Analytic Research on Inorganic Elements in Vespa mandarinia Smith

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**Abstract**: **Objective** The study lays the foundation for controlling the quality of the Vespa mandarinia Smith by systematically an- alyzing the inorganic elements of the Vespa mandarinia Smith in different producing areas and drawing the fingerprint map of inorganic elements. **Methods** 20 kinds of inorganic elements in the Vespa mandarinia Smith were tested by using microwave digestion ICP meth- od; a control fingerprint of inorganic elements were established; and the correlation of metal elements were analyzed. **Results** There are many kinds of metal elements in the Vespa mandarinia Smith, of which P, K, Na, Mg, Ca 5 elements accounted for 92.32% of the total. The content of harmful elements Pb, Cd, As, Hg and Cu meet the requirements of the national pharmacopoeia standards. The metal elements contained in Vespa mandarinia Smith in different production areas are not same. It can be seen that the content of inorganic element shows a similar distribution in the order of atomic number from the inorganic element map. **Conclusion** Vespa man- darinia Smith contains a wealth2o2f metal elements, some of them are beneficial trace elements; the content of harmful metal elements meets the requirements of the pharmacopoeia. The inorganic element fingerprint map of Vespa mandarinia Smith can provide a certain reference basis for the identification of the Vespa mandarinia Smith.

**Keywords**: Vespa mandarinia Smith; different Producing Areas; inorganic Elements; fingerprint

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Vespa Mandarina Smith is the largest in Vespidae Vespa. Predatory carnivorous insects with fierce temperament, commonly known as "tiger headed bee" [1], also known as Chinese Tiger headed bee. Spotted wasp. Peach wasp. Head bee, etc. Its larvae. All. Bee venom and honeycomb can be used as medicine. The medicinal material is called Bumblebee (all). Wasp seed (larva). Exposed beehive (honeycomb), mainly for rheumatism and arthralgia, is a common folk Chinese medicine [2]. Bee venom made from golden ring wasp steeping wine can dispel wind dampness, treat acute and chronic rheumatic pain and rheumatoid arthritis, and has the same effect as its larvae (rhubarb wasps)[3-4], which has a long history of use in Chinese folk.

Modern research shows that the inorganic components in traditional Chinese medicine are closely related to the curative effect. The inorganic elements in traditional Chinese medicine are essential elements that participate in and regulate metabolism in the organism, and can interact with the nitrogen contained in the organism. Oxygen. Sulfur ligands form coordination bonds, coordinate the material balance in the body, and have positive synergistic or antagonistic effects on drug efficacy [5-7]. In addition, heavy metals and harmful elements are one of the important detection indicators for the import and export of traditional Chinese medicine. Accurate determination of the content of heavy metals in traditional Chinese medicine can provide a scientific basis for the quality control in the production of traditional Chinese medicine and the safety of clinical medication [7-8].

At present, the research on Vespa aurata mainly focuses on pharmacological effects. Research on DNA bar code identification and other aspects [9]. In this experiment, microwave digestion ICP method was used to determine the inorganic elements in Vespa aurata from different production areas in Yunnan, and the fingerprint of inorganic elements of Vespa aurata was made to analyze the correlation between the content of inorganic elements of Vespa aurata. It provides a reference for the research on the quality characteristics of inorganic elements of Vespa aurata, and provides a new basis for the research on the quality control of Vespa aurata.

