pp.                                    |
| 0              | BETA-SITOSTEROL-ACETATE | Plant      | --      | --       |                      | Pedersen, M. 1987. Nutritional Herbology. Pederson Publishing. Bountiful, Utah. 377 pp.                                    |
| 5              | BETA-THUJONE            | Leaf       | 1       | 30       | -0.5791445507936085  |  |
| 14             | BETAINE                 | Plant      | --      | --       |                      | Wealth of India.   |
| 2              | BETONICINE              | Plant      | --      | --       |                      | Wealth of India.   |
| 35             | BORNEOL                 | Leaf       | 6       | 275      | -0.1351054728581718  |  |
| 12             | BORNYL-ACETATE          | Plant      | --      | 50       | -0.43702890811674244 |  |
| 6              | BUTYRIC-ACID            | Plant      | --      | --       |                      | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979. |
| 102            | CAFFEIC-ACID            | Plant      | --      | --       |                      |  |
| 28             | CALCIUM                 | Plant      | 1535    | 8670     | -0.5262108144941796  |  |
| 9              | CAMPHENE                | Leaf       | 2       | 600      | 0.03409920562522311  |  |
| 0              | CAMPHERENONE            | Plant      | --      | 70       |                      |  |
| 41             | CAMPHOR                 | Leaf       | 20      | 1780     | -0.18433975802654748 |  |

| Activity Count | Chemical                    | Plant Part | Low PPM | High PPM | StdDev              | Reference Citation   |
|----------------|-----------------------------|------------|---------|----------|---------------------|--|
| 0              | CAPRIC-ACID-METHYL-ESTER    | Plant      | --      | --       |                     | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in Achillea millefolium L. (Asteraceae). Economic Botany 48(2): 111-120, 1994.                  |
| 2              | CAPRYLIC-ACID-METHYL-ESTER  | Plant      | --      | --       |                     | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in Achillea millefolium L. (Asteraceae). Economic Botany 48(2): 111-120, 1994.                  |
| 0              | CARBOHYDRATES               | Plant      | 133104  | 752000   | 0.5125462432567227  |  |
| 37             | CARVACROL                   | Leaf       | --      | --       |                     |  |
| 31             | CARYOPHYLLENE               | Leaf       | 4       | 160      | -0.5782062507598946 | Lawrence, B.M., Essential Oils 1976-1977, Essential Oils 1978, Essential Oils 1979-1980.   |
| 6              | CASTICIN                    | Plant      | --      | --       |                     | Williamson, E. M. and Evans, F. J., Potter's New Cyclopaedia of Botanical Drugs and Preparations, Revised Ed., Saffron Walden, the C. W. Daniel Co., Ltd., Essex UK, 362 pp, 1988, reprint 1989. |
| 0              | CEROTINIC-ACID              | Plant      | --      | --       |                     | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.   |
| 10             | CHAMAZULENE                 | Plant      | 50      | 2800     |                     |  |
| 0              | CHAMAZULENE-CARBOXYLIC-ACID | Plant      | --      | --       |                     | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.   |
| 77             | CHLOROGENIC-ACID            | Plant      | --      | --       |                     | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in Achillea millefolium L. (Asteraceae). Economic Botany 48(2): 111-120, 1994.                  |

