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24-EPIBRASSINOLIDE

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Rapporteur Member State-: Austria

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B.3.2. FUNCTION
The active substance 24-Epibrassinolide is an **elicitor** of plant's self-defence mechanisms against fungal diseases, as well as a **plant activator** to protect plants against abiotic stresses and to promote plant development.

B.3.2.1 Function as elicitor
The active substance 24-Epibrassinolide is an elicitor of plant's self-defence mechanisms against fungal diseases such as grey mould BOTRCI (*Botryotinia fuckeliana*) on wine and table grapes VITVI, downy mildew and bottom rot RHIZSO (*Thanatephorus cucumeris*) on leaf vegetables e.g. lettuce LACSA, and leaf spot of beet CERCBE (*Cercospora beticola*) on sugar beet BEAVA.

B.3.2.2 Function as plant activator
The active substance 24-Epibrassinolide is a plant activator with stress-protective properties against abiotic stress such as salinity, drought, cold and mechanical stress. Additionally, 24-Epibrassinolide increases the utilisation of nutrients and thus increases crop quality and yield. As plant activator, 24-Epibrassinolide protects wine and table grapes VITVI and cucurbits 1CUCF/FFFKU against environmental stress and promotes yield and quality increase.

B.3.3. EFFECTS ON HARMFUL ORGANISMS
24-Epibrassinolide does not target pathogens directly, and has no direct fungicidal or any antagonistic effect against harmful organisms. It acts by activating and enhancing the defence and immune system of plants.

Brassinosteroids in general are recognized by plant receptors and trigger a cascade of biochemical reactions and protein-protein interactions. Brassinosteroids stimulate the level of proteins and osmoprotectants (Anuradha and Rao, 2002; Bajguz and Hayat, 2009) and increase the relative water content and water uptake, leaf water potential, water use efficiency, stomatal conductance, transpiration rate, photosynthetic activity and antioxidative enzyme activity within the plant (Anjum et al., 2011; Fariduddin et al., 2013; Hayat et al., 2010). In summary, Brassinosteroids applied preventively in the appropriate stage of plant development and within a certain concentration range, activate plant activity and elicit plant's self-defence mechanisms resulting in a more efficient response when pathogens attack the plant or when environmental stress occurs. 24-Epibrassinolide has no direct effect on harmful organisms.

Endogenous Brassinosteroids are synthesized inside the cell and only transported over short distances to the exterior surface of this cell or to the surfaces of neighbouring cells (Symons et al., 2008). This is consistent with results of studies showing that Brassinosteroid biosynthesis genes are widely expressed in plant tissues, and transcript levels are generally higher in tissues with high Brassinosteroid levels (reviewed by Nomura and Bishop, 2006). Thus, it is likely that endogenous Brassinosteroid levels in plant tissues are primarily regulated through the tissue-specific control of Brassinosteroid synthesis, catabolism, and inactivation rather than through long-distance transport (Symons and Reid, 2004).

Some transport studies have been performed with exogenously applied Brassinosteroids on roots that show root to shoot movement (e.g. Yokota et al., 1992; Nishikawa et al., 1994). However, when applied directly to shoot tissues, exogenous Brassinosteroids appear to be relatively immobile. For instance, when 3H-labelled Brassinolide or 3H-labelled Castosterone was applied to pea leaves, it entered the leaves, but was not transported to other plant organs (Symons and Reid, 2004). It is therefore concluded that long distance transport of exogenously applied brassinosteroids is unlikely to occur, and if, only very slow movement is expected.

B.3.4. FIELD OF USE ENVISAGED
24-Epibrassinolide is an elicitor of plant's self-defence mechanisms and a plant activator in agriculture (viticulture, arable crops, and vegetable production).

B.3.4.1: Field of use envisaged - elicitor
24-Epibrassinolide is applied as an elicitor of plant's self-defence mechanisms in agricultural crops:

Viticulture - wine and table grapes VITVI
Arable crops – sugar beet BEAVA
Vegetable production –e.g. lettuce (field and glasshouse use) LACSA

For the use as an elicitor of plant's self-defence mechanisms against grey mould BOTRCI (*Botryotinia fuckeliana*) in grapes a maximum of three applications at BBCH 15 to 85 by air blast spraying is recommended per season. To control *Cercospora beticola* CERCBE on sugar beet a maximum of three applications at BBCH 12-39 by foliar application is recommended per season. For downy mildew and Rhizoctonia bottom rot RHIZSO (*Thanatephorus cucumeris*) in leaf vegetables e.g. lettuce a maximum of two applications at BBCH 10-41 by foliar application is recommended per season.

Products containing 0.01% of 24-Epibrassinolide act concentration-dependent and have to be applied with a dilution rate of 1:2000 for wine and table grapes and sugar beet; and with a dilution rate of 1:1000 for lettuce. It is not possible to determine a fixed application rate in kg or g per ha. Therefore the product dose or amount of a.s. /ha will vary with the spray volume.

Remark evaluator: In particular in high growing crops such as grapevine different spray volumes are applied in practise, depending on the application technique, and also due to local preferences. Therefore a fixed concentration will be difficult to allocate to practice. In the grapevine use already a concentration range is indicated (See B.3.3-PPP). Overall, the minimum effective doses will be determined on product level.

24-Epibrassinolide is to be applied preventively before biotic stress occurs. For all crops the minimal interval between applications is seven days.

B.3.4.1: Field of use envisaged – plant activator
24-Epibrassinolide is applied as a plant activator in agricultural crops:

Viticulture - wine and table grapes VITVI
Vegetable production – cucurbits 1CUCF/FFFKU, leaf vegetables e.g. lettuce LACSA (both field and glasshouse use)

24-Epibrassinolide is applied in wine and table grapes and cucurbits to protect the crops against environmental stress. For the prevention of environmental stress and thus for quality and yield increase in wine and table grapes a maximum of two applications is recommended at BBCH 71-79. For the use against abiotic stress in cucurbits a maximum of three applications at BBCH 12 to 69 is recommended per season.

Products containing 0.01% of 24-Epibrassinolide act concentration-dependent and have to be applied with a dilution rate of 1:2000 to 1:3000 for wine and table grapes and cucurbits. 24-Epibrassinolide has to be applied preventively before abiotic stress occurs. The minimal interval between applications is seven days.

Remark evaluator: Due to the fact that depending on the application technique, and also due to local preferences, different spray volumes are applied in practise, in particular in high growing crops such as grapevine. Therefore a fixed concentration will be difficult to allocate to practice; and in the grapevine use already a concentration range is indicated (See B.3.3-PPP). However, the minimum effective doses will be assessed later on product level.

B.3.5. HARMFUL ORGANISMS CONTROLLED AND CROPS OR PRODUCTS PROTECTED OR TREATED

No direct effect on harmful organisms occurs but numerous plant defence responses against pathogens are activated. Applied preventively, 24-Epibrassinolide is intended to protect the plants against biotic and abiotic stress by activating and enhancing the defence and immune system of plants.

According to the fields of use envisaged, 24-Epibrassinolide is intended to induce plant's self-defence mechanisms against grey mould BOTRCI in grapes VITVI, CERCBE on sugar beet BEAVA, and downy mildew BREMLA and RHIZSO in leaf vegetables e.g. lettuce LACSA.
Furthermore, 24-Epibrassinolide is intended to protect wine and table grapes VITVI and cucurbits 1CUCF/FFFKU against environmental stress, and to increase quality and yield of wine and table grapes.

B.3.6. MODE OF ACTION

The presence of steroidal hormones in plants was detected more than three decades ago, when brassinolide was found in *Brassica napus* pollen (Grove et al., 1979). The precursor of brassinolide in biosynthesis, castasterone, was isolated from insect galls of *Castanea crenata* (Yokota et al., 1982).
Brassinosteroids including 24-Epibrassinolide are naturally occurring, plant growth promoting molecules, present in higher plants, lower plants (e.g. *Equisetum*; Takatsuto et al., 1990a), and outside the regnum of plants, also in higher fungi. An example table is available in MCA-3, Table 3.7-1. 24-Epibrassinolide was found in higher plants such as *Phoenix, Oryza, Gypsophila, Fagopyrum, Daucus, Arabidopsis, Brassica, Vicia, Phaseolus, Malus, Aegle, Thea, Helianthus, Bacopa, Coffea, Solanum.*
Brassinosteroids are present in all plant organs such as pollen, anthers, seeds, leaves, stems, roots, flowers, grains and fruits, with the highest concentrations found in pollen, seeds and fruits (Zhu et al., 2013), and considered an obligatory plant constituent. Pollen and immature seeds show contents of Brassinosteroids in a range of 0.001 – 6400 µg/kg fresh weight, while shoots and leaves usually show lower concentrations of 0.001 – 100 µg/kg fresh weight. Fruits, e, g. apples contain 10-35 µg/kg fresh weight.

The concentration of Brassinosteroids in plants is regulated by a complex system of feedback pathways (e.g. Saini et al., 2015) and Brassinosteroids are constantly synthesised, metabolised, activated and inactivated depending on the plant's needs as well as environmental cues. The concentrations of Brassinosteroids are continuously fluctuating - spatially and temporally: in a single plant, different concentrations can be measured simultaneously in different plant organs, cell structures and cells as well as in the same location at different times (e.g. Symons et al., 2008).

Brassinosteroids have been found to play an important role in various vital functions of plants, including stem elongation, pollen tube growth, leaf bending, leaf unrolling, root inhibition, and cell elongation (Nakashita et al., 2003). Furthermore, various studies verified mediation of plant stress responses such as activation of cold resistance and induction of ethylene biosynthesis.
Khripach et al. (2000) have shown that Brassinosteroids mediate augmented resistance to unfavourable environmental factors, stress and diseases. Exogenous exposure has been connected to specific antioxidative effects, via improvement of synthesis of photosynthetic pigments and antioxidant enzymes activity (Niu et al., 2016).

Intracellularly, Brassinosteroids have been found as free molecules, as well as conjugated to sugar and fatty acids due to their lipophilic nature (Bajguz and Tretyn, 2003). Within the scope of molecular characterisation, most research on the Brassinosteroid receptor system has been conducted with the Brassinosteroid Brassinolide.