Table 1 sample information

|  |  |
| --- | --- |
| Serial No. | Collection place |
| 1 | Mang City, Dehong Prefecture |
| 2 | Yingjiang County, Dehong Prefecture |
| 3 | Longchuan County, Dehong Prefecture |
| 4 | Longchuan County, Dehong Prefecture |
| 5 | Yingjiang County, Dehong Prefecture |
| 6 | Longchuan County, Dehong Prefecture |
| 7 | Longchuan County, Dehong Prefecture |
| 8 | Longchuan County, Dehong Prefecture |
| 9 | Mang City, Dehong Prefecture |
| 10 | Guangnan County, Wenshan Prefecture |
| 11 | Guangnan County, Wenshan Prefecture |
| 12 | Guangnan County, Wenshan Prefecture |

**1 instruments and materials**

**1.1 instrument**

7200 inductively coupled plasma spectrometer (German thermoelectric company); mars6 microwave digestion instrument (CEM company), al204 Mettler electronic analytical balance; afs-9530 Dual Channel Atomic Fluorescence Photometer (Beijing haiguang Instrument Co., Ltd.), milli-q pure water instrument.

**1.2 reagents**

Single element standard solution (GSB g62027-903301, general iron and Steel Research Institute of national iron and steel materials testing center); 70% nitric acid (MOS grade, Tianjin fengchuan chemical reagent Technology Co., Ltd.), hydrogen peroxide (30% aqueous solution, CMOS, Sinopharm Chemical Reagent Co., Ltd.).

**1.3 sample information and preparation**

The experimental samples came from 14 different regions in Yunnan Province. All samples were identified by Professor guoyunjiao of Dehong normal college, Vespa mandarinia Smith. The information of each sample is shown in Table 1. After collecting the samples, freeze them at low temperature.

**2 methods and results**

**2.1 sample solution preparation**

Accurately weigh 0.3 g of homogenized Vespa aurea in the digestion tank, add 8mLof nitric acid, pre digest at 100℃ for 20 minutes, place it in the microwave digestion instrument, digest it according to the heating procedure (rise to 120℃ for 10 minutes, keep it for 5 minutes, rise to 150℃ for 10 minutes, keep it for 5 minutes, rise to 185℃ for 10 minutes, keep it for 35 minutes), take it out after cooling, drive out the acid at 100℃ for 1 hour, then fix the volume of 25.00mLwith ultra pure water, and determine it by ICP method. Among them, the sample solution for the determination of arsenic is taken out after cooling, the acid is driven to about 1mLat 150℃, the volume is fixed to 22.5mLwith 1 mol/l hydrochloric acid, and 2.5mLof 50 g/l thiourea ascorbic acid is added, which is determined by atomic fluorescence method after 0.5 H.

Table 2 20 linear regression equations of inorganic elements

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Element | | Regression equation | R | | Linear range | |
| Al | | *Y*=284*X*+15760 | 1 | | 0~10mg/L | |
| B | | *Y*=1648*X*+4743 | 0.9978 | | 0~1mg/L | |
| Ba | | *Y*=88.3*X*+828800 | 0.9998 | | 0~1mg/L | |
| Cu | | *Y*=-0.5859*X*+31910 | 0.9997 | | 0~0.5mg/L | |
| Fe | | *Y*=57.65*X*+20330 | 0.9999 | | 0~5mg/L | |
| Mn | | *Y*=18.62*X*+61370 | 0.9993 | | 0~0.5mg/L | |
| Ni | | *Y*=128.9*X*+5736 | 0.9995 | | 0~5mg/L | |
| Sr | | *Y*=563.7*X*+1613000 | 0.9994 | | 0~1mg/L | |
| Ti | | *Y*=193.4*X*+31350 | 0.9996 | | 0~1mg/L | |
| V | | *Y*=29.78*X*+10650 | 0.9996 | | 0~0.5mg/L | |
| Zn | | *Y*=119*X*+15120 | 0.9998 | | 0~5mg/L | |
| Ca | | *Y*=1203*X*+13600 | 0.9995 | | 0~80mg/L | |
| K | | *Y*=28.58*X*+485.6 | 0.9998 | | 0~80mg/L | |
| Mg | | *Y*=38.67*X*+1912 | 0.9997 | | 0~80mg/L | |
| Na | | *Y*=50.32*X*+407.9 | 0.9999 | | 0~80mg/L | |
| P | *Y*=-0.1733*X*+549.5 | | | 0.9998 | | 0~80mg/L |
| Hg | *Y*=496.208*X*+19.914 | | | 0.9997 | | 0~4μg/L |
| As | *Y*=102.505*X*-16.404 | | | 0.9996 | | 0~10μg/L |
| Pb | *Y*=0.00780*X*+0.02109 | | | 0.9989 | | 0~10μg/L |
| Cd | *Y*=0.12234*X*+0.02021 | | | 0.9985 | | 0~3.2μg/L |