| Activity Count | Chemical                    | Plant Part | Low PPM | High PPM | StdDev               | Reference Citation  |
|----------------|-----------------------------|------------|---------|----------|----------------------|---|
| 20             | CHOLINE                     | Plant      | --      | --       |                      | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in Achillea millefolium L. (Asteraceae). Economic Botany 48(2): 111-120, 1994. |
| 24             | CHROMIUM                    | Plant      | 0.4     | 2.5      | -0.6300345087929166  |   |
| 0              | CHRSANTHENYL-ACETATE        | Leaf       | --      | --       |                      |   |
| 0              | CINEOLE                     | Plant      | --      | --       |                      | Pedersen, M. 1987. Nutritional Herbology. Pederson Publishing. Bountiful, Utah. 377 pp.   |
| 0              | CIS-BETA-FARNESENE          | Plant      | --      | 110      |                      |   |
| 0              | CIS-CARVEOL                 | Plant      | --      | 200      | 1                    |   |
| 0              | CIS-CHRSANTHENOL            | Leaf       | 1       | 30       |                      |   |
| 3              | CIS-DEHYDROMATRICARIA-ESTER | Leaf       | --      | --       |                      | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.  |
| 0              | CIS-JASMONE                 | Leaf       | 2       | 125      | 1.7044539014540394   |   |
| 0              | CIS-NEROLIDOL               | Plant      | --      | 230      | 1                    |   |
| 0              | CIS-SABINENE-HYDRATE        | Leaf       | 1       | 80       | -0.2862032724587523  |   |
| 0              | CIS-SABINOL                 | Plant      | --      | 100      | 1                    |   |
| 2              | COBALT                      | Plant      | 0.6     | 3.1      | -0.37614265145342984 |   |
| 1              | COPAENE                     | Leaf       | 1.5     | 60       | 1.1888404716143406   | Lawrence, B.M., Essential Oils 1976-1977, Essential Oils 1978, Essential Oils 1979-1980.  |
| 4              | COSMOSIIN                   | Plant      | --      | --       |                      | Wealth of India.  |



| Activity Count | Chemical             | Plant Part | Low PPM | High PPM | StdDev              | Reference Citation   |
|----------------|----------------------|------------|---------|----------|---------------------|--|
| 0              | COUMARINS            | Plant      | --      | 3500     | -1                  | Bisset, N.G., ed. 1994. Herbal Drugs and Phytopharmaceuticals. CRC Press. Boca Raton, FL. 566 pp.  |
| 10             | CUMINALDEHYDE        | Leaf       | 0.3     | 11       | -0.8843635097531161 | Lawrence, B.M., Essential Oils 1976-1977, Essential Oils 1978, Essential Oils 1979-1980.   |
| 0              | DEACETYLMATRICAININE | Leaf       | --      | --       |                     |  |
| 0              | DEACETYLMATRICARIN   | Plant      | --      | --       |                     |  |
| 0              | DELTA-4-CARENE       | Leaf       | --      | --       |                     |  |
| 9              | DELTA-CADINENE       | Leaf       | 0.2     | 8        | -0.4292576505663304 | Lawrence, B.M., Essential Oils 1976-1977, Essential Oils 1978, Essential Oils 1979-1980.   |
| 0              | DESACETYLMATRICIN    | Leaf       | --      | --       |                     | Bisset, N.G., ed. 1994. Herbal Drugs and Phytopharmaceuticals. CRC Press. Boca Raton, FL. 566 pp.  |
| 1              | DEXTROSE             | Plant      | --      | --       |                     | Newall, C. A., Anderson, L. A. and Phillipson, J. D. 1996. Herbal Medicine - A Guide for Health-care Professionals. The Pharmaceutical Press, London. 296pp. |
| 0              | DIHYDROPARTHENOLIDE  | Leaf       | --      | --       |                     | Bisset, N.G., ed. 1994. Herbal Drugs and Phytopharmaceuticals. CRC Press. Boca Raton, FL. 566 pp.  |
| 2              | DULCITOL             | Plant      | --      | --       |                     | Pedersen, M. 1987. Nutritional Herbology. Pederson Publishing. Bountiful, Utah. 377 pp.  |
| 0              | EO                   | Flower     | 700     | 5000     | -0.256861435811866  | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.                                   |
| 0              | EO                   | Leaf       | 250     | 14000    | 0.3927378316881657  |  |