Within plants, Brassinosteroids bind to specific membrane-bound plant receptors, leading to distinct signal transduction cascades which are currently not fully characterized. One of the best defined membrane receptors is the plant specific leucine-rich repeat receptor-like kinase BRI1 (Ross and Reid, 2010). After indirect binding of active Brassinolide, presented on carrier proteins (Thummel and Chory, 2002) to the outer-membrane bound domain, the intracellular leucine-rich receptor-like kinase BRI1-Associated Receptor Kinase1 (BAK1) is activated. This activation leads to ligand-induced homo- or hetero-oligomerization, followed by autophosphorylation of the cytoplasmic domain (Wang et al., 2005). Subsequently, intracellular signal transduction is activated, consisting of the soluble glycogen synthase kinase 3-like kinase (BIN2), the phosphatase Serine/threonine-protein phosphatase BSU1 and the Brassinosteroid signalling positive regulator transcription factors, BZR1 and BZR2. Activation of this highly conserved pathway, leads to gene activation, promoting cell elongation, division and differentiation of monocot, as well as eudicot cells. Current research has shown that defects of BRI1 lead to deficiency in plant growth, like dwarfism, delayed senescence, flowering and male infertility (Wang et al., 2008).

However, the distinct role of BAK1 is yet not fully understood. Current findings have raised the possibility of BAK1-independent binding of Brassinosteroids to the inactive BRI1 homodimer which induces dissociation of the BRI1 monomers, followed by interaction with BAK1 via the kinase domain (Wang et al., 2005). Another target for BAK1 is the *Botrytis*-Induced Kinase1 (BIK1) which plays important roles in induced defence against fungal and bacterial pathogens (Lei et al., 2014) yet this kinase has been found to negatively regulate Brassinolide signalling (Kazan and Lyons, 2014).

Furthermore, BRI1 was found to be associated with the pathogen-associated molecular pattern (PAMP) receptors FLS2 and EFR upon PAMP binding (Kazan and Lyons, 2014). Concluding from this interaction, BAKI1 function can be associated with plant defence and hormone signalling, promoting resistance or susceptibility against different pathogens (Kazan and Lyons, 2014; Nakashita et al, 2003). In addition to that, the activated BZR1 transcription factor is known to affect expression of WRKY transcription factors, as well as other defence genes. Hereby, Brassinolide-mediated plant growth and plant defence mechanisms are negatively correlated.

Structurally, the Brassinolide receptor system is related to the TGF-β transmembrane receptor kinase signal transduction pathway in animals (Ross and Reid, 2010). However, the effect of Brassinolide has been validated as limited to higher protein metabolism, not linked to any sex hormone receptor (Oklešt′ková et al., 2015). Brassinosteroids act independently of the genome via cell-surface signalling, involving indirect inactivation of the plant glycogen synthetase kinase 3 (GSK3)-like kinase BIN2 (Esposito et al., 2011). In animals, lipophilic steroids bind to steroid receptors, located either in the cytosol or in the nucleus by diffusing through the plasma membrane. This ligand binding leads to conformal change and dimerization, targeting direct DNA binding. In experimental binding assays, Brassinolide has been shown not to be capable of binding to these mammalian-specific receptors (Oklešt′ková et al., 2015). This has been confirmed by genome alignment, not revealing BRI1-like gene sequences in mammals and, vice versa, no animal-receptor similarity in plants (Ross and Reid, 2010). Furthermore, Thummel and Chory (2002) have shown that BRI1 perceives the BR signal through its extracellular domain and initiates a signal transduction cascade through its cytoplasmic kinase activity. This poses the striking difference to animal steroid nuclear receptors that directly activate target gene expression upon ligand binding.

An important feature is the ability of Brassinosteroids to act in extremely low concentrations. The typical range of brassinosteroids for agricultural applications is between 5 and 50 mg per hectare for growing plants. The authors further conclude that if it is assumed that the highest dose is fully absorbed by plants, the average brassinosteroid concentration is 10^{-7}% or 2.1 x 10^{-3} nmol/g at a plant biomass of 50 tonnes per hectare. If only a part of the brassinosteroid is absorbed by the plants, the concentration would be even lower. Although this concentration is extremely low, the result is close to the natural brassinosteroid concentration in plants (Khripach et al, 2000).

24-Epibrassinolide belongs, besides 28-Homobrassinolide and Brassinolide, to the most biological active Brassinosteroids, all three having similar chemical structures. 24-Epibrassinolide differs from Brassinolide by the configuration at C24 (Khripach et al., 2000). All three act in low concentrations between 0.1 – 0.001 ppm (Ikekawa and Zhao, 1991).

B.3.6.1 Mode of Action – Plant activator use

Application of brassinosteroids leads to a complex sequence of biochemical reactions such as activation or suppression of key enzymatic reactions, induction of protein synthesis and the production of various chemical defence compounds (Bajguz and Hayat, 2009). Brassinosteroid treated plants are more tolerant to abiotic stress than untreated plants.

Drought, salinity or freeze-induced dehydration leads to osmotic stress within the plant because homeostasis and ion distribution in the plant cells are disrupted. Brassinosteroid application stimulates the level of proteins and osmoprotectants (e.g. proline) (Anuradha and Seeta Ram Rao, 2002; Bajguz and Hayat, 2009). Moreover, brassinosteroid application can increase the relative water content and water uptake, leaf water potential, water use efficiency, stomatal conductance, transpiration rate, photosynthetic activity and antioxidative enzyme activity (Anjum et al. 2011; Fariduddin et al., 2013; Hayat et al., 2010).

High temperature, drought and salinity can cause oxidative stress which results in denaturation of structural proteins and an increase of Reactive Oxygen Species (ROS). Exogenous application of Brassinosteroids modifies antioxidant enzymes and non-enzymatic antioxidants (e.g. ascorbic acid). In regard of heavy metal stress, application of Brassinosteroids stimulates the synthesis of phytochelatins (heavy metal-binding peptides) and enhances enzyme activity. Moreover, Brassinosteroid pre-treatment can increase resistance of plants to pesticides, which might be mediated by enhanced activities of CO_2 assimilation (Bajguz and Hayat, 2009).

Brassinosteroids activate the plant's self-defence mechanisms meditating the plant's resistance to unfavourable environmental stress like salinity, drought, cold and heat stress. The molecular mode of action of BR-signaling that enables abiotic stress responses is largely unknown. An exemption is an actual study of Eremina et al. 2016, who investigated the molecular mode of action of Brassinosteroid participation in the control of freezing tolerance. It was shown that Brassinosteroids promote the freezing resistance of plants before and after cold acclimation whereas BR-deficient mutants were hypersensitive to freezing stress. Evidence was provided that the BR-controlled basic helix-loop-helix transcription factor CESTA (CES) can contribute to the constitutive expression of the C-REPEAT/DEHYDRATION-RESPONSIVE ELEMENT BINDING FACTOR [CBF) transcriptional regulators that control cold responsive (COR) gene expression. These COR genes are a group of genes which are induced by cold and other types of abiotic stress such as drought or osmotic stress. In addition, non CBF regulon types of COR Genes are identified that are regulated by the BR-CES/BEE pathway during cold acclimation. In the study *Arabidopsis* was exposed in laboratory experiments to slowly decreasing temperatures. It was found that with decreasing temperature, the transcription starts to change. In contrast, BR deficient mutants, which were no longer able to produce brassinosteroids themselves or recognize them as a signal, already showed significant damage at temperatures of minus six degrees. For this reason, brassinosteroids may offer solutions for problems that could arise in agriculture in the course of the climate change.

B.3.6.2 Mode of Action – Elicitor use

Brassinosteroid application can reduce incidence and severity of different pathogens by increasing the natural plant resistance (Ding et al., 2009; Khripach et al., 2000; Nakashita et al., 2003; Xia et al., 2011). Most data from literature show that 24-Epibrassinolide elicits self-defence mechanisms against fungal diseases (Ding et al., 2009; Khripach et al., 2000; Xia et al. 2011). Furthermore an enhancement of plant resistance to viral and bacterial infections is described (Khripach et al.; Nakashita et al., 2003). These data indicate that exogenous Brassinosteroids can act efficiently in plants as immuno-modulators, when applied at the appropriate dose and at the correct stage of plant development.

The pathogen-protective action of Brassinosteroids is the result of a complex sequence of biochemical shifts such as activation or suppression of key enzymatic reactions, induction of protein synthesis, and the production of various chemical defence compounds.

Ding et al. (2009) investigated the effect of root and foliar applications of 24-Epibrassinolide on fusarium wilt in cucumber. Moreover, the influence on the antioxidant and phenolic metabolism in roots was evaluated. The results showed that treatment with 24-Epibrassinolide significantly reduced disease severity of fusarium wilt on cucumber. In addition, plant growth was improved and thus losses in biomass could be reduced. It was shown, that treatment with 24-Epibrassinolide reduces the pathogen-induced accumulation of Reactive Oxygen Species (ROS), flavonoids and phenolic compounds. Moreover, Brassinosteroid application triggers a slight increase in H_2O_2 concentration followed by the expression of defence-related genes.

Tofighi, et al (2017) investigated the effect of the application of 24- Epibrassinolide on wheat plants under salt stress inoculated with the arbuscular mycorrhizal fungus, *Glomus mosseae*. Both 24-Epibrassinolide and the mycorrhizial fungus positively influenced plant development independent from each other; no direct interaction between the fungus and 24-Epibrassinolide was described. For this reason, the combination of the fungus and 24-Epibrassinolide had a cumulative effect on plant development and growth, but no direct effect between *Glomus mosseae* and 24-Epibrassinolide is reported, or to be expected.

Growth promoting or stimulating effects of certain brassinosteroids are not only described for plants but also for the development of certain fungi. Moreover, brassinosteroids are naturally occurring in some fungi (Takatsuto et al., 1990a) e.g. in *Cercospora arachidicola* (Zakharychev, 1999, in Tsavkelova et al., 2006).