**2.2 preparation of standard curve**

**2.3 methodological review**

**2.3.1 precision**

Take the same mixed standard solution for continuous determination for 6 times, and the RSD of each element is 0.05%~1.26%, indicating that the precision of the instrument is good.

**2.3.2 repeatability**

Take No. 1 sample, do three groups of parallel experiments, and calculate the relative standard deviation between the three groups by using the average test results. Through calculation, the precision between the three groups is between 0.02% and 1.14%, indicating that the method deviation is small.

**2.3.3 stability**

Take the No. 1 sample, prepare the sample according to 2.1, and measure 20 metal elements in the sample solution at 0, 2, 4, 6, 8, 16, and 24 h. The element is stable within 24h.

**2.3.4 method recovery**

The recovery rate of spiked sample 1 was tested, and the recovery rate of the method was the average value of three parallel determinations. Results the recoveries of spiked samples were between 80% and 120%. The method was accurate and met the requirements of determining the content of elements in traditional Chinese medicine.

**2.4 determination results and analysis of metal elements of Vespa aurata from different places of origin**

The results of the determination of 20 metal elements in wasps from different production areas are shown in Table 3. It can be seen from Table 3 that the content of Ca, K, Mg, Na and P in the golden-ringed Vespa is relatively large, the content of 20 inorganic metal elements is large, which is 2507.1629 mg/kg, and the content of Hg is the lowest, which is 0.0107 mg/kg. . B, Cd, and Pb elements were not detected in wasps in many production areas. The 2020 edition of the Pharmacopoeia stipulates harmful metal elements in Chinese medicinal materials. Pb, Cd, As, Hg, and Cu cannot exceed 5, 1, 2, 0.2, 20 mg /kg, the contents of Pb, Cd, As, Hg, and Cu in the 14 different producing areas of Vespa were all higher than the limit values of the Chinese Pharmacopoeia, indicating that the harmful metal elements in the Vespa complied with the requirements of the National Pharmacopoeia. Among the 20 metal elements, the coefficient of variation of Sr element is the largest, indicating that the Sr element fluctuates greatly in different production areas, while the coefficient of variation of Ca element is the smallest, indicating that the fluctuation of Ca element in the golden-ringed wasp from different production areas is small. It can be seen that the content of P element in the golden-ringed Vespa is relatively high, accounting for 47.12%, the content of K element is 25.05%, the content of Na element is 9.29%, the content of Mg element is 6.23%, the content of Ca element is 4.63%, and the rest Elements accounted for 7.68%, indicating that the golden-ringed wasp is rich in nutrients.

Table 3 Determination results of metal elements in fresh wasps (mg/kg)