| Activity Count | Chemical       | Plant Part | Low PPM | High PPM | StdDev               | Reference Citation  |
|----------------|----------------|------------|---------|----------|----------------------|---|
| 0              | EO             | Plant      | 177     | 14000    | 0.3238465858545322   |   |
| 13             | EUCALYPTOL     | Plant      | --      | --       |                      | Newall, C. A., Anderson, L. A. and Phillipson, J. D. 1996. Herbal Medicine - A Guide for Health-care Professionals. The Pharmaceutical Press, London. 296pp.                    |
| 76             | EUGENOL        | Plant      | --      | --       |                      | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in Achillea millefolium L. (Asteraceae). Economic Botany 48(2): 111-120, 1994. |
| 2              | FARNESENE      | Plant      | --      | --       |                      |   |
| 0              | FAT            | Plant      | 7080    | 40000    | -0.1714507664609065  |   |
| 0              | FAT            | Seed       | 223000  | 334000   | 0.3614060995374496   | CRC Handbook of Medicinal Herbs and/or CRC Handbook of Proximate Analyses   |
| 61             | FERULIC-ACID   | Plant      | --      | --       |                      | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in Achillea millefolium L. (Asteraceae). Economic Botany 48(2): 111-120, 1994. |
| 15             | FIBER          | Plant      | 69000   | 201000   | -0.16122268403058113 |   |
| 0              | FIBER(CRUDE)   | Plant      | --      | 69000    | -0.6486558303247424  |   |
| 0              | FIBER(DIETARY) | Plant      | --      | 412000   | 0.5188999674765548   |   |
| 15             | FOLACIN        | Plant      | --      | --       |                      |   |
| 23             | FOLIC-ACID     | Leaf       | --      | --       |                      | Wealth of India.  |
| 13             | FORMIC-ACID    | Plant      | --      | --       |                      | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.  |

| Activity Count | Chemical         | Plant Part | Low PPM | High PPM | StdDev              | Reference Citation  |
|----------------|------------------|------------|---------|----------|---------------------|---|
| 6              | FURFURAL         | Plant      | --      | --       |                     |   |
| 1              | FURFURYL-ALCOHOL | Plant      | --      | --       |                     |   |
| 1              | GALACTOSE        | Plant      | --      | --       |                     | Pedersen, M. 1987. Nutritional Herbology. Pederson Publishing. Bountiful, Utah. 377 pp.   |
| 62             | GALLIC-ACID      | Plant      | --      | --       |                     | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in Achillea millefolium L. (Asteraceae). Economic Botany 48(2): 111-120, 1994. |
| 0              | GAMMA-CADINENE   | Leaf       | --      | --       |                     |   |
| 11             | GAMMA-TERPINENE  | Leaf       | 9       | 370      | 0.34147926512769305 | Lawrence, B.M., Essential Oils 1976-1977, Essential Oils 1978, Essential Oils 1979-1980.  |
| 13             | GERANIAL         | Leaf       | 1       | 50       | -0.3978078018016716 |   |
| 5              | GERANYL-ACETATE  | Plant      | --      | 36       | -0.5241410325713916 |   |
| 2              | GERMACRENE-D     | Leaf       | --      | --       |                     |   |
| 7              | GLUCOSE          | Plant      | --      | --       |                     | Pedersen, M. 1987. Nutritional Herbology. Pederson Publishing. Bountiful, Utah. 377 pp.   |
| 8              | GLUTAMIC-ACID    | Plant      | --      | --       |                     | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in Achillea millefolium L. (Asteraceae). Economic Botany 48(2): 111-120, 1994. |
| 12             | GLYCINE          | Plant      | --      | --       |                     | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in Achillea millefolium L. (Asteraceae). Economic Botany 48(2): 111-120, 1994. |