Cultivation of the mycelium of the fungus *Psilocybe cubensis*, a species of psychedelic mushrooms, in the presence of the synthetic, unnatural 22S, 23S-homobrassinolide resulted in a 2-3 times accelerated mycelial growth on malt agar. Moreover, an increase in biomass, a decrease in number of weeks to produce fruiting bodies and a higher number of produced fruiting bodies, compared to the untreated control was detected on dung/grain substrate (Gartz, 1990). Finally, application of the synthetic and unnatural 22S, 23S-homobrassinolide influenced the morphology of the fungus and suppressed the formation of incomplete fruit body production.

22S, 23S-homobrassinolide is a synthetic brassinosteroid analog not occurring naturally in which the carbon skeleton of the side chain that is characteristic for natural brassinosteroids is maintained but an unnatural configuration of the hydroxyl groups at C22 and C23 (22S, 23S diol functional group) is present.

The results of Gartz 1990 suggest that synthetic brassinosteroid analogs, not occurring naturally, could play a physiological role in higher fungi and could also be relevant for the production of mushrooms to promote the development of fruiting bodies and to improve crop quality of eatable mushrooms.

Growth promoting effects of 24-Epibrassinolide on plant pathogenic fungi are not to be expected due to the following reasons:
- Effects of brassinosteriods on fungi (Gartz 1990) are described for synthetic brassinosteroid analogs, not occurring naturally in the environment
- Natural occurring brassinosteroids, such as 24-Epibrassinolide represent ubiquitous, phylogenetically ancient phytohormones, which may have evolved in the Pre- Cambrian (Kutschera and Wang, 2012). Therefore fungi and plant pathogenic fungi are exposed to brassinosteroids since millions of years.
- Brassinosteroids are naturally occurring in some fungi (Takatsuto et al., 1990a) e.g. in *Cercospora arachidicola* (Zakharychev, 1999 in Tsavkelova et al., 2006)*
- In the trials conducted with 24-Epibrassinolide in wine and table grapes, lettuce and sugar beet (Please refer to 3CP-B3) a decrease in severity of disease symptoms caused by the plant pathogens *Botrytis cinerea* in wine grapes, *Bremia lactucae* and *Thanatephorus cucumeris* in lettuce, and *Cercospora beticola* in sugar beet were observed. In addition, the reduction of incidence and severity of different fungal plant pathogens is described for brassinosteroids widely in literature for many fungal pathogen species and crops (e.g. Ding et al., 2009; Khripach et al., 2000; Xia et al., 2011). The beneficial effect of brassinosteroids ascribed to the increase of the natural resistance of the plants treated and not on direct effects of brassinosteroids on fungi in general or plant pathogenic fungi in particular.

Studies submitted as well as literature data indicate, that exogenously applied Brassinosteroids can act efficiently in plants as immuno-modulators, when applied at the appropriate dose and at the correct stage of plant development without showing any adverse effects to the crop or direct influences on growth of plant pathogenic fungi.

B.3.6.3 Mode of Action – literature search

The mode of action of 24-Epibrassinolide as a plant activator and elicitor is evident from the descriptions of the agricultural use of Brassinosteroids in scientific literature.

A literature search for the active substance 24-Epibrassinolide was performed in accordance to the provisions of the EFSA Guidance "Submission of scientific peer-reviewed open literature for the approval of pesticide active substances under Regulation (EC) 1107/2009; EFSA Journal 2011, 9(2):2092".

Data point addressed:	CA 3.6.3/01
Author(s) (year):	Reisinger, T., Huber, L. (2017)
Title:	LITERATURE REVIEW REPOT - ACTIVE SUBSTANCE: 24-Epibrassinolide
Laboratory report / project Number (Doc. No.):	PP309-00002
Testing facility:	Scientific Consulting Company, Bad Kreuznach, Germany
Published:	No
Test guideline used:	
Deviations:	None
GLP:	No

In total, 854 records were retrieved from bibliographic databases and were screened by expert reviewers as described under MCA 9.1.

Moreover, the records of the literature search were also screened regarding descriptions of plant activator effects (biostimulant and stress-protective effects) as well as elicitor effects (induction of plant resistance). Based on the evaluation of the titles, 479 of 854 records (56.1%) deal with plant activator effects of 24-Epibrassinolide and 25 of 854 records (2.9%) deal with elicitor effects of 24-Epibrassinolide. Furthermore, the 479 titles which describe plant activator effects were categorized in more detail as shown in Table 3.6.3-1. The overview shows, that the stress-protective properties of 24-Epibrassinolide are subject of many research projects and thus are well known and described. 24-Epibrassinolide shows anti stress activity against cold stress, heat stress, drought stress, heavy metal stress, salt stress and oxidative stress. 37.6 % of the records deal with biostimulant effects such as yield and quality increase, enhanced photosynthetic effects and anti-senescence effects.

Table 3.6.3-1: Literature evaluation of EFSA compliant literature search regarding plant activator effects of 24-Epibrassinolide

Biostimulant and stress protective effects	Number of records	%
Cold stress	37	7.7
Heat stress	34	7.1
Drought stress	21	4.4
Heavy metal stress	64	13.4
Salt stress	70	14.6
Oxidative stress	19	4.0
Environmental stress[1]	54	11.3
Biostimulant effects	180	37.6
Total	479	100

[1] Different stresses were investigated

Remark evaluator: According to Art. 8(%) of Regulation 1107/2009, “*Scientific peer-reviewed open literature, as determined by the Authority, on the active substance and its relevant metabolites dealing with side-effects on health, the environment and non-target species and published within the last 10 years before the date of submission of the dossier shall be added by the applicant to the dossier*.” Therefore, usually no literature search is carried out for Section B-3.

B.3.7. INFORMATION ON THE OCCURRENCE OR POSSIBLE OF THE DEVELOPMENT OF RESISTANCE AND APPROPRIATE MANAGEMENT STRATEGIES

Resistance of a pathogen to a plant protection active substance, results from mutation of one or more genes in the genome of the pathogen population and differential survival of its offspring in presence of the chemical (Brent et al., 2007).

Elicitors and plant activators such as 24-Epibrassinolide do not target pathogens directly and no selective pressure is exerted on the pathogen or its descendants. As it has been shown, 24-Epibrassinolide triggers numerous natural, plant‘s own defence responses. Therefore, no development of resistance in a pathogen is expected. Moreover, according to the Fungicide Resistance Action committee (FRAC Code List 2016: Fungicides sorted by mode of action (including FRAC Code numbering)), no pathogen resistance has been observed for the Mode of Action Code P: Host Plant defence induction. Brassinosteroids are not jet included in the FRAC MOA list.

Brassinosteroids represent ubiquitous, phylogenetically ancient phytohormones that promote growth in land plants as well as in green freshwater algae. According to Kutschera and Wang (2012), Brassinosteroids may have evolved in the Pre-Cambrian, at a time during the evolution of life on earth, when the split between uni- and multicellular green algae (which later gave rise to the embryophytes) had not yet occurred. Brassinosteroids are present in all plant organs such as pollen, anthers, seeds, leaves, stems, roots, flowers, grains and fruits with the highest concentrations found in pollen, seeds and fruits (Zhu et al., 2013). Pollen and immature seeds show contents of Brassinosteroids in a range of 0.001 – 6400 µg/kg fresh weight, while shoots and leaves usually show lower concentrations of 0.001 – 100 µg/kg fresh weight. These data confirm that Brassinosteroids are obligatory plant constituents. The range of concentrations and structures of Brassinosteroids that can be found in plants are temporally and spatially very variable and characteristic for a given plant species at specific stages of plant development and plant organ. The highest measured concentration is about 6400 ng 6-Deoxotyphasterol/g fresh weight in the pollen from Arizona Cypress (*Cupressus arizonica* Greene).

For Elicitors and plant activators such as 24-Epibrassinolide no development of resistance or cross-resistance is expected due to their mode of action and due to the fact that they do not target pathogens directly and that they are obligatory plant constituents.

In document M-CA3 a summary table is provided (Table 3.7-1) based on open literature and without any claim to completeness. According to the presented literature, 24-Epibrassinolide was found in higher plants such as *Phoenix, Oryza, Gypsophila, Fagopyrum, Daucus, Arabidopsis, Brassica, Vicia, Phaseolus, Malus, Aegle, Thea, Helianthus, Bacopa, Coffea, Solanum*. It is to be expected that Brassinosteroids are also ubiquitous distributed in organisms not included in this table.

B.3.8. References relied on

Data Point	Author(s)	Year	Title Compagny Report No. Source (where different from company) GLP or GEP status Published or not	Vertebrate study Y/N	Data protection claimed Y/N	Justification if data protection is claimed	Owner	Previous evaluation
KCA 3.1/01, KCA 3.6/01, KCA 3.7/80	Takatsuto, S. Abe, H. Gamoah, K.	1990	EVIDENCE FOR BRASSINOSTEROIDS IN STROBILUS OF EQUISETUM ARVENSE L. Report No.: na (092-059) Agricultural and Biological Chemistry, 1990, 54 (4), 1057-1059 Not GLP, published	N	N		public	N.A.
KCA 3.1/02, KCA 3.6/02, KCA 3.7/04	Zhu, J.-Y. Sae-Seaw, J. Wang, Z.-Y.	2013	BRASSINOSTEROID SIGNALLING Report No.: na (092-165) Development, 2013, 140(8), 1615-1620; doi: 10.1242/dev.060590 Not GLP, published	N	N		public	N.A.
KCA 3.1/03, KCA 3.7/03	Kutschera, U., Wang, Z.-Y.	2012	BRASSINOSTEROID ACTION IN FLOWERING PLANTS: A DARWINIAN PERSPECTIVE Report No.: na (092-036) Journal of Experimental Botany, 2012, 63 (10), 3511-3522; doi:10.1093/jxb/ers065 Not GLP, published	N	N		public	N.A.
KCA 3.1/04, KCA 3.6/06, KCA 3.6.2/02	Khripach, V. Zhabinskii, V. De Groot, A.	2000	TWENTY YEARS OF BRASSINOSTEROIDS: STEROIDAL PLANT HORMONES WARRANT BETTER CROPS FOR THE XXI CENTURY Report No.: na (092-	N	N		public	N.A.