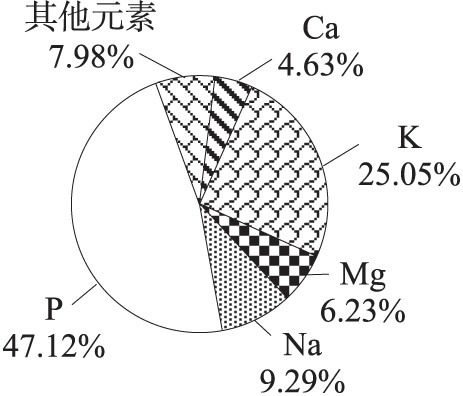
|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number | Al | B | Ba | Cu | Fe | Mn | Ni | Sr | Ti | V | Zn |
| 1 | 57.7600 | 2.2321 | 2.5078 | 7.8356 | 82.8056 | 30.2737 | 0.3786 | 0.3480 | 1.6825 | 0.0944 | 55.2353 |
| 2 | 129.8263 | 6.7818 | 1.1094 | 13.9344 | 158.1097 | 43.3843 | 0.5597 | 3.4530 | 5.5316 | 0.0083 | 61.3936 |
| 3 | 74.0978 | 1.5267 | 1.5914 | 11.6722 | 84.7411 | 24.3447 | 0.7643 | 0.2371 | 2.5399 | 0.1245 | 43.0028 |
| 4 | 102.7904 | Not detected | 0.7795 | 8.3786 | 69.6482 | 6.6667 | 0.2044 | 0.2868 | 2.2221 | 0.0721 | 50.4765 |
| 5 | 304.0420 | 1.9420 | 1.7226 | 12.7378 | 351.6171 | 41.3725 | 0.4769 | 0.6345 | 14.4550 | 0.3059 | 71.7324 |
| 6 | 108.0528 | 2.5849 | 0.6924 | 13.2370 | 66.8235 | 68.7297 | 0.3920 | 0.2723 | 3.4918 | Not detected | 46.4422 |
| 7 | 49.6457 | Not detected | 0.5942 | 9.7525 | 43.9799 | 20.5043 | 0.2092 | 0.1324 | 0.8194 | Not detected | 32.1938 |
| 8 | 108.0774 | Not detected | 1.0577 | 8.7007 | 262.7732 | 21.8213 | 0.7772 | 0.3073 | 4.6358 | 0.1136 | 71.9831 |
| 9 | 325.5352 | 1.0968 | 1.0764 | 10.5219 | 434.5564 | 17.1126 | 0.3934 | 0.5054 | 6.0796 | 0.1554 | 84.5402 |
| 10 | 90.0188 | Not detected | 0.7904 | 11.3663 | 148.3649 | 27.3487 | 0.3374 | 0.2693 | 18.1523 | 0.1174 | 63.2740 |
| 11 | 97.7950 | Not detected | 0.9713 | 11.2246 | 125.6730 | 50.6634 | 0.6494 | 0.4480 | 7.4815 | 0.0777 | 75.1964 |
| 12 | 81.5372 | Not detected | 0.4758 | 10.0609 | 344.2862 | 26.2840 | 0.4139 | 0.2304 | 6.2573 | 0.1144 | 102.0759 |