| Activity Count | Chemical        | Plant Part | Low PPM | High PPM | StdDev              | Reference Citation   |
|----------------|-----------------|------------|---------|----------|---------------------|--|
| 6              | GUAIAZULENE     | Plant      | --      | --       |                     | Williamson, E. M. and Evans, F. J., Potter's New Cyclopaedia of Botanical Drugs and Preparations, Revised Ed., Saffron Walden, the C. W. Daniel Co., Ltd., Essex UK, 362 pp, 1988, reprint 1989. |
| 0              | HEPTADECANE     | Plant      | --      | --       |                     |  |
| 7              | HISTIDINE       | Plant      | --      | --       |                     | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in Achillea millefolium L. (Asteraceae). Economic Botany 48(2): 111-120, 1994.                  |
| 0              | HOMOSTACHYDRINE | Plant      | --      | --       |                     | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in Achillea millefolium L. (Asteraceae). Economic Botany 48(2): 111-120, 1994.                  |
| 2              | HUMULENE        | Leaf       | 0.5     | 22       | -0.3745832187878271 |  |
| 32             | HYDROQUINONE    | Plant      | --      | --       |                     | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in Achillea millefolium L. (Asteraceae). Economic Botany 48(2): 111-120, 1994.                  |
| 0              | HYDROXYACHILLIN | Plant      | --      | --       |                     | Williamson, E. M. and Evans, F. J., Potter's New Cyclopaedia of Botanical Drugs and Preparations, Revised Ed., Saffron Walden, the C. W. Daniel Co., Ltd., Essex UK, 362 pp, 1988, reprint 1989. |
| 8              | INOSITOL        | Plant      | --      | --       |                     | Pedersen, M. 1987. Nutritional Herbology. Pederson Publishing. Bountiful, Utah. 377 pp.  |
| 19             | INULIN          | Plant      | --      | --       |                     | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.   |
| 6              | IRON            | Plant      | --      | --       |                     |  |

| Activity Count | Chemical            | Plant Part | Low PPM | High PPM | StdDev               | Reference Citation   |
|----------------|---------------------|------------|---------|----------|----------------------|--|
| 0              | ISOARTEMISIA-KETONE | Leaf       | 20      | 16000    |                      | Bisset, N.G., ed. 1994. Herbal Drugs and Phytopharmaceuticals. CRC Press. Boca Raton, FL. 566 pp.  |
| 0              | ISOARTEMISIA-KETONE | Plant      | --      | --       |                      |  |
| 7              | ISOBORNEOL          | Leaf       | 5       | 320      | -0.49513094589241385 |  |
| 3              | ISOBUTYL-ACETATE    | Plant      | --      | --       |                      |  |
| 11             | ISORHAMNETIN        | Plant      | --      | --       |                      | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in <i>Achillea millefolium</i> L. (Asteraceae). <i>Economic Botany</i> 48(2): 111-120, 1994.    |
| 0              | ISOSCHAFTOSIDE      | Plant      | --      | --       |                      | Bisset, N.G., ed. 1994. Herbal Drugs and Phytopharmaceuticals. CRC Press. Boca Raton, FL. 566 pp.  |
| 5              | ISOVALERIC-ACID     | Plant      | --      | --       |                      | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.   |
| 0              | KILOCALORIES        | Plant      | 2900    | 2900     | -0.36931512722389037 | Pedersen, M. 1987. Nutritional Herbology. Pederson Publishing. Bountiful, Utah. 377 pp.  |
| 0              | LAVANDULOL          | Leaf       | 1       | 15       | 1.7320504652833757   |  |
| 0              | LEUCODIN            | Plant      | --      | --       |                      | Williamson, E. M. and Evans, F. J., Potter's New Cyclopaedia of Botanical Drugs and Preparations, Revised Ed., Saffron Walden, the C. W. Daniel Co., Ltd., Essex UK, 362 pp, 1988, reprint 1989. |
| 60             | LIMONENE            | Leaf       | 1       | 170      | -0.268944101986277   |  |
| 53             | LINALOOL            | Leaf       | 1       | 4000     | 2.122508536493081    |  |