			029) Annals of Botany, 2000, 86, 441-447; doi:10.1006/anbo.2000.1227 Not GLP, published					
KCA 3.3/01, KCA 3.6.1/02	Anuradha, S. Seeta Ram Rao, S.	2002	ALLEVIATING INFLUENCE OF BRASSINOLIDE ON SALINITY STRESS INDUCED INHIBITION OF GERMINATION AND SEEDLING GROWTH OF RICE Report No.: na (092-131) Indian Journal of Plant Physiology, 2002, 7 (4), 384-387 Not GLP, published	N	N		public	N.A.
KCA 3.3/02, KCA 3.6.1/01	Bajguz, A. Hayat, S.	2009	EFFECTS OF BRASSINOSTEROIDS ON THE PLANT RESPONSES TO ENVIRONMENTAL STRESSES Report No.: na (092-133) Plant Physiology and Biochemistry, 2009, 47, 1-8; doi:10.1016/j.plaphy.2008.10.002 Not GLP, published	N	N		public	N.A.
KCA 3.3/03, KCA 3.6.1/03	Anjum, S.A. Wang, L.C. Farooq, M. Hussain, M. Xue, L.L. Zou, C.M.	2011	BRASSINOLIDE APPLICATION IMPROVES THE DROUGHT TOLERANCE IN MAIZE THROUGH MODULATION OF ENZYMATIC ANTIOXIDANTS AND LEAF GAS EXCHANGE Report No.: na (092-130) Journal of Agronomy and Crop Science, 2011, 197, 177-185; doi:10.1111/j.1439-037X.2010.00459.x Not GLP, published	N	N		public	N.A.
KCA 3.3/04, KCA 3.6.1/04	Fariduddin, Q. Khalil, R.R.A.E. Mir, B.A.	2013	24-EPIBRASSINOLIDE REGULATES PHOTOSYNTHESIS, ANTIOXIDANT	N	N		public	N.A.

	Yusuf, M. Ahmad, A.		ENZYME ACTIVITIES AND PROLINE CONTENT OF CUCUMIS SATIVUS UNDER SALT AND/OR COPPER STRESS Report No.: na (092-137) Environmental Monitoring and Assessment, 2013, DOI 10.1007/s10661-013-3139-x Not GLP, published					
KCA 3.3/05, KCA 3.6.1/05	Hayat, S. Hasan, S.A. Yusuf, M. Hayat, Q. Ahmad, A.	2010	EFFECT OF 28-HOMOBRASSINOLIDE ON PHOTOSYNTHESIS, FLUORESCENCE AND ANTIOXIDANT SYSTEM IN THE PRESENCE OR ABSENCE OF SALINITY AND TEMPERATURE IN VIGNA RADIATA Report No.: na (092-138) Environmental and Experimental Botany, 2010, 69, 105–112; doi:10.1016/j.envexpbot.2010.03.004 Not GLP, published	N	N		public	N.A.
KCA 3.3/06, KCA 3.6/04	Symons, G.M. Ross, J.J. Jager, C.E. Reid, J.B.	2008	BRASSINOSTEROID TRANSPORT Report No.: na (092-094) Journal of Experimental Botany, 2008, 59 (1), 17-24; doi:10.1093/jxb/erm098 Not GLP, published	N	N		public	N.A.
KCA 3.3/07	Nomura, T. Bishop, G.J.	2006	CYTOCHROME P450S IN PLANT STEROID HORMONE SYNTHESIS AND METABOLISM Report No.: na (092-089) Phytochemistry Reviews, 2006, 5, 421-432; DOI 10.1007/s11101-006-9024-2 Not GLP, published	N	N		public	N.A.
KCA	Symons,	2004	BRASSINOSTEROID	N	N		public	N.A.

3.3/08	G.M. Reid, J.B.		S DO NOT UNDERGO LONG-DISTANCE TRANSPORT IN PEA. IMPLICATIONS FOR THE REGULATION OF ENDOGENOUS BRASSINOSTEROID LEVELS Report No.: na (092-095) Plant Physiology, 2004, 135, 2196-2206; doi: 10.1104/pp.104.043034 Not GLP, published					
KCA 3.3/09	Yokota, T. Higuchi, K. Kosaka, Y. Takahashi, N.	1992	TRANSPORT AND METABOLISM OF BRASSINOSTEROID S IN RICE Report No.: na (092-098) Progress in Plant Growth Regulation, 1992, 13, 298-305 Not GLP, published	N	N		public	N.A.
KCA 3.3/10	Nishikawa, N. Toyama, S. Shida, A. Futatsuya, F.	1994	THE UPTAKE AND THE TRANSPORT OF 14C-LABELED EPIBRASSINOLIDE IN INTACT SEEDLINGS OF CUCUMBER AND WHEAT Report No.: na (092-088) Journal of Plant Research, 1994, 107, 125-130 Not GLP, published	N	N		public	N.A.
KCA 3.6/03	Saini, S. Sharma, I. Pati, P.K.	2015	VERSATILE ROLES OF BRASSINOSTEROID IN PLANTS IN THE CONTEXT OF ITS HOMOEOSTASIS, SIGNALING AND CROSSTALKS Report No.: na (092-182) Frontiers in Plant Science, 2015, 6, 950; doi: 10.3389/fpls.2015.0095 0 Not GLP, published	N	N		public	N.A.
KCA 3.6/05, KCA 3.6.2/03	Nakashita, H. Yasuda, M.	2003	BRASSINOSTEROID FUNCTIONS IN A BROAD RANGE OF DISEASE	N	N		public	N.A.

	Nitta, T. Asami, T. Fujioka, S. Arai, Y. Sekimata, K. Takatsuto, S. Yamaguchi, I. Yoshida, S.		RESISTANCE IN TOBACCO AND RICE Report No.: na (092-141) The Plan Journal, 2003, 33, 887-898 Not GLP, published					
KCA 3.6/07	Niu, J.-H. Anjum, S.A. Wang, R. Li, J.-H. Liu, M.-R. Song, J.-X. Zohaib, A. Lv, J. Wang, S.-G. Zong, X.-F.	2016	EXOGENOUS APPLICATION OF BRASSINOLIDE CAN ALTER MORPHOLOGICAL AND PHYSIOLOGICAL TRAITS OF LEYMUS CHINENSIS (TRIN.) TZVELEV UNDER ROOM AND HIGH TEMPERATURES Report No.: na (092-111) Chilean Journal of Agricultural Research, 2016, 76 (1), 27-33; doi: 10.4067/S0718-58392016000100004 Not GLP, published	N	N		public	N.A.
KCA 3.6/08,	Bajguz, A. Tretyn, A.	2003	THE CHEMICAL CHARACTERISTICS AND DISTRIBUTION OF BRASSINOSTEROIDS IN PLANTS Report No.: na (092-132) Phytochemistry, 2003, 62, 1027-1046 Not GLP, published	N	N		public	N.A.
KCA 3.6/09	Ross, J.J. Reid, J.B.	2010	EVOLUTION OF GROWTH-PROMOTING PLANT HORMONES Report No.: na (092-091) Functional Plant Biology, 2010, 37, 795-805 Not GLP, published	N	N		public	N.A.
KCA 3.6/10	Thummel, C.S. Chory, J.	2002	STEROID SIGNALING IN PLANTS AND INSECTS--COMMON THEMES, DIFFERENT	N	N		public	N.A.

			PATHWAYS Report No.: na (092-114) Genes & Development, 2002, 16, 3113-3129; DOI: 10.1101/gad.1042102 Not GLP, published					
KCA 3.6/11	Wang, S. Tiwari, S.B. Hagen, G. Guilfoyle, T.J.	2005	AUXIN RESPONSE FACTOR7 RESTORES THE EXPRESSION OF AUXIN-RESPONSIVE GENES IN MUTANT ARABIDOPSIS LEAF MESOPHYLL PROTOPLASTS Report No.: na (092-142) The Plant Cell, 2005, 17, 1979-1993; DOI: 10.1105/tpc.105.031096 Not GLP, published	N	N		public	N.A.
KCA 3.6/12	Wang, S. Kota, U. He, K. Blackburn, K. Li, J. Goshe, M.B. Huber, S.C. Clouse, S.D.	2008	SEQUENTIAL TRANSPHOSPHORYLATION OF THE BRI1/BAK1 RECEPTOR KINASE COMPLEX IMPACTS EARLY EVENTS IN BRASSINOSTEROID SIGNALING Report No.: na (092-143) Developmental Cell, 2008, 15, 220-235; doi: 10.1016/j.devcel.2008.06.011 Not GLP, published	N	N		public	N.A.
KCA 3.6/13	Lei, J. Finlayson, S.A. Salzman, R.A. Shan, L. Zhu-Salzman, K.	2014	BOTRYTIS-INDUCED KINASE1 MODULATES ARABIDOPSIS RESISTANCE TO GREEN PEACH APHIDS VIA PHYTOALEXIN DEFICIENT4 Report No.: na (092-140) Plant Physiology, 2014, 165, 1657-1670; DOI: 10.1104/pp.114.242206 Not GLP, published	N	N		public	N.A.
KCA 3.6/14	Kazan, K. Lyons, R.	2014	INTERVENTION OF PHYTOHORMONE PATHWAYS BY PATHOGEN	N	N		public	N.A.

			EFFECTORS Report No.: na (092-139) The Plant Cell, 2014, 26, 2285-2309; DOI: 10.1105/tpc.114.125419 Not GLP, published					
KCA 3.6/15	Oklešt′ková, J., Rarova, L., Kvasnica, M., Strnad, M.	2015	BRASSINOSTEROIDS: SYNTHESIS AND BIOLOGICAL ACTIVITIES Report No.: na (092-090) Phytochemistry Reviews, 2015, 14, 1053-1072; DOI 10.1007/s11101-015-9446-9 Not GLP, published	N	N		public	N.A.
KCA 3.6/16	Esposito, D. Komarnytsky, S. Shapses, S. Raskin, I.	2011	ANABOLIC EFFECT OF PLANT BRASSINOSTEROID Report No.: na (092-081) FASEB Journal, PMC3177571, 2011, 25 (10), 3708-3719; doi: 10.1096/fj.11-181271 Not GLP, published	N	N		public	N.A.
KCA 3.6/17	Ikekawa, N. Zhao, Y.-J.	1991	APPLICATION OF 24-EPIBRASSINOLIDE IN AGRICULTURE Report No.: na (092-026) ACS Symposium series, 1991, 474, Chapter 24, 280-291 Not GLP, published	N	N		public	N.A.
KCA 3.6.1/06	Eremina, M. Unterholzner, S.J. Rathnayake, A.I. Castellanos, M. Khan, M. Kugler, K.G. May, S.T. Mayer, K.F.X. Rozhon, W. Poppenberger, B.	2016	BRASSINOSTEROIDS PARTICIPATE IN THE CONTROL OF BASAL AND ACQUIRED FREEZING TOLERANCE OF PLANTS Report No.: na (092-136) Proceedings of the National Academy of Sciences, 2016, 113 (40), E5982-E5991 Not GLP, published	N	N		public	N.A.
KCA	Ding, J.	2009	EFFECTS OF ROOT	N	N		public	N.A.