Table 3 continued

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number | Al | | B | | Ba | | Cu | Fe | | Mn | | Ni | | Sr | | Ti | | V | Zn |
| 13 | 77.0850 | | Not detected | | 0.7338 | | 12.8072 | 132.6728 | | 59.0063 | | 0.4897 | | 0.2918 | | 5.0547 | | 0.0715 | 28.1446 |
| 14 | 103.0059 | | Not detected | | 0.9044 | | 11.6134 | 80.9785 | | 67.0220 | | 0.1637 | | 0.9645 | | 3.5995 | | Not detected | 29.1786 |
| Average value | 122.0907 | | — | | 1.0719 | | 10.9888 | 170.5022 | | 36.0382 | | 0.4436 | | 0.5986 | | 5.8574 | | — | 58.205 |
| Maximum value | 304.042 | | — | | 2.5078 | | 13.9344 | 351.6171 | | 68.7297 | | 0.7772 | | 3.453 | | 18.1523 | | — | 102.0759 |
| Minimum value | 57.76 | | — | | 0.4758 | | 8.3786 | 43.9799 | | 6.6667 | | 0.1637 | | 0.1324 | | 0.8194 | | — | 28.1446 |
| Range | 246.282 | | — | | 2.032 | | 5.5558 | 307.6372 | | 62.063 | | 0.6135 | | 3.3206 | | 17.3329 | | — | 73.9313 |
| Standard deviation | 84.43 | | — | | 0.54 | | 1.88 | 125.67 | | 19.33 | | 0.19 | | 0.85 | | 4.87 | | — | 21.80 |
| Coefficient of variation/% | 69.15 | | — | | 50.45 | | 17.07 | 73.71 | | 53.64 | | 43.55 | | 141.69 | | 83.09 | | — | 37.45 |
| Number | | Ca | | K | | Mg | | | Na | | P | | Hg | | Cd | | Pb | | As |
| 1 | | 186.3197 | | 1317.3483 | | 310.7797 | | | 521.3059 | | 2280.2926 | | 0.0167 | | Not detected | | 0.0096 | | 0.0539 |
| 2 | | 284.6252 | | 1417.7697 | | 302.8855 | | | 490.3359 | | 2520.2846 | | 0.0084 | | Not detected | | 0.0122 | | 0.0252 |
| 3 | | 214.5174 | | 1154.4972 | | 273.9524 | | | 325.4752 | | 2055.5373 | | 0.0048 | | 0.0203 | | 0.0063 | | 0.2060 |
| 4 | | 216.8136 | | 1393.9267 | | 297.0097 | | | 480.7419 | | 2465.3466 | | 0.0084 | | Not detected | | 0.0326 | | 0.0915 |
| 5 | | 260.7579 | | 1417.1042 | | 349.8203 | | | 496.3336 | | 2425.3594 | | 0.0081 | | Not detected | | 0.1691 | | 0.1003 |
| 6 | | 266.0596 | | 1461.7011 | | 357.7300 | | | 564.4860 | | 2617.4952 | | 0.0098 | | Not detected | | Not detected | | 0.0301 |
| 7 | | 199.1978 | | 1149.5334 | | 226.9966 | | | 342.7227 | | 1979.7806 | | 0.0092 | | Not detected | | 0.0137 | | 0.1640 |
| 8 | | 196.5293 | | 141.4959 | | 303.6274 | | | 455.5538 | | 2357.3464 | | 0.0076 | | Not detected | | 0.0131 | | 0.0817 |
| 9 | | 261.2009 | | 2014.6692 | | 450.4298 | | | 712.0329 | | 3475.2676 | | 0.0230 | | Not detected | | 0.1124 | | 0.0313 |
| 10 | | 232.3710 | | 1272.3202 | | 353.7896 | | | 548.1893 | | 2710.6991 | | 0.0106 | | Not detected | | Not detected | | 0.2061 |
| 11 | | 265.7022 | | 1212.4616 | | 281.6073 | | | 351.2500 | | 2204.9401 | | 0.0086 | | Not detected | | 0.0224 | | 0.2205 |
| 12 | | 248.3798 | | 1722.7839 | | 406.8493 | | | 599.1343 | | 2995.5345 | | 0.0137 | | 0.014 | | Not detected | | 0.1526 |
| 13 | | 322.5957 | | 1590.9947 | | 383.2891 | | | 608.2201 | | 2969.8384 | | 0.0101 | | 0.02 | | Not detected | | 0.1165 |
| 14 | | 293.6817 | | 1393.6077 | | 338.9688 | | | 423.8752 | | 2042.5588 | | 0.0110 | | 0.0488 | | 0.0502 | | 0.0170 |
| Average value | | 246.3394 | | 1332.8724 | | 331.2668 | | | 494.2612 | | 2507.1629 | | 0.0107 | | — | | — | | 0.1069 |