| Activity Count | Chemical                            | Plant Part | Low PPM | High PPM | StdDev | Reference Citation  |
|----------------|-------------------------------------|------------|---------|----------|--------|---|
| 27             | LINOLEIC-ACID                       | Leaf       | --      | --       |        | Leung, A. Y. and Foster, S. 1995. Encyclopedia of Common Natural Ingredients 2nd Ed. John Wiley & Sons, New York. 649 pp.   |
| 0              | LINOLEIC-ACID-ETHYL-ESTER           | Plant      | --      | --       |        | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in <i>Achillea millefolium</i> L. (Asteraceae). <i>Economic Botany</i> 48(2): 111-120, 1994. |
| 0              | LINOLEIC-ACID-METHYL-ESTER          | Plant      | --      | --       |        | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in <i>Achillea millefolium</i> L. (Asteraceae). <i>Economic Botany</i> 48(2): 111-120, 1994. |
| 2              | LINOLENIC-ACID-METHYL-ESTER         | Plant      | --      | --       |        | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in <i>Achillea millefolium</i> L. (Asteraceae). <i>Economic Botany</i> 48(2): 111-120, 1994. |
| 78             | LUTEOLIN                            | Plant      | --      | --       |        | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in <i>Achillea millefolium</i> L. (Asteraceae). <i>Economic Botany</i> 48(2): 111-120, 1994. |
| 7              | LUTEOLIN-7-GLUCOSIDE                | Plant      | --      | --       |        |   |
| 0              | LUTEOLIN-7-O-BETA-D-GLUCOPYRANOSIDE | Plant      | --      | --       |        | List, P.H. and Horhammer, L., <i>Hager's Handbuch der Pharmazeutischen Praxis</i> , Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.  |
| 2              | LUTEOLIN-7-O-GLUCOSIDE              | Plant      | --      | --       |        | List, P.H. and Horhammer, L., <i>Hager's Handbuch der Pharmazeutischen Praxis</i> , Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.  |

| Activity Count | Chemical                 | Plant Part | Low PPM | High PPM | StdDev              | Reference Citation   |
|----------------|--------------------------|------------|---------|----------|---------------------|--|
| 4              | LYSINE                   | Plant      | --      | --       |                     | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in Achillea millefolium L. (Asteraceae). Economic Botany 48(2): 111-120, 1994.                  |
| 65             | MAGNESIUM                | Plant      | 340     | 1920     | -0.6662824225194472 |  |
| 2              | MALTOSE                  | Plant      | --      | --       |                     | Newall, C. A., Anderson, L. A. and Phillipson, J. D. 1996. Herbal Medicine - A Guide for Health-care Professionals. The Pharmaceutical Press, London. 296pp.                                     |
| 4              | MANDELIC-ACID            | Plant      | --      | --       |                     | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in Achillea millefolium L. (Asteraceae). Economic Botany 48(2): 111-120, 1994.                  |
| 0              | MANDELONITRILE-GLUCOSIDE | Plant      | --      | --       |                     | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in Achillea millefolium L. (Asteraceae). Economic Botany 48(2): 111-120, 1994.                  |
| 14             | MANGANESE                | Plant      | 1       | 5        | -0.6590690061822261 |  |
| 18             | MANNITOL                 | Plant      | --      | --       |                     | Pedersen, M. 1987. Nutritional Herbology. Pederson Publishing. Bountiful, Utah. 377 pp.  |
| 0              | MATRICIN                 | Plant      | --      | --       |                     | Bisset, N.G., ed. 1994. Herbal Drugs and Phytopharmaceuticals. CRC Press. Boca Raton, FL. 566 pp.  |
| 63             | MENTHOL                  | Plant      | --      | --       |                     |  |
| 0              | MILLEFIN                 | Plant      | --      | --       |                     | Williamson, E. M. and Evans, F. J., Potter's New Cyclopaedia of Botanical Drugs and Preparations, Revised Ed., Saffron Walden, the C. W. Daniel Co., Ltd., Essex UK, 362 pp, 1988, reprint 1989. |