3.6.2/01	Shi, K. Zhou, Y.-H.		AND FOLIAR APPLICATIONS OF 24-EPIBRASSINOLIDE ON FUSARIUM WILT AND ANTIOXIDANT METABOLISM IN CUCUMBER ROOTS Report No.: na (092-135) HortScience, 2009, 44 (5), 1340-1345 Not GLP, published					
KCA 3.6.2/04	Xia, X.-J. Zhou, Y.-H. Ding, J. Shi, K. Asami, T. Chen, Z. Yu, J.-Q.	2011	INDUCTION OF SYSTEMIC STRESS TOLERANCE BY BRASSINOSTEROID IN CUCUMIS SATIVUS Report No.: na (092-144) New Phytologist, 2011, 191, 706-720; doi: 10.1111/j.1469-8137.2011.03745.x Not GLP, published	N	N		public	N.A.
KCA 3.6.3/01	Reisinger, T. Huber, L.	2017	LITERATURE REVIEW REPORT ACC. TO EFSA GUIDANCE “SUBMISSION OF SCIENTIFIC PEER-REVIEWED OPEN LITERATURE FOR THE APPROVAL OF PESTICIDE A. S. UNDER REG. (EC) NO 1107/2009; EFSA JOURNAL 2011, 9(2):2092” - ACTIVE SUBSTANCE: 24-EPIBRASSINOLIDE Report No.: PP309-00002 (091-001) Scientific Consulting Company, Bad Kreuznach, Germany Not GLP, unpublished	N	Y	New study necessary for the approval of 24-Epibrassinolide	Suntton GmbH	N.A.
KCA 3.7/01	Brent, K.J. Hollomon, D.	2007	FUNGICIDE RESISTANCE IN CROP PATHOGENS: HOW CAN IT BE MANAGED? Report No.: na (092-134) Fungicide Resistance Action Committee 2007, FRAC Monograph No. 1 (2nd,	N	N		public	N.A.

			revised edition), ISBN 90-72398-07-6 Not GLP, published					
KCA 3.7/02	Anonymous	2016	FRAC CODE LIST © 2016: FUNGICIDES SORTED BY MODE OF ACTION (INCLUDING FRAC CODE NUMBERING) Report No.: FRAC Code List 2016 (381-001) Fungicide Resistance Action Committee Not GLP, unpublished	N	N		public	N.A.
KCA 3.7/05	Bajguz, A. Tretyn, A.	2003	THE CHEMICAL STRUCTURES AND OCCURRENCE OF BRASSINOSTEROIDS IN PLANTS Report No.: na (092-145) Brassinosteroids. Chapter 1, 2003, 1-44 Not GLP, published	N	N		public	N.A.
KCA 3.7/06	Hayat, s. Ahmad, A.	2011	BRASSINOSTEROIDS: A CLASS OF PLANT HORMONE Report No.: na (092-146) Springer Verlag, 2011, 1-477, DOI 10.1007/978-94-007-0189-2; ISBN: 978-94-007-0188-5 Not GLP, published	N	N		public	N.A.
KCA 3.7/07	Abe, H. Nakamura, K. Morishita, T. Uchiyama, M. Takatsuto, S. Ikekawa, N.	1984	ENDOGENOUS BRASSINOSTEROIDS OF THE RICE PLANT: CASTASTERONE AND DOLICHOSTERONE Report No.: na (092-004) Agricultural and Biological Chemistry, 1984, 48 (4), 1103-1104 Not GLP, published	N	N		public	N.A.
KCA 3.7/08	Abe, H. Takatsuto, S. Nakayama, M. Yokota, T.	1995	28-HOMOTYPHASTEROL, A NEW NATURAL BRASSINOSTEROID FROM RICE (ORYZA SATIVA L.) BRAN Report No.: na (092-006) Bioscience,	N	N		public	N.A.

			Biotechnology and Biochemistry, 1995, 59 (2), 176-178 Not GLP, published					
KCA 3.7/09	Park, K.-H. Park, J.-D. Hyun, K.-H. Nakayama, M. Yokota, T.	1994	BRASSINOSTEROIDS AND MONOGLYCERIDES IN IMMATURE SEEDS OF CASSIA TORA AS THE ACTIVE PRINCIPLES IN THE RICE LAMINA INCLINATION BIOASSAY Report No.: na (092-046) Bioscience, Biotechnology and Biochemistry, 1994, 58 (7), 1343-1344 Not GLP, published	N	N		public	N.A.
KCA 3.7/10	Khripach, V.A. Litvinovskaya, R.P. Kurtikova, A.L. Drach, S.V. Pryadko, A.G. Mirantsova, T.V. Baranovskiy, A.V.	2013	ENZYME IMMUNOASSAY OF THE CONTENT OF ENDOGENOUS BRASSINOSTEROIDS IN PHYTOGENIC FOOD PRODUCTS Report No.: na (092-030) National Academy of Sciences of Belarus, 2013, 57 (2), 63-69 Not GLP, published	N	N		public	N.A.
KCA 3.7/11	Yokota, T. Nakayama, M. Wakisaka, T. Schmidt, J. Adam, G.	1994	3-DEHYDROTEASTERONE, A 3,6-DIKETOBRASSINOSTEROID AS A POSSIBLE BIOSYNTHETIC INTERMEDIATE OF BRASSINOLIDE FROM WHEAT GRAIN Report No.: na (092-078) Bioscience, Biotechnology and Biochemistry, 1994, 58 (6), 1183-1185 Not GLP, published	N	N		public	N.A.
KCA 3.7/12	Suzuki, Y. Yamaguchi, I. Yokota, T. Takahasi,	1986	IDENTIFICATION OF CASTASTERONE, TYPHASTEROL AND TEASTERONE FROM THE POLLEN OF	N	N		public	N.A.

	N.		ZEA MAYS Report No.: na (092-053) Agricultural and Biological Chemistry, 1986, 50 (12), 3133-3138 Not GLP, published					
KCA 3.7/13	Kim, S.-K. Chang, S.C. Lee, E.J. Chung, W.-S. Kim, Y.-S. Hwang, S. Lee, J.S.	2000	INVOLVEMENT OF BRASSINOSTEROIDS IN THE GRAVITROPIC RESPONSE OF PRIMARY ROOT OF MAIZE Report No.: na (092-034) Plant Physiology, 2000, 123, 997-1004 Not GLP, published	N	N		public	N.A.
KCA 3.7/14	Yasuta, E. Terahata, T. Nakayama, M. Abe, H. Takatsuto, S. Yokota, T.	1995	FREE AND CONJUGATED BRASSINOSTEROIDS IN THE POLLEN AND ANTHERS OF ERYTHRONIUM JAPONICUM DECNE Report No.: na (092-067) Bioscience, Biotechnology and Biochemistry, 1995, 59 (11), 2156-2158 Not GLP, published	N	N		public	N.A.
KCA 3.7/15	Suzuki, H. Fujioka, S. Yokota, T. Murofushi, N. Sakurai, A.	1994	IDENTIFICATION OF BRASSINOLIDE, CASTASTERONE, TYPHASTEROL AND TEASTERONE FROM THE POLLEN OF LILIUM ELEGANS Report No.: na (092-054) Bioscience, Biotechnology and Biochemistry, 1994, 58 (11), 2075-2076 Not GLP, published	N	N		public	N.A.
KCA 3.7/16	Abe, H. Honjo, C. Kyokawa, Y. Asakawa, S. Natsume, M. Narushima, M.	1994	3-OXOTEASTERONE AND THE EPIMERIZATION OF TEASTERONE: IDENTIFICATION IN LILY ANTHERS AND DISTYLIUM RACEMOSUM LEAVES AND ITS BIOTRANSFORMATION INTO	N	N		public	N.A.

			TYPHASTEROL Report No.: na (092-005) Bioscience, Biotechnology and Biochemistry, 1994, 58 (5), 986-989 Not GLP, published					
KCA 3.7/17	Asakawa, S. Abe. H. Kyokawa, Y. Nakamura, S. Natsume, M.	1994	TEASTERONE 3-MYRISTATE: A NEW TYPE OF BRASSINOSTEROID DERIVATIVE IN LILIUM LONGIFLORUM ANTHERS Report No.: na (092-009) Bioscience, Biotechnology and Biochemistry, 1994, 58 (1), 219-220 Not GLP, published	N	N		public	N.A.
KCA 3.7/18	Asakawa, S. Abe, H. Nishikawa, N. Natsume, M. Koshioka, M.	1996	PURIFICATION AND IDENTIFICATION OF NEW ACYL-CONJUGATED TEASTERONES IN LILY POLLEN Report No.: na (092-010) Bioscience, Biotechnology and Biochemistry, 1996, 60 (9), 1416-1420 Not GLP, published	N	N		public	N.A.
KCA 3.7/19	Soeno, K. Kyokawa, Y. Natsume, M. Abe, H.	2000	TEASTERONE-3-O-ß-D-GLUCOPYRANOSIDE, A NEW CONJUGATED BRASSINOSTEROID METABOLITE FROM LILY CELL SUSPENSION CULTURES AND ITS IDENTIFICATION IN LILY ANTHERS Report No.: na (092-050) Bioscience, Biotechnology and Biochemistry, 2000, 64 (4), 702-709 Not GLP, published	N	N		public	N.A.
KCA 3.7/20	Plattner, R.D. Taylor, S.L.	1986	DETECTION OF BRASSINOLIDE AND CASTASTERONE IN	N	N		public	N.A.