Table 3 continued

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number | Ca | K | Mg | Na | P | Hg | Cd | Pb | As |
| Maximum value | 322.5957 | 2014.6692 | 450.4298 | 712.0329 | 3475.2676 | 0.023 | — | — | 0.2205 |
| Minimum value | 186.3197 | 141.4959 | 226.9966 | 325.4752 | 1979.7806 | 0.0048 | — | — | 0.017 |
| Range | 136.276 | 1873.1733 | 223.4332 | 386.5577 | 1495.487 | 0.0182 | — | — | 0.2035 |
| Standard deviation | 40.29 | 413.71 | 58.19 | 110.43 | 422.01 | 0.00 | — | — | 0.07 |
| Coefficient of variation/% | 16.36 | 31.04 | 17.57 | 22.34 | 16.83 | 42.27 | — | — | 67.71 |



|  |
| --- |
| Other elements |

Figure 1 Analysis of the proportion of inorganic elements in Vespa aurata

**2.5 establishment of inorganic element fingerprint of Vespa aurata**

The quantitative levels of the 20 inorganic elements in the golden-ringed Vespa were quite different. In order to draw fingerprints more accurately, the contents of some elements are enlarged or reduced to the same order of magnitude, among which B, Cu, Ti are enlarged by 10 times, K, P are reduced by 10 times, Ba, Ni, Sr are enlarged by 100 times, V, Pb and As are enlarged by 1000 times, and Hg is enlarged by 10000 times. According to the order of atomic numbers of 20 inorganic elements, with the elements as the abscissa and the element content as the ordinate, the fingerprints of the inorganic elements of the golden-ringed Vespa are drawn, as shown in Figure 2. It can be seen that there are differences in the content of metallic elements in different production areas, but the inorganic element content in the whole production area presents a similar distribution trend in the order of atomic number. It can be seen from Figure 2 that the inorganic element spectrum of Golden-ringed Vespa has strong characteristics and consistency, and the generated inorganic element fingerprint can provide a certain reference for the identification of Golden-ringed Vespa.

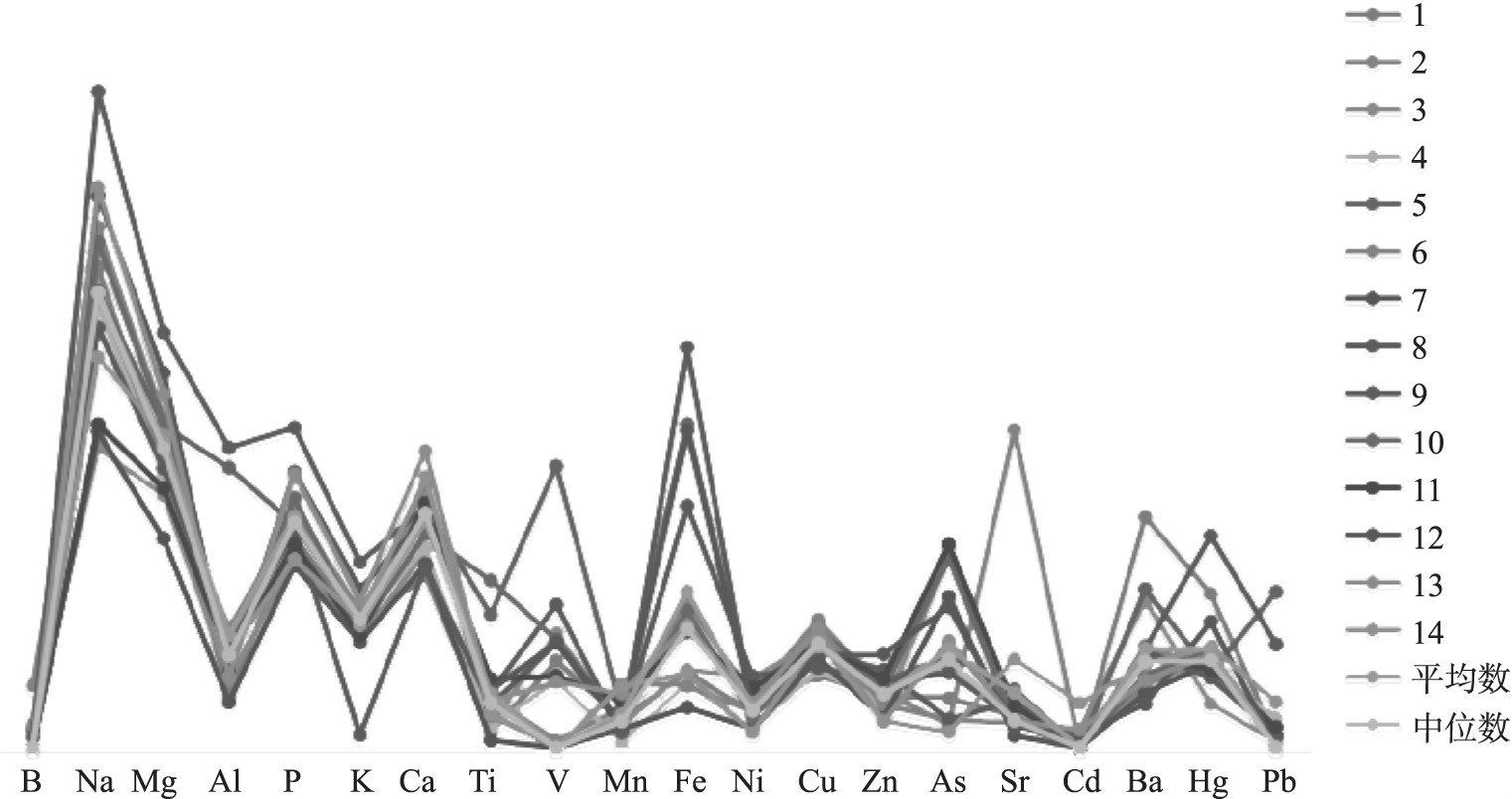
**2.6 correlation analysis of inorganic element content of Vespa aurata**