| Activity Count | Chemical                  | Plant Part | Low PPM | High PPM | StdDev              | Reference Citation   |
|----------------|---------------------------|------------|---------|----------|---------------------|--|
| 0              | MILLEFOLIDE               | Plant      | --      | --       |                     | Williamson, E. M. and Evans, F. J., Potter's New Cyclopaedia of Botanical Drugs and Preparations, Revised Ed., Saffron Walden, the C. W. Daniel Co., Ltd., Essex UK, 362 pp, 1988, reprint 1989. |
| 0              | MOSCHATINE                | Plant      | --      | --       |                     | Williamson, E. M. and Evans, F. J., Potter's New Cyclopaedia of Botanical Drugs and Preparations, Revised Ed., Saffron Walden, the C. W. Daniel Co., Ltd., Essex UK, 362 pp, 1988, reprint 1989. |
| 22             | MYRCENE                   | Leaf       | 0.5     | 20       | -0.1654584943659963 |  |
| 6              | MYRISTIC-ACID             | Plant      | --      | --       |                     | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.   |
| 5              | NERYL-ACETATE             | Plant      | --      | 28       | -0.5370290118452437 |  |
| 39             | NIACIN                    | Plant      | --      | --       |                     |  |
| 0              | OCTEN-3-OL                | Leaf       | --      | --       |                     |  |
| 18             | OLEIC-ACID                | Plant      | --      | --       |                     | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.   |
| 16             | P-CYMENE                  | Leaf       | 9       | 370      | 0.584380733883737   |  |
| 13             | PALMITIC-ACID             | Plant      | --      | --       |                     | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.   |
| 1              | PALMITIC-ACID-ETHYL-ESTER | Plant      | --      | --       |                     | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in <i>Achillea millefolium</i> L. (Asteraceae). <i>Economic Botany</i> 48(2): 111-120, 1994.    |



| Activity Count | Chemical                   | Plant Part | Low PPM | High PPM | StdDev              | Reference Citation  |
|----------------|----------------------------|------------|---------|----------|---------------------|---|
| 0              | PALMITIC-ACID-METHYL-ESTER | Plant      | --      | --       |                     | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in <i>Achillea millefolium</i> L. (Asteraceae). <i>Economic Botany</i> 48(2): 111-120, 1994. |
| 0              | PENTACOSANE                | Plant      | --      | --       |                     |   |
| 26             | PHENOL                     | Plant      | --      | 155      | -1                  |   |
| 8              | PHLOROGLUCINOL             | Plant      | --      | --       |                     | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in <i>Achillea millefolium</i> L. (Asteraceae). <i>Economic Botany</i> 48(2): 111-120, 1994. |
| 4              | PHOSPHORUS                 | Plant      | 522     | 2950     | -0.3068982377399405 |   |
| 3              | PONTICAEPOXIDE             | Plant      | --      | --       |                     | List, P.H. and Horhammer, L., <i>Hager's Handbuch der Pharmazeutischen Praxis</i> , Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.  |
| 14             | POTASSIUM                  | Plant      | 3151    | 17800    | -0.278763301762186  |   |
| 0              | PROAZULENE                 | Plant      | --      | --       |                     |   |
| 0              | PROCHAMAZULENE             | Plant      | --      | --       |                     | Bisset, N.G., ed. 1994. <i>Herbal Drugs and Phytopharmaceuticals</i> . CRC Press. Boca Raton, FL. 566 pp.   |
| 0              | PROTEIN                    | Plant      | 19116   | 108000   | -0.5364847835043116 |   |
| 0              | PROTEIN                    | Seed       | 286000  | 369000   | 1.2027089985205746  | CRC Handbook of Medicinal Herbs and/or CRC Handbook of Proximate Analyses   |
| 43             | PROTOCATECHUIC-ACID        | Plant      | --      | --       |                     | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in <i>Achillea millefolium</i> L. (Asteraceae). <i>Economic Botany</i> 48(2): 111-120, 1994. |