	Grove, M.D.		ALNUS GLUTINOSA (EUROPEAN ALDER) POLLEN BY MASS SPECTROMETRY/MASS SPECTROMETRY Report No.: na (092-047) Journal of Natural Products, 1986, 49 (3), 540-545 Not GLP, published					
KCA 3.7/21	Takatsuto, S. Abe, H. Yokota, T. Shimada, K. Gamoh, K.	1996	IDENTIFICATION OF CASTASTERONE AND TEASTERONE IN SEEDS OF CANNABIS SATIVA L. Report No.: na (092-062) Japan Oil Chemists' Society, 1996, 45 (9), 871-873 Not GLP, published	N	N		public	N.A.
KCA 3.7/22	Schmidt, J. Boehme, F. Adam, G.	1996	24-EPIBRASSINOLIDE FROM GYPSOPHILA PERFOLIATA Report No.: na (092-049) Zeitschrift für Naturforschung, 1996, 51 c, 897-899 Not GLP, published	N	N		public	N.A.
KCA 3.7/23	Yokota, T. Arima, M. Takahashi, N.	1982	CASTASTERONE, A NEW PHYTOSTEROL WITH PLANT-HORMONE POTENCY, FROM CHESTNUT INSECT GALL Report No.: na (092-072) Tetrahedron letters, 1982, 23 (12), 1275-1278 Not GLP, published	N	N		public	N.A.
KCA 3.7/24	Ikeda, M. Takatsuto, S. Sassa, T. Ikekawa, N. Nukina, M.	1983	IDENTIFICATION OF BRASSINOLIDE AND ITS ANALOGUES IN CHESTNUT GALL TISSUE Report No.: na (092-024) Agricultural and Biological Chemistry, 1983, 47 (3), 655-657	N	N		public	N.A.

			Not GLP, published					
KCA 3.7/25	Ikekawa, N. Takatsuto, S.	1984	MICROANALYSIS OF BRASSIOSTEROIDS IN PLANTS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY Report No.: na (092-025) Mass Spectroscopy, 1984, 32 (1), 55-70 Not GLP, published	N	N		public	N.A.
KCA 3.7/26	Arima, M. Yokota, T. Takahashi, N.	1984	IDENTIFICATION AND QUANTIFICATION OF BRASSINOLIDE-RELATED STEROIDS IN THE INSECT GALL AND HEALTHY TISSUES OF THE CHESTNUT PLANT Report No.: na (092-008) Phytochemistry, 1984, 23 (8), 1587-1591 Not GLP, published	N	N		public	N.A.
KCA 3.7/27	Takatsuto, S. Omote, K. Gamoh, K. Ishibashi, M.	1990	IDENTIFICATION OF BRASSINOLIDE AND CASTASTERONE IN BUCKWHEAT (FAGOPYRUM ESCULENTUM MOENCH) POLLEN Report No.: na (092-060) Agricultural and Biological Chemistry, 1990, 54 (3), 757-762 Not GLP, published	N	N		public	N.A.
KCA 3.7/28	Sondhi, N. Bhardwaj, R. Kaur, S. Chandel, M. Kumar, N. Singh, B.	2010	INHIBITION OF H2O2-INDUCED DNA DAMAGE IN SINGLE CELL GEL ELECTROPHORESIS ASSAY (COMET ASSAY) BY CASTASTERONE ISOLATED FROM LEAVES OF CENTELLA ASIATICA Report No.: na (092-155) Health, 2010, 2 (6), 595-602; doi:10.4236/health.201	N	N		public	N.A.

			0.26088 Not GLP, published					
KCA 3.7/29	Swaczynova, J. Novak, O. Hauserova, E. Fuksova, K. Sisa, M. Kohout, L. Strnad, M.	2007	NEW TECHNIQUES FOR THE ESTIMATION OF NATURALLY OCCURRING BRASSINOSTEROIDS Report No.: na (092-057) Journal of Plant Growth Regulation, 2007, 26, 1-14; DOI: 10.1007/s00344-006-0045-2 Not GLP, published	N	N		public	N.A.
KCA 3.7/30	Fujioka, S. Choi, Y.-H. Takatsuto, S. Yokota, T. Li, J. Chory, J. Sakurai, A.	1996	IDENTIFICATION OF CASTASTERONE, 6-DEOXOCASTASTERONE, TYPHASTEROL AND 6-DEOXOTYPHASTEROL FROM THE SHOOTS OF ARABIDOPSIS THALIANA Report No.: na (092-018) Plant & Cell Physiology, 1996, 37 (8), 1201-1203 Not GLP, published	N	N		public	N.A.
KCA 3.7/31	Fujioka, S. Li, J. Choi, Y.-H. Seto, H. Takatsuto, S. Noguchi, T. Watanabe, T. Kuriyama, H. Yokota, T. Chory, J. Sakurai, A.	1997	THE ARABIDOPSIS DEETIOLATED2 MUTATNT IS BLOCKED EARLY IN BRASSINOSTEROID BIOSYNTHESIS Report No.: na (092-019) The Plant Cell, 1997, 9, 1951-1962 Not GLP, published	N	N		public	N.A.
KCA 3.7/32	Nomura, T. Sato, T. Bishop, G.J. Kamiya, Y. Takatsuto, S.	2001	ACCUMULATION OF 6-DEOXOCATHASTERONE AND 6-DEOXOCASTASTERONE IN ARABIDOPSIS, PEA AND TOMATO IS SUGGESTIVE OF	N	N		public	N.A.

	Yokota, T.		COMMON RATE-LIMITING STEPS IN BRASSINOSTEROID BIOSYNTHESIS Report No.: na (092-040) Phytochemistry, 2001, 57, 171-178 Not GLP, published					
KCA 3.7/33	Bancos, S. Nomura, T. Sato, T. Molnar, G. Bishop, G.J. Koncz, C. Yokota, T. Nagy, F. Szekeres, M.	2002	REGULATION OF TRANSCRIPT LEVELS OF THE ARABIDOPSIS CYTOCHROME P450 GENES INVOLVED IN BRASSINOSTEROID BIOSYNTHESIS Report No.: na (092-161) Plant Physiology, 2002, 130, 504-513; DOI: 10.1104/pp.005439 Not GLP, published	N	N		public	N.A.
KCA 3.7/34	Schmidt, J. Altmann, T. Adam, G.	1997	BRASSINOSTEROIDS FROM SEEDS OF ARABIDOPSIS THALIANA Report No.: na (092-048) Phytochemistry, 1997, 45 (7), 1325-1327 Not GLP, published	N	N		public	N.A.
KCA 3.7/35	Choe, S. Fujioka, S. Noguchi, T. Takatsuto, S. Yoshida, S. Feldmann, K.A.	2001	OVEREXPRESSION OF DWARF4 IN THE BRASSINOSTEROID BIOSYNTHETIC PATHWAY RESULTS IN INCREASED VEGETATIVE GROWTH AND SEE YIELD IN ARABIDOPSIS Report No.: na (092-015) The Plant Journal, 2001, 26 (6), 573-582 Not GLP, published	N	N		public	N.A.
KCA 3.7/36	Fujioka, S. Takatsuto, S. Yoshida, S.	2002	AN EARLY C-22 OXIDATION BRANCH IN THE BRASSINOSTEROID BIOSYNTHETIC PATHWAY Report No.: na (092-020) Plant Physiology, 2002, 130 (2), 930-939;	N	N		public	N.A.

			doi/10.1104/pp.008722 Not GLP, published					
KCA 3.7/37	Shimada, Y. Goda, H. Nakamura, A. Takatsuto, S. Fujioka, S. Yoshida, S.	2003	ORGAN-SPECIFIC EXPRESSION OF BRASSINOSTEROID-BIOSYNTHETIC GENES AND DISTRIBUTION OF ENDOGENOUS BRASSINOSTEROIDS IN ARABIDOPSIS Report No.: na (092-162) Plant Physiology, 2003, 131, 287-297; DOI: 10.1104/pp.013029 Not GLP, published	N	N		public	N.A.
KCA 3.7/38	Abe, H. Morishita, T. Uchiyama, M. Marumo, S. Munakata, K. Takatsuto, S. Ikekawa, N.	1982	IDENTIFICATION OF BRASSINOLIDE-LIKE SUBSTANCES IN CHINESE CABBAGE Report No.: na (092-002) Agricultural and Biological Chemistry, 1982, 46 (10), 2609-2611 Not GLP, published	N	N		public	N.A.
KCA 3.7/39	Ikekawa, N. Takatsuto, S.	1984	MICROANALYSIS OF BRASSIOSTEROIDS IN PLANTS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY Report No.: na (092-025) Mass Spectroscopy, 1984, 32 (1), 55-70 Not GLP, published	N	N		public	N.A.
KCA 3.7/40	Kanwar, M.K. Bhardwaj, R. Chowdhary, S.P. Arora, P. Sharma, P. Kumar, S.	2013	ISOLATION AND CHARACTERIZATION OF 24-EPIBRASSINOLIDE FROM BRASSICA JUNCEA L. AND ITS EFFECTS ON GROWTH, NI ION UPTAKE, ANTIOXIDANT DEFENSE OF BRASSICA PLANTS AND IN VITRO CYTOTOXICTY Report No.: na (092-118)	N	N		public	N.A.