See Table 4 for the content correlation of inorganic metal elements in golden ring wasp. The results show that 16 pairs of metal elements in golden ring wasp are significantly positively correlated (p<0.01), and 10 pairs of elements are positively correlated (p<0.05). The positive correlation shows that the accumulation process of inorganic metal elements in golden ring wasp is synergistic. The correlation analysis of the content of inorganic elements in Vespa aurata can explore the synergistic effect of the accumulation of various elements in the growth process, which can provide a useful reference for further regulating the feeding mechanism in the growth and development process of Vespa aurata.

Table 4 Correlation Analysis of inorganic element content of Vespa aurata

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Al | B | Ba | Cu | Fe | Mn | Ni | Sr | Ti | V | Zn | Ca | K | Mg | Na | P | Hg | Cd | Pb | As |
| Al | 1 | 0.181 | 0.172 | 0.234 | 0.767＊＊ | －0.083 | 0.029 | 0.137 | 0.402 | 0.659\* | 0.431 | 0.255 | 0.369 | 0.542\* | 0.458 | 0.49 | 0.417 | －0.216 | 0.909＊＊ | －0.346 |
| B |  | 1 | 0.342 | 0.493 | －0.012 | 0.197 | 0.213 | 0.835＊＊ | －0.048 | －0.114 | 0.031 | 0.174 | 0.149 | －0.063 | 0.074 | 0.008 | －0.048 | －0.252 | 0.046 | －0.459 |
| Ba |  |  | 1 | －0.204 | 0.012 | －0.096 | 0.261 | 0.066 | －0.028 | 0.428 | 0.01 | －0.354 | －0.109 | －0.153 | －0.111 | －0.263 | 0.132 | －0.127 | 0.29 | －0.158 |
| Cu |  |  |  | 1 | 0.015 | 0.684＊＊ | 0.176 | 0.495 | 0.336 | －0.044 | －0.176 | 0.771＊＊ | 0.316 | 0.201 | 0.079 | 0.127 | －0.284 | 0.195 | 0.13 | －0.082 |
| Fe |  |  |  |  | 1 | －0.259 | 0.224 | 0.019 | 0.423 | 0.691＊＊ | 0.786＊＊ | 0.137 | 0.243 | 0.688＊＊ | 0.583\* | 0.671＊＊ | 0.491 | －0.191 | 0.610\* | －0.133 |
| Mn |  |  |  |  |  | 1 | －0.011 | 0.221 | 0.042 | －0.31 | －0.36 | 0.726＊＊ | 0.147 | 0.142 | 0.005 | －0.11 | －0.165 | 0.447 | －0.059 | －0.267 |
| Ni |  |  |  |  |  |  | 1 | 0.112 | 0.067 | 0.3 | 0.299 | －0.059 | －0.47 | －0.125 | －0.21 | －0.046 | －0.349 | －0.186 | －0.106 | 0.287 |
| Sr |  |  |  |  |  |  |  | 1 | 0.022 | －0.244 | 0.025 | 0.381 | 0.101 | －0.075 | －0.008 | －0.018 | －0.101 | －0.005 | 0.037 | －0.427 |
| Ti |  |  |  |  |  |  |  |  | 1 | 0.586\* | 0.4 | 0.205 | 0.085 | 0.342 | 0.25 | 0.283 | －0.021 | －0.209 | 0.361 | 0.315 |
| V |  |  |  |  |  |  |  |  |  | 1 | 0.516 | －0.113 | 0.056 | 0.332 | 0.223 | 0.263 | 0.109 | －0.245 | 0.705＊＊ | 0.2 |
| Zn |  |  |  |  |  |  |  |  |  |  | 1 | －0.124 | 0.117 | 0.444 | 0.383 | 0.498 | 0.377 | －0.425 | 0.26 | 0.11 |
| Ca |  |  |  |  |  |  |  |  |  |  |  | 1 | 0.516 | 0.493 | 0.342 | 0.376 | 0.04 | 0.432 | 0.167 | －0.249 |
| K |  |  |  |  |  |  |  |  |  |  |  |  | 1 | 0.614\* | 0.573\* | 0.586\* | 0.573\* | 0.13 | 0.28 | －0.185 |
| Mg |  |  |  |  |  |  |  |  |  |  |  |  |  | 1 | 0.910＊＊ | 0.891＊＊ | 0.671＊＊ | 0.122 | 0.319 | －0.335 |
| Na |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 1 | 0.934＊＊ | 0.720＊＊ | －0.152 | 0.2 | －0.441 |
| P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 1 | 0.657\* | －0.202 | 0.182 | －0.217 |
| Hg |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 1 | －0.092 | 0.261 | －0.393 |
| Cd |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 1 | －0.073 | －0.115 |
| Pb |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 1 | －0.268 |
| As |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 1 |

Note: \* P<0.05, \*\*P<0.01.



|  |
| --- |
| Average |
| Median |

Figure 2 fingerprint of inorganic elements of Vespa aurata

**3 conclusion**

ICP method was used to analyze and measure the contents of 20 inorganic elements in Vespa aurata from 14 different production areas, and the fingerprint of inorganic elements of Vespa aurata was established. The results showed that there were many kinds of metal elements in Vespa aurata, including many beneficial trace elements, and the inorganic element was P. K. Na. Mg. CA is dominant, P is the highest, followed by K. Na. Mg. Ca, five elements account for 92.32% of the total elements determined. Through experiments, it is concluded that there are differences in the content of metal elements in different production areas, which may be related to the living environment (altitude) of wasps. Climate). Type of food. The accumulation law of metal elements in wasps. Pb in Vespa aurata from 14 different production areas. Cd. As. Hg. The content of Cu did not exceed the limit value of Chinese Pharmacopoeia, indicating that the harmful metal elements in Vespa aurata met the requirements of national pharmacopoeia standards. Through the content analysis of metal elements, the establishment of the fingerprint of inorganic elements of Vespa aurata can provide a certain reference for the identification of Vespa aurata.

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