| Activity Count | Chemical            | Plant Part | Low PPM | High PPM | StdDev               | Reference Citation  |
|----------------|---------------------|------------|---------|----------|----------------------|---|
| 2              | PRUNASIN            | Plant      | --      | --       |                      | Bisset, N.G., ed. 1994. Herbal Drugs and Phytopharmaceuticals. CRC Press. Boca Raton, FL. 566 pp.   |
| 12             | PYROCATECHOL        | Plant      | --      | --       |                      | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in Achillea millefolium L. (Asteraceae). Economic Botany 48(2): 111-120, 1994. |
| 176            | QUERCETIN           | Plant      | --      | --       |                      | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in Achillea millefolium L. (Asteraceae). Economic Botany 48(2): 111-120, 1994. |
| 0              | QUERCETIN-GLYCOSIDE | Plant      | --      | --       |                      |   |
| 44             | QUERCITRIN          | Plant      | --      | --       |                      |   |
| 0              | RESIN               | Plant      | 6000    | 6000     | -0.8622069963910537  | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.  |
| 15             | RIBOFLAVIN          | Plant      | 1       | 5.6      | -0.40499841324824026 |   |
| 87             | RUTIN               | Plant      | --      | --       |                      | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in Achillea millefolium L. (Asteraceae). Economic Botany 48(2): 111-120, 1994. |
| 5              | SABINENE            | Leaf       | 1       | 1225     | 0.5192871434052357   |   |
| 34             | SALICYLIC-ACID      | Plant      | --      | --       |                      | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in Achillea millefolium L. (Asteraceae). Economic Botany 48(2): 111-120, 1994. |

| Activity Count | Chemical      | Plant Part | Low PPM | High PPM | StdDev               | Reference Citation   |
|----------------|---------------|------------|---------|----------|----------------------|--|
| 5              | SAPONINS      | Leaf       | --      | --       |                      | Leung, A. Y. and Foster, S. 1995. Encyclopedia of Common Natural Ingredients 2nd Ed. John Wiley & Sons, New York. 649 pp.                                    |
| 60             | SELENIUM      | Plant      | 0.3     | 1.6      | -0.35611748372726487 |  |
| 4              | SILICON       | Plant      | 1       | 4.5      | -0.5190064670266766  |  |
| 1              | SODIUM        | Plant      | 15      | 82       | -0.2995388449907829  |  |
| 0              | SPATHULENOL   | Plant      | --      | 495      | 2.658868354096619    |  |
| 6              | STACHYDRINE   | Plant      | --      | --       |                      |  |
| 8              | STEARIC-ACID  | Plant      | --      | --       |                      | Newall, C. A., Anderson, L. A. and Phillipson, J. D. 1996. Herbal Medicine - A Guide for Health-care Professionals. The Pharmaceutical Press, London. 296pp. |
| 12             | STIGMASTEROL  | Plant      | --      | --       |                      |  |
| 7              | SUCCINIC-ACID | Leaf       | --      | --       |                      | Leung, A. Y. and Foster, S. 1995. Encyclopedia of Common Natural Ingredients 2nd Ed. John Wiley & Sons, New York. 649 pp.                                    |
| 7              | SUCCINIC-ACID | Plant      | --      | --       |                      |  |
| 14             | SUCROSE       | Plant      | --      | --       |                      | Newall, C. A., Anderson, L. A. and Phillipson, J. D. 1996. Herbal Medicine - A Guide for Health-care Professionals. The Pharmaceutical Press, London. 296pp. |
| 3              | SWERTISIN     | Plant      | --      | --       |                      | Bisset, N.G., ed. 1994. Herbal Drugs and Phytopharmaceuticals. CRC Press. Boca Raton, FL. 566 pp.  |
| 0              | T-CADINOL     | Leaf       | 1       | 15       | -0.5225815390117998  |  |