			Acta Physiologiae Plantarum, 2013, 35, 1351-1362; DOI 10.1007/s11738-012-1175-8 Not GLP, published					
KCA 3.7/41	Grove, M.D. Spencer, G.F. Rohwedder, W.K. Mandava, N. Worley, J.F. Warthen, J.D. Steffens, G.L. Flippen-Anderson, J.L. Cook, J.C.	1979	BRASSINOLIDE, A PLANT GROWTH-PROMOTING STEROID ISOLATED FROM BRASSICA NAPUS POLLEN Report No.: na (092-022) Nature, 1979, 281, 216-217 Not GLP, published	N	N		public	N.A.
KCA 3.7/42	Pan, J. Hu, Y. Liang, T. Li, G.	2012	PREPARATION OF SOLID-PHASE MICROEXTRACTION FIBERS BY IN-MOLD COATING STRATEGY FOR DERIVATIZATION ANALYSIS OF 24-EPIBRASSINOLIDE IN POLLEN SAMPLES Report No.: na (092-041) Journal oh Chromatography A, 2012, 1262, 49-55; doi: 10.1016/j.chroma.2012.09.008 Not GLP, published	N	N		public	N.A.
KCA 3.7/43	Baba, J. Yokota, T. Takahashi, N.	1983	BRASSINOLIDE-RELATED NEW BIOACTIVE STEROIDS FROM DOLICHOS LABLAB SEED Report No.: na (092-011) Agricultural and Biological Chemistry, 1983, 47 (3), 659-661 Not GLP, published	N	N		public	N.A.
KCA 3.7/44	Yokota, T. Baba, J. Takahashi,	1983	BRASSINOLIDE-RELATED BIOACTIVE	N	N		public	N.A.

	N.		STEROLS IN DOLICHOS LABLAB: BRASSINOLIDE, CASTASTERONE AND A NEW ANALOG HOMODOLICHOLIDE Report No.: na (092-073) Agricultural and Biological Chemistry, 1983, 47 (6), 1409-1411 Not GLP, published					
KCA 3.7/45	Yokota, T. Baba, J. Koba, S. Takahashi, N.	1984	PURIFICATION AND SEPARATION OF EIGHT STEROIDAL PLANT-GROWTH REGULATORS FROM DOLICHOS LABLAB SEED Report No.: na (092-075) Agricultural and Biological Chemistry, 1984, 48 (10), 2529-2534 Not GLP, published	N	N		public	N.A.
KCA 3.7/46	Abe, H. Takatsuto, S. Okuda, R. Yokota, T.	1995	IDENTIFICATION OF CASTASTERONE, 6-DEOXOCASTASTERONE, AND TYPHASTEROL IN THE POLLEN OF ROBINIA PSEUDO-ACACIA L. Report No.: na (092-007) Bioscience, Biotechnology and Biochemistry, 1995, 59 (2), 309-310 Not GLP, published	N	N		public	N.A.
KCA 3.7/47	Park, K.-H. Yokota, T. Sakurai, A. Takahashi, N.	1987	OCCURRENCE OF CASTASTERONE, BRASSINOLIDE AND METHYL 4-CHLOROINDOLE-3-ACETATE IN IMMATURE VICIA FABA SEEDS Report No.: na (092-044) Agricultural and Biological Chemistry, 1987, 51 (11), 3081-3086 Not GLP, published	N	N		public	N.A.

KCA 3.7/48	Ikekawa, N. Nishiyama, F. Fujimoto, Y.	1988	IDENTIFICATION OF 24-EPIBRASSINOLIDE IN BEE POLLEN OF THE BROAD BEAN, VICIA FABA L. Report No.: na (092-027) Chemical and Pharmaceutical Bulletin, 1988, 36 (1), 405-407 Not GLP, published	N	N		public	N.A.
KCA 3.7/49	Yokota, T. Morita, M. Takahashi, N.	1983	6-DEOXOCASTASTERONE AND 6-DEOXODOLICHOSTERONE: PUTATIVE PRECURSORS FOR BRASSINOLIDE-RELATED STEROIDS FROM PHASEOLUS VULGARIS Report No.: na (092-074) Agricultural and Biological Chemistry, 1983, 47 (9), 2149-2151 Not GLP, published	N	N		public	N.A.
KCA 3.7/50	Yokota, T. Koba, S. Kim, S.K. Takatsuto, S. Ikekawa, N. Sakakibara, M. Okada, K. Mori, K. Takahashi, N.	1987	DIVERSE STRUCTURAL VARIATIONS OF THE BRASSINOSTEROIDS IN PHASEOLUS VULGARIS SEED Report No.: na (092-076) Agricultural and Biological Chemistry, 1987, 51 (6), 1625-1631 Not GLP, published	N	N		public	N.A.
KCA 3.7/51	Kim, S.-K. Yokota, T. Takahashi, N.	1987	25-METHYLDOLICHOSTERONE, A NEW BRASSINOSTEROID WITH A TERTIARY BUTYL GROUP FROM IMMATURE SEED OF PHASEOLUS VULGARIS Report No.: na (092-032) Agricultural and Biological Chemistry, 1987, 51 (8), 2303-	N	N		public	N.A.

			2305 Not GLP, published					
KCA 3.7/52	Kim, T.-W. Park, S.-H. Han, K.-S. Choo, J. Lee, J.S. Hwang, S. Kim, S.-K.	2000	OCCURRENCE OF TEASTERONE AND TYPHASTEROL, AND THEIR ENZYMATIC CONVERSION IN PHASEOLUS VULGARIS Report No.: na (092-035) Bulletin-Korean Chemical Society, 2000, 21 (4), 373-374 Not GLP, published	N	N		public	N.A.
KCA 3.7/53	Kim, S.-K.	1991	NATURAL OCCURRENCES OF BRASSINOSTEROIDS Report No.: na (092-033) ACS Symposium series, 1991, 474, Chapter 3, 26-35 Not GLP, published	N	N		public	N.A.
KCA 3.7/54	Park, S.C. Kim, T.-W. Kim, S.-K.	2000	IDENTIFICATION OF BRASSINOSTEROIDS WITH 24R-METHYL IN IMMATURE SEEDS OF PHASEOLUS VULGARIS Report No.: na (092-043) Bulletin-Korean Chemical Society, 2000, 21 (12), 1274-1276 Not GLP, published	N	N		public	N.A.
KCA 3.7/55	Nomura, T. Nakayama, M. Reid, J.B. Takeuchi, Y. Yokota, T.	1997	BLOCKAGE OF BRASSINOSTEROID BIOSYNTHESIS AND SENSITIVITY CAUSES DWARFISM IN GARDEN PEA Report No.: na (092-038) Plant Physiology, 1997, 113, 31-37 Not GLP, published	N	N		public	N.A.
KCA 3.7/56	Nomura, T. Kitasaka, Y. Takatsuto, S. Reid, J.B. Fukami,	1999	BRASSINOSTEROID/STEROL SYNTHESIS AND PLANT GROWTH AS AFFECTED BY IKA AND IKB MUTATIONS OF PEA Report No.: na (092-	N	N		public	N.A.

	M. Yokota, T.		039) Plant Physiology, 1999, 119, 1517-1527 Not GLP, published					
KCA 3.7/57	Sondhi, N. Bhardwaj, R. Kaur, S. Kumar, N. Singh, B.	2008	ISOLATION OF 24-EPIBRASSINOLIDE FROM LEAVES OF AEGLE MARMELOS AND EVALUATION OF ITS ANTIGENOTOXITIY EMPLOYING ALLIUM CEPA CHROMOSOMAL ABERRATION ASSAY Report No.: na (092-154) Plant Growth Regulation, 2008, 54, 217-224; DOI: 10.1007/s10725-007-9242-7 Not GLP, published	N	N		public	N.A.
KCA 3.7/58	Motegi, C. Takatsuto, S.	1994	IDENTIFICATION OF BRASSINOLIDE AND CASTASTERONE IN THE POLLEN OF ORANGE (CITRUS SINENSIS OSBECK) BY HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY Report No.: na (092-037) Journal of Chromatography A, 1994, 658, 27-30 Not GLP, published	N	N		public	N.A.
KCA 3.7/59	Abe, H. Morishita, T. Uchiyama, M. Takatsuto, S. Ikekawa, N.	1984	A NEW BRASSINOLIDE-RELATED STEROID IN THE LEAVES OF THEA SINENSIS Report No.: na (092-003) Agricultural and Biological Chemistry, 1984, 48 (8), 2171-2172 Not GLP, published	N	N		public	N.A.
KCA 3.7/60	Gupta, D. Bhardwaj, R. Nagar, P.K.	2004	ISOLATION AND CHARACTERIZATION OF BRASSINOSTEROIDS FROM LEAVES OF	N	N		public	N.A.

	Kaur, S.		CAMELLIA SINENSIS (L.) O. KUNTZE Report No.: na (092-153) Plant Growth Regulation, 2004, 43, 97-100 Not GLP, published					
KCA 3.7/61	Choi, Y.-H. Inoue, T. Fujioka, S. Saimoto, H. Sakurai, A.	1993	IDENTIFICATION OF BRASSINOSTEROID-LIKE ACTIVE STUBSTANCES IN PLANT-CELL CULTURES Report No.: na (092-016) Bioscience, Biotechnology and Biochemistry, 1993, 57 (5), 860-861 Not GLP, published	N	N		public	N.A.
KCA 3.7/62	Fujioka, S. Inoue, T. Takatsuto, S. Yanagisawa, T. Yokota, T. Sakurai, A.	1995	IDENTIFICATION OF A NEW BRASSINOSTEROID, CATHASTERONE, IN CULTURED CELLS OF CATHARANTHUS ROSEUS AS A BIOSYNTHETIC PRECURSOR OF TEASTERONE Report No.: na (092-017) Bioscience, Biotechnology and Biochemistry, 1995, 59 (8), 1543-1547 Not GLP, published	N	N		public	N.A.
KCA 3.7/63	Park, K.-H. Saimoto, H. Nakagawa, S. Sakurai, A. Yokota, T. Takahashi, N. Syono, K.	1989	OCCURRENCE OF BRASSINOLIDE AND CASTASTERONE IN CROWN GALL CELLS OF CATHARANTHUS ROSEUS Report No.: na (092-045) Agricultural and Biological Chemistry, 1989, 53 (3), 805-811 Not GLP, published	N	N		public	N.A.
KCA 3.7/64	Suzuki, H. Fujioka, S. Takatsuto, S. Yokota, T.	1995	BIOSYNTHESIS OF BRASSINOSTEROIDS IN SEEDLINGS OF CATHARANTHUS ROSEUS,	N	N		public	N.A.

	Murofushi, N. Sakurai, A.		NICOTIANA TABACUM, AND ORYZA SATIVA Report No.: na (092-056) Bioscience, Biotechnology and Biochemistry, 1995, 59 (2), 168-172 Not GLP, published					
KCA 3.7/65	Yokota, T. Ogino, Y. Takahashi, N. Saimoto, H. Fujioka, S. Sakurai, A.	1990	BRASSINOLIDE IS BIOSYNTHESIZED FROM CASTASTERONE IN CATHARANTHUS ROSEUS CROWN GALL CELLS Report No.: na (092-077) Agricultural and Biological Chemistry, 1990, 54 (4), 1107-1108 Not GLP, published	N	N		public	N.A.
KCA 3.7/66	Takatsuto, S. Yokota, T. Omote, K. Gamor, K. Takahashi, N.	1989	IDENTIFICATION OF BRASSINOLIDE, CASTASTERONE AND NORCASTASTERONE (BRASSINONE) IN SUNFLOWER (HELIANTHUS ANNUUS L.) POLLEN Report No.: na (092-058) Agricultural and Biological Chemistry, 1989, 53 (8), 2177-2180 Not GLP, published	N	N		public	N.A.
KCA 3.7/67	Yamamoto, R. Fujioka, S. Demura, T. Takatsuto, S. Yoshida, S. Fukuda, H.	2001	BRASSINOSTEROID LEVELS INCREASE DRASTICALLY PRIOR TO MORPHOGENESIS OF TRACHEARY ELEMENTS Report No.: na (092-066) Plant Physiology, 2001, 125, 556-563 Not GLP, published	N	N		public	N.A.
KCA 3.7/68	Suzuki, Y. Yamaguchi, I. Takahasi, N.	1985	IDENTIFICATION OF CASTASTERONE AND BRASSINONE FROM IMMATURE SEEDS OF PHARBITIS	N	N		public	N.A.

			PURPUREA Report No.: na (092-052) Agricultural and Biological Chemistry, 1985, 49 (1), 49-54 Not GLP, published					
KCA 3.7/69	Jang, M.-S. Han, K.-S. Kim, S.-K.	2000	IDENTIFICATION OF BRASSINOSTEROIDS AND THEIR BIOSYNTHETIC PRECURSORS FROM SEEDS OF PUMPKIN Report No.: na (092-028) Bulletin-Korean Chemical Society, 2000, 21 (2), 161-164 Not GLP, published	N	N		public	N.A.
KCA 3.7/70	Tripathi, S. Sharma, P.	2015	CHARACTERIZATION OF BRASSINOSTEROID ISOLATED FROM BACOPA MONNIERI L. AND THEIR FREE RADICAL SCAVENGING ACTIVITY Report No.: na (092-156) International Journal of Science and Research (IJSR), 2015, 4 (4), 2738-2742 Not GLP, published	N	N		public	N.A.
KCA 3.7/71	Yokota, T. Nomura, T. Nakayama, M.	1997	IDENTIFICATION OF BRASSINOSTEROIDS THAT APPEAR TO BE DERIVED FROM CAMPESTEROL AND CHOLESTEROL IN TOMATO SHOOTS Report No.: na (092-070) Plant & Cell Physiology, 1997, 38 (11), 1291-1294 Not GLP, published	N	N		public	N.A.
KCA 3.7/72	Bishop, G.J. Nomura, T. Yokota, T. Harrison, k. Noguchi, T. Fujioka, S.	1999	THE TOMATO DWARF ENZYME CATALYSES C-6 OXIDATION IN BRASSINOSTEROID BIOSYNTHESIS Report No.: na (092-014) Proceedings of the National Academy of	N	N		public	N.A.

	Takatsuto, S. Jones, J.D.G. Kamiya, Y.		Sciences, 1999, 96, 1761-1766 Not GLP, published					
KCA 3.7/73	Griffiths, P.G. Sasse, J.M. Yokota, T. Cameron, D.W.	1995	6-DEOXOTYPHASTEROL AND 3-DEHYDRO-6-DEOXOTEASTERONE, POSSIBLE PRECURSORS TO BRASSINOSTEROIDS IN THE POLLEN OF CUPRESSUS ARIZONICA Report No.: na (092-021) Bioscience, Biotechnology and Biochemistry, 1995, 59 (5), 956-959 Not GLP, published	N	N		public	N.A.
KCA 3.7/74	Takatsuto, S. Abe, H. Shimada, K. Nakayama, M. Yokota, T.	1996	IDENTIFICATION OF TEASTERONE AND 4-DESMETHYLSTEROLS IN THE SEEDS OF GINKGO BILOBA L. Report No.: na (092-061) Japan Oil Chemists' Society, 1996, 45 (12), 1349-1351 Not GLP, published	N	N		public	N.A.
KCA 3.7/75	Kim, S.-K. Abe, H. Anthony Little, C.H. Pharis, R.P.	1990	IDENTIFICATION OF TWO BRASSINOSTEROIDS FROM THE CAMBIAL REGION OF SCOTS PINE (PINUS SILVERSTRIS) BY GAS CHROMATOGRAPHY-MASS SPECTROMETRY, AFTER DETECTION USING A DWARF RICE LAMINA INCLINATION BIOASSAY Report No.: na (092-031) Plant Physiology, 1990, 94, 1709-1713 Not GLP, published	N	N		public	N.A.
KCA	Yokota, T.	1983	2-	N	N		public	N.A.

3.7/76	Arima, M. Takahashi, N. Takatsuto, S. Ikekawa, N. Takematsu, T.		DEOXYCASTASTERONE, A NEW BRASSINOLIDE-RELATED BIOACTIVE STEROID FROM PINUS POLLEN Report No.: na (092-071) Agricultural and Biological Chemistry, 1983, 47 (10), 2419-2420 Not GLP, published					
KCA 3.7/77	Yokota, T. Higuchi, K. Takahashi, N. Kamuro, Y. Watanabe, T. Takatsuto, S.	1998	IDENTIFICATION OF BRASSINOSTEROIDS WITH EPIMERIZED SUBSTITUENTS AND / OR THE 23-OXO GROUP IN POLLEN AND ANTHERS OF JAPANESE CEDAR Report No.: na (092-068) Bioscience, Biotechnology and Biochemistry, 1998, 62 (3), 526-531 Not GLP, published	N	N		public	N.A.
KCA 3.7/78	Watanabe, T. Yokota, T. Shibata, K. Nomura, T. Seto, H. Takatsuto, S.	2000	CRYPTOLIDE, A NEW BRASSINOLIDE CATABOLITE WITH A 23-OXO GROUP FROM JAPANESE CEDAR POLLEN/ANTHER AND ITS SYNTHESIS Report No.: na (092-065) Journal of Chemical Research (S), 2000, 18-19 Not GLP, published	N	N		public	N.A.
KCA 3.7/79	Yokota, T. Ohnishi, T. Shibata, K. Asahina, M. Nomura, T. Fujita, T. Ishizaki, K. Kohchi, T.	2017	OCCURRENCE OF BRASSINOSTEROIDS IN NON-FLOWERING LAND PLANTS, LIVERWORT, MOSS, LYCOPHYTE AND FERN Report No.: na (092-069) Phytochemistry, 2017, xxx, 1-10; doi: 10.1016/j.phytochem.2016.12.020	N	N		public	N.A.

			Not GLP, published					
KCA 3.7/81	Park, S.-H. Han, K.-S. Kim, T.-W. Shim, J.-K. Takatsuto, S. Yokota, T. Kim, S.-K.	1999	IN VIVO AND IN VITRO CONVERSION OF TEASTERONE TO TYPHASTEROL IN CULTURED CELLS OF MARCHANTIA POLYMORPHA Report No.: na (092-042) Plant & Cell Physiology, 1999, 40 (9), 955-960 Not GLP, published	N	N		public	N.A.
KCA 3.7/82	Stirk, W.A. Balint, P. Tarkowska, D. Novak, O. Strnad, M. Oerdoeg, V. van Staden, J.	2013	HORMONE PROFILES IN MICROALGAE: GIBBERELLINS AND BRASSINOSTEROIDS Report No.: na (092-051) Plant Physiology and Biochemistry, 2013, 70, 348-353; doi: 10.1016/j.plaphy.2013.05.037 Not GLP, published	N	N		public	N.A.
KCA 3.7/83	Bajguz, A.	2009	ISOLATION AND CHARACTERIZATION OF BRASSINOSTEROIDS FROM ALGAL CULTURES OF CHLORELLA VULGARIS BEIJERINCK (TREBOUXIOPHYCEAE) Report No.: na (092-013) Journal of Plant Physiology, 2009, 166, 1946-1949; doi:10.1016/j.jplph.2009.05.003 Not GLP, published	N	N		public	N.A.
KCA 3.7/84	Hamdy, A.-H. A. Aboutabl, E.A. Sameer, S. Hussein, A.A. Diaz-Marrero, A.R. Darias, J.	2009	3-KETO-22-EPI-28-NOR-CATHASTERONE, A BRASSINOSTEROID-RELATED METABOLITE FROM CYSTOSEIRA MYRICA Report No.: na (092-023) Steroids, 2009, 74, 927-	N	N		public	N.A.

	Cueto, M.		930; doi: 10.1016/j.steroids.2009.06.008 Not GLP, published					
KCA 3.7/85	Tsavkelova, E.A. Klimova, S.Y. Cherdyntseva, T.A. Netrusov, A.I.	2006	HORMONES AND HORMONE-LIKE SUBSTANCES OF MICROORGANISMS: A REVIEW Report No.: na (092-064) Applied Biochemistry and Microbiology, 2006, 42 (3), 229-235 Not GLP, published	N	N		public	N.A.
KCA 3.7	Tofighi, C., Khavari-Nejad, R. A., Najafi, F., Razavi, K., Rejali, F.	2017	Physiol. Mol. Biol. Plants 23(3): 557-564 Not GLP. published	N	N		public	N.A.
KCA 3.7	Gartz, J, Adam, G., Vorbrodt, H.-M.	1990	Growth-Promoting Effect of a Brassinosteroid in Mycelial Cultures of *Psilocybe cubensis* Naturwissenschaften 77, 388-389 (19909 Not GLP. published	N	N		public	N.A.