| Activity Count | Chemical                      | Plant Part | Low PPM | High PPM | StdDev               | Reference Citation  |
|----------------|-------------------------------|------------|---------|----------|----------------------|---|
| 41             | TANNIC-ACID                   | Plant      | --      | --       |                      | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in <i>Achillea millefolium</i> L. (Asteraceae). <i>Economic Botany</i> 48(2): 111-120, 1994. |
| 35             | TANNIN                        | Plant      | 28000   | 40000    | -0.6370616203493836  |   |
| 23             | TERPINEN-4-OL                 | Leaf       | 3       | 430      | -0.24039913557404782 |   |
| 18             | TERPINEOL                     | Plant      | --      | --       |                      |   |
| 9              | TERPINOLENE                   | Leaf       | 1       | 50       | -0.1684008925639172  |   |
| 31             | THIAMIN                       | Plant      | --      | --       |                      | Pedersen, M. 1987. <i>Nutritional Herbology</i> . Pederson Publishing. Bountiful, Utah. 377 pp.   |
| 0              | THIAMINE                      | Plant      | --      | --       |                      |   |
| 0              | THIOPHENES                    | Flower     | 167     | 167      |                      |   |
| 0              | THIOPHENES                    | Leaf       | 167     | 167      |                      |   |
| 17             | THUJONE                       | Plant      | --      | --       |                      |   |
| 71             | THYMOL                        | Leaf       | 1       | 15       | -0.41187649807173515 |   |
| 4              | TIN                           | Plant      | 5       | 26       | 0.34911685139896836  |   |
| 1              | TRANS-CARVEOL                 | Plant      | --      | 150      | 1.4141140551271352   |   |
| 2              | TRANS-DEHYDROMATRICARIA-ESTER | Leaf       | --      | --       |                      | List, P.H. and Horhammer, L., <i>Hager's Handbuch der Pharmazeutischen Praxis</i> , Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.  |
| 0              | TRANS-TRANS-FARNESOL          | Plant      | --      | 160      |                      |   |
| 0              | TRICOSANE                     | Plant      | --      | --       |                      |   |

| Activity Count | Chemical                      | Plant Part | Low PPM | High PPM | StdDev              | Reference Citation  |
|----------------|-------------------------------|------------|---------|----------|---------------------|---|
| 0              | TRICYCLENENE                  | Leaf       | 0.6     | 27       | -0.8389074385035388 | Lawrence, B.M., Essential Oils 1976-1977, Essential Oils 1978, Essential Oils 1979-1980.  |
| 15             | TRIGONELLINE                  | Plant      | --      | --       |                     | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in <i>Achillea millefolium</i> L. (Asteraceae). <i>Economic Botany</i> 48(2): 111-120, 1994. |
| 2              | UNDECYLENIC-ACID-METHYL-ESTER | Plant      | --      | --       |                     | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in <i>Achillea millefolium</i> L. (Asteraceae). <i>Economic Botany</i> 48(2): 111-120, 1994. |
| 24             | VANILLIC-ACID                 | Plant      | --      | --       |                     | Tunon, H., Thorsell, W., and Bohlin, L. 1993. Mosquito Repelling Activity of Compounds Occurring in <i>Achillea millefolium</i> L. (Asteraceae). <i>Economic Botany</i> 48(2): 111-120, 1994. |
| 0              | VIBURNITOL                    | Plant      | --      | --       |                     |   |
| 0              | VICENIN-2-SCHAFTOSIDE         | Plant      | --      | --       |                     | Bisset, N.G., ed. 1994. <i>Herbal Drugs and Phytopharmaceuticals</i> . CRC Press. Boca Raton, FL. 566 pp.   |
| 0              | VICENIN-3-SCHAFTOSIDE         | Plant      | --      | --       |                     | Bisset, N.G., ed. 1994. <i>Herbal Drugs and Phytopharmaceuticals</i> . CRC Press. Boca Raton, FL. 566 pp.   |
| 0              | WATER                         | Plant      | --      | 823000   | 0.22291061491730124 |   |
| 0              | YOMOGI-ALCOHOL                | Leaf       | 5       | 270      |                     |   |
| 77             | ZINC                          | Plant      | --      | --       |                     |   |